

Is it Getting Hot in Here?

Subject: Social Studies, Art, Science

Duration: 1-2 hours

Location: Classroom and outdoors

Next Generation Sunshine State Standards:

SC.5.L.14.2 SC.5.L.15.1 SS.5.C.2.4 SS.5.C.2.5

LA.5.5.2.2

Key Vocabulary: Greenhouse gas, fossil fuels, energy, heat.



Objectives The students will be able to show how Infra-Red radiation is trapped by green house gasses. Students will understand what happens to the temperature of the planet if more greenhouse gasses are put into the atmosphere.

Method Students will create models of greenhouse gas molecules, and play a game that will show greenhouse gasses trapping heat radiating off the earth's surface.

Background Energy can be heat, or light. A farmer's greenhouse traps heat from the sun which keeps the inside of a greenhouse warm for plants to grow - even when it is cold outside. The earth's atmosphere and surface is a complex system of energy exchanges - but basically it is like a greenhouse. Infra-red (I.R) radiation is a type of energy that is reflected off the the planet surface. Any kind of gas in the earth's atmosphere that traps heat is called a greenhouse gas. Greenhouse gasses trap reflected infra-red radiation. Greenhouse gasses are vital to keep the earth warm enough for life to survive. Without greenhouse gasses the Earth temperature would cycle from freezing and boiling - like on the Moon or Mars. Venus has greenhouse gasses that keep that planet always extremely hot. Carbon dioxide (CO₂) and methane (CH₄) are natural greenhouse gasses. Volcanoes emit greenhouse gasses.

Since the start of the industrial revolution in the 1770s, humans have been burning billions of tons of fossil fuels for use as energy. Burnt fossils fuels (coal, gas, and oil) release greenhouse gasses. Methane traps 24x as much heat in the atmosphere than carbon dioxide does. The extra billions of tons a year of released greenhouse gases from human activities has upset the natural atmospheric balance of energy absorption and release. Global temperatures have been proven to be increasing due to human activities - and not due to natural variations in solar, or earth cycles. Our planet is warming faster than what would be "normal". This is starting to affect climates, sea level, ocean chemistry, agriculture, habitats, animal life, fresh water sources, and where / how humans live.

Materials

- Diagrams or props to show the solar energy cycle in the atmosphere.
- Costumes, diagrams or models of carbon dioxide and methane molecules.
- Two ropes to mark boundaries of earth surface and of space.

Suggested Procedure

1. Discuss how greenhouses work. Relate that to other planets, and to sustainability of life.
2. Compare infra-red radiation to heat coming off a campfire.
3. Describe the solar energy cycle.
4. Define greenhouse gasses and identify natural and human sources of them.
5. Build models, or make costumes of carbon molecules and methane molecules - enough for half of the students to wear when they play the game.
6. Play a modified version of the "Predator-Prey" game. This is when some students acting as I.R radiation (prey) leave the earth's surface and try to make their way to the "safety" of space without getting caught by greenhouse gasses (predator). More I.R students will be trapped as more greenhouse gas kids are brought into the game. The students acting as CO₂ can only take a step to catch IR, the students acting as methane can run anywhere to catch IR. This will show that as more I.R rays get caught in by greenhouse gasses then more energy (heat) stays in the atmosphere.



Evaluation

Once the students have played the game with various scenarios with more greenhouse gasses being added, you can ask...

- How do you think extra greenhouse gasses effect the atmosphere / temperature?
- How can you reduce the greenhouse gasses?
- What is a carbon footprint?
- Name some kind of energy (e.g. incoming UV rays, reflected IR, burning fossil fuels, volcanic eruptions, sun).

Extension

Students can research additional information at;

<http://www.epa.gov/climatechange/kids/basics/index.html>

<http://www.npr.org/2007/05/01/19943298/episode-1-its-all-about-carbon>

Related Activities: Carbon Budget. Sea Level Rise.