CLOUDS OVER KYOTO

THE DEBATE OVER GLOBAL WARMING

by Jerry Taylor

THE NATIONAL DEBATE over what to do, if anything, about the increasing concentration of greenhouse gases in the atmosphere has become less a debate about scientific or economic issues and more of an exercise in political theater. The reason is that the issue of global climate change is pregnant with far-reaching implications for human society and the kind of world in which our children will live decades from now. The alarmists claim that only by massively restructuring how we live and how our economy is organized can catastrophic global warming be headed-off. Skeptics smell an ideological rat.

Given this potent mix of politics and ideology, it is no surprise that the facts surrounding global climate change have been largely subsumed by political and ideological gamesmanship. Yet before the public and policy makers sign off on the Kyoto Agreement and embark on an aggressive plan to reduce greenhouse gas emissions, it would be well advised to pause for a moment and think long and hard about the wisdom of any such international accord.

As Cato Institute chairman William Niskanen has noted, for any international action to merit support, all of the following propositions must be proven true:

(1) A continued increase in the emission of greenhouse gases will increase global temperature.
(2) An increase in average temperature will generate more costs than benefits.
(3) Emissions controls are the most efficient means to prevent an increase in global temperature.
(4) Early measures to control emissions are superior to later measures.
(5) Emissions controls can be effectively monitored and enforced.
(6) Governments of the treaty countries will approve the necessary control measures.
(7) Controlling emissions is compatible with a modern economy.

HOW HOT THE GREENHOUSE?

The case for any one of those statements is surprisingly weak. The case for a global warming treaty, which depends on the accuracy of all those statements, is shockingly weak.

The first proposition, that a continued increase in the emission of greenhouse gases will increase global temperature, is terribly complex. The second Assessment Report of the International Panel on Climate Change is five hundred pages long with seventy-five pages of references. As Ben Santer, author of the key IPCC chapter that summarized climate change science has noted, there are legions of qualifications in those pages about what we know and what we do not. But, unfortunately, those qualifications get lost in the journalistic and political discourse.

Largely on the basis of computer models that attempt to reflect what is known; what is assumed; and what is guessed, many people believe that continued emissions of anthropogenic greenhouse gasses will increase global temperatures anywhere from 1 to 3.5 degrees Celsius in the next one hundred years.

It should be noted that those estimates have been coming down over time. The 1990 IPCC report predicted a little more than twice that amount of warming, and projections have been declining ever since, as better models have been constructed. One wonders, at this rate, whether the models will continue to predict increasingly smaller amounts of warming until even the upper bound forecasts become so moderate as to be unimportant.

WHAT WE KNOW, AND WHAT WE DON'T

There is little debate that ground-based temperatures stations indicate that the planet has warmed somewhere between .3 and .6 degrees Celsius since about 1850, with about half of that warming occurring since World War II. Moreover, most of the warming occurs over land, not over water; most of the warming occurs at night; and most of the warming occurs as a moderation of wintertime low temperatures.

But there are uncertainties. Shorter sets of data collected by far more precise NASA satellites and weather balloons show a slight cooling trend over the past nineteen years, the very period during which we supposedly began detecting the greenhouse signal. Those data are generally more reliable because satellites and balloons survey 99 percent of the earth's surface, whereas landbased data only unevenly cover the three-quarters of the earth's surface covered by oceans and virtually ignore polar regions. While some of that cooling was undoubtedly a result of the Mt. Pinetumbo volcano eruption and the

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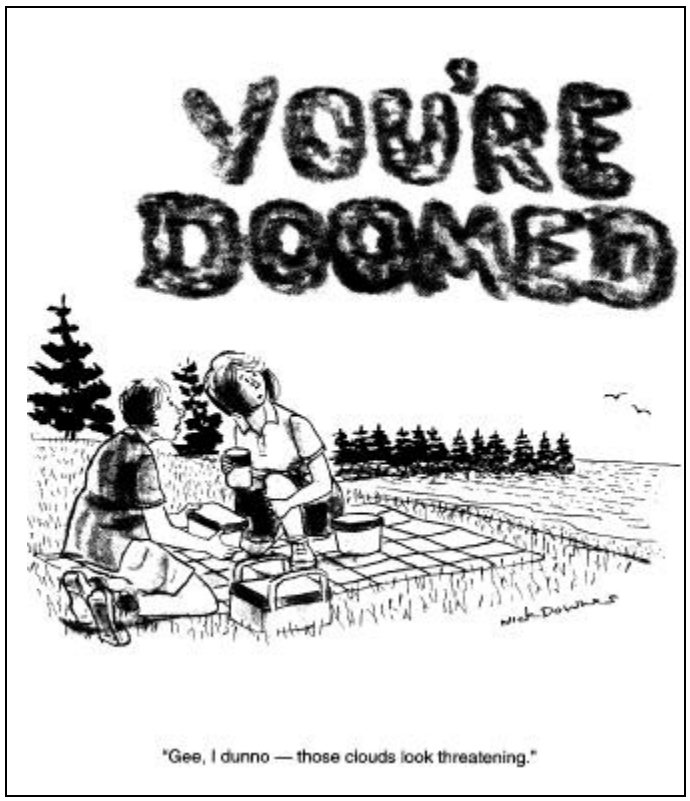


"Gee, I dunno — those clouds look threatening."

increased strength of the El Niño southern oscillation, those events fail to explain why the cooling occurred both before and after those weather events played out and why, even correcting for those events, the temperature data show no significant warming during the nineteen-year period.

While it is true, as critics point out, that satellite and weather balloons measure temperatures in the atmosphere and not on the ground–where ground-based measurements are most reliable–over the North American and European landmasses, the correlation coefficient between satellite and surface measurements is 0.95. That is close to perfect agreement. Further, the computer models predict at least as much warming in the lower atmosphere as at the surface, so if warming were occurring, it should be detectable by the satellites and weather balloons.

Even assuming that ground-based temperature data are more reflective of true climate patterns, that still leaves us with a mystery. When fed past emissions data, most of the computer models predict a far greater amount of warming by now than has actually occurred. Notes the IPCC, "When increases in greenhouse gases only are taken into account . . . most climate models produce a greater mean warming than has been observed to date, unless a lower climate sensitivity is used." Indeed, the most intensive scientific research is being done on why the amount of warming that has occurred so far is so low. After all, a 0.3 to 0.6 degree Celsius warming trend over the last 150 years all but disappears within the statistical noise of natural climate variability. There are three possibilities for the low readings: something is wrong with the temperature data; something is masking the warming that would otherwise be observed; or the atmosphere is not as sensitive to anthropogenic greenhouse gases as the models assume.

INDIRECT EVIDENCE OF GLOBAL TEMPERATURE

Scientists who argue the first possibility cite the largely incompatible, imprecise, and incomplete nature of even recent land-based temperature records. Those observations, of course, are absolutely correct. Instead of relying on the thermostats, those scientists concentrate on indirect evidence suggesting that the planet has been warming and has been warming significantly over the relatively recent past. They typically point to precipitation trends, glacial movement, sea level increases, and increased extreme temperature variability as suggestive of a significant warming trend. Let's take each of those issues in turn.

PRECIPITATION TRENDS: According to the IPCC, global rainfall has increased about 1 percent during the twentieth century, although the distribution of that change is not uniform either geographically or over time. Evidence gleaned from global snowfall is definitely mixed. Still, measuring either rain or snowfall is even more difficult than measuring simple temperature. As the IPCC notes, "Our ability to determine the current state of the global hydropologic cycle, let alone changes in it, is hampered by inadequate spatial coverage, incomplete records, poor data quality, and short record lengths."

Recent evidence from climatologist Tom Karl that the incidence of two-inch rainfalls has increased in the United States received sensational coverage but even according to Karl those increases amount to "no smoking gun." Why? Because he found only one additional day of such rainfall every two years–well within statistical noise–and most of those days occurred between 1925 and 1945, a time period that does not coincide with major increases in emissions of anthropogenic greenhouse gases.

GLACIAL MOVEMENT: The data concerning glacial movement are contradictory. Glaciers are expanding in some parts of the world and contracting in others. Moreover, glacial expansion/contraction is a long running phenomenon and trends in movement do not appear to have changed over the past century.

SEA LEVEL: While there is some evidence that sea levels have risen eighteen centimeters over the past one hundred years (with an uncertainty range of ten to twenty-five centimeters), there is little evidence that the rate of sea level rise has actually increased during the time that, theoretically, warming has been accelerating. Says the IPCC, "The current estimates of changes in surface water and ground water storage are very uncertain and speculative. There is no compelling recent evidence to alter the conclusion of IPCC (1990) that the most likely net contribution during the past one hundred years has been near zero or perhaps slightly positive."

Concerning both ice and sea level trends, the IPCC reports that, "in total, based on models and observations, the combined range of uncertainty regarding the contributions of thermal expansion, glaciers, ice sheets, and land water storage to past sea level change is about negative nineteen centimeters to positive thirty-seven centimeters."

EXTREME WEATHER VARIABILITY: Again, the data for extreme weather variability are mixed. Reports the IPCC:

> [O]verall, there is no evidence that extreme weather events, or climate variability, has increased, in a global sense, through the twentieth century, although data and analyses are poor and not comprehensive. On regional scales, there is clear evidence of changes in some extremes and climate variability indicators. Some of these changes have been toward greater variability; some have been toward lower variability.

THE MASKING THEORY

The second theory about why more global warming is not observed is more widely credited. The most likely masking culprit according to the IPCC are anthropogenic aerosols, primarily sulfates, that reflect some of the sun's rays back into space and thus have a cooling effect on the climate. That aerosols have that affect is widely understood. But as ambient concentrations of anthropogenic aerosols continue to decline (yes, global pollution is on the decline, not on the rise), the argument is that this artificial cooling effect will be eliminated and the full force of anthropogenic greenhouse gas loading will be felt in short order.

That theory becomes particularly attractive when the details of temperature variability are considered. The warming, as noted, is largely a nighttime, winter phenomenon; patterns that suggest increased cloud cover might have something to do with the temperature records.

The best evidence marshaled thus far in support of the masking theory was published in *Nature* in the summer of 1996. The study, by Santer et al., used weather balloon temperature data from 1963 to 1987 to determine temperature trends in the middle of the Southern Hemisphere, where virtually no sulfates exist to counter greenhouse warming. The article, which caused a sensation in the scientific world, showed marked warming and seemed to confirm the argument that, when sulfates were absent, warming was clearly evident. The article was featured prominently in the 1995 IPCC report as strong evidence that artificial sulfate masking was behind the dearth of surface warming.

Yet it turns out that if one examines a fuller set of data from the Southern Hemispheric (1958-1995, thirteen years' worth of data that Santer et al. did not use), no warming trend is apparent. Moreover, careful examination of the landbased temperature records show that it is the regions most heavily covered by sulfates—the midlatitude land areas of the Northern Hemisphere—that have experienced the greatest amount of warming. That, of course, is the exact opposite of what we should discover if the masking hypothesis were correct.

CLIMATE SENSITIVITY

A few of the climate models come reasonably close to replicating past and present climatic conditions when historical data are entered. Those models, interestingly enough, predict the least amount of future warming based on present trends. The two most prominent of those models, those of the National Center for Atmospheric Research and of the U.K. Meteorological Organization, predict warming of only 1.2 degrees Celsius and 1.3 degrees Celsius respectively over the next fifty years; the lowerbound estimates reported by the IPCC.

The argument for moderate climate sensitivity to anthropogenic greenhouse gas emissions largely rests on three observations.

First, there appear to be carbon sinks that continue to absorb more carbon dioxide than can be explained. While most models assume that those sinks are presently or nearly beyond their carrying capacity, there is no way of knowing.

Second, 98 percent of all greenhouse gases are water vapor, and many atmospheric physicists, most notably Richard Lindzen of MIT, doubt that a doubling of anthropogenic greenhouse gases would have much climate effect absent a significant change in the concentration of atmospheric water vapor.

Finally, a warming planet would probably lead to increased cloud cover, that in turn would have uncertain affects on climate. Concedes the IPCC, "The single largest uncertainty in determining the climate sensitivity to either natural or anthropogenic changes are clouds and their effects on radiation and their role in the hydrological cycle . . . at the present time, weaknesses in the parameterization of cloud formation and dissipation are probably the main impediment to improvements in the simulation of cloud effects on climate."

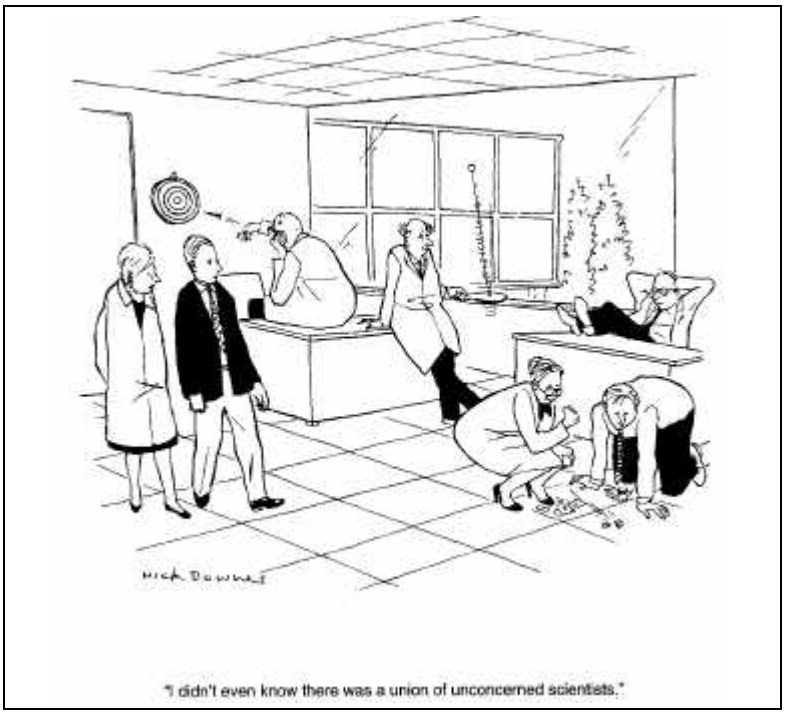
THE ANATOMY OF THE "CONSENSUS"

Despite all the uncertainty, we are constantly told that there is a "consensus" of scientific opinion that human induced climate changes are occurring and that they are a matter of serious concern. That belief is largely due to the weight given the IPCC report, where this consensus is supposedly reflected. The talismanic sentence from that report, inserted by a small, politically appointed committee after the large-scale peer review of the report was completed reads, "the balance of the evidence suggests a discernable human influence on global climate." Now, compare that statement with the following one, which appears on page 439 of the report:

> Finally, we come to the difficult question of when the detection and attribution of human-induced climate change is likely to occur. The answer to this question must be subjective, particularly in the light of the large signal and noise uncertainties discussed in this chapter. Some scientists maintain that these uncertainties currently preclude any answer to the question posed above. Other scientists would and have claimed, on the basis of the statistical results presented in Section 8.4, that confident detection of significant anthropogenic climate change has already occurred.

On p. 411, the statement is even clearer:

> Although these global mean results suggest that there is some anthropogenic component in the observed temperature record, they cannot be considered as compelling evidence of clear cause-and-effect link between anthropogenic forcing and changes in the Earth's surface temperature.



"I didn't even know there was a union of unconcerned scientists."

Counterbalancing the IPCC's note of cautious concern are other, far harsher judgements about the scientific evidence for global climate change.

Over four thousand scientists, seventy of whom are Nobel Prize winners, have signed the so-called Heidelberg Appeal. It warns the industrialized world that no compelling evidence exists to justify controls of anthropogenic greenhouse gas emissions.

A recent survey of state climatologists reveals that a majority of respondents have serious doubts about whether anthropogenic emissions of greenhouse gases present a serious threat to climate stability. Of all the academic specialists, climatologists (only about 60 of whom hold Ph.d.'s in the entire United States) and atmospheric physicists are those most qualified to examine evidence of climate change. It is those professions that are most heavily populated by the so-called "skeptics."

A recent joint statement signed by twenty-six hundred scientists under the auspices of the environmental group Ozone Action is less than compelling. A survey of those signatories by Citizens for a Sound Economy concludes that fewer than 10 percent of them had any expertise at all in any scientific discipline related to climate science.

NOTHING WRONG WITH WARMER WEATHER

The second proposition that must be proven true is that an increase in average temperature will generate more costs than benefits. How costly might global warming prove to be one hundred years hence? That largely depends on the distribution of warming through time and space. It also depends on how much warming occurs; will it be the upper bound or lower bound estimate that comes to pass?

The IPCC's summary states that the "balance of the evidence suggests" that anthropogenic greenhouse gas emissions explain some of the detected warming observed thus far over the past one hundred years. But as noted earlier, that warming has been very moderate; has been largely confined to the northern latitudes during winter nights; and has exhibited no real detrimental effects thus far. There is no reason to believe that those trends will not continue and thus it is doubtful that the costs of warming will be particularly consequential. The present observed warming pattern is certainly consistent with our understanding both of atmospheric physics, which indicates the following:

The driest airmasses will warm faster and more intensely than moister airmasses. The driest airmasses are the coldest; i.e., those in the northern latitudes during the night. And increased warming will increase the amount of water evaporation, which will in turn result in greater cloud cover. Cloud cover during the daytime has a cooling effect; during the nighttime, a warming effect.

Virginia state climatologist Patrick Michaels concludes in the journal *Waste Management* (Vol. 14, no. 2) that:

> If warming takes place primarily at night, the negative vision of future climate change is wrong. Evaporation rate increases, which are a primary cause of projected increases in drought frequency, are minimized with nighttime, as opposed to daytime, warming. The growing season is also longer because that period is primarily determined by night low temperatures. Further, many plants, including some agriculturally important species, will show enhanced growth with increased moisture efficiency because of the well-known "fertilizer" effect of CO_2. Finally, terrestrial environments with small daily temperature ranges, such as tropical forests, tend to have more biomass than those with large ones (i.e., deserts and high latitude communities) so we should expect a greener planet.

Nighttime warming also minimizes polar melting because mean temperatures are so far below freezing during winter that the enhanced greenhouse effect is insufficient to induce melting. Indeed, this warming scenario predicts benign, not deleterious, effects on both the environment and the economy.

But what if the warming turns out to be more serious? What if the median estimate reported by the climate models comes to pass: a 2.5 degree Celsius warming over the next one hundred years?

SIX STUDIES OF ECONOMIC EFFECTS

There have been six particularly comprehensive or prominent studies undertaken to estimate the macroeconomic consequences of such a warming. None of them gives us much reason for alarm. The main reason is that most modern industries are relatively immune to weather. Climate affects principally agriculture, forestry, and fishing, which together constitute less than 2 percent of U.S. gross domestic product (GDP).

Manufacturing, most service industries, and nearly all extractive industries remain unaffected by climate shifts. A few services, such as tourism, may be susceptible to temperature or precipitation alterations: a warmer climate would be likely to shift the nature and location of pleasure trips.

1974 Department of Transportation Study: Back when the world was more concerned with global cooling than global warming, the DOT brought together the most distinguished group of academics ever assembled, before or after, to examine the economic implications of both cooling and warming. In 1990 dollars, the DOT study concluded that a 0.9 degree Fahrenheit warming would save the economy $8 billion a year. Only increases in electricity demand appeared on the "cost" side of the warming ledger. Gains in wages, reduced fossil fuel consumption, lower housing and clothing expenses, and a slight savings in public expenditures appeared on the "benefit" side. The amount of warming examined by DOT is roughly equivalent to what the groundbased monitors suggest the planet has experienced over the last one hundred years.

MODERATE GLOBAL WARMING SHOULD PRODUCE A GREENER PLANET.

1986 EPA Study: Crafted mostly by internal staff (not one of whom had any economics training), the EPA produced few figures, and no quantitative estimates of costs or benefits; failed to even refer to the DOT study of only twelve years earlier; and was littered with qualifications like "could" and "might." While conceding that global warming would reduce mortality slightly, the report nonetheless concluded impressionistically that warming would probably cost the economy.

1991 Nordhaus Study. Perhaps the most prominent academic study of the economic consequences of warming was produced by Yale economist William Nordhaus, an informal adviser to the Clinton administration. Nordhaus calculates that a doubling of atmospheric carbon dioxide concentrations would cost the economy approximately $14.4 billion in 1990 dollars, or about 0.26 percent of national income. On the "cost" side, Nordhaus places increased electricity demand, loss of land due to flooding, coastal erosion, and the forced protection of various threatened seaboard properties. On the "benefits" side, Nordhaus places reductions in demand for nonelectric heat. He concludes that agricultural implications are too uncertain to calculate but estimates that losses could be as great as $15 billion annually while gains could reach $14 billion annually. Finally, Nordhaus assumes that unmeasured impacts of warming could dwarf his calculations, so he arbitrarily quadruples his cost estimates to produce an estimate of warming costs somewhere around 1 percent of GDP.

1992 Cline Study: One of the most extensive treatments of the economic consequences of climate change and climate change abatement was produced by economist William Cline of the Institute for International Economics. Instead of assuming a median 4.5 degree Fahrenheit estimate of warming a century hence (as all other studies tend to do), he assumes an eighteen degree Fahrenheit warming by 2300 and works back from there. Moreover, Cline includes an extremely low "social" discount rate to calculate the value of future investment. Despite that, his preliminary calculations reveal that, for every three dollar of benefits to be gained by emission restrictions, four dollars of costs is incurred. Only by applying arbitrary adjustments after his initial calculations are performed does he find that the benefits of control exceed their costs; but that will not occur, even according to Cline, for at least a century.

Even more controversial are Cline's allocations of the costs and benefits of warming. He finds no benefits whatsoever. Costs are found not only in the traditional places (sea level rise, species loss, and moderately increased hurricane activity) but also in areas where most economists have found benefits: agricultural productivity, forest yields, overall energy demand, and water demand. His net estimate is that, spread out over three hundred years, the costs of warming will be approximately $62 billion annually.

Unfortunately, the Cline study receives the lion's share of attention from the IPCC. The existence of contrary studies is often simply ignored in the document.

1997 Mendelsohn Study: Robert Mendelsohn of the Yale School of Forestry and Environmental Studies calculated late last year that a temperature hike of 2.5 degrees Celsius would lead to a net benefit of $37 billion for the U.S. economy. Farming, timber, and commercial energy sectors all benefit, with agriculture enjoying "a vast increase in supply from carbon fertilization."

1998 Moore Study: Economist Thomas Gale Moore of Stanford University might be termed the "antiCline." Whereas Cline has reported the steepest potential costs of warming, Moore's review of the literature in addition to his own investigation pegs net annual benefits of the median warming scenario at $105 billion. While Moore also finds costs in species loss, sea level rise, increased hurricane activity, and increased tropospheric ozone pollution, he finds moderate benefits in agricultural productivity, forest yields, marine resource availability, and transportation. Moreover, he argues that major benefits will accrue from reduced energy demand, improved human morbidity, an increase from miscellaneous amenity benefits, lower construction costs, greater opportunities for leisure activities, and increased water supplies.

HISTORICAL EVIDENCE

There is some historical precedent for optimism regarding the consequences of the median computer model warming scenario. The period 850 AD-1350 AD experienced a sharp and pronounced warming approximately equivalent to that predicted by the median warming scenario; 2.5 degrees Celsius. That period is known to climate historians as the Little Climate Optimum. While there were some climatic dislocations such as coastal flooding, there were marked increases in agricultural productivity, trade, human amenities, and measurable improvements in human morbidity and mortality.

Only when the climate cooled off at the end of the Little

Climate Optimum did trade drop off, harvests fail, and morbidity and mortality rates jump largely due to an increase in diseases, particularly the plague.

The reason for optimism here is that human civilization was far more weather dependent a millennia ago. And even our more primitive, weather dependent ancestors appeared to do fairly well during their episodic warming.

The third proposition that must be proven true is that assuming even the worst about the consequences of unabated anthropogenic greenhouse gas emissions and their economic consequences does not necessarily imply that emissions controls today make more sense than emissions controls tomorrow.

THERE IS NO COMPELLING NEED TO ACT NOW.

There is no compelling need to act now. According to a recent study by Wigley et al. in *Nature,* waiting more than twenty years before taking action to limit anthropogenic greenhouse gas emissions would result in only about a .2 degree Celsius temperature increase spread out over a one hundred year period.

Why might we want to wait a couple of decades before acting? First, we might profitably "look before we leap." There are a tremendous number of uncertainties that still need to be settled before we can be reasonably sure that action is warranted. Second, we cannot anticipate what sorts of technological advances might occur in the intervening period that might allow far more efficient and less costly control or mitigation strategies than those before us today. Given the low cost of waiting, it would seem only prudent to continue to try to answer the open questions about climate change before making major changes to Western civilization.

THE END OF THE INDUSTRIAL ECONOMY?

Controlling emissions is not compatible with a modern industrialized economy The restrictions on greenhouse gas emissions agreed to in Kyoto are not in any way minor or insubstantial. Reducing U.S. emissions 7 percent below what they were in 1990 by the year 2012 means reducing emissions almost 40 percent below what they would be absent the agreement. Adjusted for expected population growth, it means a 50 percent reduction per capita in greenhouse gas emissions. Virtually everyone agrees that the targets can be met only by reducing fossil fuel consumption, the main source of virtually all anthropogenic emissions.

Environmentalists argue that such reductions can occur relatively painlessly, that we can cut the amount of fuel we use by 50 percent and actually produce even more economic growth as a result. Virtually no mainstream academic economist shares that opinion. The two most prominent and well respected academic specialists, Robert Stavins of the John F. Kennedy School of Government at Harvard and William Nordhaus of Yale, maintain that only the functional equivalent of a $150 per ton carbon tax can accomplish that. They calculate it would reduce GDP by 3 percent, or, as Stavins puts it, "approximately the cost of complying with all other environmental regulations combined." A recent survey in *Forbes* summarizing the recent macroeconomic modeling that has been done on the subject broadly agrees with Stavins's and Nordhaus's estimates.

Then there is the matter of whether the emissions cuts presently on the table are even worth the bother. According to the best computer model from the National Center for Atmospheric Research, the Kyoto agreement, even if signed by all the nations of the world, would reduce global warming by an infinitesimal .18 degrees Celsius over the next fifty years. That is not much bang for the global warming buck.

The reason is that, according to all observers, actually stopping any further global warming—assuming the median predictions of present climate models—would require a 70 percent reduction of present emissions, roughly the equivalent of completely abandoning the use of fossil fuels. That, according to Jerry Mahlman, director of the Geophysical Fluid Dynamics Laboratory at Princeton, "might take another thirty Kyotos over the next century." Indeed, environmentalists are frequently quoted as saying that, ultimately, society will need to be completely restructured around the objective of energy efficiency and sustainability, the economic and political costs of which we can only imagine.

Unless the American people are prepared to see that journey to its completion, there is little point in even bothering to sign the Kyoto agreement because, in and of itself, it will make virtually no difference to our planetary climate.

A MATTER OF PERSPECTIVE

We are constantly urged to act because "we shouldn't be gambling with our children's future." In fact, our kids are marshaled endlessly to shame us into planning for the worst. But even assuming the absolute worst case about future planetary climate change and the most extreme estimates about what that climate change will ultimately cost society, conservative estimates are that our grandchildren one hundred years hence will not be 4.4 times wealthier than we are—as they would be absent global warming—but will instead be only 3.9 times wealthier than we are at present.

It would hardly give a grandchild comfort to know that his grandmother impoverished herself so that he could be 4.4 times wealthier than she rather than 3.9 times wealthier. Further, the increased energy costs of measures to reduce global warming would be borne most directly by the poor, who spend a greater portion of their income on energy than do the wealthy. Moreover, the poor who will pay the highest price of greenhouse gas abatement will be those in the developing world who will be denied the opportunity to better their lifestyle and standard of living. They will be "saved" from the fate of industrialization and experiencing even the most rudimentary comforts of Western consumer societies.

We are not really gambling with the lives of our grandchildren. We are gambling with the lives of today's poor, who stand to lose the most if we act rashly.

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