NATIONAL WILDLIFE FEDERATION®

CLIMATE CLASSROOM

What's up with global warming?

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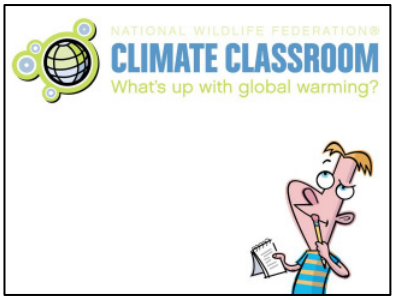
What's Up With Global Warming? Presenter's Guide

About the Guide: This guide was prepared as a companion piece to the What's Up With Global Warming? slideshow. The slideshow is intended for 5th – high school grade students and was designed in accordance with the North American Association for Environmental Education's Guidelines for Environmental Education and the National Science Education Standards. This slideshow was created in response to a survey that NWF conducted with 200 *Ranger Rick* readers, kids ages 8 to 17. The slideshow showcases the most common questions for this age group on the topic of global warming.

The slideshow can be shown as part of a science class, social studies class, or after-school environmental club meeting. You may find more information in the talking points than you need for your group, but it is included for your edification as well as to cite the sources. This information is presented in Notes and Background boxes. Please adapt the language as appropriate for the age level(s) you are working with.

Thank you for your interest in the Climate Classroom Project.

SLIDESHOW TALKING POINTS



Slide 1: Climate Classroom: What's Up with Global Warming?

DESCRIPTION: Opening slide to the presentation.

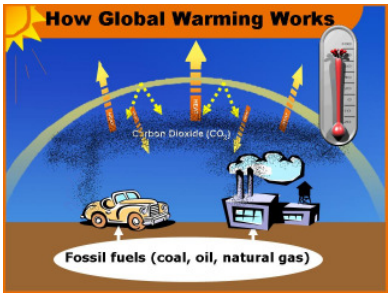
TALKING POINTS: This slide is an introduction to the presentation on what global warming is, what its impacts are on humans, wildlife, and habitat as well as steps that everyone can take to reduce the impacts of climate change.

Slide 2: What is global warming?

DESCRIPTION: This is the opening slide to this section on describing what global warming is, and what its root causes are.

TALKING POINTS: Let's go over the basics of global warming, including its causes and how greenhouse gas emissions are building up in the atmosphere and affecting the overall temperature of the Earth.

Human activity – in the form of energy production and burning of fossil fuels such as coal, oil, and natural gas – is the most significant cause of the planet heating up, and is no longer being debated by scientists, the government, elected officials, churches, or major American companies.



Slide 3: How Global Warming Works

DESCRIPTION: Animated diagram illustrating the "Greenhouse Effect." It shows direct sunlight heading toward the Earth with yellow-orange downward arrows indicating that some of the heat remains in the atmosphere and upward arrows indicating that some escapes back into space.

TALKING POINTS: When direct sunlight heads toward the Earth, it passes right through greenhouse gases. Some of the sunlight is reflected back into space by clouds or light-colored surfaces of the Earth (e.g., ice caps). But most of the sunlight is absorbed by the Earth and warms the planet's surface. The Earth then radiates some of that heat (or infrared energy) back into the atmosphere.

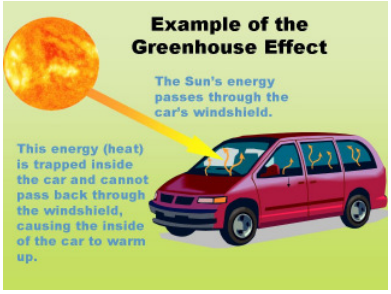
Greenhouse gases in the atmosphere, such as **carbon dioxide (CO_2)** and **methane**, absorb some of this infrared energy, heating up the atmosphere as well as re-radiating it in all directions, including back to Earth. This is basically how the **"greenhouse effect"** keeps the Earth's atmosphere and surface much warmer than they would be if these infrared radiation absorbers were absent from the atmosphere. As the atmosphere "thickens" through the addition of more greenhouse gases, more heat is held in by the atmosphere (the way throwing on a thicker blanket at night will retain more heat).

For millions of years, the amount of greenhouse gases found in the atmosphere has kept the temperatures of the planet within a range that is comfortable for humans and other living creatures. Compare this balance in temperature to two other planets: Mars has very little atmosphere, retains little heat and is very cold, while Venus has large amounts of greenhouse gases in the atmosphere and is much too hot for humans.

Illustration Source: Environmental Defense

Background: The greenhouse effect is a natural occurrence and helps to keep the lower 10 miles of our atmosphere livable.
a) The Sun's visible light passes through the atmosphere, absorbed by the Earth's surface, and radiated back as infrared radiation.
b) At this point, carbon dioxide and other greenhouse gases (methane, nitrous oxide, and water vapor) absorb some of the infrared radiation, thereby heating up the Earth's atmosphere.

Talking Tip: This is the idea of the "Goldilocks" planet. The greenhouse effect makes the temperature of the Earth "just right."



Slide 4: Example of the Greenhouse Effect

DESCRIPTION: Here's a real-life example of how the greenhouse effect works.

TALKING POINTS: When a car's windows are left up, the Sun's energy passes through the car's windshield. This energy (heat) is trapped inside the car and cannot pass back through the windshield, thereby causing the inside of the car to warm up.

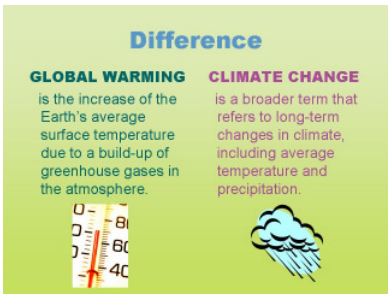
Illustration Source: NWF

Background: This example has been simplified to show the concept of how the greenhouse effect works, but the actual way that our atmosphere protects us is slightly more complicated.

Slide 5: What's the difference between "global warming" and "climate change"?

DESCRIPTION: This is a typical question asked by many people of all ages.

TALKING POINTS: Now is a good time to address the use of the terms **global warming** and **climate change**. Point out that some people think the term *global warming* is more politically charged, while *climate change* is often considered more scientific because it indicates that it isn't just temperature that changes as the earth heats up. Hotter temperatures also increase the intensity/frequency of severe weather events such as droughts and floods. You can point out that both terms are really referring to the same overall concept. However, there are some subtle differences between the two phenomena **(see the next slide)**.



Slide 6: Difference between global warming and climate change

DESCRIPTION: This text slide outlines the chief difference between global warming and climate change.

TALKING POINTS: **Global warming** is the increase of the Earth's average surface temperature due to a build-up of greenhouse gases in the atmosphere. **Climate change** is a broader term that refers to long-term changes in climate, including average temperature and precipitation.

Illustration Source: Data: Union of Concerned Scientists; Images: Microsoft Clipart

Slide 7: Effects of Global Warming

DESCRIPTION: This slide outlines the four major effects of global warming.

TALKING POINTS: Although there are many more effects of global warming, we will focus on the **four major ones** from the 2007 report by the Intergovernmental Panel on Climate Change (IPCC). The current IPCC is a group of 2,000 of the world's leading scientists. The following information comes from this report:

1. Rising sea level: Some of the most vulnerable areas are coastal regions, because they are susceptible to changes occurring in both land and sea and tend to be densely populated. In 2003, about 53% of the U.S. population lived in counties bordering the ocean. The IPCC projects sea level could rise 10-23 inches by 2100 if

we continue on our current path of increasing amounts of CO_2 in the atmosphere. Even in the most optimistic scenario presented, sea level would rise 7-15 inches by 2100.

2. Increased temperatures: The average global temperature rose just 1.3°F during the 20th century. Now climatologists are saying to expect a further rise of 4 to 11 degrees in the 21st century due to greenhouse gas pollution – a large rate of increase over the last century. The rise in temperature will affect every species on the planet, including plants, animals, and humans.

NOTE: The IPCC looked at temperature using a number of paths for emissions out to the year 2100. This is the temperature range for the path we're on today -- if we continue to depend heavily on fossil fuels. The IPCC has other temperature ranges that are based on different assumptions about the use of clean technologies. Even at its most optimistic scenario, the IPCC projects that temperature would increase significantly – from 2°F to 5°F. The best guess for that low emission scenario is 3°F, but that assumes significant cuts in coal and oil use.

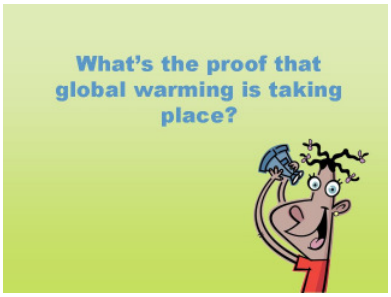
3. Habitat change and species affected: There is every likelihood that terrestrial, biological, and ecological systems will be affected, including earlier timing of spring events (such as leaf-unfolding, bird migration, and egg-laying), and poleward and upward (higher elevation and/or more northern direction) shifts in ranges in plant and animal species. Approximately **20-30% of plant and animal species are likely to be at increased risk of extinction** if increases in global average temperature continue at the same pace as today.

4. Changes in water supply: Water resources are likely to be strongly affected by global warming. In particular, some of the world's most water-stressed regions, (e.g., northeastern Brazil, southern Africa, the southwestern United States, and northern Mexico) are likely to see a **10-30% decline in water availability by the end of the century.** Snowpack in the mountains, which accumulates during the winter and provides freshwater to many areas of the western United States in summer, is also likely to decrease, exacerbating drought conditions. In the northern United States, northern Europe, and southeastern Asia, rainfall will most likely increase, which could lead to increased flooding.

Water quality is likely to decrease in many areas as warmer temperatures promote algal growth and reduce oxygen levels in rivers and lakes. Developing countries, which lack resources to deal with these changes, may be the hardest hit.

Background: The role of the IPCC is to assess on a comprehensive, objective, open, and transparent basis the scientific, technical, and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts, and options for adaptation and mitigation. The IPCC does not carry out research nor does it monitor climate-related data or other relevant parameters. It bases its assessment mainly on peer reviewed and published scientific/technical literature.

Illustration Source: Data: IPCC, February 2007, "Climate Change 2007: The Physical Science Basis Summary for Policymakers;" and IPCC Fourth Assessment Report, "Summary for Policy Makers," 2007; Images: Storm Surge: NOAA; Saltwater Intrusion: C.C. Lockwood; Temperature: Plano, TX Government; Water: Microsoft Clipart



Slide 8: What's the proof that global warming is taking place?

DESCRIPTION: This is a common question asked by kids that responded to the NWF global warming survey.

TALKING POINTS: For a long time, people didn't agree about whether global warming was really happening and, if it was, whether people were to blame. Now that has changed. There is now irrefutable proof that the Earth's climate is changing and global temperatures are rising.

First, people are seeing changes directly. Glaciers have melted in places around the world. And birdwatchers have noticed that migrating birds are returning earlier in the spring and leaving later in the fall, indicating that winters are becoming shorter. Gardeners see signs of shorter winters, too. They say that flowers are blooming earlier than they used to.

These observations all seem to be part of a pattern. But it's important to have scientific proof, too. We know that the amount of carbon dioxide in the atmosphere has increased, and we will go over those findings in later slides.

Slide 9: Portage Glacier

DESCRIPTION: These are images of the Portage glacier in Alaska taken in 1914 and 90 years later in 2004.

TALKING POINTS: Here is a major Alaskan glacier displaying a profound loss of ice, which is clearly visible over the 90-year period of these two photographs. For each of these examples, there are hundreds of others. For example, all but 100 of the 1,100 glaciers researched are receding.

Illustration Source: NOAA Photo Collection by Gary Braasch, www.worldviewofglobalwarming.org

Slide 10: Colorado River

DESCRIPTION: These are images of the Colorado River, taken **16 months** apart.

TALKING POINTS: Although river levels are variable throughout the year, they will be even more impacted by climate change. Global warming causes water in the oceans to evaporate faster, which can fill the atmosphere with more moisture in some areas, but in other areas where there is less precipitation, global warming also causes soils to dry out faster. This contributes to **desertification**.

NOTE: Increased carbon dioxide in the atmosphere will increase the degree of soil moisture reduction in large areas of the nation by 20% to 40% with a doubling of carbon dioxide, and by 40% to 60% with a quadrupling of carbon dioxide. The near doubling of carbon dioxide in the atmosphere could happen by 2050 without significant reductions in greenhouse gas emissions. It could result in an average 35% soil moisture loss in major areas of U.S. agricultural land, contributing to lower water levels and supplies.

Illustration Source: U.S. Geological Survey

Slide 11: Why is global warming happening?

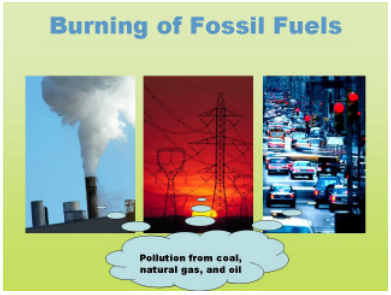
DESCRIPTION: Many people want to know why global warming is happening.

TALKING POINTS: Human beings, their industries, transportation, and settlements are now sizable and numerous enough to be capable of altering the chemistry of the Earth's atmosphere. (The creation of the ozone hole due to our releasing **chlorofluorocarbons** is one example.) Now we are concerned about the increase in greenhouse gases, especially **carbon dioxide**.

NOTE: Again, many people hold the longstanding, but false, assumption that the Earth is too vast to harm through human activity, and even if real environmental harm is done, that the Earth would recover quickly. In reality, scientists find that the Earth's atmosphere is so thin that we have been changing its chemical composition through human activities and that these changes are having observable effects.

We can alter the basic molecular components of the Earth's atmosphere and specifically are doing so with carbon dioxide. Carbon dioxide (CO_2) is a colorless, odorless, incombustible gas. It goes into the atmosphere during respiration by animals and plants, organic fuel combustion, and decomposition of organic material. Most CO_2 comes from burning of fossil fuels, but also from deforestation, agriculture, and industrial processes. Although CO_2 is a rather weak absorber of

infrared radiation, it is the most important of the greenhouse gases because we are putting so much of it into our atmosphere.



Slide 12: Burning of Fossil Fuels

DESCRIPTION: Three images of primary sources of carbon dioxide, the most prevalent greenhouse gas.

TALKING POINTS: Fossil fuels such as oil, coal and natural gas are high in carbon and, when burned, produce major amounts of carbon dioxide. A single gallon of gasoline, when burned, puts **19 pounds of carbon dioxide** into the atmosphere. Yet, today these fuels make up most of the energy production and use in the United States. This, in turn, is responsible for about **21.6%** of the world's energy use even though we have just **4%** of the world's population.

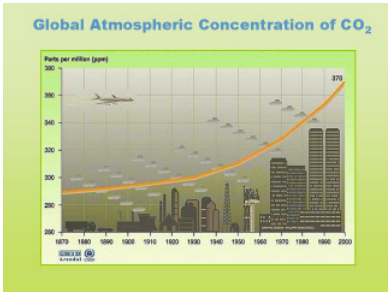
Illustration Source: Data: UNDP Report, Global Warming, 2003; images: Microsoft Clipart

Slide 13: When did global warming start?

DESCRIPTION: Many people want to know when global warming started.

TALKING POINTS: The Earth's climate is always changing. Looking back at the planet's long history, we see evidence of big changes. There were Ice Ages when much of the land was covered with thick glaciers. There were steamy hot times when plants and animals that now live only in the tropics lived on almost every continent. So global warming—and global cooling—is nothing new.

What's different this time is the reason for the change and how fast it is happening. People have been adding extra CO_2 to the atmosphere since the "Industrial Revolution." This was the time in the late 1700s and early 1800s when people started using machines instead of doing things by hand—and burning fossil fuels for energy to run the machines. Today, the amount of CO_2 is higher than at any time in the past **400,000 years**.



Slide 14: Global Atmospheric Concentration of Carbon Dioxide (CO_2)

DESCRIPTION: This is a graphical illustration showing the CO_2 concentration climbing since the start of the industrial revolution.

TALKING POINTS: The measurements show that the amount of CO_2 has increased sharply since 1800. And if we look at the Earth's average temperature over that same time period, we see that it follows the same pattern. That's just what we would expect, because we know that more CO_2 means a stronger greenhouse effect.

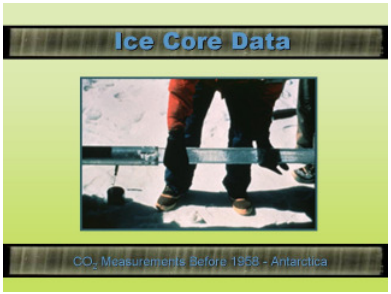
In fact, recently we've experienced the hottest years ever recorded. Nineteen of the 20 hottest years on record have occurred since 1980. The year 2005 was the hottest of any previous year and the first half of 2006 was warmer still.

Illustration Source: GRIDA UNEP – United Nations

Slide 15: How is global warming measured?

DESCRIPTION: Inquiring individuals want to know how a phenomenon such as global warming is measured.

TALKING POINTS: There are several ways to measure carbon dioxide (CO_2) concentrations in the environment.



Slide 16: Ice Core Data

DESCRIPTION: This is an image of Professor Lonnie Thompson of Ohio State University retrieving Antarctic ice cores for study. Professor Thompson takes research teams all over the world to measure the carbon concentrations trapped in ice that was formed year-by-year over the centuries.

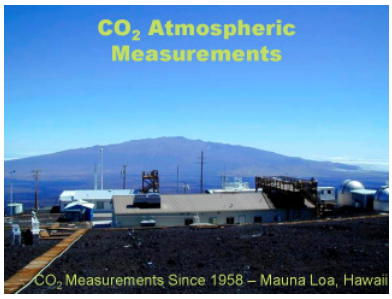
TALKING POINTS: To obtain pre-1958 data, scientists studied ice core characteristics from Antarctica so that they could determine the Earth's temperature and atmospheric gas concentrations. They use long, thin cores of ice drilled out of the Earth's large ice sheets as a "time capsule" that recorded what the Earth's atmosphere was like when each layer of ice froze.

Using data gathered from these Antarctic ice cores, scientists can also see that carbon levels have stayed within a fairly close range up until recent times when higher levels have become evident. At no point in the past 400,000 years did carbon dioxide concentrations in the atmosphere rise above 300 parts (molecules) per million molecules (PPM). In modern times, however, they are now at roughly 380 parts per million (PPM). As the atmosphere "thickens" through the addition of greenhouse gases, more heat is held in by the atmosphere (again, much like throwing on a thicker blanket at night will retain more heat).

Scientists recommend we reduce greenhouse gas emissions to stop the increase and "hold" the levels at no more than 400 to 450 parts per million. But, without any significant changes in current policies and behaviors, they project that we could see CO_2 levels of 650 parts per million by the year 2100.

In the past, the difference between a CO_2 level in the high 200s and one in the low 100s has been the difference between a warm summer day and a two mile thick sheet of ice over your head. No one knows what levels exceeding 400 PPM will mean.

Illustration Source: Dr. Lonnie Thompson, Ohio State University



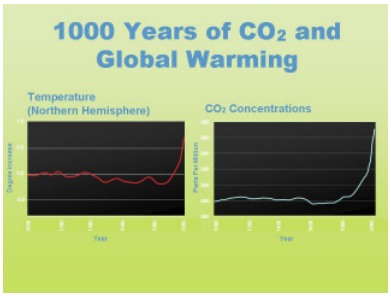
Slide 17: CO_2 Atmospheric Measurements

DESCRIPTION: An image of the NOAA atmospheric laboratory at Mauna Loa, Hawaii.

TALKING POINTS: Since 1958, scientists have been able to take atmospheric measurements for both temperature and greenhouse gas concentrations at this facility in Hawaii. There has been a steady increase in CO_2 levels annually from 1958 through 2007. The pre-industrial concentration of CO_2 was 280 parts per million. In 2005, that level, measured high above Mauna Loa, was 381 parts per million.

These measurements have continued year by year for almost half a century, and have been patiently collected daily and stand as one of the most important measures in the history of science.

Illustration Source: NOAA



Slide 18: 1000 Years of CO_2 and Global Warming

DESCRIPTION: Two layers of a line graph displayed over 1,000 years of time – the chart on the left shows variation from long-term average temperature, and the chart on the right shows CO_2 concentrations.

TALKING POINTS: Scientists have observed that, over many thousands of years, the amount of CO_2 in the atmosphere corresponds quite closely to the Earth's overall temperature. As the amount of CO_2 goes up, the temperature soon goes up and vice versa. This is one factor that contributed to the Ice Ages and warming periods extending back thousands of years.

Although these charts only show changes over the last 1,000 years, there is data available taken from ice cores in Antarctica where scientists were able to drill into the ice and go back to 400,000 years ago.

Over the past 400,000 years, there has been a close connection between the amount of CO_2 in the atmosphere and the overall temperature of the Earth. It is so striking a relationship that they look almost like the same data sets in different colors. Importantly, today's CO_2 levels are much higher than any that have been found over the past 400,000 years.

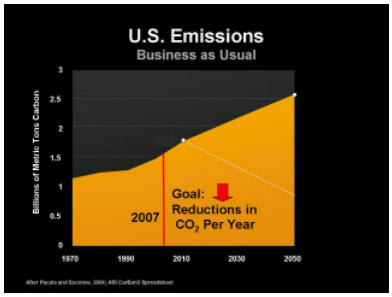
Illustration Source: : Adapted from J.R. Petit, J. Jouzel et al, Oceanic Atmospheric History of the Past 400,000 Years from the Vostok Ice Core in Antarctica, *Nature* 399, pp. 429-436, 1999.

Slide 19: Global Warming: Shifting Gears

DESCRIPTION: This slide introduces the section on global warming solutions.

TALKING POINTS: It's very clear (from the IPCC report) that we need to make changes now to reduce global warming pollution. Much of the CO_2 we put into the atmosphere today now lasts 100 years or more, so we can't delay implementing solutions for reduction. Also, it is important for all of us to take steps—to be empowered to be part of the solution.

Illustration Source: Microsoft ClipArt



Slide 20: U.S. CO_2 Emissions

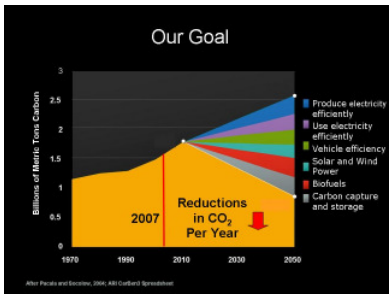
DESCRIPTION: Sometimes called the "wedge" chart, these slides show emissions levels lowering as each of six strategies are applied. Teachers should note that this is a complex series of slides.

TALKING POINTS: Greenhouse gas emissions will continue to rise and heat up the planet if we keep doing what we have been doing.

Why is an annual reduction in greenhouse gas emissions necessary between now and 2050? Climate scientists say that this level of reduction will avoid the worst case scenarios of climate change and impacts on humans as well as fish, wildlife and their habitats.

Two economists at Princeton University, Robert Socolow and Stephen Pacala, concluded that the U.S. already has the fundamental scientific, technical and industrial know-how to resolve significant carbon and climate problems over the next 50 years. They estimate emissions can be lowered in various energy sectors and with various technologies by 50%.

Illustration Source: Data: Robert Socolow and Stephen Pacala, Princeton University; Charts: NRDC



Slide 21: Our Goal

DESCRIPTION: The Wedge Description Continued

TALKING POINTS: There is no single solution to solving the global warming pollution problem. We need a multitude of ways to address the issue knowing that no single method will do the job, but combined they will accomplish the task of meeting our goal by 2050.

TALKING TIP: The bottom line on the wedges strategy is that we can bring our greenhouse gas emissions under control in the U.S. when these various approaches are done all at one time and with our basic 'know how'. By employing these strategies, we can go far in solving the climate crisis.

NOTE: The Six 'Wedges' of Progress to Stop Global Warming: The Princeton University researchers, Pacala and Socolow, identified a total of 15 categories of technology that store carbon, provide energy without producing carbon emissions or improve the efficiency of carbon-based energy supplies. They state that the large-scale use of any one of these technologies can reduce global carbon emissions by at least one billion tons a year by the year 2054. They show how each of the 15 options they identified could be pieced together in six wedges to prevent 1 billion tons of carbon pollution per year.

1. Produce electricity efficiently: We can start to see progress through more efficient production of electricity through renewable energy sources, such as wind power, solar, and biomass and biofuels from sustainable sources, and a reduction in the production of electricity from fossil fuel sources such as coal, oil, and natural gas.

2. Use electricity efficiently: We can also make progress through more efficient use of electricity in consumer activities, such as electrical use in the home.

3. Vehicle Efficiency: Higher mileage vehicles and the manufacturing of cars and trucks that run on less fossil fuel and use alternative technologies will be important.

4. Solar and Wind Power: These will play a role in helping us to increase our reliance on **renewable energy**.

5. Biofuels: There are a number of biological substances such as wood, corn, and grasses (e.g., switch grass) that can be used to create ethanol for energy. Because these energy sources are photosynthetic in origin, there is **no net increase** in CO_2 in the atmosphere, in contrast to fossil fuels which remove carbon-based fuels from the ground and increase atmospheric CO_2 levels.

6. Carbon capture and storage: Are emerging technologies with promise. The carbon emissions from power plants and industrial sources can be captured, condensed and stored much in the same way we use pollution control devices to keep pollutants out of our air and water.

Illustration Source: Data: S. Pacala and R. Socolow, "Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies," Princeton University; Charts -NRDC

BACKGROUND: The Pacala/Socolow study concentrates on CO_2. It is the most abundant of the greenhouse gases and is a byproduct of burning fossil fuels such as coal, natural gas, and oil. Historically, changes in atmospheric CO_2 levels have been directly linked to changes in temperature. Current levels of global emissions of CO_2 contain 7 billion tons of carbon per year. That amount is actually projected to about double to 14 billion tons per year in the next 50 years as the world population increases and people consume more energy. To keep the level of emissions stable, technologies and conservation efforts would have to prevent 7 billion tons worth of emissions per year by mid-century.

Slide 22: What's being done now to reduce our emissions?

DESCRIPTION: This is a slide showing three of the many ways to reduce our CO_2 emissions.

TALKING POINTS: Using energy more efficiently is a critical part of the solution to global warming, but we all know that energy drives our economy. Fortunately, there are many forms of renewable energy that do not require the burning of fossil fuels. Examples include:

- **Solar Energy** – This an important source of future energy to many people. The direct conversion of sunlight to electricity via solar cells is a promising field and will become even more so as efficiencies improve. Solar power will likely become an increasingly popular way to replace coal and gas burning as ways to produce electricity.
- **Wind Energy** – This energy source is growing in popularity as wind turbines become more efficient and as we get a better handle on sites where wind is a more dependable resource – such as areas in the West, mountaintop areas, and more. Careful attention must be paid to siting issues to minimize adverse effects of especially habitat disturbance as well as the spinning blades themselves, on birds and other wildlife.
- **Fuel Efficiency** – There are a number of fuel efficient vehicles available in many makes and models today. These include hybrid vehicles, which run on a combination of electric (battery) power and gasoline as well as vehicles that have been adapted to use ethanol, which is a biofuel made from agricultural crops.

Illustration Source: Wind turbines – EPA; Solar Panels – DOE, Hybrid - Toyota

BACKGROUND:
There are a variety of strategies and technologies that can be used to lower CO2 emissions. Two economists at Princeton University, Robert Socolow and Stephen Pacala, identified a total of 15 categories of technology that store carbon, provide energy without producing carbon emissions, or improve the efficiency of carbon-based energy supplies. We've highlighted three of those technologies above.

Solar power: If you use a solar electric system to replace 10% of your annual electric needs, you can save 1,430 lbs CO2 per year.

Fuel efficiency: When you buy a new car, it's important to choose one that gets good gas mileage. CO_2 reduction (if your new car gets 10 mpg more than your old one) is about 10,000 lbs/yr. If you buy a hybrid vehicle – the average driver saves $3,750/year, and has a CO_2 reduction of 16,000 lbs/yr.

Slide 23: We can stop global warming!

DESCRIPTION: This slide introduces the section on individual solutions.

TALKING POINTS: Scientists say we are at a turning point with global warming. They think that if we take action now, we can slow it down. But if we don't, it will soon be too late. We still don't know exactly what the effects of global warming will be, so there's no way to know exactly how much time we have. But now almost all scientists agree that it's a big problem and that the wise thing to do is to take action—**right now**.

The important thing to remember is that humans have caused this problem, so humans should be able to fix it. You're hearing a lot about global warming right now because lots of people are working to fix it. There are all kinds of ways to tackle the problem, and people are working on many possible solutions.

Slide 24: What You Can Do to Help Solve the Problem?

DESCRIPTION: Everyone can get involved with helping to solve the problem of global warming.

TALKING POINTS: Global warming is a huge problem, and that means it's going to need huge solutions. Lots of people will have to help if we are going to successfully turn the tide. It will mean changing the way we live—maybe in small ways, but maybe in some big ways, too.

We can *all* do things to help! There's no single solution to global warming—which means there are many ways to take action to help. You, your family, your school, and your community can all take steps to reduce the amount of greenhouse gases you release. For the average family in the United States, half of the CO_2 comes from heating and cooling the house. One-quarter comes from transportation, and the other one-quarter comes from using electricity. You can make changes in all of these areas to reduce your overall "carbon footprint." Some examples are shown on the following slides.

Illustration Source: Microsoft Clipart

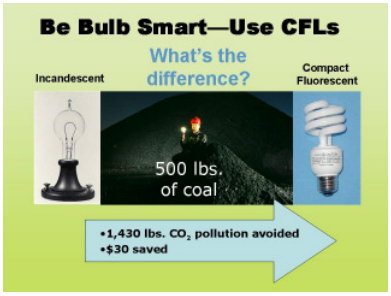
Slide 25: Simple Things to Do

DESCRIPTION: This is a list of some simple things that everyone can do to reduce global warming.

TALKING POINTS: Here are some steps you can take that can have some really positive impacts on global warming pollution!

- Turn off your computer and TV when you're not using them. **This can save up to 140 pounds of CO_2 each year.**
- Heating water takes a lot of energy. By taking shorter showers, **you can save 350 pounds of CO_2 each year.**
- By closing the blinds or drapes on a hot day, you can keep your house from heating up as much, reducing the need for your air-conditioning unit to work so hard! Ceiling fans help, too.
- Turn off the lights when you leave a room, or when you don't need them on. **This can save 380 pounds of CO_2 each year.**
- Switch to compact fluorescent light bulbs. **One bulb can reduce CO_2 by 100 pounds per year.**

Illustration Source: Data: Environmental Defense, Rocky Mountain Institute, TenPercentChallenge, National Catholic Rural Life Conference, Seattle City Light, The Tides Foundation, and www.StopGlobalWarming.org; Icons: Microsoft Clipart



Slide 26: Be Bulb Smart – Use CFLs

DESCRIPTION: This image from *National Geographic* magazine shows the spatial relationship of the savings in coal from one compact fluorescent (CFL) light bulb versus a traditional incandescent light bulb.

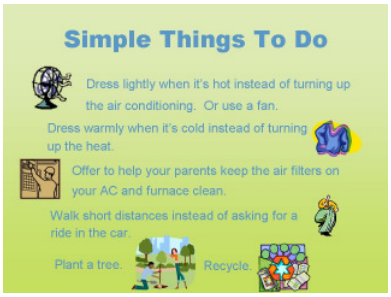
TALKING POINTS: Replacing a single incandescent light bulb (a technology from the 1800's) with a low-energy spiral (CFL) bulb would save **500 pounds of coal** over the life span of the (CFL) bulb. This would avoid some 1,430 pounds of CO_2 pollution and save $30 over the life of the bulb. We need to be turning off the incandescent bulbs and turning on compact fluorescent bulbs instead. There are an average of 50 bulbs in each house.

Illustration Source: Coal - National Geographic Society

BACKGROUND: If every American home replaced just one incandescent light bulb with an ENERGY STAR® -rated CFL, we would save enough energy to light more than 2.5 million homes for a year and prevent greenhouse gases equivalent to the emissions of nearly 800,000 cars.

ENERGY STAR® -qualified CFLs:

- Use at least two-thirds less energy than standard incandescent bulbs to provide the same amount of light and last up to 10 times longer
- Save $30 or more in energy costs over each bulb's lifetime
- Generate 70 percent less heat, so they're safer to operate and can cut energy costs associated with home cooling
- In addition to other quality requirements, most turn on instantly, produce no sound, and fall within a warm color range or are otherwise labeled as providing cooler color tones.



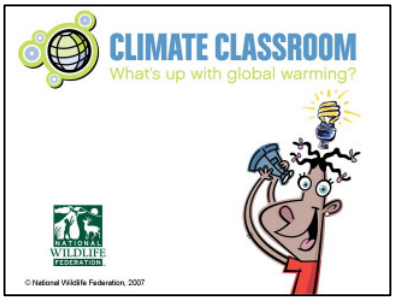
Slide 27: More Simple Things to Do

DESCRIPTION: Just a few more things you can do to reduce global warming!

TALKING POINTS: What other simple things can you can do to stop global warming?

- By wearing warm clothes in the winter (instead of turning up the heat) and wearing cool clothes in the summer (instead of turning up the air conditioning), you can set your set your thermostat a few degrees cooler or warmer. **For every two-degree adjustment up (in summer) or down (in winter), you can reduce CO_2 by 500 pounds per year.**
- By helping your parents to clean or replace the A/C and furnace filters, **you can reduce CO_2 by 175 pounds per year.**
- For short trips, try to walk or ride a bike instead of asking your parents to drive you somewhere**. For every gallon of gasoline saved, you reduce CO_2 by 20 pounds!**
- By planting trees around your house for shade, so you won't need as much air conditioning, and **trees can store up to 24 pounds of CO_2 in their leaves, branches, and soil.**
- And, don't forget to recycle! **You save 4 pounds of CO_2 for each pound of paper you recycle**! As every American use over **580 pounds of paper** each year – this can really add up!

Illustration Source: Data: Environmental Defense, Rocky Mountain Institute, TenPercentChallenge, National Catholic Rural Life Conference, Seattle City Light, The Tides Foundation, and www.StopGlobalWarming.org; Icons**:** Microsoft Clipart Microsoft Clipart



Slide 28: Ending Slide

DESCRIPTION: This is the ending slide of the "What's Up With Global Warming?" presentation.

TALKING POINTS: For additional information, please check out the web site at **www.climateclassroom.org.**

Illustration Source: All cartoon characters by Jack Desrocher.

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