

Hot Planet, Cool Solution

A Classroom Activity Exploring Energy and the Environment

Overview: In this activity, you'll conduct a short experiment that demonstrates the basics of global warming, watch a presentation that explains why this problem is happening, and discuss how saving energy helps fix this problem and save money.

Time: One class session

Materials:

- Clear plastic two-liter bottle (at least one; see note below)
- Nail (or other tool to make a hole in the plastic bottle)
- Two thermometers
- Copies of the "Greenhouse Effect" handout (the last page of this activity)
- Slide presentation (on the "For Teachers" page of the Green Allowance website)

Note: In this activity's experiment you can use one clear plastic bottle and two thermometers and have the class work together on one experiment. Or, if you prefer, you can use several bottles and thermometers and break the students into smaller groups that can each conduct the experiment with their own bottle and thermometers. If the students will conduct the experiment in groups, you may prefer to make the holes in the bottles before class, and carefully seal the holes with a small piece of tape.

Also, if you can't use the bottle, you can also conduct this experiment inside a car that's been parked in the sun with the windows up.

Set Up: Download the slide presentation (available at the "For Teachers" page of the Green Allowance website) and prepare to display it onscreen for the students. Before the class, lay the plastic bottle or bottles on the ground in full sunlight. Make copies of the "Greenhouse Effect" handout as needed.

Global warming and climate change are problems that are in the news a lot today, and some of the news can be alarming. Scientists have predicted that the world's heating climate can mean dangerous changes for life on Earth. To be sure, most environmental scientists believe that climate change is our most urgent environmental issue.

But students shouldn't be frightened. While the problem is serious, the good news is that this is a problem we can solve, and young people can play a very important role in turning the tide. In this activity, you'll introduce your students to some of the science behind this issue, and help them brainstorm things they can do to help.

1. Begin by asking the students if they've ever heard of "global warming" or "the greenhouse effect." If they have, ask the students to discuss what they think these terms mean.

When the discussion is done, or if the students aren't familiar with these terms, explain that global warming is an urgent environmental problem. In fact, many scientists think it's the most important environmental issue humans have ever faced.

It means that the Earth's temperature is rising, and it's caused by something called the greenhouse effect. Explain that you'll do a short experiment that might help demonstrate what's happening.

2. Take the students outside to the plastic bottle that's been sitting in the sun. Give the students the "Greenhouse Effect" handout, and ask the students to make a prediction about how they think the temperatures inside and outside the bottle will compare. Will the temperature be higher inside or outside the bottle, or will the temperatures be the same? Ask the students to list their predictions and explain why they've made their predictions on the handout.
3. Make a hole in the bottle and insert the thermometer into the bottle and record the temperature. At the same time, record the temperature just outside the bottle using the other thermometer. If the students are working in groups, have each group do this. Record the results on the handout. If the students are working in groups, you can have each group record the results of the other groups and average the results for all the groups.
4. Ask the students to reflect on the results and write a short explanation of why they think they got the results they did. Share some of the students' ideas through a discussion, and explain that you'll go back inside to watch a short presentation that might help explain the results.
5. Show the students the slide presentation. The presentation is a slide show saved in PDF format; each page of the file is a different slide. You can read the slides aloud, ask the students to read aloud, or simply give the students enough time to read the slides as you advance through them.
6. When the presentation is complete, ask the students if they can explain what our pollution problem is. (*Too much CO₂ in the air is causing our climate to heat up.*)

The slideshow talks about a problem called the greenhouse effect. Ask the students if they remember what the greenhouse effect is. (*CO₂ traps the sun's heat in the atmosphere, much like the glass in a greenhouse traps the sun's heat to make the greenhouse warm inside.*)

Ask the students if they see any connection between the experiment they conducted earlier and the greenhouse effect that the slide show talks about. (*The experiment probably*

generated a similar result. The temperatures inside the plastic bottles were higher than the temperatures outside the bottles. If those are the results the students got, then they've demonstrated the greenhouse effect themselves! The plastic bottle worked the same way that a greenhouse works—the bottle trapped the sun's heat inside the bottle, making it warmer inside the bottle than outside the bottle.)

Explain that the CO₂ in our planet's atmosphere is like the plastic bottle. A layer of CO₂ around the planet is trapping the sun's heat, making the air in our atmosphere warm up. Explain that while some CO₂ is important in helping warm the Earth (otherwise this would be a very cold place!), too much CO₂ is making it too warm.

7. Next, ask the students if they remember what the connection is between this problem and the electricity we use every day. *(Most power plants burn coal or gas to create electricity, and a byproduct of burning them is CO₂. Because we use a lot of electricity, our power plants are burning a lot of fuel, and, in turn, are emitting a lot of CO₂.)*
8. Wrap up the activity by discussing how we can fix this problem. If using electricity contributes to the problem, what can we do to fix it? *(The slide show suggests using less electricity to help address the problem. If we use less electricity, power plants will create less electricity, and also will emit less CO₂). The slide show also indicates that this strategy helps save money. Why? (Power companies monitor exactly how much electricity we use, and we pay for what we've used. If we use less, we pay less.)*
9. End the session by asking students to brainstorm, either as a class or in small groups, ways that they can save electricity at home. Ask the students to share some of their ideas. If you like, you can discuss their ideas, asking questions such as, "Do any of you already do some of these things? Why or why not?," "Which of these ideas seem easier to do and which seem more difficult?," and so on.

You may also want to discuss how the students think their energy-saving ideas might save them money on electric bills. Which ideas do they think might save them the most money? You can explain that it's not easy to estimate how much certain energy-saving strategies will save you on your bill. For example, turning off the lights when you leave a room always saves you money, but the amount you save depends on the kind of bulb you use and how long the light is off.

But these savings can really add up. Big power users, such as WalMart stores, can save a lot of money by turning lights off. In fact, one new strategy they're using in some of their stores involves using sunlight instead of light bulbs to light the stores during the day. The system saves them an estimated \$85,000 per store every year!¹

¹ Each day lighting system saves 800,000 kW-h. At an average cost 10.6 cents/kW-h for commercial power use, total savings is \$84,800. (http://walmartstores.com/sites/sustainabilityreport/2009/en_b_examples.html http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html)



You can also share with the students some of the following energy-saving strategies that can also save them money:

Action	Estimated Savings
Changing one traditional incandescent light bulb to a more efficient compact fluorescent (CFL) bulb	\$4.60 per year
Regularly cleaning or replacing your air conditioner filter	\$7 per year
Getting rid of a second refrigerator	\$120 per year

10. Finally, you can send the students to **greenallowance.com** to follow up on what they've learned. At the site, they can learn more strategies for saving energy, and they can talk to their parents about sharing the energy savings as a "green allowance." If your electric utility is partnered with Green Allowance, the students will receive personalized Scorecards to see real data about their household power usage and their savings. Even if your utility isn't partnered, students can still use the site, and their families will receive a Scorecard that estimates their savings. And if your students are interested, you can create a school team that can compete with students from other schools to save energy and save money. See "How to Build a School Team" in the "For Teachers" area of the site for ideas.

The experiment included in this classroom activity was inspired by "The Greenhouse Effect" lesson included in the "Climate Change, Wildlife, and Wildlands" activities created by the US EPA, National Park Service, and the US Fish and Wildlife Service, available online at:
http://www.epa.gov/climatechange/wycd/downloads/SA_Experiments.pdf

The Greenhouse Effect

Prediction:

Reason for My Prediction:

Results:

	Inside Temperature		Outside Temperature
Average Inside Temperature:		Average Outside Temperature:	

Conclusion: