



Earth Week and Beyond: Earth Science Lesson Collection

AUTHOR

Charles De Ville, *Kapolei Middle*

GRADE LEVEL

6
7
8

CONTENT TOPICS

Earth Science
Environmental Science
Science

DESCRIPTION

This in-depth collection of lessons, vocabulary, and resources can be used for Earth Week or to support Earth Science activities throughout the year. Topics include, alternative energy, advocacy, understanding carbon, energy sources, home energy inventory, global warming, the future of innovation, and differentiated summative presentation activities (oral presentation, poster).

SUGGESTED STANDARDS CONNECTIONS

Common Core ELA	CCSS.ELA-LITERACY.SL Speaking and Listening Comprehension and Collaboration Presentation of Knowledge and Ideas
NGSS	MS-ESS2 Earth's Systems MS-ESS3 Earth and Human Activity

Alternative Energy Lesson Plan

Teacher: _____

Class: _____ Period: _____ Date: _____

Standards addressed: Science in Society – how science, society and technology are inter related. Life Science – diversity and adaptation of organisms.

Science as Inquiry – abilities to do scientific inquiry.

Component: Building Awareness **Suggested Time:** 1-2 blocks **Assessment:** Formative

Objective(s):

Teachers will uncover their student's prior knowledge of climate change, pollution and energy sources while building crucial vocabulary. Ultimately, students should understand this basic concept: Creating power, from electricity in the home to acceleration in a car, often requires burning fuels. Common byproducts of burning fuel are gases that enter our atmosphere and have a number of effects.

Teacher preparation: To prepare for the conversation that will result from this activity, watch these short videos at teach.choosezero.com or see resource links page. for quick background on the sources of energy and their impact on the environment. Feel free to share these with students, too, if you determine it would be helpful.

“Energy Sources” (6 min.)

A quick comparison of the most commonly discussed sources of energy

<http://www.teachersdomain.org/resource/phy03.sci.ess.earthsys.energysource>

“Making Electricity at a Coal-Burning Plant” (5 min.)

Explaining the connection between burning fuel and producing power

<http://www.teachersdomain.org/resource/ket09.sci.phys.energy.coal>

Activity 1: Word Splash

Step 1: using a circle map, brainstorm a definition, as well as related phrases, words, or ideas associated with the term. Then give the teams 5-10 minutes to look for a definition.

As a class, check and compare the actual definitions with the groups' initial ideas and discuss misconceptions.

CARBON DIOXIDE

ENERGY

EMISSION

CARBON FOOTPRINT

GREENHOUSE EFFECT

GLOBAL WARMING

FOSSIL FUEL

RENEWABLE RESOURCE

NON-RENEWABLE RESOURCE

Step 2: Show the “Energy Sources” video to the class. Have students work in small groups to prepare for a class discussion of where energy comes from. Be sure that each group is researching a different energy source, including coal, oil,

natural gas, nuclear, hydroelectric, wind, etc. Have students compare benefits and drawbacks in a chart. (attached)

Activity 2: “You vs. CO₂!” Game Show

Step 1: Divide class into two groups to take part in the “You vs. CO₂!” Game Show. Take turns asking the following questions of each group. Each right answer earns a point; if one team fails to get the answer, offer it to the other. If both fail, give the point to “CO₂.” High score wins; don’t let “CO₂” come out!

“You vs. CO₂!” Game Show Questions

1. What is the C in CO₂? (*carbon*)
2. Name one source of carbon dioxide. (*human breath, burning trees, burning fossil fuels*)
3. Name three greenhouse gases. (*carbon dioxide, water vapor, methane, ozone, nitrous oxide*)
4. Greenhouse gases get their name because of what they do to our atmosphere. What is that? (*heat it; trap heat; raise temperature*)
5. Name two reasons we burn fuels. (*generate electricity, transportation, heating and cooling homes*)
6. The measure of how much carbon dioxide emissions you’ve helped produce is called your ...? (*carbon footprint*)
7. Fossil fuels emit carbon when burned. Name two kinds. (*coal, oil, natural gas*)
8. Name two things that absorb carbon from the atmosphere. (*plants, oceans*)
9. Name two renewable energy sources. (*solar, wind, hydroelectric, biomass*)
10. Name one way to reduce your carbon footprint. (*Various answers are acceptable, but the best will focus on consuming less energy. Bonus points for creativity!*)

Suggested Assessments:

Comparing Sources of Energy: Provide students with other research links from the Department of Energy. Divide students into groups and assign them a different source of energy to present to the class. What are the benefits of each? What are the challenges that keep us from relying on them 100%?

Greenhouse Poster: Have students make a bulletin board display or poster explaining the greenhouse gas effect. Links from the U.S. Environmental Protection Agency provide helpful guidance.

Component: Understanding Carbon **suggested time:** 1 block assessment: formative

Objective(s):

Students will build a 10 g “carbon cube” from recycled materials and use it to visualize the amounts of carbon emitted by everyday activities. Teachers may optionally build a 1 kg model to further illustrate emissions.

Teacher preparation: To prepare for discussions of how carbon emissions lead to global warming, view “Studying Global Warming in Biosphere 2” (5 min.) at teach.choosezero.com or see resource links page.

Activity: Connecting Carbon to Climate Change

Step 1: Ask: “How does the morning bus ride to school make our atmosphere warmer?” While students share answers, write this grid on a blackboard or whiteboard:

Step 2: Have students take turns suggesting items for the “Activities” column (such as “watch TV”) as well as sources of required energy (such as “electricity” or “gasoline”). Ask them to estimate the size of the “Carbon result” using multiple plus signs (or minus signs if the activity absorbs carbon or is neutral). What activities do students think will lead to a lot of carbon emissions? What activities lead to only a little? Which activities are habits they could change to reduce the carbon result?

Step 3: Write “Eating an apple” in the first column. To fill in the second column, ask students for all the ways energy is used to bring that apple to their table, from harvesting to transporting. Then try “planting a garden” and “biking to school” in the first column to examine other actions that could reduce carbon results.

Step 4: When reproducing the worksheet at right, copy the Carbon Menu (attached) on the reverse, or project it large enough for students to see. This gives students one more point of reference for visualizing carbon emissions.

Suggested Assessments:

The Hamburger Cube. Follow our instructions for building a 1 kg “carbon cube.” This activity uses recycled cardboard to build a cube that helps students visualize the carbon emissions of a hamburger.

The 10 g Cube: Follow our templates and instructions for building a smaller cube that represents 10 grams of carbon. Students can hold this cube in their hands and combine them for further visualization exercises.

Global emissions diagram: Using graph paper and data from the Union of Concerned Scientists, have students make a bar chart of the 10 countries with the largest carbon emissions.

VISUAL IZING CARBON

We produce carbon dioxide (CO₂) every time we consume energy. Since carbon dioxide (CO₂) is an invisible gas, we’ll need to picture it in a way we can all understand.

Visualization Method 1: 1 kg of carbon dioxide would occupy the space under a standard school desk.

Visualization Method 2: In the corner of your classroom, measure 32” away from the corner along one wall and mark the distance with a length of masking tape. Repeat this until you have marked three 32” x 32” squares

that meet in the corner of your room. {Thumbnail illustration showing this method}

Visualization Method 3: Your teacher may help you make a “Carbon Cube” from recycled cardboard to visualize carbon emissions with something you can actually hold.

1. Use a tape measure or a cardboard carbon cube to estimate how many 1 kg cubes of carbon would fit in your classroom.

2. A load of hot-water laundry represents 1 kg of CO₂. How many loads of laundry does your household do in a week? How many 1 kg cubes would you have to build to represent this amount?

3. Two miles of driving a standard car represent 1 kg of CO₂. How many miles does your family car travel in a day? How many 1 kg cubes would you have to build to represent this amount?

4. A 10-minute shower represents 1 kg of CO₂. If everybody in your class took a 5-minute shower, how many days would it take to save one classroom-full of carbon dioxide?

Component: Consequences **Suggested time:** 1-2 blocks **Assessment:** Formative

Objective(s):

Students will conduct research on animals affected by global warming and predict how other animals and habitats might be affected by climate change.

Activity: How Global Warming Affects Animals

Step 1: Distribute the KWL worksheet (attached). Students will use it to gather facts about polar bears, and they will also choose another animal to research. Give them time to fill out the first column.

Step 2: Explain that global warming is a threat to these animals, but it will be up to them to discover why. They should now fill out the second column so they know how to direct their research. If you like, use the resources at teach.choosezero.com or on the resource links page to get students on their way.

Step 3: After they have had time to research, bring them together to share their findings. On a blackboard, list what they learned about how melting arctic habitat hurts polar bears' ability to hunt and reproduce. Have groups of students present what they learned about their chosen animal. How are the plights of these animals related? Can they predict other consequences of global warming that could affect other animals?

Step 4: At teach.choosezero.com, watch "Polar Bears and Climate Change" (3 min.) with the class for powerful analysis of how shrinking arctic regions are affecting the polar bear population.

Suggested Assessments:

"Adopt an Animal" Endangered Animal Study: Students can use research the links resources to learn more about affected species and complete the worksheet.

Arctic Slideshow: Evocative photos illustrate the arctic landscape as it exists now.

Beyond Animals: Before having students visit the "Global Warming Effects

Map” and “Global Warming Impacts” online activities, ask students to predict other consequences that result from global warming. Then, after viewing those resources, have each student explain one consequence to the class. Were their guesses accurate? What affects of global warming are most surprising? Will we feel any of those impacts where we live?

Component: Personal Action **Suggested Time:** 2-4 blocks **Assessment:** Formative

Objective(s):

Students will do an inventory of their home and school to find places where energy could be saved.

Activity: Home Energy Inspection

Step 1: Pass out the inspection sheet (attached) and explain that students are going to hunt for obvious energy savings in their own home. They’ll start in four areas.

Share these facts to help them understand why these areas are important:

Lighting: Unlike incandescent bulbs that heat a metal filament to produce light, CFLs use far less energy by running a current through a tube containing argon gas and mercury vapor. This process uses about 75% less energy than incandescents, and the bulbs last 10 times longer.

Appliances: Appliances like computers and TVs still drain power while turned off. This “standby power” accounts for 5-10% of energy used in homes, making it responsible for almost 1% of global CO₂ emissions.

Recycling: The United States recycles 32% of its waste; this saves an amount of greenhouse gas equivalent to removing 39.6 million cars from the road. Increasing the rate to 35% would reduce emissions by an additional 5.2 million metric tons.

Cooling: Home heating and cooling systems are the largest energy consumers in the home, so saving energy here can have the biggest effect the fastest. U.S. electricity consumption totaled nearly 3,741 billion kilowatt hours (kWh) in 2009. That’s about 13 times greater than 1950.

Step 2: Have students research more ways to save energy in the home, then present their favorite tip to the class. They should make a case for why the rest of the class should adopt this idea. Vote for the most popular idea. What makes that idea the favorite? Is there something about this idea that can appeal to parents and others to get them engaged with cutting energy use?

Source: U.S. Department of Energy, Environmental Protection Agency, Lawrence Berkeley National Laboratory

Suggested Assessments:

Tips for Greener Living: Develop a listing of Resources for student research on energy-saving habits.

Footprint Calculator: Compare energy use and carbon emissions between students in the classroom.

Forming a School Eco-Team: How to track your school’s energy use and encourage reductions.

EXTENSION ACTIVITY: (additional 2 weeks) Integrate the MSOSW curriculum on the ‘Standby Power Conservation Project’ – KillAWatt activity distributed through RET (8/13/2010)

Component: Solutions **Suggested Time:** 1 block **Assessment:** Formative

Objective(s):

Students will examine ways the science can reduce carbon emissions, then brainstorm ways future innovation can improve modern solutions.

Activity 1: Renewable vs. Nonrenewable

Step 1: Ask students to name a “renewable energy source” (such as solar, wind, hydroelectric or geothermal power). Discuss how these differ from nonrenewable ones for which only a fixed amount exists (coal, oil, natural gas).

Use the following videos (found at teach.choosezero.com or resource links page) to get students thinking about alternative solutions to current problems.

“Solar House” (4 min.):

An excellent overview of solar technology, and how energy-efficient technologies can reduce the carbon footprint of the home of the future.

“Designing Future Cities: Alternative Energy” (2 min.):

How a team of students are designing cities of the future by considering the energy that powers the grid.

Step 2: Split students into groups and assign them a power source to research and analyze. Ask the groups to chart the advantages and disadvantages of each source. Then, as a class, have each group propose ways that your school currently uses that power source, or could use that power source in the future. What do they recommend as the best solution for the school? What are the challenges to switching to different power sources? What needs to happen for some of them to become more viable options?

Activity 2: Innovation For The Future

Step 1: Use the worksheet (attached) to get students thinking about how scientists are tackling the problem of carbon emissions. When they complete the imagination exercise, share their ideas as a class to see if they inspire each other with further developments and improvements—just the way real scientists work!

Suggested Assessments:

Innovation in Transportation: Students can report on other creative ways that the Center for Transportation Technologies and Systems is meeting the emissions challenge.

Embracing the Electric Car: New Yorkers discuss why electric cars would work in their city (2 min.). After watching the video,

Building Better Batteries: How a car can run solely on batteries. Students can report on innovations in battery technology.

Component: Advocacy **Suggested Time:** 1-3 blocks **Assessment:** Summative

Objective(s):

Students will create a poster or advertisement that 1) highlights an ecological issue, 2) presents a factual argument, and 3) instructs and inspires a change in behavior in the audience.

Activity 1: Persuasive Arguments

Step 1: Have students brainstorm about ads they've seen on TV, the radio, the Internet, or in print that they've seen recently. Discuss the ways in which the ads try to persuade the viewer/listener, as well as the advertiser's goal for running the ad (to inform, to sell a product, to persuade others to a cause, etc.). You may wish to have your own examples of persuasive ads to show online.

Step 2: Ask students to name the tactics these ads use to influence the viewer. Refer to this list of common techniques to see if they can name them all. If there are any techniques missing from the ads you've discussed, ask students to research examples and share them with the class. What is the most influential ad they can uncover? Does it change behavior, or does it simply make you aware of the brand or topic?

- A strong visual
- Powerful, persuasive headlines or catchy language/phrases
- Clear, persuasive facts, statistics, and/or logic
- Important people or sources that provide credibility
- Appeals to the audience's emotions and feelings
- A sense of urgency

Activity 2: Become an Earth Advocate

Step 1: Using the worksheet (attached), get students to choose an environmental from the list provided, or help them come up with one of their own they're passionate about.

Step 2: Have students create a poster, advertisement or PowerPoint presentation that highlights their issues and inspires a change in behavior that will have a positive impact. Answering the questions on the worksheet will help students research their topic and create a cogent argument based on facts, not

just opinions.

Suggested Assessments / Extensions:

Ad Archive: Students can study these classic print ads and posters to show how to get a message across.

Letter Campaign: How to contact politicians about cutting emissions and saving polar bears.