# Global Warming

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Global Warming is one of the most-often publicly discussed scientific issues. Many people have and express very strong opinions about the human role in climate change, and often the facts and the complexity of this issue take a back seat to the heated political debate. The goal of our next set of presentations will be to use demonstrations to introduce our audience to some of the basic scientific principles that influence Earth's climate.

## Assignment

For Friday, November 18, we will prepare group presentations on the topics listed below. Presentations should be about 20 minutes long, and should be geared toward an audience of high school students. As was the case last time, presentations will be limited in technical content by the intended audience, but you should strive to avoid developing misconceptions.

Groups will consist of three or four students. You should develop a demonstration for your topic, and then explain to students the role of the illustrated phenomenon in the global warming debate.

## Topics

### 1 Solar Energy

Presently, the total power used by humanity is about 14 TW. For this demonstration, an experiment should be done to show how much energy can be produced by a common solar cell. The result should then be used to figure out how much land would need to be covered with solar cells to provide for all human energy needs. This area should be illustrated in an intuitive way (for example with a map). Issues such as cloud cover, practical difficulties (like pollution) manufacturing solar cells, and other complicating factors should be considered.

### 2 Burning

Much of the energy we use comes from burning. This demonstration should illustrate how useful energy can be produced by burning, and what the byproducts of combustion are. The production, use by plants, and effects of atmospheric $CO_2$ should be discussed. Some questions to address are: How much energy is produced when 1 kg of oil is burned? How much of

that can be put to use? How much $CO_2$ is produced in the process? In the distant past, $CO_2$ concentration in the atmosphere appears to have tracked global temperature. How do we know this? Does that mean $CO_2$ is a cause of warming, an effect, or both?

## 3 Solar Heating

In common experience, black objects left out in the sun (or under a hot lamp) become hotter than otherwise-identical white objects. On the other hand, if an object is placed in a closed, evacuated box with the walls at a uniform temperature, the object will eventually come to thermal equilibrium with the walls no matter what color it is. In this demonstration, two identical objects should be made, except that one should be reflective and the other absorptive. The two objects should then be placed in the sun (or under a lamp) and their temperatures compared as they absorb solar radiation. The results should be carefully explained. Some issues to address when relating this to the Earth: Is the Earth like an object in an evacuated box? If so, what is the equivalent temperature of the walls? How can the atmosphere and surface be at different temperatures? What would the temperature of Earth be with no atmosphere?