



Hidden Energy: Secondary Carbon Footprints

Overview

In this activity, students will work in small groups to observe an everyday object and diagram its lifecycle: the materials, marketing, and transportation that go into getting this product to the consumer as well how it is disposed of after use. A consumer's secondary carbon footprint refers to the combined indirect CO₂ emissions resulting from the lifecycles of products used by that consumer. Students will also be asked to consider how their object can be manufactured in an effort to minimize its carbon footprint. Ultimately, students will learn how their behavior and consumer choices impact their own carbon footprint and they will also have the opportunity to compare the carbon footprints of different products that meet the same consumer need.

This activity is adapted from "Hidden Energy Uses" in the *Environmental Science Activity Kit* by Michael Roa, 1993.

Alignment to North Carolina Essential Standards for Biology

Bio.2.2: Understand the impact of human activities on the environment (one generation affects the next).

Alignment to North Carolina Essential Standards for Earth/Environmental Science

EEEn.2.8: Evaluate human behaviors in terms of how likely they are to ensure the ability to live sustainably on Earth.

Essential Questions

- How is energy used in the production, transport, marketing, and disposal of a product?
- What is the connection between energy use and carbon dioxide (CO₂)?
- What is a carbon footprint? A secondary carbon footprint?
- What actions might manufacturers take to reduce the carbon footprint of a product?
- What action(s) might a consumer take to reduce the carbon footprint of a product?
- What action(s) might a consumer take to reduce his/her secondary carbon footprint?

Materials

- Poster paper, one sheet per group
- Crayons, colored pencils, or markers, one set per group
- An assortment of everyday consumer products, one item per group. Try to find some products that meet the same need in different ways (e.g. disposable water bottle versus a refillable water bottle; local apple versus a non-local Apple; disposable diaper versus cloth diaper).
 - Aluminum cans, plastic water or soda bottles, toilet paper, Styrofoam packaging, an apple, a processed food item (candy bar, spaghetti sauce), bar of soap, a DVD, a book, a newspaper, etc.
 - You could make this themed-based by focusing solely on food, or school supplies, etc.

Student Preparation for Activity

This activity should be preceded by a discussion of how energy and carbon dioxide are connected and how increased carbon dioxide emissions contribute to global warming. Students should also be familiar with the definition of "carbon footprint" and perhaps have an understanding of their own personal carbon footprint (See also *Calculating your Carbon Footprint*).

Duration

30-45 minutes

Procedure

1. Divide students into partners or small groups. Present each group with one everyday object and invite them to observe their object and any ingredient label present and then to use the poster paper and markers provided to draw/diagram the object's complete lifecycle based on what they know about the object: the materials used to make, market, utilize and

dispose of this object. Instruct students to record any questions or information that they don't know on a separate sheet of paper. Allow approximately 10 minutes for groups to make their initial diagram.

2. Next, invite groups to revisit their diagram to make sure they have accounted for (and labeled) the following attributes of their object's lifecycle:
 - Raw materials (source, how obtained, distance from manufacturer)
 - Manufacturing
 - Packaging, transport, and storage
 - Marketing
 - Use/Lifespan
 - Disposal
3. Next, ask students to indicate the steps on their diagram that use energy and result in CO₂ emissions. They might indicate this by drawing smoke containing CO₂ emerging from these energy consuming steps. Finally, invite students to approximate the size of the carbon footprint for their object (small, medium, large).
4. Ask students to consider their object from the perspective of the manufacturer and to record their answers to the following questions:
 - How can the carbon footprint of this object be reduced? (*Answers may include: using local sources for raw materials, reduced packaging, increased fuel efficiency, using renewable energy etc.*)
 - How might this reduction affect the manufacturer's production costs and profit?
 - Why should manufacturers consider reducing the carbon footprint of items they produce?
5. Ask students to consider their object from the perspective of the consumer and to record their answers to the following questions:
 - How can the carbon footprint of the object be reduced, if it is purchased? (*Answers may include: use all of product, reuse or recycle packaging*)
 - What is our responsibility to environmental issues as consumers? (*Discuss researching production methods of products and choosing those produced in more environmentally friendly fashions, such as recycled products.*)
 - Why is it important to consider production methods when purchasing, and/or reducing the carbon footprint of an object once purchased?
6. Ask students to consider if there is an alternative object that would meet the same need but with a smaller carbon footprint (e.g., a locally grown organic apple versus an apple from New Zealand). Ask students to discuss alternatives and to record their ideas/suggestions.
7. Invite a few student groups to discuss their object's lifecycle and its carbon footprint as well as the answers to some of the questions from above. If any groups evaluated different objects that meet the same need, be sure to have both groups present so that the class can compare footprints.
8. Conclude this activity by starting a discussion centered around these questions:
 - How is energy used in marketing an object?
 - Why is packaging important?
 - How is energy used in disposing of an object?
 - Did anything surprise you about your object and its lifecycle?
 - How can consumers reduce their secondary carbon footprints? (*Answers may include: buying locally produced goods, eating organic and seasonal produce, reducing meat consumption, reusing or recycling packaging, composting, avoiding use of disposable shopping bags, supporting sustainable business practices, etc.*)
 - When you purchase an item, what does that money go towards?
 - Discuss the concept that consumers can "vote with their wallet" and influence consumer products.

Extension

Show the online video *The Story of Stuff* available at <http://www.storyofstuff.org/movies-all/story-of-stuff/> and follow with a class discussion. Description from the website: "a 20-minute, fast-paced, fact-filled look at the underside of our production and consumption patterns, with a special focus on the United States. All the stuff in our lives, beginning from the extraction of the resources to make it, through its production, sale, use and disposal, affects communities at home and abroad, yet most of this is hidden from view. *The Story of Stuff* exposes the connections between a huge number of environmental and social issues and calls for all of us to create a more sustainable and just world."

Differentiation

Students with Special Needs

- Place students in mixed ability partners or small groups.
- Allow additional time for small group discussion and for drawing/diagramming the lifecycle of the object.

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- Invite students to complete this task individually, perhaps using an item of their choosing and/or conducting research into the details of the steps of the object's lifecycle (e.g., how are the raw materials acquired?).
- Have students visit a place that serves as one "stop" in a product's lifecycle and evaluate the energy efficiency of this "stop" and determine how it could become more energy efficient (e.g. a farm, a mine, a factory, or a solid waste facility).
- Have students conduct research and write an essay or hold a debate centered around the question "Is eating local always best?"

Resources

Sustainable Packaging

Science Friday- "Packaging- How Green?"

http://www.sciencefriday.com/pages/2007/Jul/hour2_071307.html

Sustainable is Good

<http://www.sustainableisgood.com/>

Sustainable Packaging, It's all about Harmony

<http://www.sustainableisgood.com/blog/2007/10/sustainable-pac.html>

Reflections from Dennis Salazar, president of Salazar_Packaging Inc., a certified MBE (Minority Business Enterprise) company specializing in flexible packaging products, equipment and solutions.

Interested in North Carolina's packaging industry?

<http://www.sustainableisgood.com/blog/2007/10/napco-eco-tray-.html>

NC-based Napco specializes in design and manufacturing of packaging for the entertainment industry. The company has developed a new product called ECOtray CD & DVD packaging made from 100% recycled pulp paper. The company claims ECOtray is one of the most environmentally friendly packaging solutions available in its category

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<http://calculator.carbonfootprint.com/calculator.aspx?tab=7>

<http://www.carboncycle.biz/carbon-footprint.html>

Climate Biz: The Business Resource for Climate Management

<http://www.climatebiz.com/>

EPA's WasteWise Climate Campaign

<http://www.epa.gov/epaoswer/non-hw/reduce/wstewise/climate/index.htm>