



## Do people cause global warming?

By Frederick Seitz and Robert Jastrow

The debate over the President's decision on the Kyoto Protocol has focused media and public attention on the question of global climate: Do people cause global warming?

During the last 100 years, the average temperature of the Earth's surface has increased by one degree Fahrenheit. In that same period, the atmospheric concentration of carbon dioxide increased by 25 percent. A large part of the increase in carbon dioxide is the product of human activities such as the burning of fossil fuels. Is it possible that these two increases--the rise in Earth's temperature and the rise in carbon dioxide resulting from human activity--are connected?

A blue ribbon panel of scientists, convened by the National Academy of Sciences in response to a request by President Bush, concluded that they are. The separate summary that accompanies the panel's full report states in its opening sentence: "Changes [in the temperature of the Earth] observed in the last several decades are likely mostly due to human activities." But the report also states that "The most valuable contribution U.S. scientists can make is to continually question basic assumptions and conclusions." It is in that spirit that this critique is written.

We find the scientific evidence clearly indicates the global warming in the last 100 years is likely not due mostly to human activities.

The first thing to note is that the 100 years of global warming occurred in two stages--a temperature rise of approximately a half-degree Fahrenheit early in the century from 1910 to 1940, and another half-degree temperature rise toward the end of the century in the 1980s and 1990s.

Between these two periods of warming, from the 1940s to the 1970s, the Earth actually cooled somewhat. Greenhouse gases like carbon dioxide cannot cool the planet; they can only warm it. So we have to conclude that some other natural factors in climate change were at work in those middle decades of the century.

- For example, we know the brightness of the sun changes now and then; if the sun's brightness decreased, that would cause a global cooling.

- It has been suggested that the cooling effect of aerosols is the explanation for the occurrence of the global cooling in the 1950s and 1960s, rather than the predicted global warming. Aerosols are small particles which partly screen the earth from incident sunlight and tend to cool the planet.

This explanation for the absence of greenhouse warming in the 1950s and 1960s can be tested by looking at the Northern and Southern Hemispheres separately. Aerosols are produced mainly in the industrialized nations of the Northern Hemisphere and usually do not get across the equator; they are washed out by rain in a few weeks. Consequently, the Southern Hemisphere is relatively free of aerosols.

In the Southern Hemisphere the warming effect of carbon dioxide in the atmosphere should be fully evident. But it is not. The two hemispheres display the same pattern of temperature change. The fact that the cooling in the 1950s and 1960s is a feature of the temperature records of both hemispheres indicates that the absence of the predicted global warming cannot be due to aerosols.

How about the warming of the Earth early in the century, from 1910 to 1940? At that time, the global emission of carbon dioxide from cars, trucks, and factories was relatively low--too low to account for the half-degree warming. Here also, natural factors in climate change, rather than human activities, must have been responsible.

That leaves the second spell of global warming, from the 1980s through the 1990s. By that time, copious amounts of carbon dioxide produced by human activities were entering the atmosphere at many times the rates of emission earlier in the century. This recent global warming fits the timing of those big increases in carbon dioxide emissions, and could have been caused by them.

However, it could also be due to natural causes of climate change, such as an increase in the sun's brightness, or a change in the circulation of the oceans. On natural variability, the NAS study has this to say: "Because there is considerable uncertainty in current understanding of how the climate system varies naturally and reacts to emissions . . . current estimates of future warming should be regarded as tentative and subject to future adjustment (either upward or downward)."

How can we tell whether human activity, in contrast to natural variability, is the probable cause of the recent global warming?

### **Greenhouse "fingerprint"**

Fortunately, the temperature increases caused by the greenhouse effect have a special property--the greenhouse "fingerprint"--that does not appear to be possessed by other causes of global warming.

This "fingerprint" is connected with the way the greenhouse effect works. When carbon dioxide is emitted into the atmosphere, it absorbs heat coming up from the surface of the Earth. The absorbed heat warms the atmosphere, and the warm atmosphere then radiates some of that heat back downward to the surface of the Earth, warming the surface. That chain of events is the greenhouse effect.

The key link in the chain is the absorption of heat by the carbon dioxide in the atmosphere. As noted, this absorption warms the atmosphere, which in turn warms the Earth's surface. If there is no warming in the atmosphere, there is no additional warming of the Earth's surface, and therefore no greenhouse effect. A warming trend in the atmosphere is the "fingerprint" of the greenhouse effect.

What do the temperature measurements tell us? Satellites and high altitude balloons have been monitoring the temperature of the atmosphere throughout the 1980s and 1990s, and they show no warming trend. The greenhouse "fingerprint" is missing.

The NAS study acknowledges the difficulty this creates for the prevailing theories of global warming based on carbon dioxide and the greenhouse effect. It is surprising, therefore, that it did not acknowledge the lack of the greenhouse "fingerprint"; without this, it cannot be the greenhouse effect that caused the global warming of the 1980s and 1990s. Once again, that global warming must be mainly the result of natural factors influencing climate.

### **Science concludes warming is natural**

So we see that the scientific facts indicate that all the temperature changes observed in the last 100 years were largely natural changes and were not caused by carbon dioxide produced in human activities. At least one distinguished member of the NAS panel agrees.

Richard Lindzen--professor of meteorology at MIT, highly respected atmospheric physicist, and member of the National Academy of Sciences as well as the special NAS panel on global warming--said in a recent commentary, "I cannot stress this enough--we [cannot] confidently attribute past climate change to carbon dioxide."

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