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CO_2 and You!

An Interactive Family Forum on Climate Change

by

Sciencenter, Ithaca, NY
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Presenter's Guide

BACKGROUND

CO_2 and You! is a PowerPoint presentation on climate change for family audiences that covers:

- The basic science of climate change
- Actions people can take in response to climate change

The program is designed for museum theaters and amphitheaters and is intended for family groups with children ages 6-12. Its primary goal is to empower people to address their role in energy use and climate change.

As a presenter, you don't need to have answers to all possible questions on climate change, and you do not need to be an expert on the science of climate change to effectively present this program.

When a question comes up that you can't answer, you may respond the questions with, "That's a good question. I'll look into that, and if you give me your name afterward, I'll get back to you with an answer in the next few days."

TOOLS & MATERIALS NEEDED

- Computer with MS-PowerPoint software
- Projector and screen

- *CO_2 and You!* PowerPoint presentation (two versions available, one using clickers[1], one without)
- Clickers, receiver unit, and software from Turning Technologies, Inc. (if you plan to use anonymous electronic polling during the presentation)
- 2 clip-on light fixtures, each with 250-watt heat lamp
- Hair dryer (optional; only the presenter should use it)
- 3 small fleece blankets (to demonstrate addition of greenhouse gases)
- Smart strip (optional)

WHY TWO VERSIONS?

To make the presentation as fun, lively, and educational as possible, we encourage audience participation at various points. To present the first version, each family group is given an electronic clicker as they enter the amphitheater. When the presentation offers a question, such as "Do you think climate change will affect you during your lifetime?" audience members can discuss the question and then vote by pressing a button on the clicker.

The results are anonymously compiled and immediately displayed as a histogram on the corresponding PowerPoint slide. The technology is simple to use and greatly increases audience engagement with the presentation.

The equipment needed for this type of audience participation includes a receiver (the size of a large USB flash drive and costing $395, including software) and each clicker has a cost of $39. You can download the software from the Turning Technologies website. A set of 30 clickers will accommodate an audience of 100 people in family groups at a total system cost of about $1565. Audience participation using the clickers can be used in future PowerPoint presentations at your facility.

For further information on purchasing clickers, contact:

www.TurningTechnologies.com
Turning Technologies
255 West Federal Street
Youngstown, OH 44503
+1 866.746.3015
+1 330.884.6065 (fax)

[1] "Clickers" are wireless devices that look much like a TV remote. Audience members can press a button on the clicker to select from multiple choice answers to a question on the screen. The receiver tallies the audience votes and displays the results on the screen in real time.

For museums that do not have Turning Technologies polling devices, presenters can ask family groups to discuss the question and then raise hands to indicate their choice, as in "How many groups think "Yes"? followed by "How many groups think "No"? Another creative way to engage the audience is to hand them four different colored flags that represent each answer, when a multiple choice question comes up, each group will be able to raise a flag to communicate their answer.

The presenter can then summarize the results by saying, "OK, it appears that about 2/3 of the groups think they will be affected by climate change in their lifetimes."

The disadvantage of raising hands or using another strategy of gathering audience input is that the votes are not anonymous so that fewer people participate, and the results are not added up and displayed on the screen. In our experience, clickers greatly increase audience interest in the presentation, and the hardware can be used in many other presentations.

COMMENTARY ON SLIDES

The following commentary provides talking points for each slide. These points are not intended to be a script, and you should feel free to use this information in its current form or adapt it in whatever way is useful to you.[2]

Slide 1: Title Slide

a. Explain to the audience that they are going to take part in a forum presentation on climate change, during which they will have an opportunity to discuss a number of questions in their family groups and express their group (or individual) opinions if they wish to do so. You may also mention that the Sciencenter is a hands-on science museum located in central upstate New York, and that the Institute of Library and Museum Services funded this work.

b. Present the title and ask the audience if they know what CO_2 means, and briefly explaining that CO_2 is the chemical abbreviation used for carbon dioxide.

c. The following two slides will help the audience warm up and understand how to use the clickers.

d. Mention that no one is required to vote on any of the issues brought up in the presentation but it is highly encouraged.

Slide 2: Do you know what climate change is?

a. Motivate your audience to participate, also at this point it is best to reinforce how to use the clickers.

b. Express that there is no right or wrong answer, and that some of them will learn new things today and other will be able to re-enforce their knowledge.

[2] Please send any comments, errors, or corrections to: info@Sciencenter.org

c. You can expect that most of your audience will participate. Be sure to give them a full minute to answer each polling slide.

Slide 3: How much have you thought about climate change today?

a. At this point your audience should understand how to use the clickers, but you may reinforce on how to use them once more.

Slide 4: Temperature is rising

a. This very widely used graph shows that during that past 125 years, global temperatures have risen together in synch with the amount of CO_2 in the atmosphere.

b. The graph does not indicate which one causes the other, or if they are both due to some third factor.

c. However, the concentration of CO_2 is higher than at any time in the past 800,000 years, and almost all scientists who have studied the issue now believe that CO_2 is causing the rise we see in global temperatures.

Slide 5: How does CO_2 reach the atmosphere?

a. The following slide is an animation that will help you explain how does CO_2 reach the atmosphere. Each click on this slide produces an animation, and the following talking points will guide you thru the animation:

   i. This image is going to help us understand how our use of carbon-based fossil fuels has increased the amount of carbon dioxide in the atmosphere. To begin with we need to understand that the atmosphere is composed of gases.

   ii. One of the most important gases is oxygen, which are represented by red circles. In reality oxygen atoms are much much smaller. Another important gas in the atmosphere is carbon dioxide, which is composed of two oxygen atoms joined with a carbon atom, which is represented by a black circle.

   iii. Carbon dioxide is another important gas in the atmosphere, carbon dioxide is necessary for plants to grow and traps heat and helps to insulate the earth—this means it is a greenhouse gas.

   iv. For thousands of years the amounts of oxygen and carbon have existed in a balance, and plants and animals have adapted to this balance.

   v. Carbon dioxide in the air is not the only place that we find carbon. There is a massive amount of carbon stored underground in the form of coal. Coal seams are the ancient remains of plants and animals and store large amounts of energy. These carbon atoms represent the carbon that is stored under the surface of the Earth.

   vi. For the last hundred years people have been mining this carbon in the form of coal, to harvest the enormous amount of energy that is stored

in coal. The first step in this process is to extract the coal from the deposits underground.

vii. Once we have taken carbon out of the ground we have to transport it over to a factory where the energy released from the coal turns turbines that produce electricity.

viii. Like many things in nature carbon moves around in cycles. when we burn the coal the carbon doesn't disappear but is released into the atmosphere.

ix. Burning coal releases carbon atoms, but carbon atoms don't like to be alone, so instead they bond, or join together with two oxygen atoms. Each carbon atom that is released joins with two oxygen atoms and creates a carbon dioxide molecule.

x. Scientists have noticed a huge increase in carbon dioxide molecules over the past century. As we continue to burn carbon based fuels such as coal, oil, or natural gas for energy more carbon is released into the atmosphere, and more carbon dioxide is created. Because carbon dioxide is a greenhouse gas that traps heat it leads to the warming of the atmosphere, which results in all different types of changes to the climate.

Slide 6: Feel the Greenhouse Effect Activity

a. At this point, you may want to do a simple audience participation demonstration to reinforce the concept of the greenhouse effect and how the rate of temperature rise is accelerating. In this demonstration, the addition of greenhouse gases will be modeled by addition of blankets to a child standing near a heat lamp. Using the materials listed at the beginning of this guide:

i. You may want to mark a rectangle about 1 x 2 meters on the floor with masking tape and ask that no one except the audience volunteer come inside the rectangle. Place a chair inside the rectangle.

ii. Ask for three volunteers from the audience to help. One will sit on the chair and the other two will hold the lamps. They should be someone at least 6-7 years old. Do not choose a very young child, because he or she may not be able to stand still long enough to complete the demonstration.

iii. Turn on the heat lamps at a distance about ½ meter away from the child and ask if the child sitting down feels the heat of the lamps. The child will probably say "yes." If you want them to feel even more heat you can use a hair dryer as well.

iv. Say that adding more carbon dioxide to the atmosphere is like adding another blanket around the Earth. Tell the audience that the amount of CO_2 that people added to the atmosphere during the 100 years before 1950 can be represented by one blanket. Drape a blanket around the child and ask what happens. He or she will likely say they feel hotter.

v. Say that the amount of CO_2 added to the atmosphere in the 35 years between 1950 and 1985 can be represented by another blanket. Wrap another blanket around the child and ask what happens. *Be careful not to wrap the blanket too tightly.* He or she will likely say they feel hotter.

vi. Then say that the amount of CO_2 added to the atmosphere in the last 20 years alone can be represented by a third blanket. Wrap the last blanket around the child and ask what happens. *Be careful not to wrap the blanket too tightly.* He or she will likely say they feel still very hot.

vii. Mention that the time periods represented by each new blanket of CO_2 is getting shorter and shorter. Say that this is one reason that many scientists are getting very concerned about climate change.

Slide 7: Which one of these symbols represents carbon dioxide?

a. After the polling has ended you can also mention that CO_2 is the chemical formula that represents carbon dioxide.

b. It identifies each constituent element by its symbol and indicates the number of atoms of each element.

Slide 8: How much is a ton of CO_2?

a. The average person in the US produces near to 20 tons of CO_2 a year[3].

b. This is what a ton of CO_2 looks like. Imagine that this cube is like a giant balloon that is filled up with CO_2.

c. A science teacher built this cube to show his students what a ton of CO_2 looks like, since its something hard to imagine.

d. A metric ton of CO_2 is 2,204 pounds. The cube shown has the following dimensions: 27 feet wide by 27 feet high by 27 feet deep.

e. Explain that when many people all do something small, the cumulative effect can be very large.

f. If everyone throughout the world would make even small changes to their own lifestyles, the rate of climate change could be dramatically decreased.

g. In the next few slides, we'll show some simple things that everyone can do to decrease their carbon emissions.

Slide 9: What can I do? – Change to compact fluorescent light (CFL) bulbs

a. Explain that regular incandescent bulbs create more heat than light, and they waste vast amounts of electricity.

b. Compact fluorescent bulbs are now less expensive, they use only ¼ as much energy for the same amount of light; and last much longer than incandescent bulbs.

[3] Data from U.S Energy Information Administration for 2008.

c. CFL bulbs are therefore more economical in the long run and significantly reduce the amount of greenhouse gas going into the atmosphere.

d. Explain that if every household in the U.S. switched 5 incandescent to CFL bulbs, we would save 30 million tons of CO_2 from going into the atmosphere every year, because less electricity would be needed.

e. Tell your audience to try to imagine 30 million cubes just like they saw on the previous slide, you could also go back to the slide to give more emphasis on this issue.

Slide 10: Do you have CFL bulbs in your home?

a. After the polling has ended you can also mention that LED light bulbs are also very energy efficient and they can even last longer than CFL and incandescent bulbs, but they are currently more expensive.

Slide 11: What can I do? – Reduce shower time to 5 minutes and install a low-flow shower head.

a. Explain that a typical shower lasts 10 minutes.

b. If people reduce their shower time to 5 minutes, they will have that extra time to use for other activities and will also reduce CO_2 by reducing the amount of hot water that needs to be created.

c. Low-flow shower heads cost less than $15 at most hardware stores and take about 2 minutes to install. They last for more than 10 years, so the cost is less than $1.50 per year.

d. A low-flow shower head delivers a finer spray that saves water while still providing a pleasant shower.

e. If everyone in the U.S. did these two things, we could cut about 64 million tons of CO_2 each year.

Slide 12: Do you have a low-flow shower head in your home?

a. After the polling is ended you can also mention that another simple way of reducing the amount of water we use is by making sure that you don't keep the water running while you are washing your teeth or doing the dishes.

Slide 13: What can I do? – Turn down the thermostat when heating your home.

a. Explain that heating homes is one of the biggest sources of atmospheric CO_2 because we either burn coal, oil, or gas to run our furnaces, or we make electricity to power our electric heaters and radiators. Burning fossil fuels puts significant quantities of CO_2 into the atmosphere.

b. Putting on a sweater during the day and turning down the thermostat even a few degrees can make a big difference in the amount of energy we need to heat our homes.

c. Putting on an extra blanket and turning down the thermostat to 55 deg F (13 deg C) at night also makes a big difference in energy usage.

d. If everyone in the U.S. did this, they would both save on energy costs and eliminate about 71 million tons of CO_2 each year. Remind your audience of the size of a ton of CO_2 (Slide 9).

Slide 14: What can I do? – Turn off the lights when you don't need them.

a. Many of us leave the lights on when we leave a room.

b. Turning off the lights saves energy, reduces our electricity bill, and reduces the amount of CO_2 going into the atmosphere.

c. If everyone in the U.S. turned off unneeded lights, we could eliminate about 20 million tons of CO_2 each year.

d. Also explain that standby, phantom, or vampire power is the power that appliances use when they are off mode but still plugged in. This is commonly the small amount of power it takes to run the clock on your microwave or allow your TV to receive a signal from a remote control.

e. Although it is a small amount of power, the power consumption does add up, and it accounts for a small percentage of your energy use. Vampire power can be prevented simply by unplugging the appliance from the wall when it is not in use or by using a smart strip. At this point you may want to show the audience the smart strip.

Slide 15: Do you remember to turn of your lights?

a. After the polling has ended you can also mention that this is something very easy to do, but we frequently forget to do. You can try placing some signs next to light switches to remind yourself and your family members to turn off the lights when not needed.

Slide 16: What can I do? – Buy locally and be a conscious consumer

a. The average U.S household generates 8.1 tons of green house gases a year from food consumption.

b. Eating locally grown foods reduces fossil fuels burned during preparation and transport. Foods that travel by air produce far more green house gases than foods that are produced locally.

c. Local foods are fresher and they also help the local economy.

d. What you choose to eat also can reduce your carbon footprint, because some foods during the production phase produce greater amount of CO_2 than others.

e. Meats generally produce more greenhouse gas emissions than vegetables do; this means that by balancing your diet you can also contribute to reducing carbon emissions.

Slide 17: What Else Can I Do?

a. Explain to the audience that it will take everyone working together to reduce climate change and that they can now be ambassadors.

b. Explain that, now that they understand how climate change is caused by people putting carbon dioxide and other greenhouse gases into the atmosphere, they can help by teaching others what they know.

c. Mention that if they urge decision makers (politicians, business leaders) to look for solutions to climate change, we still have a chance to sustain our environment for our children and their children.

d. But if we fail to act now, we run the risk of making large portions of the Earth uninhabitable because of hot temperatures, lack of water, flooding, and/or extreme weather conditions. Climate change affects different latitudes and environments of the Earth differently.

e. The audience could also be asked if they have any other suggestions that would help reduce greenhouse emissions.

Slide 18: What is 350?

a. Supporting events that encourage climate change education also helps reduce greenhouse gas emissions.

b. 350.org is an international campaign that's building a movement to unite the world around solutions to the climate crisis. Its mission is to inspire the world to rise to the challenge of the climate crisis—to create a new sense of urgency and of possibility for our planet.

c. The name 350 arose because 350 ppm (parts per million) is what scientists say is the safe upper limit for carbon dioxide in the atmosphere. Climate scientist James Hansen stated that any atmospheric concentration of CO_2 above 350 ppm is unsafe for the planet.

Slide 19: You can have fun while helping to reduce carbon emissions!

a. The following pictures show how you can have fun while helping to reduce carbon emissions.

b. The audience can observe how different creative ways were used to promote climate awareness on one same day around the world.

c. Mention to your audience that by participating in fun activities like these they will also have the opportunity to do something that can make a difference in life and pass on a gift to future generations.

Slide 20: With everyone's help, we can change the world

a. Repeat that if everyone works together to make even small changes, the effects will add up and make a big difference in reducing climate change.

b. It takes everyone talking about it and reminding each other to make the right choices.

Slide 21: Questions?

a. The audience is likely to have questions after the presentation. Be sure to encourage family groups to come up with a question and also to pair up with other family groups or individuals to come up with questions. Often, the

creative energy resulting from group discussions brings up pressing questions, more ideas, and grounding to reality.

b. Remember that in keeping with the spirit of a public forum, as a presenter, you do not have to have all the answers! (i.e., you do not need to be an expert on climate change science).

c. When a question comes up that you can't answer, you may respond the questions with, "That's a good question. I'll look into that, and if you give me your name and contact information afterward, I'll get back to you with an answer in the next few days."

d. Keep the discussion going as long as people are interested. Our experience has been that many people will stay for 5-10 minutes for questions.

e. You may want to collect frequently asked questions, in case they are asked again in the future.

ADDITIONAL REFERENCES

For information on IMLS and other educational resources:
http://www.imls.gov/

Other useful resources:

www.350.org
www.Energy.gov
www.GetEnergySmart.org
www.NASA.gov
www.NOAA.gov
www.PowerNaturally.org
www.TheClimateProject.org
http://www.eia.doe.gov/