8th grade Science Learning Cluster 5 Assignments 1-3: Human Impact Study

Due: Weekly assignments due each Sunday by 10am

Human Impact Week 1 Assignment: What is the GreenHouse Effect? **Due: Sunday 5/31 10am**

Student Honor Code: By providing my initials, I as a KCMS student pledge my honor that this assignment contains only my original thought and work and has not been copied or plagiarized. I understand that plagiarized work will result in a zero and I will not receive credit for the assignment. *Student Initials:* _____

The **greenhouse effect** is a natural process that occurs when greenhouse gases (like carbon dioxide and methane) in Earth's atmosphere trap the Sun's heat. This process makes Earth much warmer than it would be without an atmosphere. Without the greenhouse effect, Earth would be too cold to support life. In recent years scientists have noticed changes in the concentration of greenhouse gases. Complete task 1 below to investigate how our atmosphere traps heat and how it has changed over time. *If you have internet access only complete task 1 and skip task 2. If you do not have internet access skip task 1 and complete only task 2.*

Task 1:

1. Go to https://phet.colorado.edu/sims/cheerpj/greenhouse/latest/greenhouse.html
   If the link above does not work go to https://phet.colorado.edu/en/simulation/greenhouse and download the simulation.

2. On the "Greenhouse Effect" tab set the greenhouse gas concentration to none. Observe the sunlight photons and infrared photons.
   a. What happens to the sunlight photons?

   b. What happens to the infrared photons?

   c. What is the temperature reading?

   d. Add 3 clouds. How does the activity of the infrared photons change?

   e. How does the activity of sunlight photons change?

   f. What is the temperature reading after adding 3 clouds?

   g. How was temperature affected by the clouds?

3. Set cloud count back to zero and set greenhouse gas concentration to LOTS. Observe the sunlight photons and infrared photons.
   a. What happens to the sunlight photons?

   b. What happens to the infrared photons?

   c. What is the temperature reading? How does the temperature compare to when there were no greenhouse gases in the atmosphere?

MS-ESS3-4 Earth and Human Activity: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

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4. Select the ice age, 1750's, and today tab and record the changes in greenhouse gases and temperature.

Greenhouse Gas Concentration	Carbon Dioxide Concentration (CO_2)	Methane Concentration (CH_4)	Nitrous Oxide Concentration (N_2O)	Temperature
Ice Age				
1750				
Today				

a. What are three greenhouse gases (hint, look at the chart above!)?

b. Have greenhouse gas concentrations increased or decreased since 1750?

c. What do you think is responsible for the changes we have seen in greenhouse gas concentrations since 1750?

d. What happens to the temperature as the greenhouse gas concentration increases?

Task 2: Non Internet Assignment

If you are unable to access the internet please read the article below and answer the questions.

The Greenhouse Effect

Have you ever wondered why we can live on the Earth but not the moon? Both are floating masses in space with gravity, and are almost an equal distance from the sun for light and warmth. Why is it that when colonization is mentioned, no one ever talks about the moon? Comparing the Earth and the moon from outer space, the blue color of our planet gives away an important answer: there is no water (or not enough accessible) on the moon for survival. However, another answer evades us from just a glance: the lack of an atmosphere. What exactly is an atmosphere, and what role does it play in maintaining life?

The atmosphere is a thin layer of gases which surrounds our planet and is composed of 99% nitrogen and oxygen. Its lower layer forms clouds, holding water (up to 12,900 cubic kilometers' worth), and giving us weather patterns. The atmosphere is often imagined to be a veil that nurtures the Earth and protects its living organisms from cosmic harm, almost like a greenhouse protecting its plants from the harsh weather. This veil of air can prevent physical objects such as meteoroids from impacting the earth. It also prevents harmful radiation from the Sun from reaching the surface. The ozone layer is responsible for filtering out much of the ultraviolet radiation, while other gaseous layers filter gamma and x-rays, which could cause dangerous mutations or other such genetic harm. The third protective mechanism is a modern buzzword: The Greenhouse Effect.

What is the Greenhouse Effect?

The greenhouse effect is the mechanism by which the atmosphere keeps the Earth's temperature warm enough to be safe for life. Without the greenhouse effect, our planet's temperature would be an average of about 33oC (91.4oF)

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colder than it is and it would fluctuate much like the moon's. Temperature on the moon can be as low as negative 157oC (-250oF) and as high as 121oC (250oF). How does it work? The name gives it away -- it is about the property of the gases.

There are more gases than just nitrogen and oxygen in the atmosphere. Traces of carbon dioxide (CO_2), water vapor, methane, ozone, and a variety of other chemicals known as greenhouse gases are also found there. These gases differ from others by having the ability to absorb heat. It is this property that gives them their name. Greenhouse gases are defined by their ability to trap heat in our atmosphere.

Light from the sun exists as visible light and ultraviolet light (a more energetic and harmful radiation that can cause sunburn and even cancer). Most of this harmful radiation is absorbed and filtered out or reflected into space through the veil of our atmosphere, while some manages to reach the surface of the earth. The earth absorbs a portion of this energy in the form of heat, and re-emits a less energetic radiation called infrared light back into space. We have all seen, or rather felt, infrared light as we walk into a cafeteria. It is the dim red light that keeps food warm. It is also released from regular everyday light bulbs. The infrared light that travels into the atmosphere is absorbed by the greenhouse gases and is radiated up into space and reflected down toward Earth. This reflected infrared light keeps our planet warm.

Sources of Greenhouse Gases

Where do these greenhouse gases come from?

Greenhouse gases are produced by natural and artificial processes. Humans release more CO_2 and methane than any other greenhouse gases. Human and animal respiration, volcanic eruptions, deep sea vent release, decomposition, and natural forest fires are all sources of natural CO_2 emission. Wetlands, termites, and the oceans all emit methane into the atmosphere naturally. The Industrial Revolution, which took place in the 18th century, produced a new form of CO_2 emission, termed anthropogenic carbon dioxide emission. Burning of fossil fuels in power plants and automobiles is the primary method by which we introduce CO_2 into the atmosphere (87% of anthropogenic CO_2 emission). However, deforestation and various industrial processes also contribute to our emissions. Carbon dioxide, once emitted into the atmosphere, can remain there for centuries. Methane is released through fossil fuel production and livestock farming (60% of anthropogenic methane emission). However, landfills, burning, rice farming, and biofuels are further anthropogenic methane sources.

Naturally, the greenhouse gases serve to keep our planet warm. But what happens when levels of these gases become too high in our atmosphere? Many of you may have guessed: Global Warming. Additional CO_2 allows for more heat trapping and makes our planet warmer than it should be. Although the human addition of CO_2 is small compared to what is released naturally, the balance of CO_2 in the atmosphere is delicate. A small tipping of the scale can bring large environmental consequences—rising sea levels, droughts, new and intense weather patterns, and melting glaciers to name a few. Such environmental consequences can have devastating effects on ecosystems and their inhabitants, including humans, around the globe. Some species have already been observed shifting their ranges to seek out cooler temperatures. Others have experienced population declines. Those unable to shift their ranges may go extinct. Polar bears have become skinner on average in recent years due to loss of the ice on which they live and fish. While some species experience habitat loss, invasive species are on the rise. Sea level rise threatens low-lying coastal and island communities worldwide. Floods, droughts, and hurricanes are all expected to intensify and become more common. Diseases, especially the mosquito-borne variety, will become more prevalent. The recent Zika outbreak is an example of this effect.

What Can You Do to Reduce Greenhouse Gas Emissions?

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With such dire predicted consequences, we as a species should try to reduce our greenhouse gas emissions. But with 7 billion people on the planet and counting, it seems a daunting mission. Even so, there are actions individuals can take to reduce their own emissions. Every little bit helps, and if more people shift their behavior and energy consumption, we may be able to slow the effects of excess greenhouse gases.

There are several things you can do to reduce anthropogenic greenhouse gas emissions. For example, using renewable energy, such as solar power. Solar panels are available for private residences. You can also help by adjusting your thermostat to use less energy, allowing it to remain a bit cooler in the winter and warmer in the summer.

Energy-efficient appliances (bearing an Energy Star label) cut down on electricity usage. When you're ready to replace your refrigerator or another large appliance, opt for an appliance with an Energy Star label. Energy-saving light bulbs will also help reduce your energy consumption as will washing your clothes in cold or warm water instead of hot and line-drying them. On top of reducing emissions, lowering your energy consumption can help you save on your electricity bill. Even planting a native garden can reduce the need for herbicides and fertilizers that are often produced using petroleum or natural gas (fossil fuels).

It is up to us to help conserve our environment by being more conscientious inhabitants of the planet.

1. Why is the atmosphere sometimes compared to a greenhouse?

2. What are the main components of the atmosphere?

3. Name two greenhouse gases.

4. Explain the Greenhouse Effect.

5. What does the word anthropogenic mean?

6. Name two natural and two anthropogenic sources of CO_2.

7. Name two natural and two anthropogenic sources of methane.

8. Name three environmental consequences of global warming.

9. Name three adverse effects of global warming for living organisms.

10. What do you think would happen if greenhouse gases disappeared?

11. What do you think would happen if greenhouse gases continued to increase?

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Human Impact Week 2 Assignment: Energy Resources **Due: Sunday 6/7 10am**

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Task 1: Renewable and Nonrenewable Energy Resources

Based on data from the past 150 years, we know that the greenhouse effect is being enhanced. One reason for the increase in concentration of greenhouse gasses is the burning of fossil fuels. Currently the majority of energy used around the world and within the USA is produced using these fossil fuels(coal, oil and natural gas). In this next task you will review what Renewable and Nonrenewable energy resources are and you will investigate the impact they have on the environment.

Directions: Read Renewable Energy and then Nonrenewable Energy Articles and complete the table below.
https://www.eia.gov/kids/energy.cfm?page=renewable_home-basics
https://www.eia.gov/kids/energy.cfm?page=nonrenewable_home-basics

Renewable	Nonrenewable
1. Which energy sources are Renewable ?	2. Which energy sources are Nonrenewable ?
3. What does renewable mean?	4. What does nonrenewable mean?
5. As of 2018 what percentage of USA power came from renewable energy resources?	6. Where do we get nonrenewable resources?
7. Renewable energy plays an important role in:	8. What fossil fuels were formed from buried remains of plants and animals that lived millions of years ago?
9. Why don't we use more renewable energy?	10. If uranium is not a fossil fuel, what is it?

11. Is one type of energy better than the other?

12. Which energy sources do you think are the best to use and WHY?

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Task 2: Which Energy Resource is the Best?

Directions: Complete chart below with pros and cons of each energy source to decide which energy resources should be used to generate the energy that powers the world.

http://www.childrensuniversity.manchester.ac.uk/learning-activities/science/energy-and-the-environment/advantages-and-disadvantages/

Non-Renewable Energy Sources	**Describe Each Energy Source:**	**Pros**	**Cons**
	Oil and Gas-		
	Uranium ore (Nuclear)-		
	Coal-		
Renewable Energy Sources	Solar-		
	Wind-		
	Geothermal-		
	Hydroelectric-		

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Assignment #2 Task 1 Article: Renewable vs. Non-Renewable Energy Resources

Types of Energy Resources

Energy resources can be put into two categories—renewable or non-renewable. Non-renewable resources are used faster than they can be replaced. Renewable resources can be replaced as quickly as they are used. Renewable resources may also be so abundant that running out is impossible.

The difference between non-renewable and renewable resources is like the difference between ordinary batteries and rechargeable ones. If a flashlight with ordinary batteries goes dead, the batteries need to be replaced. But if the flashlight has rechargeable batteries, the batteries can be placed in a charger. The charger transfers energy from an outlet into the batteries. Once recharged, the batteries can be put back into the flashlight. Rechargeable batteries can be used again and again. In this way, the energy in the rechargeable batteries is renewable.

Types of Non-Renewable Resources

Fossil fuels include coal, oil, and natural gas. Fossil fuels are the greatest energy source for modern society. Millions of years ago, plants used energy from the Sun to form carbon compounds. These compounds were later transformed into coal, oil, or natural gas. Fossil fuels take millions of years to form. For this reason, they are non-renewable. We will use most fossil fuels up in a matter of decades. Burning fossil fuels releases large amounts of pollution. The most important of these may be the greenhouse gas, carbon dioxide.

Types of Renewable Resources

Renewable energy resources include solar, water, wind, biomass, and geothermal power. These resources are usually replaced at the same rate that we use them. Scientists know that the Sun will continue to shine for billions of years. So we can use the solar energy without it ever running out. Water flows from high places to lower ones. Wind blows from areas of high pressure to areas of low pressure. We can use the flow of wind and water to generate power. We can count on wind and water to continue to flow! Burning wood (Figure below), is an example of biomass energy. Changing grains into biofuels is biomass energy. Biomass is renewable because we can plant new trees or crops to replace the ones we use. Geothermal energy uses water that was heated by hot rocks. There are always more hot rocks available to heat more water.

Even renewable resources can be used unsustainably. We can cut down too many trees without replanting. We might need grains for food rather than biofuels. Some renewable resources are too expensive to be widely used. As the technology improves and more people use renewable energy, the prices will come down. The cost of renewable resources will go down relative to fossil fuels as we use fossil fuels up. In the long run renewable resources will need to make up a large amount of what we use.

Important Things to Consider About Energy Resources

Before we put effort into increasing the use of an energy source, we should consider two things. Is there a practical way to turn the resource into a useful form of energy? For example, it is not practical if we don't get much more energy from burning a fuel than we put into making it. For example, what if it took more energy to make solar panels than we could get from the solar panels once they were working? Then solar energy would not be worth pursuing until better solar panels were developed.

What happens when we turn the resource into energy? What happens when we use that resource? Mining the resource may cause a lot of health problems or environmental damage. Using the resource may create a large amount of pollution. In this case, that fuel may also not be the best choice for an energy resource.

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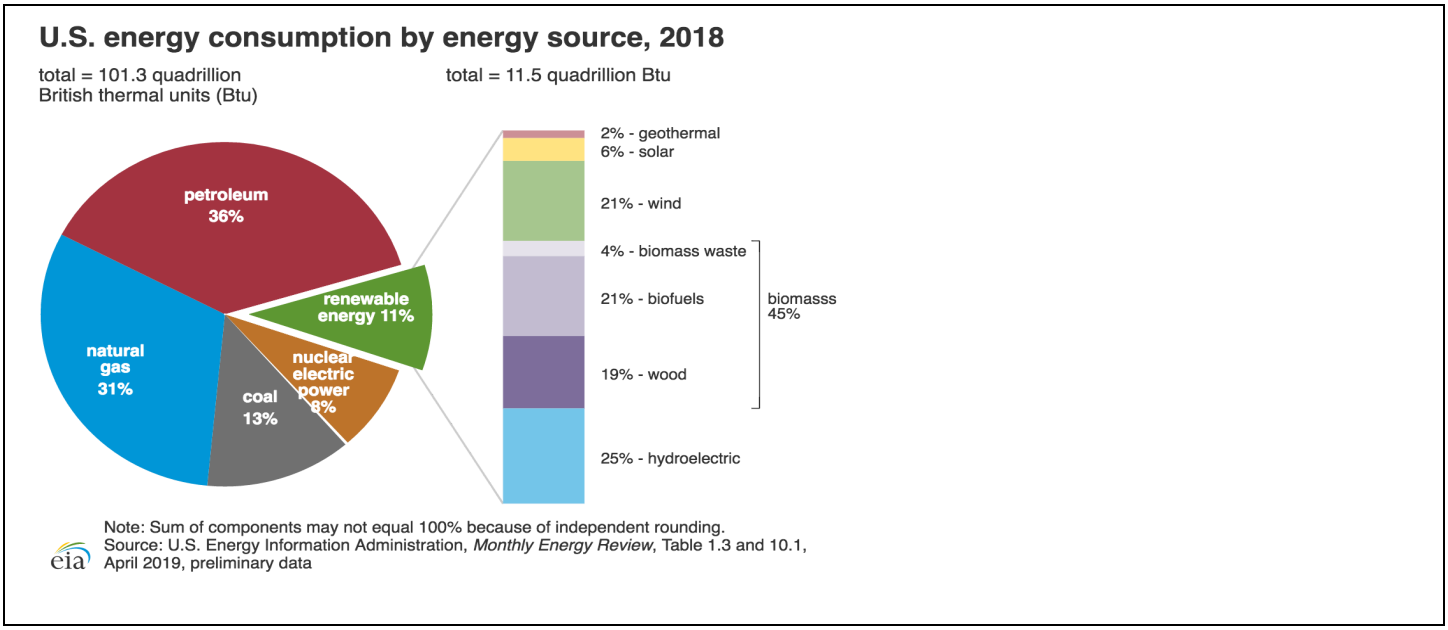

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Assignment #2 Task 2 Article: Pros and Cons of Renewable vs. Non-Renewable Energy Resources

NATURAL GAS Advantages • Burns clean compared to cola, oil (less polluting) • 70% less carbon dioxide compared to other fossil fuels • helps improve quality of air and water (not a pollutant) • does not produce ashes after energy release • has high heating value of 24,000 Btu per pound • inexpensive compared to coal • no odor until added Drawbacks • not a renewable source • finite resource trapped in the earth (some experts disagree) • inability to recover all in-place gas from a producible deposit because of unfavorable economics and lack of technology (It costs more to recover the remaining natural gas because of flow, access, etc.) Other information • 5,149.6 trillion cubic feet of natural gas reserve left (more than oil but less than coal) • 23.2% of total consumption of natural gas is in the United States

WATER POWER Pros • Provides water for 30-30% of the world's irrigated land • Provides 19% of electricity • Expands irrigation • Provides drinking water • Supplies hydroelectric energy (falling water used to run turbines) • Easier for third world countries to generate power (if water source is available) • It is cheaper Cons • Destabilizes marine ecosystems • Water wars (up river and down river; e.g., the water war between Georgia, Alabama, and Florida is ongoing) • Dam building is very costly • People have to relocate • Some dams have to be torn down (Some older ones are not stable.) • Restricted to areas with flowing water • Pollution affects water power • Flooding of available land that could be used for agriculture

CRUDE OIL Advantages • Oil is one of the most abundant energy resources • Liquid form of oil makes it easy to transport and use • Oil has high heating value • Relatively inexpensive • No new technology needed to use Disadvantages • Oil burning leads to carbon emissions • Finite resources (some disagree) • Oil recovery processes not efficient enough—technology needs to be developed to provide better yields • Oil drilling endangers the environment and ecosystesm • Oil transportation (by ship) can lead to spills, causing environmental and ecological damage (major oil spill near Spain in late Fall 2002) Issues • The world consumes more than 65 billion barrels of petroleum each day. By 2015 the consumption will increase to 99 billion barrels per day. • Fossil fuels such as oil take billions of years to form. • In 1996, the Energy Information Administration estimates of crude oil reserves were 22 billio nbarrels. In 1972, the estimate was 36.3 billion barrels.

NUCLEAR POWER Pros • Clear power with no atmospheric emissions • Useful source of energy • Fuel can be recycled • Low cost power for today's consumption • Viable form of energy in countries that do not have access to other forms of fuel Cons • Potential of high risk disaster (Chernobyl) • Waste produced with nowhere to put it • Waste produced from nuclear weapons not in use • Earthquakes can cause damage and leaks at plants • Contamination of the environment (long term) • Useful lifetime of a nuclear power plant • Plant construction is highly politicized

WIND POWER Advantages • Continuous sources of energy • Clean source of energy • No emissions into the atmosphere • Does not add to thermal burden of the earth • Produces no health-damaging air pollution or acid rain • Land can be sued to produce energy and grow crops simultaneously • Economical • Benefits local communities (jobs, revenue) Disadvantages • For most locations, wind power density is low • Wind velocity must be greater than 7 mph to be usable in most areas • Problem exists in variation of power density and duration (not reliable) • Need better ways to store energy • Land consumption

COAL Pros • One of the most abundant energy sources • Versatile; can be burned directly, transformed into liquid, gas, or feedstock • Inexpensive compared to other energy sources • Good for recreational use (charcoal for barbequing, drawing) • Can be used to produce ultra-clean fuel • Can lower overall amount of greenhouse gases (liquification or gasification) • Leading source of electricity today • Reduces dependence on foreign oil • By-product of burning (ash) can be used for concrete and roadways Cons • Source of pollution: emits waste, SO_2 , Nitrogen Oxide, ash • Coal mining mars the landscape • Liquification, gasification require large amounts of water • Physical transport is difficult • Technology to process to liquid or gas is not fully developed • Solid is more difficult to burn than liquid or gases • Not renewable in this millennium • High water content reduces heating value • Dirty industry—leads to health problems • Dirty coal creates more pollution and emissions

SOLAR POWER Pros-Reduced electricity bills,Financial support from the government, Energy independence, Reduce your carbon footprint, Requires little maintenance and has longevity. Cons-High initial cost, Weather dependence, Inability to take it with you when you move, Limitations from your surroundings, Inconvenience in inner cities and other areas with limited space

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Human Impact Week 3 Assignment: Reducing our Carbon Footprint? **Due: Friday 6/12 10am**

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For your final (Yes FINAL!) science assignment we want you to think about ways you can reduce your greenhouse gas emissions. In task 1 you will calculate your carbon footprint. Your carbon footprint is an estimation on how much carbon dioxide your daily life contributes to the atmosphere. In task two you will research ways you can reduce your carbon footprint as you design your dream home.

Task 1: Calculate your carbon footprint.

Go to https://ei.lehigh.edu/learners/cc/carboncalc.html and calculate your carbon footprint. If you do not have access to the internet, use the questionnaire below to calculate your carbon footprint. Record your results below:

Your CO2 Emissions	**Average US CO2 Emissions**
Household: Transportation: Food:	Household: Transportation: Food:

1. Reflect on your score. Are you surprised by your results? Why or why not?

2. Which area was the highest (household, transportation, or food)? Why do you think that is?

***Non Internet Instructions:** Answer the questions below, then fill in the corresponding values on the far right. Tally the values to find your carbon footprint. Only fill in one value for each question, unless otherwise stated.

Ex. Do you turn off the lights when you leave a room? a. Yes b. No	a. 133 b. 268	***133***

1. How do you get to school?
   a. walk — a. 0 _____
   b. bike — b. 0 _____
   c. car — c. 1115 _____
   d. bus — d. 131 _____
   e. carpool — e. 459 _____
2. Do you eat mostly…
   a. fast food — a. 4818 _____
   b. home cooked food — b. 629 _____

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3. Do you eat mostly…
   a. vegetables/fruits a. 153 _____
   b. meat b. 644 _____
   c. bread c. 364 _____
4. Do you turn off lights when you leave a room?
   a. yes a. 133 _____
   b. no b. 268 _____
5. Do you unplug appliances/chargers when not in use?
   a. yes a. 9 _____
   b. no b. 18 _____
6. How do you dry clothes?
   a. hang to dry a. 0 _____
   b. dryer b. 750 _____
   c. both c. 375 _____
7. Do you turn off the water when brushing your teeth?
   a. yes a. 34 _____
   b. No b. 274 _____
8. Do you turn off the TV when you're not watching it?
   a. yes a. 47 _____
   b. no b. 140 _____
9. Do you turn off your video game system when you're not using it?
   a. yes a. 29 _____
   b. no b. 90 _____
   c. don't have/use one c. 0 _____
10. Do you recycle? (for this question, select all that apply)
   a. magazines a. -15 _____
   b. newspaper b. -90 _____
   c. glass c. -7 _____
   d. plastic d. -19 _____
   e. aluminum and steel cans e. -86 _____

Add together all the values in the far right column and report here: _____

This total is your "carbon footprint" in the number of pounds of carbon dioxide per year. The lower the number, the fewer greenhouse gasses are emitted into the atmosphere.

1. Reflect on your score. Are you surprised by your results? Why or why not?

2. What areas caused your score to go up?

3. Did any of your actions cause your score to go down?

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Task 2: Your Dream "Green" House

Imagine that you have been asked to design your dream home that is both energy efficient AND reduces you and your family's carbon footprint. First, research innovative ways you can reduce the carbon footprint of the home you design. Then create a final product (digital floor plan, google slideshow, poster, brochure, or your own creative twist!) that explains what you would design and why.

Your final product will need to include the following:

Description of what the greenhouse effect is and how it is being enhanced (changed). _____/10
Explanation of what a carbon footprint is. ____/ 2
Description or drawing of your dream home _____ /10
A detailed discussion of a minimum of 4 ways to reduce your carbon footprint and how they work _____/ 8
A detailed discussion of at least one renewable energy source you would include in the design and why. _____/5
Spelling/grammar/Polish _____/ 5

Below is a list of resources you can use to help in your research:

Walk through an energy efficient home!
https://www.energystar.gov/index.cfm?fuseaction=popuptool.athome

Easy to read resource on how we can help reduce our carbon footprint.
https://climatekids.nasa.gov/how-to-help/

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