POLAR TREC
Learning Resources

Details

Completion Time: Less than a week

Permission: Download, Share, and Remix

Human Creativity and Climate Change

Overview

Humans are creative. They try to solve problems in original ways. For example, some scientists are thinking of ways to decrease the amount of greenhouse gases in the air. Other scientists are thinking of ways to limit the amount of sun that reaches Earth so that the Earth won't get so warm. Like most ideas, there are pros (good things) and cons (bad things). Students will explore one creative solution to climate change and share their findings with the class.

Objectives

Students should be able to list the pros and cons of one geoengineering solution to climate change and give their opinion as to whether humans should pursue this solution.

Lesson Preparation

Students should already have a prior understanding of climate change and the greenhouse effect before doing this lesson. They should already be able to define climate change and understand that climate change is a result of both natural causes and human activities. They also should already be able to draw and label a diagram of the greenhouse effect and explain how greenhouse gases influence Earth's climate. The US Environmental Protection Agency's web site listed below is a good resource for students and teachers. http://www.epa.gov/climatechange/kids/basics/index.html

Procedure

Engage: (Whole Class). The teacher will spend about 10 minutes introducing the different ways that humans are trying to deal with climate change. The purpose of this introduction is to expose the students to the different geoengineering ideas that have been proposed without going into too much detail. The attached PowerPoint slideshow could be used as a starting point.

Materials

- PowerPoint slide show for Introduction
- Student handout (includes a rubric)
- Website links for student research
- Internet for research

The geoengineering proposals can be put into 3 categories:

A. Solutions that limit some of the sunlight from reaching earth. (Examples: space mirrors, artificial volcanoes, cloud-making ships, white roofs, and painting mountains white)
B. Solutions that attempt to remove large amounts of greenhouse gases that are already in the air. (Examples: artificial trees (or other air scrubbers), biochar, seaweed farms, dumping iron into the ocean, greening the desert, and storing carbon dioxide underground or in the ocean)
C. Solutions that attempt to limit the amount of greenhouse gases that humans put into the air. (Examples: switching to one or more types of renewable energy, switching to the fuel that cars use (hydrogen, electricity, compressed air, sunlight) or saving energy at home or at school)

Explore:
Individual students or pairs of students choose a solution to research and create a product to share with the class. The requirements of the project and the suggested rubric are attached. The student handout offers some suggested ways for the students to present their findings and the requirements.

The challenging part of this assignment will be for the students to list the pros and cons of their solution. The students may not be able to find much information from the research but encourage the students to use their common sense. For example, if one country attempts to do something, will the effect be limited to that country only?

As the teacher, you will be impressed by their ability to point out potential pitfalls or concerns.

Explain:
Students share their findings with the class.

Extension
After presentations, the students could have a class conference to discuss what solution or solutions would be the best to pursue.

In addition, the teacher may wish to give the students a broader choice of products during the "explore" stage of this lesson. For instance, instead of posters or slideshows, students might be able to create one of these other types of products:

1. a model of their solution (with a written manual explaining how it would work)
2. a comic book
3. a movie
4. a website

Learning Resources

Resources
See attached list of web sites.

Assessment
The student products will be assessed. The rubric attached to the student handout was designed to assess the "Communication in Science" criterion for the International Baccalaureate Middle Years Programme. It is scored on a 0 to 6 scale. You may wish to adapt the rubric to fit your needs.

Credits
Kevin McMahon, 2011 PolarTREC teacher.

Learning Resources

National Science Education Standards (NSES):

Content Standards, Grades 5-8

Content Standard D: Earth and Space Science
a. Structure of the earth system

Content Standard E: Science and Technology
a. Abilities of technological design
b. Understandings about science and technology

Content Standard F: Science In Personal and Social Perspectives
d. Risks and benefits
e. Science and technology in society

Georgia Standards:

S6CS5. Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.
S6E6. Students will describe various sources of energy and with their uses and conservation.
a. Explain the role of the sun as the major source of energy and its relationship to wind and water energy.
b. Identify renewable and nonrenewable resources.

Climate Change Project

Group Product Choices:

1. Poster
2. Slide Show
3. Your choice (must be approved by teacher)

I. Background Information

Humans are creative. They try to solve problems in original ways. Because many humans are concerned about the planet getting warmer because of the amount of greenhouse gases in the air, some scientists have come up with very clever ways to deal with this issue. Like most ideas, there are pros (good things) and cons (bad things). Their ideas can be grouped into three categories:

A. Ways to limit the amount of sun that reaches Earth (so the Earth won't get so warm)

1. **Space Mirrors** (Put a Giant Mirror or Mirrors into Space to Make Some of Sunlight Bounce Back to Space).
2. **Artificial Volcanoes** – pump sulfur into the air, just like a volcano, so sunlight can hit the sulfur and bounce back into space.
3. **Cloud-Making Ships**
4. **White Roofs**
5. **Painting Mountains White**

B. Ways to remove large amounts of greenhouse gases from the air.

1. **Artificial Trees (or other Air Scrubbers)**
2. **Biochar**
3. **Seaweed Farms**
4. **Dumping Iron into the Ocean**
5. **Greening the Desert**
6. **Storing Carbon Dioxide Underground or in the Ocean**

C. Ways for humans to put less greenhouse gases in the air (by changing their energy sources away from fossil fuels).

1. **Switching to one or more types of renewable energy.**

2. **Switching the fuel that our cars use (hydrogen, electricity, compressed air, sunlight)**
3. **Saving energy at home or at school. Perhaps you could look at examples in your community.**

II. Product Requirements

Your product should:

1. In two sentences or less, define "climate change" and explain how greenhouse gases are involved.
2. Describe the solution you researched. Hint: It should be from the list above.
3. Explain how the solution will keep the Earth from getting too warm.
4. Explain the pros (good things) and the cons (bad things) of the solution.
5. Have a drawing of the "greenhouse effect" as it works now, and a second drawing of the greenhouse effect as it would work if scientists try your solution.
6. List the resources you used to get information or pictures.
7. Contain any other information that is important to your topic.

Remember, you have great ideas so make sure you use your own words. A good rule of thumb is that if you don't know what a word means, you shouldn't use it in your product because other people won't know it either.

Be creative! Be neat! Proofread your work!

This project is due on _____.

You may work individually or with another classmate.

Word bank of some scientific words:

climate change	**greenhouse effect**	**hypothesis**
predict	**greenhouse gases**	**carbon dioxide**
evidence	**theory**	**fossil fuels**

You will be assessed using the "Communication in Science" Rubric.

"Communication in Science" Rubric

5-6	3-4	1-2
o My product contains all the required information and it is correct. o I use the appropriate scientific words in my product. o I present scientific information in an appropriate way. o I acknowledge sources. o I use technology to access, process, and/or communicate scientific information appropriately.	o My product contains most of the required information and it is correct. o Most of the time, I use the appropriate scientific words. o Most of the time, I present scientific information in an appropriate way. o I acknowledge most sources. o I use technology, to access, process, and/or communicate scientific information appropriately most of the time.	o I attempt to communicate scientific information using some scientific language. o I present some of the information in an appropriate form.

Human Creativity and Climate Change

Is geoengineering a good thing?

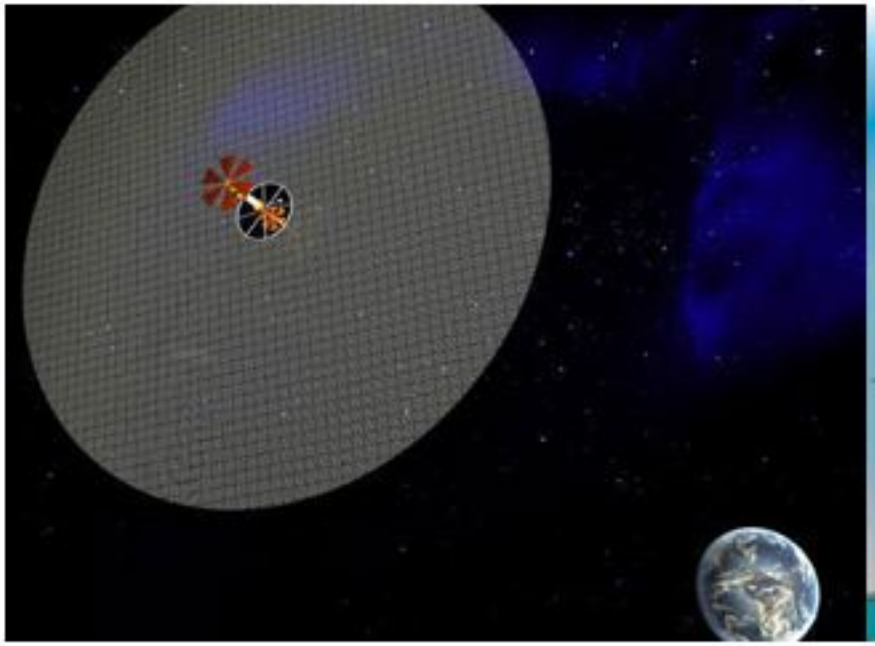
GEOENGINEERING

- **Humans are creative. They try to solve problems in original ways.**

- **Many scientists are concerned about the earth's climate getting too warm. They have come up with some creative ways to deal with this climate change.**

One Idea: Limit the Amount of Sun that Reaches Earth

Examples:



A Giant Solar Mirror to Block Some Sunlight

Artificial "Fake" Volcanoes to Put Particles in the Air to Block Some Sunlight

Limit the Amount of Sun that Reaches Earth (cont.)

Cloud-Making Ships

White Roofs

Painting Mountains White

A Second Idea – Remove Large Amounts of Greenhouse Gases from the Air

Examples:

Artificial Trees to Remove some Carbon Dioxide from the Air

Putting "Biochar" in the Soil to Keep Some Carbon Dioxide From Getting Back into the Air

A Second Idea – Remove Large Amounts of Greenhouse Gases from the Air (continued)

Seaweed Farms (above) and Dumping Iron in the Ocean (below)

Greening the Desert (above) and Storing Carbon Dioxide On the Ocean Floor or Underground (below)

Third Idea – Cut down on human activities that put greenhouse gases in the air

Examples:

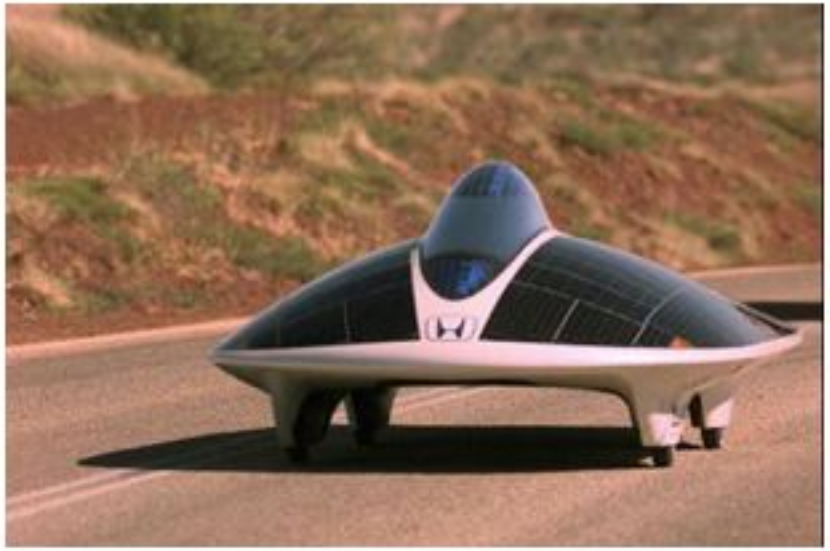
Switch to one or more types of renewable energy.

Can you think of other renewable energy sources besides wind and the sun?

Third Idea – Cut down on human activities that pu greenhouse gases in the air (continued)

- Switch the fuel that cars use (from gasoline to hydrogen, electricity, compressed air or sunlight).

A car that runs on compressed air.



A car that is powered by the sun

Third Idea – Cut down on human activities that put greenhouse gases in the air (continued)

Save energy at home or at school