

Global warming: who's right?

Facts about a debate that's
turned up more questions than answers



EXXON CORPORATION
Fall 1996

Climate change: don't ignore the facts

*The issue reaches into every home and
pocketbook around the world.*

by Lee R. Raymond
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In the debate over global climate change, one of the most critical facts has become one of the most ignored – the undeniable link between economic vitality and energy use.

Achieving economic growth remains one of the world's critical needs, and with good reason. It creates more and better jobs, improves our quality of life and enables us to safeguard the environment. When economies grow, their energy consumption rises. It's no accident that nations with the highest standard of living have the highest per-capita use of energy, about 85 percent of which comes from fossil fuels.

Today, however, a multinational effort, under the auspices of the United Nations, is under way to cut the use of fossil fuels, based on the unproven theory that they affect the earth's climate.

In July, the U. S. administration, without full public discussion and debate, and to the surprise of nearly everyone, proposed the concept of a binding international agreement requiring developed nations to reduce greenhouse gas emissions after the year 2000, and committed the United States to such an agreement. This policy, if implemented, has ominous economic implications that could touch pocketbooks and impair lifestyles throughout and even beyond the industrialized world.

Developing nations, which will account for most of the growth in greenhouse gas emissions, are excluded from most emission-reduction proposals, but they're not immune to their impact. In our increasingly integrated world economy, policies that limit growth in industrialized nations affect trade with developing nations and hinder their economies as well.

This would have profound implications since developing nations face real and immediate problems. The World Bank says one-third of the world's population lacks adequate sanitation and more than one billion people are without safe drinking water – conditions that inevitably lead to disease and suffering.

Solving these problems as populations increase requires economic growth, which, in turn, requires rising energy use.

Politicization stirs fears

Proponents of the global warming theory say that higher levels of greenhouse gases – especially carbon dioxide – are causing world temperatures to rise and that burning fossil fuels is the reason. (See *Global Warming – What to Think? What to Do?* page 4.) Yet scientific evidence remains inconclusive as to

whether human activities affect global climate.

While the atmospheric concentration of greenhouse gases is increasing, 96 percent of the carbon dioxide entering the atmosphere is produced by nature and is beyond our control. Even a small increase in these natural-source emissions could negate any cuts made in the 4 percent of emissions caused by humans. Moreover, forecasts show that even if developed nations reduced their carbon dioxide emissions to zero today, the overall level of atmospheric concentra-

tions of CO₂ would continue to rise because of growth in the developing world.

Unfortunately, huge economic consequences and scientific uncertainty have not prevented activists from politicizing the issue and trying to stir up unreasonable fears. They say the industrialized world should cut back on the use of fossil fuels and that developed nations should agree to legally binding actions by the end of next year. This stance overlooks the need for longer-term research to determine whether human activity impacts global climate.

High costs ignored

In advocating this course of action, proponents ignore the significant costs of mandated reductions in energy use. Every

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credible forecast predicts continued economic growth and increased consumption of fossil fuels in both industrial and developing nations. The International Energy Agency has said that regardless of what assumptions it makes about economic growth, energy prices and energy efficiency, it sees global energy demand growing substantially.

Meeting unrealistic targets for reductions in greenhouse gas emissions will require extreme measures involving increased central government control over energy use. Such measures would include higher energy taxes, fuel rationing and other steps designed to limit energy consumption.

Studies by authoritative organizations such as DRI and Charles River Associates show that taxes required to reduce fossil fuel use to 1990 levels would be substantial. They could add about 60 cents to the price of a gallon of gasoline in the United States, more than quadrupling the federal excise tax on motor fuel, and could raise the price of residential and commercial fuels by 50 percent. The effect of such taxes could be slower economic growth, job losses and impaired ability to compete in foreign markets.

Worldwide fuel rationing

The U.S. administration has also called for the use of "tradable permits" for fuel usage – another term for rationing.

As consumers, we should ask pointed questions about how a worldwide rationing program would work. What international agency would decide how much of what fuel each nation may have "permits" to use? Within each country, who would decide how much gasoline an individual or business could use every month, or how much heating oil one could have for home heating?

Better understanding needed

With these considerations in mind, what's the best way to manage the issue of potential global climate change?

First, we must understand it better, and that's why Exxon is conducting its own research and supports that of others dealing with related science, economics and policy options.

In addition, a constructive approach should consider these points:

- Taking drastic action immediately is unnecessary since many scientists agree there's ample time to better understand climate systems and develop the best long-term strategies.
- Mandating reductions in

fossil fuel use now is needlessly expensive. It would force replacement of major portions of energy-consuming capital stock, such as power plants and other facilities, before the end of their useful life. It would be far less costly to replace this equipment when it would normally be retired.

- Policy proposals should undergo careful analysis and disclosure of their economic, social and competitive impacts, and their acceptability and consequences should be tested in thorough and open public debates.

- If action is needed, it should come in the form of truly global measures that include developing nations, since they will account for most of the growth in greenhouse gas emissions.

- Increased efficiency in energy supply and demand should be encouraged by liberalizing trade, opening world markets and reducing government intervention and subsidies. The world

needs more opportunities for technology transfer through market mechanisms such as investment. This will help to improve energy efficiency and emissions control in developing countries.

- Natural means of carbon dioxide absorption should be part of the analysis of the issue and any policy approach. Measures could include slowing deforestation and encouraging sound forest management practices.

- Voluntary, market-based steps, along with a better understanding of how humans and ecosystems can

adapt to potential climate change, offer the best hope for setting policies that are rational, scientifically sound and cost-effective.

Dealing with facts

Whatever choices we ultimately make about global climate change, let's build on a foundation of facts. Perhaps the most important is the worldwide need to achieve continued economic growth while minimizing the impact on the environment.

Economic vitality, energy use and environmental protection are strongly interrelated, and the world needs all three. Economic growth improves the quality of life and helps pay the costs of protecting the environment. A strong economy in turn depends on the availability of abundant, competitive, affordable and increasingly cleaner supplies of energy, with price and availability being determined in a freely operating marketplace.

Precipitous, poorly considered action on climate change could inflict severe economic damage on industrialized nations and dramatically change your way of life. Those who say otherwise are drawing on bad science, faulty logic or unrealistic assumptions. We must reject policies that will clearly impose a heavy burden of costs but offer benefits that are largely speculative and undefined.

Lee Raymond

**'...poorly considered action
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Is the world getting too warm?

Residents of parts of central Texas, where the mercury hit 100 degrees F last *February*, might think so.

Across the Atlantic, the British Meteorological Office reported that 1995 was the hottest year on record.

Some say that not only is the earth's temperature rising, but to find out why we need only look in the mirror.

Specifically, it's argued, the burning of oil and other fossil fuels has increased the level of certain gases in the earth's atmosphere. This has enhanced the natural "greenhouse

Global warming

We
face more
questions than
answers on almost
every aspect of
this issue.

by Jonathan H. Adler

effect," which in turn has caused global warming.

The United Nations issued a summary report, observing in part that "a pattern of climatic response to human activities is identifiable in the climatological record."

But none of this is as clear-cut as it may seem.

While parts of Texas overheated in February, the Northeast endured a brutal winter that dumped more than 75 inches of snow on New York City.

(Some scientists say blizzards and droughts are signs of global warming.)

The British Meteorological Office's declaration of 1995 as the hottest year on record was based on incomplete

data and did not meet universal acceptance.

The designation was founded on measurements for only the first 11 months of the year. The figures for December were estimates. In reality, temperatures at the end of the year throughout the Northern Hemisphere took the steepest plunge on record.

Global weather satellites, which have taken the earth's temperature since 1979, found that 1995 was actually an average year.

In addition, Australian researchers reported that temperature data in the

way a greenhouse traps heat. In this way the gases help warm the planet. If they didn't, the earth would be frigid, desolate and uninhabitable.

The concentration of greenhouse gases in the earth's atmosphere is increasing.

Atmospheric concentrations of greenhouse gases have been on the rise. Since the beginning of the Industrial Revolution, carbon dioxide in the atmosphere has risen by about 28 percent.

The earth's temperature has been rising.

Since 1881, global average temperatures

the moon, have shown absolutely no warming trend over the past 17 years. (See chart, next page.)

Finally, most of the recorded temperature rise occurred prior to World War II. But it was during the postwar economic boom that human activity produced a significant increase in greenhouse gas emissions.

Predictions of global warming are based on computer models that have proved to be inaccurate.

Most of the predictions cited in the news have been generated by complex

What to think? What to do?

Southern Hemisphere did not support the hottest-year conclusion.

As far as the U.N. declaration goes, the full underlying report acknowledged great uncertainty about climate change. It stopped short of blaming human activity for any recent trends.

So what should we think about global warming? Let's start with what's known and agreed on.

The greenhouse effect is real.

The natural greenhouse effect is unquestionably real and definitely a good thing. It's what makes the earth's atmosphere livable.

Certain atmospheric gases, such as water vapor, carbon dioxide (CO₂) and methane, trap solar radiation in the same

have risen approximately half a degree centigrade.

Both sides in the debate agree on these three points. The arguing begins with the search for cause and effect.

Here are the issues:

Increases in global temperature may or may not be a sign of global warming caused by human activity.

The rise in temperature since the late 19th century could be part of the natural fluctuations that occur over long periods of time. Such fluctuations took the earth in and out of ice ages for millennia.

Satellite measurements, which can record tiny temperature fluctuations caused by the reflection of sunlight off

computer programs known as general circulation models, or GCMs.

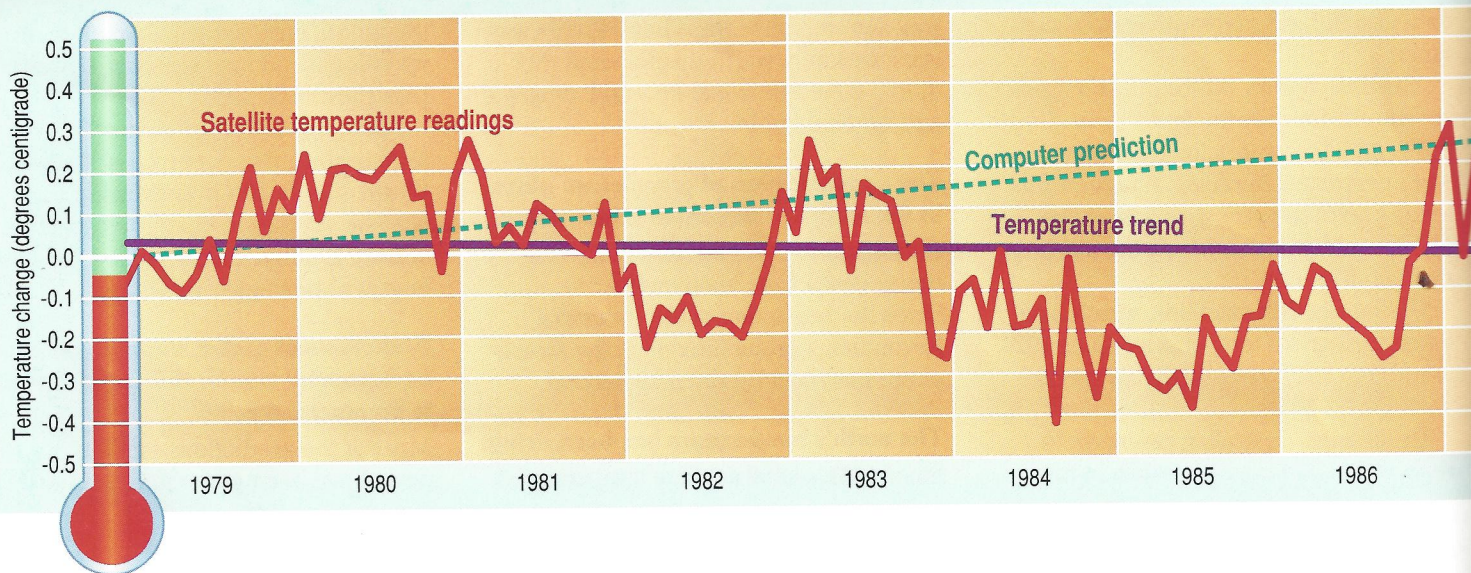
Scientists use these models to simulate the earth's climate and the factors that affect it. These factors range from contours of the planet surface and ocean circulation to the hydrological cycle and albedo (a measurement of sunlight reflected by the earth).

Some scientists point out that computer-based models have been unable to represent current temperatures and climate accurately and are therefore a questionable guide to the next 50 to 100 years. The world has not warmed nearly as much as the models say it should have by now.

The greatest difficulty has been programming the models to accurately

Taking the world's temperature

Contrary to computer predictions, precise satellite measurements show no warming trend.



include the many variables affecting climate.

Modelers have had a particularly hard time accounting for the effects of two critical variables – clouds and precipitation. Clouds can have both warming and cooling impacts, and most models significantly underestimate precipitation.

Dr. David Legates, a climatologist at the University of Oklahoma, adds that computer simulations of precipitation are “exceptionally poor,” in part because they are unable to replicate actual weather.

As models have improved, predicted temperatures have fallen.

Computer models are becoming more consistent at estimating current temperatures. In the process, they’ve begun forecasting less extreme temperature rises caused by the accumulation of greenhouse gases.

For example, computer simulations have only just begun to estimate the impact of sulfate aerosols – dispersed particles that could mitigate warming caused by increases in carbon dioxide. When this is added to the models, the result is the lowest projected temperature change generated by a computer model to date.

The model upon which the U.N. based its most recent report predicts a warming of 0.9 to 3.5 degrees C by the year 2100. The lower-bound warming estimate is approximately half that predicted just four years ago.

We need to know more about the effect of solar cycles on global temperature.

Although they’re getting better, current computer models may still overestimate observed warming. One possible reason for this is the sun.

As *Science* magazine reported earlier this year, several recent studies have found a correlation between temperature changes and solar cycles.

According to *Science*, “the sun could have been responsible for as much as half of the warming of the past century. If so, the role of greenhouse gases would dwindle – as would estimates of how much they will warm the climate in the future as they continue to build up.”

To date, solar cycles have not been incorporated into global climate computer models.

Is global warming good or bad?

Let’s say human activity *does* contribute to warming the planet. What would that warming mean?

The earth’s climate has changed dramatically over the course of history, and one should not assume that any climatic change is inherently bad. “What matters is *how* the climate changes,” notes University of Virginia climatologist Patrick Michaels.

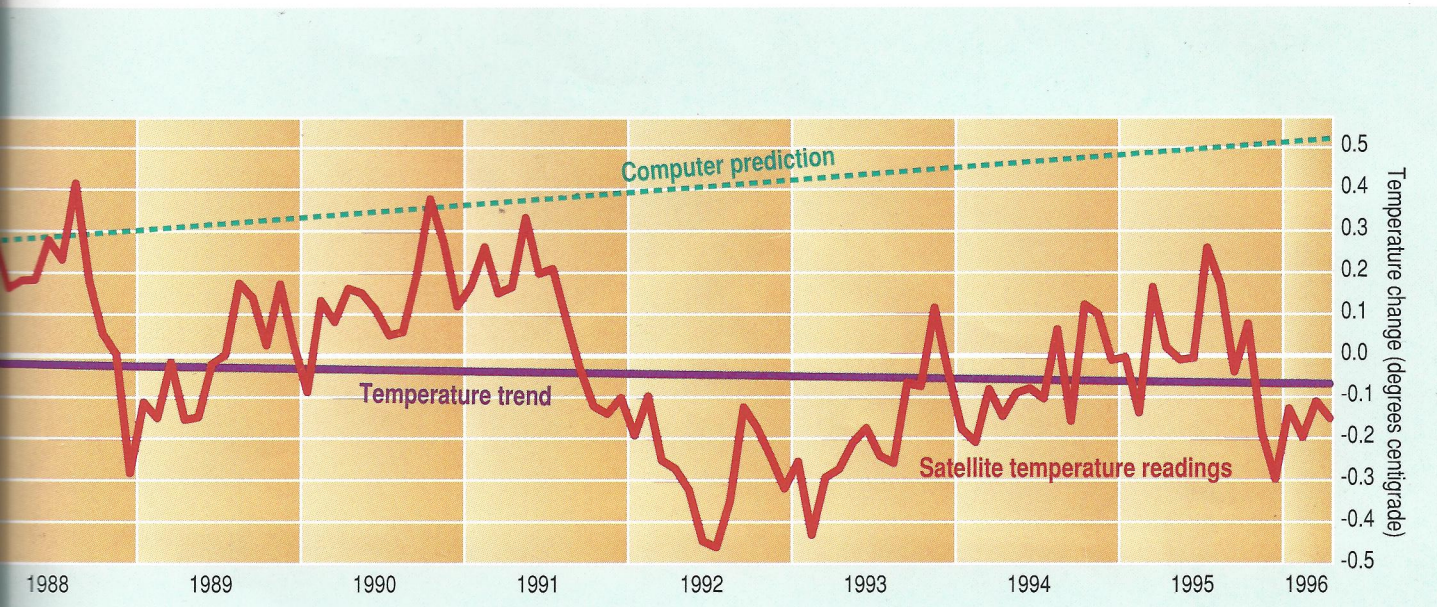
If warming is focused in the summer, we could certainly expect worse droughts and more heat waves.

But warming that occurs mostly during the winter would reduce extreme cold, increase cloud cover and moderate temperature fluctuations. This sort of warming is more likely to raise soil moisture levels than to produce severe droughts.

To the extent that questions about the effects of global warming have been answered, the indications are that a warmer world would be far more benign than many imagine.

Nighttime warming should expand growing seasons, at the same time that higher levels of carbon dioxide accentuate the growth of plants, according to the research of Sherwood Idso at Arizona State University. Thus, an enhanced greenhouse world would be one with more agricultural productivity.

Research at Stanford University’s Hoover Institution suggests that a



What steps should we take...and when?

Global questions about global warming

moderate warming would reduce mortality rates in the U.S., so a slightly warmer climate would be more healthful.

Some claim that global warming will increase the number and severity of tropical storms. On a worldwide basis, precipitation could increase if the world warms up, but tropical storms are still a question mark.

Recent climate modeling suggests that the number of hurricanes and their average wind speed will decline. Slightly warmer winters will also mean that winter storms may be deprived of the frigid polar air masses upon which they depend.

Finally, although changing weather patterns could mean disruption, the human capacity for adaptation has been established throughout recorded time. That adaptability should be taken into account in considering the potential effects of global warming as well.

Clearly, considerable uncertainty exists about future climate change. We are faced with more questions than answers on almost every aspect of this issue, including whether possible changes could be both good and bad.

When facing a clear and obvious danger, most citizens expect their government to pursue a course of action that assures their safety and security. But does this mean governments should adopt policies now aimed at dramatically reducing greenhouse gas emissions – at huge economic costs to society?

There is still a tremendous amount of uncertainty about how the climate will change in the 21st century. More certain is the fact that seeking to achieve dramatic reductions in greenhouse gas emissions will require steep cuts in the use of energy from fossil fuels and greatly disrupt the world economy.

Given this uncertainty, what, if any, policy steps should governments take to address global warming?

Some considerations:

Most of the future growth in greenhouse gas emissions will come from developing countries, not the industrialized world.

Although the United States is the world's largest emitter of greenhouse gases, this will change as the economies of China and India expand. Over the next century

the U.S. will account for only 10 percent or so of global greenhouse gas emissions.

Yet in 1992 the United States and more than 150 other nations accepted a non-binding aim for industrial nations to reduce their greenhouse gas emissions to 1990 levels by the year 2000.

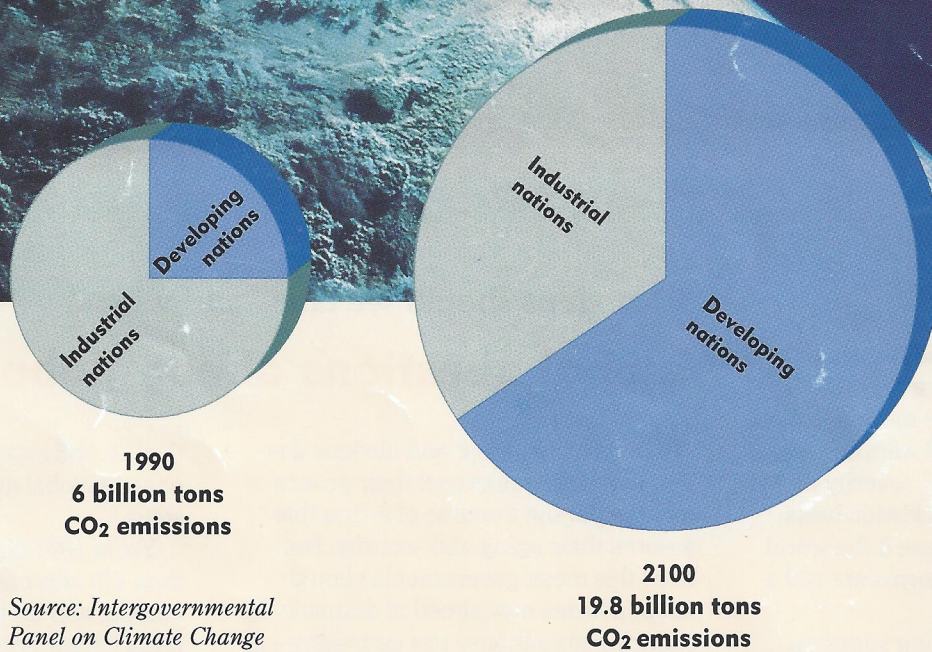
A very limited number of countries will meet this aim. Nevertheless, at a follow-up conference in Berlin last year, delegates from around the world agreed to develop more rigid policy goals for industrial nation emissions beyond the year 2000. Certain political representatives heralded this as an important step toward addressing global climate change.

In July 1996, most delegates at a conference in Geneva reaffirmed this objective, as well as their desire to achieve a legally binding international agreement at a meeting in Japan in December 1997.

However, if predictions of future emissions are right, this agreement will do little about the problem since most of the growth in emissions will occur in the developing world.

“Unless the developing countries

Developing nations to account for most emissions growth



Source: Intergovernmental Panel on Climate Change

Proposals to reduce emissions only in industrial countries ignore rapid growth in developing nations.

participate, it would be impossible to hold global emissions to current levels even if the United States and the [other industrial nations] were to be removed from the picture entirely," says economist

W. David Montgomery, an expert on climate change policy.

Developing nations, intent upon growing their own economies to improve living conditions for their citizens, are unwilling to commit to any emissions reductions.

The cost of reducing greenhouse gas emissions could be staggering.

If model predictions are accurate, extreme measures would be necessary on a worldwide basis to prevent global warming.

Researchers at the Worldwatch Institute argue that nations will have to cut emissions to "60 to 80 percent below today's rate" to change the course of predicted global warming significantly. The cost of doing so would be enormous.

For example, a Department of Energy

study estimates that reducing carbon dioxide emissions by only 20 percent from 1990 levels within 10 years would eventually cost the United States \$95 billion annually.

Another study concludes that applying a carbon tax of \$200 per metric ton could raise gasoline prices as much as 60 cents a gallon and boost residential and commercial fuel prices more than 50 percent.

Drastic measures now will not yield significant benefits.

Cutting the emission of greenhouse gases can be viewed as a form of insurance against a potential greenhouse world. But what exactly would these costly premiums buy?

Studies show the projected temperature in the middle of the next century will scarcely be affected whether policies are

enacted now or 20 years from now.

In any case, the prestigious journal *Nature* published a recent study that suggests dramatic action now may be premature.

Technological advances will make

greenhouse emissions reductions easier in the future – if the developing science confirms that such steps are in fact needed.

Notwithstanding the tremendous uncertainty surrounding global warming, delegates from around the world have scheduled several U.N.-sponsored meetings to chart a course for taking drastic action. Specifically, they will seek to negotiate targets and timetables for reducing greenhouse gas emissions in developed countries. Then they will try at the December 1997 meeting in Japan to agree on those plans.

The biggest remaining question is which will we begin to feel first: the possible heat of global warming or the weight of global warming policy? 🐦