Name: _____ **Date:** _____ **Class/Period:**_____

Activity 5.1: How Much Difference Can a Bulb Make?

Background

Because energy cannot be created or destroyed, all the energy you use must be obtained and transformed from another source. Turning on the lights in your house requires energy to be transformed in an electrical power plant. Considering that many power plants still burn fossil fuels to make electricity, turning on a light bulb or an appliance in your house adds carbon dioxide to the atmosphere.

Prediction

You can buy different types of light bulbs for your house – incandescent light bulbs and compact fluorescent light (CFL) light bulbs are the two most standard bulbs that people buy. Look at the descriptions of the two below.

Incandescent Light Bulb	Compact Fluorescent Light (CFL) Bulb
Lasts 500-2000 hours	Lasts about 6000 – 10,000 hours
10% energy used for light	> 80% energy used for light
100 watts (amount of energy) = 1500 lumens (amount of light)	25 watts (amount of energy) = 1500 lumens (amount of light)

If you had the two types of light bulbs on for 10 hours a day for one year (10 hours a day for 365 days a year = 3650 hours), which one do you think would result in adding more carbon dioxide to the atmosphere? How many pounds more do you think it adds? Why?

Students' responses will vary. The purpose is just to get them to think about the quantity before they calculate it.

Directions
The amount of carbon dioxide added to the atmosphere from using a light bulb depends on where your electric company obtains the energy. Typically electric companies obtain energy from a variety of sources such as natural gas, oil, nuclear, hydro, solar and coal. This means the amount of carbon dioxide emissions does vary, but one estimate for how electricity use translates into carbon dioxide added to the atmosphere is:

1 watt - hour of electricity = **0.00164 pounds of carbon dioxide**

Below we used the estimate to calculate how much carbon dioxide a typical refrigerator adds to the atmosphere in one day – 28.536 lbs.

Use the table below to calculate how many pounds of CO_2 an incandescent light bulb adds if it is on for 10 hours and then 10 hours/day for an entire year (3650 hours). Then calculate how many pounds of CO_2 a CFL light bulb adds if it is on for 10 hours and then 10 hours/day for an entire year (3650 hours).

Appliance	**Watts/hour X**	**Hours X**	**0.00164 lbs CO_2 =**	**Total lbs CO_2**
Example: Refrigerator	*725 watts/hour*	*24 hours*	*0.00164 lbs CO_2*	*28.536 lbs*
incandescent light bulb	*100 watts*	*10 hours*	*0.00164 lbs CO_2*	*1.64 lbs CO_2*
incandescent light bulb	*100 watts*	*3650 hours*	*0.00164 lbs CO_2*	*598.6 lbs CO_2*
CFL light bulb	*25 watts*	*10 hours*	*0.00164 lbs CO_2*	*0.41 lbs CO_2*
CFL light bulb	*25 watts*	*3650 hours*	*0.00164 lbs CO_2*	*149.65 lbs CO_2*

Conclusions:
1. Think about all of the appliances in your house and other activities you do that release carbon dioxide (e.g. cars, trains, etc). How many pounds of carbon dioxide do you think your activities add to the atmosphere each year? Why?

There is no correct answer for this question. The purpose is to get students to estimate before they use the online software to estimate their carbon dioxide emissions.

Name_____ Class/Period_____ Date_____

Activity 5.2: How many pounds of carbon dioxide do you produce each year?

Purpose
In this activity, you will calculate how many pounds of carbon dioxide you produce per year using an emissions calculator developed by the Environmental Protection Agency.

You will need to know:
- If you drive a car, the number of miles a week your drive and the average gas mileage.
- If your home is heated by natural gas, electric heat or oil.
- Your home's average monthly electric bill.
- Your home's average monthly gas bill (might not have one).
- Your home's average monthly fuel oil bill (might not have one).

Directions
1. Go to the following website: http://www.epa.gov/climatechange/emissions/ind_calculator.html
2. Answer the questions based on your home. As you complete each section, record the pounds of carbon dioxide/year in the table below.
3. After completing the section for "Your Total Emissions", then complete the section "What You Can Do to Reduce Emissions". Only select options that you think you could change in your home in the next year. Record this information below.

Source of Emission	**Pounds of Carbon Dioxide/year**
Transportation	*U.S. Average = 12,100.* *Urban students may not typically ride in cars at all during the week. One limitations is this calculator does not include public transportation*
Gas Bill	*U. S. Average = 11,000*
Electric Bill	*U.S. Average = 16,290*
Fuel Oil Bill	*U. S. Average = 14,500*
Waste	*U. S. Average = 2,020*
Total Emissions (Before Reductions)	*U.S. Average = 41,500* *This is for a household of two. If students have more individuals in their home, they would expect to be above average.*
Reductions • Amount you could reduce your emissions if you took particular actions.	*Range of possibilities. Most likely 0 – 7,000. It can reduce upwards of 20,000, but those are probably not realistic changes in the next year.*
Total Emissions (After Reductions)	*Lower based on reductions*

Conclusions

1. What was your greatest source of carbon dioxide emissions? Why do you think that activity causes the greatest production of carbon dioxide?

Probably students greatest source of emissions was their electric, gas or oil bill. It is possible that transportation could be the highest, but less likely in an urban area because of public transportation. This can be an interesting point to discuss with students. The energy we use in our homes is the greatest source of carbon dioxide, because it is used to power so many different appliances and used for heating and cooling.

2. What were some of the actions you selected to reduce carbon dioxide emissions? Do you think it is feasible for more people to make these changes? Why or why not?

There is a range of possibilities that students could include here. Some of the easiest to change are switching light bulbs and turning down heat or increasing air conditioning. You may want to talk about how if everyone made these small changes the impact could be very large. For example, the calculator has changing one light bulb as equaling 100 pounds (Note – this is lower than we calculated above, because it assumes the light bulb is on for only a couple of hours a day). If you have 30 students in your class and everyone changed one bulb, it would be 3,000 lbs of CO_2 a year. If everyone changed 10 light bulbs, it would be 30,000 lbs of CO_2 a year.

Other changes are more difficult and expensive, like purchasing a new car, refrigerator or windows. While people may not be able to financially do that now, when they purchase a new appliance in the future they should consider the impact of their choices.

3. This calculator is a rough estimate of how many pounds of carbon dioxide you produce each year. In order to be more accurate, what other information do you think it would need to consider? Why?

There are a number of things that are not included in this calculator such as using public transportation, the size of a house, where specifically people get there electricity from – some companies now have a green option where you can choose to receive a larger percentage of electricity from more environmentally friendly sources (e.g. solar, hydro, wind, etc.).