Calculating Your Carbon Footprint

Overview

In this activity, students will calculate their household's carbon footprint using the US EPA's *Personal Emissions Calculator* and will compare the size of their carbon footprint with that of another classmate. In addition, students will be asked to consider the limitations of this online carbon emissions calculator.

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

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

Essential Questions

- What is the connection between energy use and carbon dioxide (CO_2)?
- What is a carbon footprint?
- What is your household's carbon footprint?
- What actions can you take at home or in the car to reduce your carbon footprint?
- What aspect(s) of your lifestyle is(are) not taken onto account in this online carbon calculator?

Materials

- Computers with Internet access
- *Household Energy Consumption* Student Take-home Worksheet, one copy for each student, provided
- *Personal Emissions Calculator* Student Worksheet (simple or advanced version), one copy for each student, provided
- Different Sized Footprints, one copy for each student, templates provided
- Tape

Student Preparation for Activity

This activity could be preceded by a discussion of the carbon cycle and the greenhouse effect and how human activities are contributing to increased carbon dioxide levels in the atmosphere.

Duration

25-30 minutes

Procedure

1. Ask students to complete the *Household Energy Consumption* Student Take-home Worksheet with their head of household and to return their completed forms to class.
2. Distribute one copy of the *Personal Emissions Calculator* Student Worksheet (simple or advanced version, depending on the level of students) to each student. Instruct students to follow the directions on this sheet as they complete the online *Personal Emissions Calculator*.
3. Ask students to visit http://www.epa.gov/climatechange/emissions/ind_calculator.html and complete the online *Personal Emissions Calculator* by entering the data they previously recorded with their head of household on the *Household Energy Consumption* Student Take-home Worksheet. **You will need to emphasize to students that they should use the Tab button to navigate through this online calculator.**
4. Once students have calculated their total emissions (a.k.a. "carbon footprint"), ask them to come to the front of the classroom and pick up a copy of a footprint that corresponds to the size of their carbon footprint. Instruct students to write their total carbon emissions in the box indicated on the sheet and tape it to the board at the front of the room.

5. Invite students to find a partner to conduct the Think-Pair-Share activity on their *Personal Emissions Calculator* Student Worksheet.
6. Direct students to complete the section of the calculator titled "What You Can Do to Reduce Emissions." Remind students that they should only input data for realistic actions they or their parents could take.
7. Conclude this activity by starting a discussion centered around these questions:
    - Notice the variation in the sizes of your carbon footprints. What factors contribute to this variation?
    - What aspect(s) of your lifestyle were not taken into account by this carbon calculator and therefore not reflected in your footprint?"

Culminating Activities

- Ask students to discuss their carbon footprint with their families and to possibly adopt one carbon dioxide emissions reduction strategy.
- Have students complete a different online carbon calculator (see the *Resources* section) and compare their results in a writing assignment.
- Have students watch the film "Kilowatt Ours" to learn more about where electricity comes from.
- Have students conduct one or more activities from the "Kilowatt Ours" companion curriculum.

Differentiation

Students with Special Needs

- Place students in mixed ability partners for activity completion.
- Use the Carbon Calculator worksheet, simple version.

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- Use the Carbon Calculator worksheet, advanced version.
- Ask students to summarize their findings in writing.

Resources

- EPA's Power Profiler:
  This site provides a breakdown of the fuel mix used to generate electricity by zip code.
  www.epa.gov/powerprofiler/

- Kilowatt Ours Companion Curriculum:
  This curriculum includes activities focused on assessing home energy use and conservation measures.
  http://www.kilowattours.org/

Additional Online Carbon Calculators

- http://www.epa.gov/climatechange/ghgemissions/individual.html
- Carbon Footprint Calculator
- http://www.carbonfootprint.com/calculator1.html
- BP Carbon Footprint Calculator
  www.bp.com/carbonfootprint/

Name: _____

Household Energy Consumption — Student Take-home Worksheet

The following household information is required for successful completion of EPA's Personal Emissions Calculator. Please ask the head of your household to provide you with the following information and bring this completed sheet with you to class by _____.

Transportation

1. On average, how many miles do you put on your household's *primary* vehicle per year? _____miles

2. What is the average gas mileage for this vehicle (*miles per gallon*)? _____miles per gallon

Home Energy Use

3. How do you heat your house?
   O Natural Gas O Electric Heat O Fuel Oil (kerosene or propane)

4. What is your average *monthly* natural gas bill? $_____

5. What is your average *monthly* electric bill? $_____

6. What is your average *monthly* fuel oil (kerosene/propane) bill? $_____

7. Which of the following items does your household recycle?
   - O glass
   - O aluminum/steel
   - O plastic bottles
   - O magazines/catalogs
   - O newspaper
   - O paper

Name: _____

Household Energy Consumption — Student Take-home Worksheet

The following household information is required for successful completion of EPA's Personal Emissions Calculator. Please ask the head of your household to provide you with the following information and bring this completed sheet with you to class by _____.

Transportation

1. On average, how many miles do you put on your household's *primary* vehicle per year? _____miles

2. What is the average gas mileage for this vehicle (*miles per gallon*)? _____miles per gallon

Home Energy Use

4. How do you heat your house?
   O Natural Gas O Electric Heat O Fuel Oil (kerosene or propane)

4. What is your average *monthly* natural gas bill? $_____

5. What is your average *monthly* electric bill? $_____

6. What is your average *monthly* fuel oil (kerosene/propane) bill? $_____

7. Which of the following items does your household recycle?
   - O glass
   - O aluminum/steel
   - O plastic bottles
   - O magazines/catalogs
   - O newspaper
   - O paper

NAME:_____

Personal Emissions Calculator **Student Worksheet**

1. What is the connection between energy use and carbon dioxide (CO_2)?

2. What is meant by the phrase "carbon footprint?"

3. **Go to:** http://www.epa.gov/climatechange/emissions/ind_calculator.html and complete this online worksheet as you enter the information you collected on the *Household Energy Consumption* Student Take-home Worksheet. ***Note: Use the Tab button to navigate through this online calculator.***

4. Once you have entered all of the data from your *Household Energy Consumption* Student Take-home Worksheet, the online calculator will calculate your total emissions. How many TOTAL pounds of CO_2 does your household generate per year?

   Your Carbon Footprint =_____ lbs

5. **How BIG is your Carbon Footprint?** Come to the front of the classroom and pick up the footprint that corresponds to your total emissions per year. Write your total emissions per year (*from step #4 above*) on the footprint and tape it to the board at the front of the room.

6. **Think-Pair-Share Activity:** Pair up with a neighbor who has a different sized footprint than yours and discuss the reason(s) for the difference and list your ideas below:

7. **What Can You Do to Reduce Emissions?** Now, proceed through the section of the online calculator titled "What You Can Do to Reduce Emissions" and read through the list of actions (on the left side of the screen) you can take on the road, at home, and to reduce waste to determine if there is at least one action you and your parents can take to reduce your emissions.

   What action(s) can you take? _____

   What action(s) can your parents take? _____

   How much would your emissions be reduced by if you and your parents took these actions? _____ lbs

   If you and your parents took these actions, what would your **new total CO_2 emissions** be? _____ lbs

8. a. What aspect(s) of your lifestyle were not taken into account by this online carbon calculator?

   b. How would your carbon footprint be altered if the online calculator took this into account? Would it be bigger or smaller?

NAME:_____

Personal Emissions Calculator **Student Worksheet**

1. What is the connection between energy use and carbon dioxide (CO_2)?

2. What is meant by the phrase "carbon footprint?"

3. **Go to: http://www.epa.gov/climatechange/emissions/ind_calculator.html** and complete this online worksheet as you enter the information you collected on the *Household Energy Consumption* Student Take-home Worksheet. ***Note: Use the Tab button to navigate through this online calculator.***

4. **Transportation:** If you do not drive your own vehicle, enter this data for the primary vehicle your family uses to transport you to work/school/events etc. If you drive your own vehicle, enter mileage and fuel efficiency data. According to the calculator, how many pounds of CO_2/year do you generate from transportation? _____ lbs

5. **Home Energy:** According to the calculator, how many pounds of CO_2/year does your home generate through the use of natural gas, electricity, or fuel oil (kerosene/propane)? _____ lbs

6. **Home Waste:** According to the calculator, how many pounds of CO_2/year does your household generate from waste (before taking recycling into account)? _____ lbs
   Total Waste Emissions Before Recycling

7. How does household waste contribute to greenhouse gas emissions?

8. **Recycling:** After accounting for your household's recycling efforts, how many pounds of CO_2/year does your household generate from waste? _____ lbs
   Total Waste Emissions After Recycling

9. How many pounds of CO_2 does your family save by recycling? _____ lbs
   (subtract answer for step #8 from the answer for step #6)

10. Once you have entered all of the data from your *Household Energy Consumption* Student Take-home Worksheet, the online calculator will calculate your total emissions. How many TOTAL pounds of CO_2 does your household generate per year? **Your Carbon Footprint =_____ lbs**

11. **How BIG is your Carbon Footprint?** Come to the front of the classroom and pick up the footprint that corresponds to your total emissions per year. Write your total emissions per year (*from step #10 above*) on the footprint and tape it to the board at the front of the room.

12. **Think-Pair-Share Activity:** Pair up with a neighbor who has a different sized footprint than yours and discuss the reason(s) for the difference and list your ideas below:

13. **What Can You Do to Reduce Emissions?** Now, proceed through the section of the online calculator titled "What You Can Do to Reduce Emissions" and read through the list of actions (on the left side of the screen) you can take on the road, at home, and to reduce waste to determine if there is at least one action you and your parents can take to reduce your emissions.

    What action(s) can you take? _____

    What action(s) can your parents take? _____

    How much would your emissions be reduced by if you and your parents took these actions? _____ lbs

    If you and your parents took these actions, what would your **new total CO_2 emissions** be? _____ lbs

14. a. What aspect(s) of your lifestyle were not taken into account by this online carbon calculator?

    b. How would your carbon footprint be altered if the online calculator took this into account? Would it be bigger or smaller?

1. What is the connection between energy use and carbon dioxide?
   Energy made available through the burning of fossil fuels such as coal, results in the production of carbon dioxide which is released to the atmosphere. This is because the fuel used is made up almost entirely of carbon and when you burn it, the carbon joins with oxygen in the air to make carbon dioxide. Carbon dioxide is one of the greenhouse gases responsible for global warming.

2. What is meant by the phrase "carbon footprint?"
   A carbon footprint refers to the amount of carbon dioxide (pounds/year) emitted by an individual, household, or business. Having knowledge of what activities/behaviors contributes to one's carbon footprint is essential to assessing the various strategies for reducing one's carbon dioxide emissions.

3. Go to: http://www.epa.gov/climatechange/emissions/ind_calculator.html and complete this online worksheet as you enter the information you collected on the *Household Energy Consumption* Student Take-home Worksheet. ***Note: Use the Tab button to navigate through this online calculator.***

4. Your Total Emissions: How many TOTAL pounds of CO_2 does your household generate per year?
   Your Carbon Footprint = *Answers will vary* **lbs**

5. **How BIG is your Carbon Footprint?** Come to the front of the classroom and pick up the footprint that corresponds to your total emissions per year. Write your total emissions per year (*from step #4 above*) on the footprint and tape it to the board at the front of the room.

6. **Think-Pair-Share Activity:** Pair up with a neighbor who has a different sized footprint than yours and discuss the reason(s) for the difference and list your ideas below:
   Differences in footprint sizes according to this calculator may be attributed to one or more of the following:
   - *Miles driven per year*
   - *Fuel efficiency of car*
   - *Number of people in household*
   - *Thermostat settings during summer and winter*
   - *Number of household appliances*
   - *Size of house (cost of heating and cooling)*
   - *Mix of natural gas, electricity, fuel oil used*
   - *Recycling Efforts of household*

7. **What Can You Do to Reduce Emissions?** Now, proceed through the section of the online calculator titled "What You Can Do to Reduce Emissions" and read through the list of actions (on the left side of the screen) you can take on the road, at home, and to reduce waste to determine if there is at least one action you and your parents can take to reduce your emissions.

What action(s) can you take?	*Answers will vary*
What action(s) can your parents take?	*Answers will vary*
How much would your emissions be reduced by if you and your parents took these actions?	*Answers will vary*
If you and your parents took these actions, what would your new total CO_2 emissions be?	*Answers will vary*

8. What aspect(s) of your lifestyle were not taken into account by this carbon calculator? *(answers will vary; sample answers are below)*	9. How would your carbon footprint be altered if the calculator took this into account?
More than one car in household	*Carbon footprint would be greater*
Use of biofuel	*Carbon footprint would be smaller*
Use of two or more heat sources (e.g. electric heat and fuel oil)	*Carbon footprint would be greater*
Air travel of family members	*Carbon footprint would be greater*
Recycling of paper, junk mail, plastic shopping bags	*Carbon footprint would be smaller*
Use of re-useable shopping bags	*Carbon footprint would be smaller*
Family members eat meat regularly	*Carbon footprint would be greater (the raising and transport of meat uses more energy)*

This footprint size is for 10,000 - 20,000 pounds of carbon dioxide/year

Your Total Emissions =

_____

Pounds of Carbon Dioxide/Year

This footprint size is for 20,000 - 30,000 pounds of carbon dioxide/year

Your Total Emissions =

_____

Pounds of Carbon Dioxide/Year

This footprint size is for 30,000 - 40,000 pounds of carbon dioxide/year

Your Total Emissions =

_____

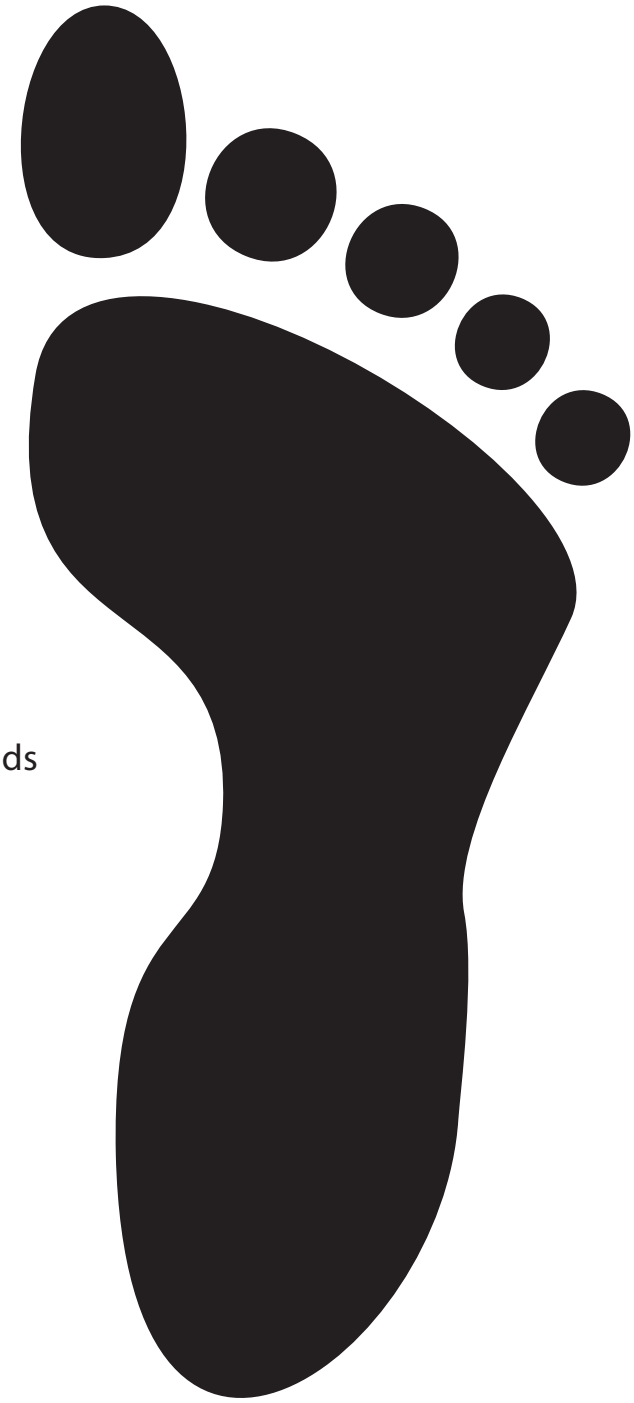
Pounds of Carbon Dioxide/Year

This footprint size is for 40,000 - 50,000 pounds of carbon dioxide/year

Your Total Emissions =

_____

Pounds of Carbon Dioxide/Year

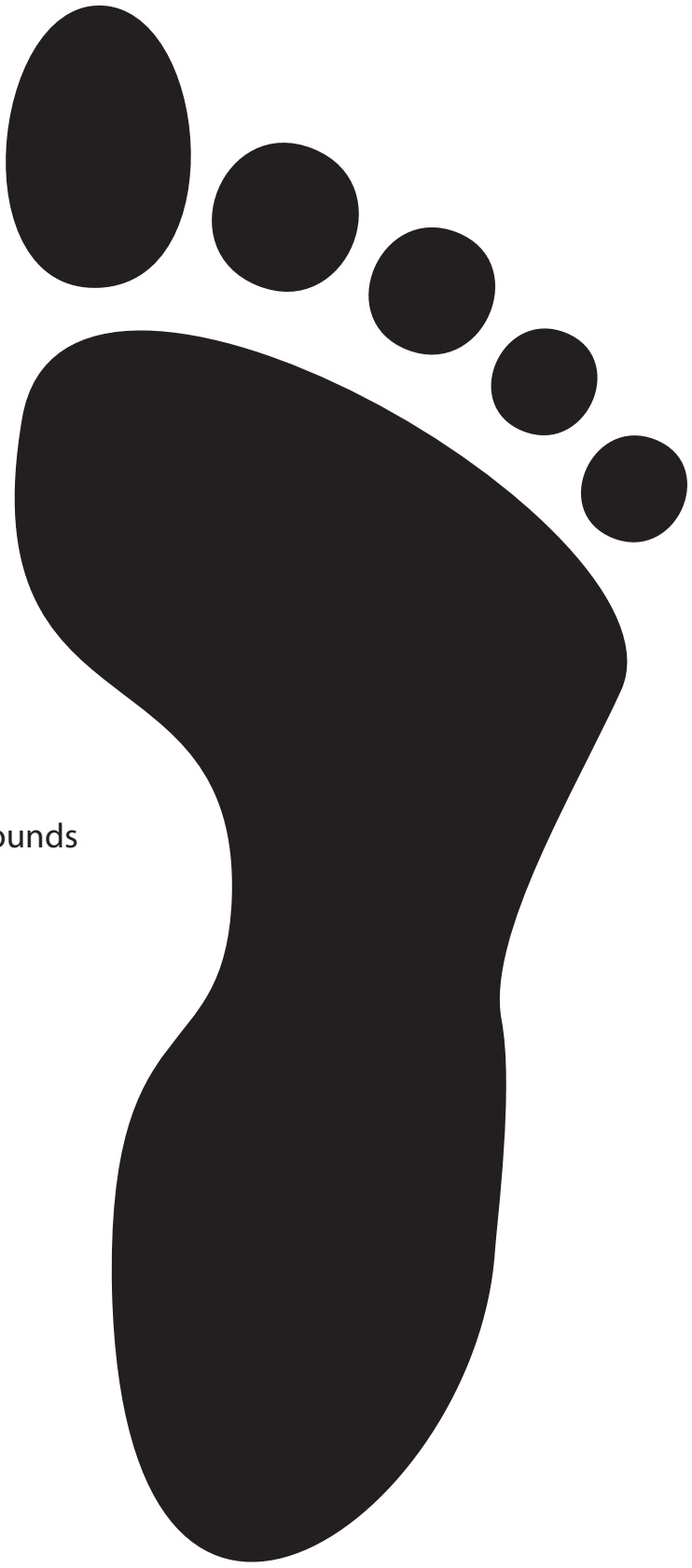


This footprint size is for 50,000 - 60,000 pounds of carbon dioxide/year

Your Total Emissions =

_____

Pounds of Carbon Dioxide/Year



This footprint size is for 60,000 or more pounds of carbon dioxide/year

Your Total Emissions =

_____

Pounds of Carbon Dioxide/Year