Climate Policy—From Rio to Kyoto: A Political Issue for 2000—and Beyond

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The greatest environmental challenge of the new century is global warming. . . . If we fail to reduce the emission of greenhouse gases, deadly heat waves and droughts will become more frequent, coastal areas will flood, and economies will be disrupted.

—President William Jefferson Clinton, State of the Union Address to Congress, January 27, 2000

The Rio Climate Treaty as Basis for Kyoto Protocol

International climate policy is embodied in the Kyoto Protocol, concluded in December 1997. Signed by most nations but not yet ratified by them or legally binding, it derives from the U.N. Framework Convention on Climate Change (FCCC), the Global Climate Treaty concluded in Rio de Janeiro in 1992.The Protocol calls for an average reduction of 5.2 percent (relative to 1990 levels) in the emissions of man-made greenhouse gases to be accomplished within the time period 2008 to 2012. It applies only to thirty-nine industrialized (so-called Annex-I) nations but not to developing nations like China and India. The United States would be required to reduce its greenhouse-gas (GHG) emissions by 7 percent from its 1990 level; in the case of carbon dioxide (CO_2), this would amount, by 2010, to an actual reduction in the use of fossil fuels of between 30 to 40 percent from the current estimate for 2010.

The Kyoto Protocol is being advertised as an international agreement to reduce the "threat" of greenhouse warming to the global climate. As its framers and supporters phrase it, global warming is the "greatest challenge to human existence on this planet"; this apparently ignores the challenges from nuclear war, attacks with biological and chemical weapons by terrorists or rogue nations, and the perennial problems of poverty and social unrest. It also ignores the very real threat of a geologically imminent ice age. The late political scientist Aaron Wildavsky more correctly characterized global warming as the "mother of all environmental scares." In reality, the Kyoto Protocol is a radical, ecology-based initiative for launching economic and social policies that threaten personal freedom, economic growth, and national sovereignty; it would also result in a major transfer of wealth from the industrialized nations.

One purpose of this essay is to examine the scientific basis of the Kyoto Protocol, which derives its legitimacy mainly from the 1996 Scientific Assessment Report of the U.N.-sponsored Intergovernmental Panel on Climate Change (IPCC). After citing many uncertainties, the 1996 IPCC report states its principal conclusion in its Summary for Policymakers (SPM): "the balance of evidence suggests that there is a discernible human influence on global climate."How did this conclusion arise and what does it mean?

This innocuous-sounding but ambiguous statement can be interpreted or misinterpreted in many different ways. I believe that the policies adopted in Kyoto flow from such a misinterpretation, which took place in Geneva in July 1996. It was there that the chief U.S. delegate first insisted on mandatory targets and timetables for the reduction of GHG emissions, in the apparent belief that the IPCC statement spelled a coming climate disaster for mankind. A second purpose of this essay, therefore, will be to trace this critical policy development, which set the stage for the Kyoto Protocol of December 1997. Much of this material has not been published previously.

The final section of this essay explains why the Kyoto Protocol is costly but ineffective. Yet its adoption will depend mainly on political factors, with the U. S. presidential elections of 2000 playing a crucial role. Without ratification by the United States, the Protocol is unlikely to become operational. There is even suspicion that many European politicians who are loudly promoting Kyoto are counting on the United States to scuttle the accord.

At the outset, it should be stated that examining the scientific base of an international agreement is not a popular exercise among diplomats and politicians. Trained mostly in law, they would much rather stipulate that the science is "settled" or "compelling." When pressed on such matters, however, they will cite an "overwhelming scientific consensus" or use similar language to avoid dealing with the scientific evidence itself. Yet common sense compels us to ask, first of all, whether there is a problem and—further—how its magnitude and likelihood compare to other problems faced by humanity. Clearly, science has much to contribute here. But before turning to these questions, I want to examine the legal basis for setting the GHG emission goals of Kyoto.

Dubious Legal Basis

Whereas the Kyoto Protocol calls for specific quantitative reductions in GHG emissions, the FCCC ("Climate Treaty") itself sets out the ultimate objective. It is not widely appreciated that the purpose of the Climate Treaty is not a reduction in GHG emissions or even in their atmospheric concentration. Rather, Article 2 states only that "the ultimate objective is to achieve *stabilization* of greenhouse gas concentrations in the atmosphere at a level that would prevent *dangerous* anthropogenic interference *with the climate system*" (emphases added). (There is no further definition here of the desired or "dangerous" level or any mention of human health or ecological values. We do know, however, that plants would stop operating if CO_2 levels were somewhat lower than during the last ice age.)

We may presume that the drafters of the FCCC were chiefly concerned with the stability of the climate system, fearing that a higher level of GHG might endanger this stability or increase the variability of global climate. This is a difficult scientific question, which was never addressed in the IPCC report. The evidence we have, however, going back to the recent Ice Age, suggests that the climate was more variable—or less stable—during *colder* periods than during the warmer period of the present Holocene (of the past ten thousand years).On shorter time scales, it also seems that warmer periods exhibit a more stable climate.

In preparing for the Kyoto negotiations, its chairman specifically requested the IPCC to provide scientific guidance on Article 2, but this request was never

fulfilled.The goal of the Climate Treaty remains undefined to this day; we simply don't know whether a higher or a lower concentration of GHG will represent a "danger to the climate system." It is known, however, that the Earth has experienced much higher levels of carbon dioxide in the past, apparently without any ill effects to the climate. We must therefore conclude that, strictly speaking, the FCCC furnishes no legal basis whatsoever for restricting the emission of greenhouse gases.

Weak Scientific Basis

To place the Kyoto Protocol in context, to understand its implications, and to appreciate its many problems—if it is ever adopted—one must first stipulate a large number of items about the science of climate change and about the economic impact of global warming. These are more fully discussed in my book *Hot Talk, Cold Science: Global Warming's Unfinished Debate (HTCS)*.Below are some of the highlights:

1. The subject of climate change must rest on observations of the climate in all of its aspects; with temperature as the most important and easily measured parameter. On the one hand, we are inundated with data, many of which do not add appreciably to the discussion; on the other hand, we lack crucial information about the past that may never be recovered. For example, individual temperature measurements using thermometers date back for only about three hundred years; the record for the Northern Hemisphere (NH) dates from about 1860; and it is only since 1979 that weather satellites have been able to obtain truly global data, including also from the hitherto poorly observed 70 percent of the surface covered by oceans.

2. To gain perspective on the subject of climate change, one needs to look at the past. Proxy data from tree rings, corals, ocean sediments, ice cores, and other evidence can tell us about paleotemperatures. Although the data are not exactly global and not always of the best quality, certain conclusions can be reached. The Earth's climate has never been steady; it has either warmed or cooled—without any human intervention. The measured variations have often been large and rapid—larger and more rapid than those predicted by climate models for the year 2100. In the last 3,000 years (i.e., during recorded human history), temperatures in the North Atlantic have changed by as much as 3°C within a few decades (*HTCS*, p. 6). During the most recent Ice Age, the

variability has been even greater. Is the climate more stable during warmer periods? We cannot be sure, but the evidence points in this direction. Current controversy revolves around whether the twentieth century was the warmest in the past thousand years. Although the analysis of some proxy data supports this notion, it is clearly contradicted by others that show evidence for the warm period around A.D. 1100, often termed the "Medieval Climate Optimum," followed by the "Little Ice Age" that lasted off and on until about 1860.

3. What has caused the climate to vary? All sorts of theories have been propounded, and many have been backed up by data. It is clear, however, that different causes can be acting simultaneously, with their importance depending primarily on the timescale involved. The frequent ice ages of the last few million years appear to be caused by changes in the absorbed incident solar radiation, in turn affected by orbit changes of the Earth described by the so-called astronomical theory. Longer-term climate changes seem to be linked to continental drift and other tectonic events, such as mountain building. Shorter variations, on the timescale of decades, appear to be caused by atmosphere-ocean interactions and changes in ocean circulation. Alternatively, they could be due to external causes, such as variations in solar irradiance (solar "constant") or in solar activity (ultraviolet radiation and/or solar corpuscular radiation). There are suggestive correlations of the 11-year sunspot cycle with cloudiness and with temperature, but as yet no convincing physical mechanism that links them (*HTCS*, p. 7).

4. What about the association of climate change with atmospheric greenhouse gases? On the timescale of hundreds of millions of years, carbon dioxide has sharply declined; its concentration was as much as twenty times the present value at the beginning of the Cambrian Period, 600 million years ago. Yet the climate has not varied all that much, and glaciations have occurred throughout geologic time even when CO_2 concentrations were high.

5. On a timescale of decades and centuries, there seems to be an association between temperature and CO_2 concentration, as judged by measurements of Greenland and Antarctic ice cores. (The association is even better for the greenhouse gas methane.) Yet the causal connection is not at all clear. Only recently has it been possible to obtain sufficient resolution to demonstrate that

the increase in CO_2 *lags* about six hundred years behind the rapid warming that signals deglaciation (the end of an ice age and the beginning of an interglacial warm period).

6. There is general agreement that the increase in atmospheric greenhouse gases, such as CO_2, methane, nitrous oxide, and so on, over the last hundred years or so is due to human activities. Attention has focused mainly on CO_2 from fossil fuel burning, the most important anthropogenic GHG. Less than half of the released CO_2 remains in the atmosphere; this fraction seems to be diminishing. The rest is absorbed by the ocean and by the biosphere, thereby speeding up the growth of agricultural crops and forests. Informed opinion holds that half of the released CO_2 is absorbed into the shallow oceans within thirty years, that the mean residence time is about seventy-five years, and that a "tail" may last more than a century (*HTCS*, p. 73). The residence time of methane is much shorter, only about twelve years. For reasons as yet unexplained, the rate of increase of atmospheric CO_2 has slowed considerably in the last decades, and methane may have stopped increasing altogether. This makes it extremely difficult to predict future concentrations of CO_2 and methane, the latter depending primarily on the rate of population growth (originating mainly through cattle raising and rice growing). With respect to CO_2, estimates of emissions vary greatly, depending on energy scenarios. These are determined not only by population growth and economic growth but also by the availability of fossil fuels—in turn a strong function of technology and of price. Much to the surprise of many experts, the price of oil has generally decreased, even as readily available low-cost resources are being depleted. There is considerable disagreement about the probable date when atmospheric GHG concentration might reach double the preindustrial level. Estimates vary from the year 2050 all the way to never.

Figure 1. Figure 1 unviable from Source

changes in the global surface air temperature since 1880 (referred to the average temperature for 1951 to 1980). Note the rapid rise up to about 1940, likely the recovery from the "little Ice Age" that followed the "Medieval Climate Optimum." Temperatures fell till about 1975, when there was a sudden jump, tied to changes in ocean circulation and other worldwide changes. The climate record since 1979 has been in controversy, with surface observations indicating a warming while satellite and balloon-borne radiosondes showed no warming of the bulk ofthe atmosphere. This disparity has not yet been satisfactorily explained. See the National Research

Council, *Reconciling Observations of Global Temperature Change* (Washington, D.C.: National Academy Press, 2000).
Note: Zero line shows the average temperature for the years 1951–1980.

There is general agreement that the global climate warmed between about 1860 and 1940, following several centuries of the "Little Ice Age," which in turn was preceded by the "Medieval Climate Optimum" around A.D. 1100 (see figure 1) There is less agreement about the causes of this recent warming, but the human component is thought to be quite small (*HTCS*). This conclusion seems to be borne out by the fact that the climate cooled between 1940 and 1975, just as industrial activity grew rapidly after World War II. It has been difficult to reconcile this cooling with the observed increases in greenhouse gases. To account for the discrepancy, the 1996 IPCC report has focused attention on the previously ignored *cooling* effects of sulfate aerosols (from coal burning and other industrial activities), by reflecting a portion of incident sunlight. But this explanation to support the "discernible human influence" conclusion is no longer considered valid. Leading modelers all agree that the aerosol forcing is more uncertain than any other feature of the climate models.

The temperature observations since 1979 are in dispute. On the one hand, surface observations with conventional thermometers show a rise of about 0.1–0.2°C per decade, which is only half that predicted by most GCMs. On the other hand, satellite data, as well as independent data from balloon-borne radiosondes, show no warming trend between 1979 and 1997 in the lower troposphere, and could even indicate a slight cooling (if one ignores the unusual warming of 1998 by El Nino).Direct temperature measurements on Greenland ice cores show a cooling trend between 1940 and 1995 (*HTCS*, p. 74). It is likely therefore that the surface data (from poorly distributed land stations and sparse ocean measurements) are contaminated by the local warming effects of "urban heat islands" (*HTCS*, p. 13).

Although it is certainly true that human activities are affected by temperatures at the surface, the GCMs are best validated by observations in the troposphere. It should be noted also that GCMs predict a warming trend that *increases* with altitude, rising to about 0.5°C per decade—in clear disagreement with all observations, whether from the surface, balloons, or

satellites (as documented in a U.S. National Research Council report of January 2000).

Climate Models

The large discrepancy between model results and observations of temperature trends (whether from the atmosphere or surface) demands an explanation. The twenty or so models developed around the world by expert groups differ among themselves by large factors (*HTCS*, p. 49). Their "climate sensitivities" (defined as the temperature increase for a doubling of GHG forcing) vary from as low as 1°C to as high as 5°C; the IPCC gives a conventional range of 1.5°C to 4.5°C. An intercomparison of models has established that a major uncertainty relates to how clouds are treated. Since the models are still quite coarse (~400 km), lacking the required spatial resolution, they must parameterize clouds and even cloud systems in some fashion. In many models, clouds add to the warming, but in others clouds produce a cooling effect (*HTCS*, p. 5). The situation is even more confused with respect to water vapor (WV), the most important greenhouse gas in the atmosphere, contributing more than 90 percent of the radiative forcing. In current climate models, water vapor is taken to produce a positive feedback, thereby amplifying the warming effects of a CO_2 increase. Everyone agrees that a warming produced by an increase in CO_2, or by any other cause, will lead to more evaporation and therefore to a higher level of atmospheric WV; however, it is the WV concentration in the upper troposphere—not in the boundary layer—that determines whether the feedback is positive or negative (*HTCS*, p. 52). On that score, opinions differ widely and probably will continue to do so until the necessary data are at hand.Yet until GCM climate sensitivity is validated by observations, one cannot accept the predictions of large future temperature increases.

Impacts of Climate Change

If the climate were to change according to model predictions, one would expect to see fewer severe storms, in view of the reduced temperature gradient between the tropics and high latitudes. Model calculations do not indicate an increase of hurricanes, El Niño events, or other kinds of climate oscillations (*HTCS*, p. 75). The empirical evidence displayed in the IPCC report shows a decline in hurricanes over the last fifty years in both frequency

and intensity; a future warming is not expected to affect frequency or intensity appreciably. Observations on El Niño events are not conclusive as yet.

With respect to sea-level rise, it has been assumed, conventionally, that a warming will increase the rate of rise because of the thermal expansion of ocean water and the melting of mountain glaciers. Certainly, when viewed on a millennial scale, sea level has been rising steadily, by about 120 meters (360 feet) since the peak of the last ice age, about fifteen thousand years ago. It will continue to rise at about 18 cm (7 inches) per century for another six thousand years or so, as the West Antarctic ice sheet slowly melts away; there is nothing humans can do to affect this (*HTCS*). But when examined on a decadal scale, which is more appropriate to human intervention, this ongoing sea-level rise is found to slow during periods of temperature increases, for example, during the temperature rise from 1900 to 1940. Evidently, increased evaporation, linked to warming, followed by precipitation, results in increased accumulation of ice in the polar regions, thereby *lowering* sea level. This conclusion seems to be backed by direct observation of ice accumulation, as well as by some modeling studies (*HTCS*, p. 18). A future modest warming should therefore slow down, not accelerate, the ongoing rise of sea level.

Economic Impact of a Possible Climate Warming

Economists have recently reexamined the 1996 IPCC (Working Group III) review of economic impacts. (Some of these studies had shown large losses for agriculture but not for sea-level rise, whereas others showed the opposite.) This reexamination shows a substantial gain for agriculture and forest growth but little effect on other economic activities in the United States; it finally concludes that a warming, from whatever cause, would produce economic benefits rather than economic losses (see table 1).The new findings on sea-level rise (above) would reinforce this conclusion, which has not yet been widely publicized or discussed.

Table 1. Estimated Annual Impact of Doubling CO_2

	New Estimate (billions of 1990$)	*Previous Estimate (IPCC 1996) (billions of 1990$)*	*Methodological Improvements*
Market Sector Estimates			
Agriculture	+$11.3	–$1 to –$18	Inclusion of additional crops and adaptation opportunities
Timber	+3.4	–1 to –44	Dynamic climate, ecological, and timber modeling
Water Resources—market only	–3.7	–7 to –16	Integrated hydrologic and economic models
Energy	–2.5	–1 to –10	Includes all space conditioning fules
Coastal structures	–0.1	–6 to –12	Dynamic analysis of representatives sites
Commercial fishing	–0.4 to +0.4	NA	First estimates
Total (market sectors)	+8.4	–14 to –68	Totals are for above market sectors only
As percent of 1990 GDP	+0.2%	–0.3% to –1.2%	
Nonmarket Sector Impact Estimates			
Water quality	–$5.7	–$32.6	Basin-based regional estimates
Recreation	+4.2	–1.7	Includes summer activities and empirical evidence

SOURCE: Chapter 12, "Synthesis and Conclusions," in *The Impact of Climate Change on the US Economy*, R. Mendelsohn and J. Neumann, eds. (Cambridge: Cambridge University Press, 1999).

How the IPCC Arrived at Its Ambiguous Conclusions

The first IPCC assessment (in 1990)reached the conclusion that the climate record of the past century was "broadly consistent" with the expected temperature rise, as calculated by climate models that incorporated the observed increase in GH gases. This conclusion, however, proved difficult to maintain in view of the absence of warming (and even a modest cooling) between 1940 and 1975 (see figure 1). (The strong temperature rise before 1940 can best be understood as a natural variation of the climate, likely associated with a variation in the solar radiation.) In preparing its second (1996) assessment, the IPCC no longer used this verbiage to claim agreement between theory and observations. Instead, it found it necessary to introduce a previously neglected climate factor, namely, a negative "radiative forcing" (cooling) from anthropogenic sulfate aerosols arising mainly from the sulfur emissions of power plants and industries in Europe and North America. Since it opposes the positive radiative forcing from GH gases, the aerosol cooling effect, by reflecting sunlight, was then put forward to account for the absence of warming and other discrepancies between observed temperature trends and calculations from General Circulation Models (GCMs). In fact, the major theme of the 1996 IPCC report is that, with aerosols included, observations and theory agree. To strengthen its conclusion, the report tries to show that, with aerosols included in GCMs, the agreement pertains not just to global average temperature, to the ratio of Northern Hemisphere (NH) to Southern Hemisphere (SH), and to latitude dependence, but also to more detailed geographic and vertical trends. If, indeed, such "fingerprints" could be shown as present in the climate record, then the evidence for human influences becomes more certain.

But the NH (where sulfate aerosols are concentrated) has been warming more rapidly than the SH, contrary to model expectations. Perhaps the strongest argument *against* the aerosol model comes from satellite observations of tropospheric temperatures. They show a cooling trend everywhere, except for a warming trend at northern mid-latitudes, just where the sources of sulfate aerosols are concentrated and their cooling effect should be most important (see *HTCS*, p. 15). (Temperature data from balloon-borne radiosondes show a similar result.) Clearly, sulfate aerosols cannot explain this large discrepancy between observations and computer models. This had been the

key conclusion of the 1996 IPCC report, but it evidently no longer holds. That the aerosol explanation is out of date is also evident from the publications of leading climate modelers who have essentially discounted the direct radiative forcing effects of aerosols in trying to explain the observations. Other contributors to the IPCC report have expressed doubts about the IPCC conclusions. A strong proponent of global warming, NASA's James Hansen wrote: "The forcings that drive long-term climate change are not known with an accuracy sufficient to define future climate change." The discrepancy between models and observations must therefore be ascribed to other exogenous factors (like solar variations) or to endogenous factors that are poorly treated in climate models, such as details of clouds or the vertical distribution of water vapor.

High government officials have declared repeatedly that climate science is "settled" and "compelling." The clear implication is that we know enough to act; any further research findings would be "policy irrelevant" and not important to the international deliberations of the parties to the Climate Treaty. This essay concludes otherwise. The observational evidence described above suggests that any warming from the growth of greenhouse gases is likely to be minor, difficult to detect above the natural fluctuations of the climate, and therefore inconsequential. In addition, the impacts of warming and of higher CO_2 levels are likely to be beneficial for human activities and especially for agriculture. Further, the ultimate goal of the Climate Treaty is still undefined; it could be a higher or a lower level of GHG than the present one. Finally, the Kyoto Protocol (calling for an average cut of 5.2 percent in GHG emissions by industrialized nations) is not sufficient to reduce significantly the ongoing growth of GHG in the atmosphere; its effect on temperature would imperceptible. As pointed out in the initial IPCC report, however, stabilization at the present GHG level requires that emissions be cut by 60–80 percent—worldwide.

Clearly, climate science is neither "compelling" nor "settled"—as often claimed by politicians and accepted by much of the public—but remains a challenging field for research.

"Discernible Human Influence"? The Shaky Science behind IPCC's Chapter 8

Chapter 8 of the 1996 IPCC report is the crucial chapter, concerned with the problem of "Detection of Climate Change and Attribution of Causes." Since the scientific evidence for the IPCC conclusion (about "discernible human influence") is derived from that chapter, we will examine here the two crucial analyses in chapter 8, and then discuss subsequent publications that claim to present evidence for a human influence on climate.

Geographic Pattern Correlation

Climate is constantly changing, showing a warming trend or a cooling trend, depending on the choice of time interval. It is important, therefore, to distinguish between a warming due to natural causes and a warming that could be due to human activities—such as an increase in CO_2, as moderated by an increase in aerosols. The technique adopted, termed "fingerprinting," consists of comparing the detailed geographic pattern of climate change with what is calculated from climate models. This comparison, as published in the IPCC report, seems to indicate a growing correspondence between observed and calculated patterns. On closer examination, however, this result is obtained only if the chosen time interval is 1943 to 1970. More recent decades show no such increase; use of the complete record, from 1905 onward, shows no increase either. We are thus led to conclude that the evidence presented is based on selective data and does not support the IPCC's conclusion that a human influence can be discerned.

Thermal (Altitude-Latitude) Structure of the Atmosphere

If man-made aerosols (emitted mainly in the NH) played an important role in affecting the temperature patterns, then we would expect to see striking differences in temperature trends as a function of latitude and altitude, with the SH warming more rapidly. But again, the claimed results depend on a particular choice of time intervaland thus do not support the IPCC conclusion.

To sum up: Neither of the claimed pattern correlations supports the conclusion that "the balance of evidence suggests a discernible human influence on global climate." Despite such inadequate scientific evidence, the lead authors of chapter 8 strongly uphold such a conclusion:

There is evidence of an emerging pattern of climate response to forcings by greenhouse gases and sulphate aerosols . . . from the geographical, seasonal and vertical patterns of temperature change. . . . These results point towards a human influence on global climate. (IPCC 1996, p. 412)

But in a concurrently appearing research paper, involving some of the same authors, we read:

Estimates of . . . natural variability are critical to the problem of detecting an anthropogenic signal. . . . We have estimated the spectrum . . . from palaeo-temperature proxies and compared it with . . . general circulation models. . . . None of the three estimates of the natural variability spectrum agree with each other. . . . Until . . . resolved, it will be hard to say, with confidence, that an anthropogenic climate signal has or has not been detected.(Emphases added)

No Evidence for Anthropogenic Contributions to Twentieth-Century Warming

Much has been made by the IPCC and others that the "fingerprint" method (comparing computed and observed temperature change patterns) can identify anthropogenic global warming. But this method should only be used to distinguish anthropogenic from other causes when warming actually takes place. The appropriate test would be the period between 1920 and 1940, when global temperatures rose sharply despite emissions being less than one-sixth of today's value (see figure 1). Is the cause there anthropogenic? Not if one believes in the result of the fingerprint method, as displayed in figure 8.10b of the IPCC report (which shows the pattern correlation *decreasing* between 1920 and 1940).

Fingerprint Analysis

The leader of the largest German climate institute, Klaus Hasselmann, a well-known promoter of global warming, has tried to address this question.He finally concludes that "uncertainties in the detection of anthropogenic climate change can be expected to subside only gradually in the next few years, while the predicted signal is still slowly emerging from the natural climate variability noise . . . once the signal has been unequivocally detected above the background noise." I take this convoluted language to mean that a human influence on global climate has not yet been detected.

The most recent status report by the leading international group of specialists in this technique, representing ten major climate centers, concludes:

> *At present it is not possible to make a very confident statement about the relative contributions of specific natural and anthropogenic forcings to observe climate change. One of the main reasons is that fully realistic simulations of climate change due to the combined effects of all anthropogenic and natural forcings mechanisms have yet to be computed.*

Autocorrelation Analysis

Another prominent group of IPCC authors claims to have demonstrated a human influence on climate during the past century by means of an involved statistical (autocorrelation) analysis.But their method is inappropriate and their conclusion is spurious. All they have demonstrated is that model simulations cannot adequately account for the natural variability of the climate. This comes as no surprise since climate models do not include external forcings from volcanic eruptions or solar variability, important on eleven-year and longer timescales. Nor can the models simulate the complicated interactions between atmosphere and oceans, such as the El Niño-Southern Oscillation, the North Atlantic Oscillation, and other as yet unidentified oscillations. I have critiqued the published analysis and draw the opposite conclusion: The autocorrelation analysis does not provide support for an anthropogenic effect on global temperature.

The National Research Council Report on Reconciling Temperature Trend Disparities

There are still many outstanding puzzles in interpreting climate data. Why do surface observations show a warming trend from 1979 to 1998 of about 0.15°C per decade, while satellite data (as well as radiosondes carried in weather balloons) show hardly any warming of the bulk of the atmosphere? The NRC panel writing the report included four prominent critics of the satellite data; yet they had to endorse their validity.

The panel could not explain the disparity between surface and atmosphere, however.It may well be that the surface data are contaminated by the effect of urban "heat islands" (*HTCS*, p. 12) or by instrumental problems stemming

from the multitude of methods used to measure the temperatures of the sea surface and changes in their mix over time.

More significant for the central problem of the validity of climate models, GCMs predict a surface warming of 0.2 to 0.3°C per decade and a much stronger warming, about 0.5°C, for the upper troposphere. The NRC panel did not address this major discrepancy between climate models and observations.

Politics Enters into Drafting the IPCC Report

The small group of IPCC scientists involved in preparing the main conclusion in the Summary of the IPCC report went through many agonizing drafting sessions. In a paper presented at the Twenty-eighth International Geographical Congress in The Hague, Netherlands, in August 1996, Bruce Callander, head of Atmospheric Processes Research of the U.K. Meteorological Office, relates the six different formulations that were discussed in meetings between March 1995 and the Madrid meeting of the IPCC in November 1995.

The IPCC Summary for Policy Makers (SPM) was approved at the Rome meeting of the IPCC plenary in December 1995, and the full report was accepted, including chapter 8. After the printed report appeared in May 1996, it was discovered that there had been some unannounced editing of this crucial chapter, which backs up the main conclusion of the IPCC report about a "discernible human influence." There is no question that substantial changes were made between the time when the report was approved in Madrid and the time it was printed. The convening lead author, Ben Santer, readily admitted to making these changes.

The fact that these changes were made, and the key deleted phrases, was brought to wide attention in the summer of 1996 in an article in the *Wall Street Journal*, written by Professor Frederick Seitz.In response, he was subjected to personal attacks and his article disparaged since it was claimed that he had not published research papers in climate science—an entirely irrelevant objection.

The full comparison of the approved draft and the final printed text is available; we quote here key phrases that were deleted from the approved draft before printing:

1. "None of the studies cited above has shown clear evidence that we can attribute the observed [climate] changes to the specific cause of increases in greenhouse gases."

2. "While some of the pattern-based studies discussed here have claimed detection of a significant climate change, no study to date has positively attributed all or part [of the climate change observed to date] to anthropogenic [man-made] causes. Nor has any study quantified the magnitude of a greenhouse-gas effect or aerosol effect in the observed data—an issue of primary relevance to policy makers."

3. "Any claims of positive detection and attribution of significant climate change are likely to remain controversial until uncertainties in the total natural variability of the climate system are reduced."

4. "While none of these studies has specifically considered the attribution issue, they often draw some attribution conclusions, for which there is little justification."

5. "When will an anthropogenic effect on climate be identified? It is not surprising that the best answer to this question is, `we do not know.'"

   The following sentence was *added* in the final printed version:

6. "The body of statistical evidence in Chapter 8, when examined in the context of our physical understanding of the climate system, now points to a discernible human influence on the global climate." (Ref. 2. p. 439)

   The important questions are whether the alterations and deletions were in accord with IPCC procedures, who authorized and approved them, and whether they were merely stylistic or whether they affected the sense of the report. According to *Nature*(381 [1996]: 539), rarely critical of the IPCC, the emendations affected the sense of chapter 8 and were designed to "ensure that it conformed" to the politically arrived-at Summary for Policymakers.

One can trace the text changes to a letter of instruction from the U.S. Department of State, dated November 15, 1995, shortly before the Madrid meeting. It was addressed to Sir John Houghton, head of the IPCC Working Group I (Climate Science), and signed by a Mr. Day Mount, acting deputy assistant secretary of state, environment and development. The operative phrase appears in the final paragraph of suggested changes and instructions:

> *It is essential that the chapters not be finalized prior to the completion of discussions at the IPCC WG I plenary in Madrid, and that chapter authors be prevailed upon to modify their text in an appropriate manner following discussion in Madrid.*

A report in the June 20, 1996, issue of *Nature* first mentioned the existence of the letter; a leading article in the June 13 issue assigned responsibility for the changes to IPCC officials and stated that the changes were made to "conform" the chapter to the SPM. It appears, therefore, that the IPCC conformed its scientific report to the political agenda of setting up international controls on energy use.

The Myth of a "Scientific Consensus"

To deflect criticism from the "scientific cleansing" of chapter 8, attacks directed against Professor Seitz and other skeptics claimed support from a "scientific consensus." On this issue, the following points should be noted:

It is sheer fantasy to suggest that a majority of scientists with expertise in disciplines related to global climate change endorse an alarmist interpretation of the data. In 1992, a "Statement of Atmospheric Scientists on Greenhouse Warming," opposing global controls on industrial greenhouse-gas emissions, drew about a hundred signatures, mostly from members of technical committees of the American Meteorological Society. The 1992 "Heidelberg Appeal," which also expressed skepticism on the urgency for global action to restrict greenhouse-gas emissions, drew more than 4,000 signatures from scientists worldwide. The 1996 "Leipzig Declaration," which echoed the previously released Heidelberg Appeal, has been signed by more than a hundred climate and other scientists, including several who participated in the IPCC report. The statement emerged from an international conference on the greenhouse-gas controversy in November 1995 in Leipzig, Germany,

sponsored by the prime minister of the state of Saxony. In 1998, more than 17,000 scientists signed the "Oregon Petition," which expressed similar skepticism about the need for government action to address global warming and opposed the Kyoto Protocol.

Ultimately, of course, a "show of hands" or a majority vote of researchers does not discover scientific truth. It is discovered through a process of debate, investigation, and research. Reason and data—not democracy—ultimately establish scientific truth. Arguments should be accepted or rejected based on a consideration of the facts presented and the interpretation of those facts that seems most reasonable. "A lot of scientists disagree with you" is not a persuasive rebuttal to an argument. Were it otherwise, science would still be in the Dark Ages.

The attack against the Leipzig Declaration and the Oregon Petition has degenerated to a very low level. In the case of the Leipzig Declaration, it was claimed (on a Danish television program) that some of the scientists did not actually sign the Declaration; this claim has been exposed as untrue, as had to be admitted by the program. The program's attack was then directed against one of the signers, a TV meteorologist, who did not have the appropriate academic credentials. It turns out that they picked the wrong person; he is not only an elected fellow of the American Meteorological Society but also taught meteorology for several years before taking the TV position.

In the case of the Oregon Petition, the detractors managed to insert a few fake names and then miraculously "discovered" these names in the list. This maneuver, of course, cannot disqualify the more than 17,000 scientists who signed the Petition.

By contrast, the claim that 2,500 IPCC scientists support the IPCC conclusion cannot be sustained. Only about a hundred of the fewer than two thousand names listed in the three volumes of the 1996 report have appropriate scientific credentials, and many of these are on record as opposing or doubting the IPCC conclusion. In any case, the only poll conducted of IPCC contributors and reviewers back in 1991 showed that, while the majority supported the chapter they worked on, this did not extend to the Summary.

The Road from Rio to Kyoto

Following the 1992 Rio de Janeiro Conference and ratification of the U.N. Framework Convention on Climate Change (FCCC), the Conference of the Parties (COP) met for the first time in 1995 in Berlin. At that meeting, attended by delegations from some 150 countries, an important decision was taken. The "Berlin Mandate" called on industrialized countries (only) to reduce emissions voluntarily to the 1990 levels. Developing countries were not required to do so.

The following year, COP-2 met in Geneva. At that meeting, the Leipzig Declaration was released, reminding that "there is still no consensus on the subject of global warming. On the contrary, most scientists now accept the fact that actual observations from earth satellites show no climate warming whatsoever [since 1979]." At a press conference, the executive secretary of the FCCC was asked if there had been any attempt to measure the degree of scientific consensus. Obviously irritated, he replied, "Consensus is not unanimity; it is very much up to the president [of COP-2]."

As reported, the head of the American delegation, U.S. undersecretary of state for global affairs Tim Wirth, also made some rather critical remarks about "a couple of revisionist scientists." In the published transcript of the press conference, his words came out this way: "Scientific consensus does not mean unanimity. There are a handful of scientists who remain in a very different position from the overwhelming consensus of the international scientific community."

Wirth then changed the dynamics of COP-2 by suddenly calling for a legally binding agreement to reduce post-2000 industrialized country emissions of carbon dioxide and other greenhouse gases. The United States recommended that future negotiations focus on an agreement that sets a realistic, verifiable, and binding medium-term emissions target. This support for legally binding targets and timetables set the stage for the subsequence COP-3 meeting in Kyoto in 1997.

The U.S. delegation also issued a ringing endorsement of the IPCC, stating that "the science calls on us to take urgent action." However, this policy switch had been in the works long before the IPCC report was finalized. *Nature* (July

25, 1996) cites a direct quote by Deputy Assistant Secretary of State Rafe Pomerantz that "the Administration has been working on this policy for more than a year." In his official statement on July 17, 1996, as head of the U.S. delegation, Wirth elaborated, stressing the catastrophic nature of a projected global warming:

> *The chemical composition of the atmosphere is being altered by anthropogenic emissions of greenhouse gases. The continued buildup of these gases will enhance the natural greenhouse effect and cause the global climate to change. Based on these facts and additional underlying science, the Second [1996] Assessment [of the IPCC] reported that "the balance of evidence suggests that there is a discernible human influence on global climate." This seemingly innocuous comment is in fact a remarkable statement: for the first time ever, the world's scientists have reached the unavoidable conclusion that the world's changing climatic conditions are more than the natural variability of weather. Human beings are altering the Earth's natural climate system. In turn, the best scientific evidence indicates that human-induced climate change, if allowed to continue unabated, could have profound consequences for the economy and the quality of life of future generations: Human health is at risk from projected increases in the spread of diseases like malaria, yellow fever and cholera; food security is threatened in certain regions of the world; water resources are expected to be increasingly stressed, with substantial economic, social and environmental costs in regions that are already water-limited, and perhaps even political costs where there is already conflict over limited resources. Coastal areas—where a large percentage of the global population lives—are at risk from sea-level rise. In our opinion, the IPCC has clearly demonstrated to policymakers that action must be taken to address this challenge and that, as agreed in Berlin, more needs to be done through the Convention. This problem cannot be wished away. The science cannot be ignored and is increasingly compelling. The obligation of policymakers is to respond with the same thoughtfulness that has characterized the work of the world's scientific community. (Official Statement of U.S. delegation, July 16, 1996)*

When the delegations to COP-2 could not reach consensus, it was decided to issue a Ministerial Declaration. In it, the ministers

Recognize and endorse the Second Assessment Report [SAR, published in 1996] of the IPCC as currently the most comprehensive and authoritative assessment of the science of climate change, its impacts and response options now available. Ministers believe that the Second Assessment Report [SAR] should provide a scientific basis for urgently strengthening action at the global, regional and national levels, particularly action by Annex-I Parties [industrialized nations] to limit and reduce emissions of greenhouse gases, and for all Parties to support the development of a Protocol or another legal instrument; and note the findings of the IPCC, in particular the following:

º The balance of evidence suggests a discernible human influence on global climate. Without specific policies to mitigate climate change, the global average surface temperature relative to 1900 is projected to increase by about 2°C (between 1°C and 3.5°C) by 2100; average sea level is projected to rise by about 50 centimeters (between 15 and 95 centimeters) above present levels by 2100. Stabilization of atmospheric concentrations at twice pre-industrial levels will eventually require global emissions to be less than 50 percent of current levels. (Paragraph 2 and subparagraph 1 of the July 18, 1996, Ministerial Declaration.)

This Ministerial Declaration evidently echoes Wirth's misinterpretation of the science by linking and equating the IPCC conclusion (about a discernible human influence) with a warming of 2°C by the year 2100. In fact, the IPCC report specifically denies such a conclusion:

To date, pattern-based studies have not been able to quantify the magnitude of a greenhouse gas or aerosol effect on climate. (IPCC 1996, p. 434)

Following these events, a number of independent scientists under the leadership of Professor Seitz signed a letter (August 20, 1996) addressed to Professor Bert Bolin, then chairman of the IPCC, urging him to take action and clear up the misinterpretation of the IPCC's scientific report:

We note that a major conclusion in the SPM is the ambiguous phrase, taken from ch. 8: "the balance of evidence suggests a discernible human influence on global climate." The existence of such presumed human influences does not by itself validate the climate models. In particular, it cannot be used to claim a substantial temperature rise in the next century—nor does the IPCC Summary make such a claim. The likely reason: IPCC scientists would never

agree to this. What the Summary does is to report the outcome of climate model calculations (that have never been validated). It then implies—by juxtaposition—that the "human influences" somehow validate these models.

Thus while the IPCC phrase does not in any way confirm a future warming, it does convey such an impression to policymakers; and indeed, since we do not find any specific disclaimer in the Summary, this may have been the purpose. Judging from statements in Geneva by government officials, this purpose has been accomplished. The Ministerial Declaration of 18 July 1996, under paragraph 2, specifically—and improperly—links the IPCC phrase about "human influence" to a temperature increase of 2°C by 2100.

Our question is: Is the IPCC going to do something about this "misunderstanding"? Does not scientific integrity demand that you complain about the misuse of the IPCC report for political purposes and draw attention to the explicit sentence in the SAR section 8.4.2.3 (p.434): "To date, pattern-based studies have not been able to quantify the magnitude of a greenhouse gas or aerosol effect on climate."

We detect here a serious misuse of science and of scientists for political purposes. We earnestly request that you respond to these concerns in order to protect the scientific integrity of the IPCC process.

Professor Bolin and the IPCC leadership did not act, however, and Wirth's misinterpretation of the science became generally accepted. In particular, it led directly to the stringent controls proposed in Kyoto a year later.

Detailed Critique of the Kyoto Protocol

It may be appropriate to list here some scientific and other problems with the Protocol:

- *The 5.2 percent cut in emissions (by industrialized nations only) is ineffective in slowing down the increase in GHG levels.* If one accepts the model results quoted in the IPCC report, then the business-as-usual scenario would lead to a hypothetical warming of 1.4°C by 2050. Again, using the IPCC data, a full implementation of the Kyoto Protocol would lower this value to 1.35°C, a change of only 0.05°C (*HTCS*, p. 68). It is generally recognized that more drastic steps are required to achieve a substantial slowing down of the

ongoing increase in GHG. According to the IPCC, stabilization of CO_2 concentration at the 1990 level requires emission cuts of between 60 and 80 percent on a *worldwide* basis, not just from industrialized nations. Informed estimates hold that emissions from developing nations will predominate after about 2020.

- *The Kyoto Accord is so complicated as to be practically infeasible.* It has the certainty of endless disputes about what constitutes an emission cut or how to gain credits for establishing a carbon sink. Here are some questions:

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1. The initial problem, of course, arises with the allocation of national quotas, especially if the Protocol were to be extended to developing nations. Should quotas be based on present energy consumption, on the 1990 level, or on some hypothetical future level extrapolated from population growth? And should the per capita consumption of developing nations be set at some higher level than the present one; if so, at what level?

2. Nor are these the only issues that must be resolved. To whom should a nation's emission quotas be allocated—to oil companies that sell petroleum products (e.g., gasoline) to the marketplace or to businesses and household purchasers of transportation fuel; to coal, oil, and natural gas companies that supply electric utility companies; or to the utilities generating electric power? Will importers of plastics (that incorporate fossil fuels) or of aluminum (that incorporates electric power) bear charges for the emissions? How will credits be assigned to entities that manage to reduce net emissions by fuel switching, introducing methane or nuclear power, or by setting up schemes for sequestering CO_2? Will credits be given to users of dirty coal, which creates sulfur-dioxide pollution leading to sulfate aerosols that cool the atmosphere? Conversely, who will bear the burden of producing clean coal or low-sulfur gasoline, as required by government regulations, all of which also require large energy expenditures?

3. Trading of emission permits has been hailed as a way of reducing the financial burden of emission cuts. But the process is clearly political, depending crucially on the initial assignment of quotas. If eventual quotas for developing countries are large, then permits may trade at a low price; but it

will do little to cut total global emissions. More likely, this will create a permanent entitlement program that funnels money from industrialized nations needing emission permits to nations willing to sell. It may even have the perverse effect of keeping developing nations from developing, if their government officials decide that the transferred funds can be put to a "better" use, like building showy luxury projects or diverting it into foreign bank accounts. Even if the money is not squandered or misappropriated, it is likely to nurture a huge bureaucracy that could seriously throttle free enterprise and economic development.

4. On the other hand, if assigned quotas are low, permits become scarce and costly. Emission trading then emerges as a hidden energy tax for industrialized nations. Whoever buys the emission permits, whether electric power companies or oil firms, they will have to pass the cost along to the consumer. Just keeping emissions at the 1990 level might require a carbon tax of $100 a ton or more and would lead to corresponding increases in energy prices. However, modest price increases may not be enough to suppress demand. After all, raising gasoline prices by anything less than a dollar a gallon will hardly reduce the demand for driving. For the average motorist, fuel cost is a small fraction of the total cost of automobile transportation, on the order of 20 percent. The price of gasoline would have to go up by several dollars to make a real impact on driving habits.

5. Finally, an international authority will have to be created to monitor emissions, enforce compliance, and punish treaty violators?

- *The Kyoto Protocol is costly.* There is little doubt that implementation of the emission cuts would be extremely expensive, in terms of higher energy prices, reduced economic growth, and loss of employment as industry moved to countries not required to cut emissions. (These include such giants as China, India, Brazil, and Mexico.) Depending on the degree of permitted emission trading and on other assumptions, the cost estimates of Kyoto to the United States range from less than 1 percent (by the White House) to 4 percent (by the Energy Information Administration of the U.S. Department of Energy).Such costs might be considered acceptable if the losses due to warming exceeded this value. However, a detailed reevaluation of the economic impact of warming has concluded that the impact would be *positive* and raise GNP, rather than lower it (see table 1).

The evidence of inadequate scientific support might persuade scientists that climate policy based on Kyoto is not appropriate. As far as the general public is concerned, the economic arguments could carry an even stronger weight. In particular, the "precautionary principle" is not relevant when the cost of the "insurance policy" dwarfs any imagined benefits that might be gained by avoiding a slight additional climate warming.

- *To sum up*: Controlling emissions, by whatever method, is extremely costly, distorts economic decisions, destroys jobs, is difficult to monitor, and practically impossible to enforce. It is likely to create huge international bureaucracies and police forces, damaging not only industrialized countries but also certainly coal and oil exporters, and most of the developing countries, since they depend on trade with the industrialized nations. In addition, controls would do little good unless emissions are cut drastically worldwide.

The Political Battle about Kyoto Heats Up

The foregoing discussion should make it clear that the Kyoto Protocol is not needed, is not effective in mitigating climate change (even if developing nations were to cooperate), is economically destructive, and is therefore politically unacceptable. Yet it has already spawned a large international bureaucracy—even before being implemented. It is becoming evident that the Protocol will lead to endless negotiations as national interests collide and will likely require renegotiation. At present, it is little more than a framework—and an immensely complicated one. Even after agreement has been reached regarding proposed emission cutbacks by individual nations, little has been done so far to establish the terms for inspection, monitoring, and enforcement. At the present time, negotiations are proceeding on how to establish allowances for carbon sinks, such as tree planting, or for increases in efficiency. The problems here are detailed and endless.

To complicate matters further, the United States has been persistent in advocating a scheme of unlimited international emission trading, which would lower the cost of complying with the Protocol. Entities, whether industries or countries, that find it easier to cut back emissions could sell their unused allowances to entities that would incur a high cost. European nations and many environmental groups oppose unlimited trading. They point out that rich countries could "buy their way out" of emission cuts. They are partly correct,

particularly if the price of permits is low. In that case also the global level of emissions may not even be reduced.

There are also provisions in the Protocol whereby industrialized nations, which are required to reduce emissions, can gain credits by helping developing nations that are not required to reduce emissions. One such scheme is called "Joint Implementation"; for example, a U.S. electric utility can gain credit for planting trees in Central America to sequester CO_2 from the atmosphere. Another scheme is the Clean Development Mechanism, which consists of transferring technology, equipment, and/or capital to developing nations to let them acquire more efficient power plants and other methods of reducing emissions.

We can see here the beginning of a policy to transfer resources to developing nations in order to persuade them to comply, if only voluntarily, with the kind of emission cutbacks called for in the Protocol. The international emission-trading ideas are beginning to look a lot like the New International Economic Order (NIEO), which has been high on the agenda of developing countries for decades. Cynics have described the NIEO rather unkindly as the transfer of resources from the poor in the rich countries to the rich in the poor countries.

On an international scale, many countries signed the Protocol before the deadline of March 15, 1999, but only some small nations have ratified it so far. Iceland has announced that it will not sign, citing its need for energy to develop industry and maintain its standard of living. For the Protocol to go into effect, 55 percent of the nations representing at least 55 percent of emissions will have to ratify. Since the United States is the largest emitter of carbon dioxide (36 percent), it holds the key to its implementation.

But within the United States, a huge political battle has been shaping up. In July 1997, the U.S. Senate passed the (anti-Kyoto) Resolution 98, the so-called Byrd-Hagel resolution, by a vote of ninety-five to zero. The Resolution demands that the administration not enter into a treaty that would either damage the United States economically or exempt nations that emit greenhouse gases. In response to the Resolution, the administration, after signing the Protocol in November 1998, has decided not to submit it for Senate ratification since it would surely be turned down. Instead, the White House is engaged in a campaign to circumvent Congress in a variety of ways.

The White House drive to make the Protocol the law of the land without Senate ratification is probably unconstitutional. The scheme to circumvent Congress is multifaceted, using executive orders, regulatory rulings, and money to buy off and split the opposition.

The Environmental Protection Agency may be attempting to classify CO_2 as a pollutant that could be controlled by the EPA under the terms of the Clean Air Act. This ploy will be difficult to achieve since CO_2 is not injurious to human health. Furthermore, Congress is likely to legislate against such a regulation and interpretation of the Clean Air Act. The White House is also trying to enlist public opinion behind the Protocol by organizing eighteen regional workshops that stress the dangers of GH warming to different regions of the United States, using funds that were appropriated for climate research. In addition, President Clinton has asked for four billion dollars to support a Climate Change Technology Initiative, a system of subsidies and tax credits for industries interested in government support for developing alternative energy sources—a replay of the panicky efforts of Nixon's Project Independence and later programs under Jimmy Carter. Clinton's FY 2001 budget requests $2.4 billion for various tax credits linked to CO_2 emission reductions.

The most interesting scheme for getting industry behind the Protocol is legislation to give marketable credits to industries for taking "early action" to cut CO_2 emissions. But these credits would only gain value if indeed the Protocol becomes the law of the land. It therefore turns these industries into promoters of Kyoto by giving them financial incentives. Conversely, since this is a zero-sum game, businesses and consumers that do not reduce emissions within the early period would pay more heavily when trying to meet the requirements for emission reduction.

If such a scheme should ever become law, it will cause tremendous problems within the United States and give rise to conflicting interpretations. For example, would a public utility gain credits for buying a nuclear power plant? Would suppliers of natural gas incur heavy penalties as they increase gas supplies to power plants switching from coal to gas? Could an industry gain credits for taking steps that it would do anyway, either because they make economic sense or because of pollution regulations? For example, would a utility get credits for actions to reduce nitrogen-oxide pollution, as required by law, while at the same time reducing CO_2 output?

Aside from gaining public support for the Kyoto agreement, the administration is also attempting to circumvent the Senate's objection that most of the world's nations are not part of the Protocol. We are already witnessing diplomatic efforts by the White House to persuade countries to undertake voluntary cuts in emissions. So far, Argentina and Kazakhstan seem to have made noises in that direction; we can only guess at the quid pro quo offered to them.

The White House has also made subtle attempts to redefine the Senate Resolution by claiming that it could be satisfied if "key" developing countries were to take "meaningful" steps. But what is meant by "meaningful"? And who should define the term? Clearly, as the body responsible for approving treaties, only the U.S. Senate can decide on the proper definition. Its members should not concede this task to other branches of government.

From a scientific point of view, "meaningful" emission reductions are those that can make a noticeable impact on the atmospheric concentration of greenhouse gases and on temperature. By this criterion, the Kyoto Protocol itself is not meaningful. Even if punctiliously observed by all industrial states, the 5.2 percent average reduction (with respect to 1990 emission rates) would lower the calculated temperature increase for 2050 by only 0.05 degrees C (from 1.40°C to 1.35°C). Even ten Kyotos would not stabilize atmospheric GH gas levels, but merely slow down the current rate of increase.

From an economic point of view, a meaningful reduction by developing nations should be large enough so as not to induce U.S. industry to move its energy-consuming manufacturing activities offshore. From a political point of view, a meaningful reduction by developing nations should be one that satisfies the above criteria—without requiring offsetting foreign aid or other payments that constitute a bribe paid by the U.S. taxpayer.

The administration's strategy for meeting the other objection of the Senate is to rely on emission trading to reduce the cost of Kyoto. In principle, trading should reduce the cost of compliance, with the lowest-cost industries cutting their emissions and selling their unused permits to those whose control costs are higher. This procedure seems to work well with permits for sulfur dioxide within the United States. But there's no guarantee that it will work for CO_2 on an international scale. There is first of all the matter of objections from those who feel that this is simply a method of "buying out" from emission cuts.

Former U.K. environment minister John Gummer has lambasted the United States in vehement terms.European governments have been cool to emission trading and generally seem to feel that is essential that one suffers hardships; it is considered a kind of moral imperative. While the U.S. favors unrestricted emissions trading, the European Union wants to impose a limit of about 50 percent. The EU position is somewhat difficult to maintain since, under its agreed "bubble" concept, trading among its member states is unrestricted. The matter is likely to continue under negotiation for a long time to come.

But the real problem, as already mentioned, is the initial assignment of emission quotas. A subtle point here was the decision to use 1990 as the base year. The choice of 1990 gives a major preference to Great Britain and Germany, as well as to the former Soviet Union. In the case of Great Britain, it has switched from coal to gas and thereby reduced its CO_2 emissions while at the same time closing down economically unproductive coal mines. The unification of East and West Germany resulted in the closing down of extremely inefficient and uneconomic power plants and industries; as a result, between 1990 and 1995 Germany actually reduced its emissions of CO_2 by 25 percent! In the case of the former Soviet Union, the economic collapse has reduced its emissions greatly. France, on other hand, switched to nuclear power before 1990 and does not get credit for these large reductions in emissions. This matter is likely to cause problems when the final adjustments are made within the European Union. In the meantime, Russia has a lot of "hot air" emission credits to sell to Western nations, particularly the United States. If international emission trading is approved, the developing countries will want to sell "tropical air" to the United States in a giant income transfer.

As mentioned earlier, there is a catch here, of course. If these countries have plentiful emission credits for sale, then their price will not be very high. This means that the United States would be able to buy permits cheaply and proceed as if the Protocol did not exist. In other words, the existence of large unused quotas of emission permits means that the emissions will continue as before Kyoto and that the atmospheric concentration will be little changed.

But if the quotas are set tightly, then prices will be at the high end. The cost will be passed along to the consumer by power stations and industries, in addition to the direct expenditures for transportation and heating. The vaunted trading scheme will then become mostly a carbon tax. By making energy

costly in the United States, it will cause industry and jobs to move overseas where there are no restrictions—exactly what Senate Resolution 98 tries to oppose.

We have not even dealt in depth with the problems of accounting, measuring, monitoring, enforcement, and sanctions. The details of all of these are mind-boggling and likely to involve lengthy negotiations. They certainly represent an intrusion on industries and consumers in the United States by a bureaucracy that is controlled by an international elite that is not responsive to voters since it is not elected. In many ways, this is one of the most objectionable and disagreeable aspects of any protocol that tries to limit emissions on an international basis.

What's Driving the Support for the Kyoto Protocol?

With all these problems and with so little scientific and economic justification, why the support for Kyoto within the administration and many other sectors of society? There are, of course, several different strands here; it is useful to disentangle them and discuss them separately. There is, first of all, a large group of people without any hidden agenda who simply believe that global warming is real and is posing a threat to their welfare and to the welfare of their children and grandchildren. Let's refer to them as the "upper-middle-class, overanxious." (Perhaps they can be educated, but this will require a major effort.) Working-class men and women, and especially organized labor, are not likely to share these views, being more concerned about the immediate loss of jobs than about a future hypothetical warming.

We then have groups that gain directly from the Kyoto Protocol in one way or another. Scientists of all stripes get more funds for research, not just climate experts but also social scientists and even theologians who ponder the ethics of environmental change. Bureaucrats see their power increase as their budgets grow; they receive perks, recognition, and the ability to control the lives of others. Environmental activists, and especially their well-paid leaders, share some of the same objectives; perhaps that's why they work so well with government. The media find disasters of any kind irresistible—even if fictitious, they sell newspapers and airtime on TV. Many consulting groups and industries receive direct financial benefits from the two-billion-dollar-a-year research budget of the federal government. And don't forget the finance

ministers, who see this as a convenient way of raising additional revenue through a large-scale energy tax or carbon tax—basically a consumption tax. Like a gasoline tax, it is regressive but it is easy to control—and is touted to be kind to the environment. It also permits more government spending—which gets us back to those who receive the funds.

But we also have groups with broader agendas, some of them open, some others hidden. The "one worlders," including U.N. officials, see this as an opportunity to strengthen world government. Global warming is of little concern to them except as a means of setting up and empowering U.N. bodies to supplant national sovereignty. A different agenda fuels the antigrowth and antitechnology advocates, who want to deindustrialize the United States and other developed countries. Ironically, most of them also oppose nuclear power, the major non-CO_2-emitting energy source today; but this only proves that they are against energy rather than warming. Some of them have a romantic view of returning to a preindustrial rural existence; others are driven by less noble ideals. Here we have the core of all the environmental movements, including the neo-Malthusians who believe that we are running out of resources—that the world is facing disaster unless we cut back on growth.

Finally, there are the neopagans, who put Nature above mankind, worship plants and animals, and consider humans to be outside of nature. Examples of this kind of thinking abound: the Morelia Declaration signed by several prominent scientists in 1991 or the remarkable testament of Al Gore's thinking, *Earth in the Balance*, his 1992 compendium of environmental alarms.

Conclusion: Let the U.S. Senate Withdraw from the Treaty

By almost any assessment, human-induced climate change over the next hundred years is likely to be much less important than other agents of global change, such as population growth, economic growth, and development of new technology. If, as has been argued here, climate change is a minor problem compared to other societal problems, then adaptation becomes the preferred option; one can then devote any resources thus saved to more urgent societal problems. It is difficult to justify major expenditures, governmental or private, for mitigation or for the control of GHG emissions

that ignore other unmet human needs: improved health care, adequate nutrition, sanitary drinking water, education, and personal and public safety.

Can we predict the outcome of this struggle about the adoption of the Kyoto Protocol? If the basis were just science or economics, then Kyoto won't make it. But in a democracy, the battle will be political, which makes the outcome a little difficult to fathom, particularly since the media appear to have already chosen to accept and promote global warming fears.

The science is fairly straightforward. Even if one were to trust the model predictions of future temperature rise, Kyoto is not the way to go: too expensive and quite ineffective. If it is decided that the Climate Treaty (FCCC) calls for limits to CO_2 in the atmosphere, sequestration may be the better alternative for mitigation—at least as an adjunct to the emission controls of the Kyoto Protocol. (Current research suggests that fertilizing the oceans with iron, a micronutrient, may become a cost-effective method.) But the main message from science is that we have already seen high temperatures in the historic climate record; and further, we can be fairly sure that a little warming will restrain sea-level rise—not accelerate it—and that severe storms and even hurricanes will not increase. Economics also paints a benign picture of global warming. If the latest analyses are borne out, then more warming is what we need—to increase GNP and prosperity.

But both scientific and economic arguments are contentious and lead to debates that the media and decision makers, not to mention the public, will find difficult to follow. Therefore, it will come down to a political decision. Because of the leading position of the United States in emissions, it will be a U.S. political decision that determines the global fate of the global Protocol.

In Congress, the division is likely to have a partisan tinge. Even though the Senate voted unanimously for the Byrd-Hagel resolution, many Democrats may ultimately support President Clinton and Al Gore. The position of labor unions, blue-collar workers, and minorities will be crucial. If they become convinced that Kyoto spells job losses, they may well vote against the Democrats. In the coming presidential campaign, populists like Pat Buchanan may have much to say about Kyoto and jobs.

But the key factor will be the election in the year 2000 of the president of the United States. Here the Kyoto debate could play a significant role since Vice President Al Gore is so strongly identified with support of Kyoto. To many voters therefore he comes across as a zealot; to ecoactivists, however, he comes across as a hypocrite for not pushing the issue harder during the campaign. The fate of the Protocol may well depend on whether Gore wins or loses the election in 2000. Conversely, an informed debate about the scientific and economic problems of the Kyoto Protocol could scuttle the Gore presidential bid.

Recommendation: In the absence of scientific support or any evidence that a warmer climate would on balance be harmful, and in view of the ineffectiveness and exorbitant cost of the Kyoto Protocol, it is recommended that the United States exercise Article 2 of the FCCC and withdraw from the Climate Treaty. Such an action would have a sobering effect on politicians globally and allow them to focus on real world problems: avoidance of general warfare and alleviation of poverty in the developing countries.

The text of the 1992 Global Climate Treaty, formally known as the Framework Convention on Climate Change (FCCC), and of the 1997 Kyoto Protocol (listing Annex-I countries and status of ratification) is available at www.unfccc.de.

IPCC WG-I, J. T. Houghton et al., eds., *Climate Change 1995: The Science of Climate Change* (Cambridge, U.K.: Cambridge University Press, 1996). See SPM, p. 5.

I have raised the issue in a forum article in the Transactions of the American Geophysical Union ("Unknowns about Climate Variability Render Treaty Targets Premature," *Eos* 78 [1997]: 584; *Eos* 79 [1998]: 188). The variability of the past climate is documented in references listed there.

R. Estrada, chairman, Kyoto conference, lecture at Stanford University, Center for Environmental Science and Policy, February 11, 1999.

Most of the issues entering into the scientific debate are discussed in S. Fred Singer, *Hot Talk, Cold Science: Global Warming's Unfinished Debate (HTCS)* (Oakland, Calif.: Independent Institute, 1997). A second edition

of *HTCS* (1999) updates the scientific discussion and includes a summary of the economic impact of a hypothetical global warming.

Additional scientific points

1. There is a striking contrast between theory and measurements. The models expect the most dramatic temperature rise at high latitudes, but scientists searching for such evidence in the polar regions are coming up empty-handed (J. D. Kahl et al., "Absence of Evidence for Greenhouse Warming over the Arctic Ocean in the Past 40 Years," Nature 361 [1993]: 335–37). Temperature records taken at the South Pole between 1957 and 1987 also show no warming (J. Sansom, "Antarctic Surface Temperature Time Series," Journal of Climate 2 [1989]: 1164).

2. A recent paper by D. Dahl-Jensen et al. ("Past Temperatures Directly from the Greenland Ice Sheet," Science282 [1999]: 268–79) displays a temperature record from a Greenland ice-core borehole that clearly shows an absence of warming in the last fifty years.

3. Another important paper is by H. Conway et al. ("Past and Future Grounding-Line Retreat of the West Antartic Ice Sheet," Science 286 [1999]: 280–83); it demonstrates the continuing melting of the West Antarctic ice sheet, which is responsible for much of the sea-level rise that has been ongoing since the end of the last Ice Age, about 15,000 years ago. HTCS (figure 11 and the accompanying discussion on pp. 18–19) suggests that a putative global warming will slow down rather than speed up the ongoing sea-level rise as more evaporation and precipitation lead to more rapid ice accumulation on the Antarctic continent.

James E. Hansen et al., "Climate Forcings in the Industrial Era" *Proceedings of the National Academy of Sciences* 95 (1998): 12753–58. The paper throws doubt on the ability of models to make predictions: "The forcings that drive long-term climate change are not known with an accuracy sufficient to define future climate change." Some supporting facts are the following:

1. Climate models have not yet incorporated the presumed large but poorly understood indirect cooling effects of sulfate aerosols (by increasing cloudiness) or the quite different optical effects of carbon soot from industrial

and biomass burning and of mineral dust arising from disturbances of the land.

2. None of the climate models incorporate the effects of a variable sun. It has always been assumed that solar variability is simply too small, but this view is now changing. Even if the radiative forcing from changes in solar irradiance is less than that from GHG, the larger variability of the sun in the ultraviolet may play a much greater role. Evidence is now forthcoming that UV-caused variations of the ozone layer or changes in solar corpuscular emissions ("solar wind") could (indirectly) influence atmospheric circulation or cloudiness—which in turn can cause significant climate changes. (HTCS, p. 15)

3. Climate models generally do not incorporate the large surface albedo changes that have come about through land-clearing for agriculture and, more recently, through reforestation in some parts of the world. Nor do the models take account of the likely climate effects of rapidly growing air traffic. (HTCS, p. 54)

4. Even though the models are not yet validated as far as temperature trends are concerned, some human influences on climate may already be noticeable. Observations indicate that the diurnal temperature range has been decreasing in the Northern Hemisphere (NH) and perhaps in the Southern Hemisphere (SH) as well. These could be caused by possible increases in aerosols or cloudiness. There is evidence also for winter warming, but not yet for the expected warming at high latitudes predicted by the climate models. On the other hand, observed stratospheric cooling appears in line with what one might expect from the increase in CO_2, as well as from the ongoing depletion of ozone.

5. An earlier story by Richard Kerr exposed other shortcomings of climate models: "Climate Modeling's Fudge Factor Comes under Fire," Science 263 (1994): 1528. He refers in particular to the need for "flux adjustments," an arbitrary correction of the energy flux between atmosphere and ocean to prevent a drift of the atmospheric temperature. One researcher stated bluntly: "The oceanographic models that are coupled to the atmospheric ones are so primitive that I have no confidence in any integration carried out for a year or two" (reported in S. Shackley et al., Adjusting to Policy Expectations on Climate Change Modeling: An Interdisciplinary Study of Flux Adjustments in

Coupled Ocean-Atmosphere General Circulation Models. Report No. 48 [Cambridge, Mass.: MIT Joint Program on the Science and Policy of Global Change, 1999]).

J. R. Christy et al., "MSU Tropospheric Temperatures: Dataset Construction and Radiosonde Comparisons," *Journal of Atmospheric and Oceanic Technology* (in press) 2000. See also figure 9 and discussion in *HTCS* (p. 19).

National Research Council, *Reconciling Observations of Global Temperature Change* (Washington, D.C.: National Academy Press, January 13, 2000). The report confirms the validity of the satellite data that show no appreciable warming of the bulk of the atmosphere and of the surface data that show a strong warming of the surface in the past twenty years. The report does not resolve the disparity.

The book *HCST* also discusses cloud feedback and water vapor feedback uncertainties and quotes (on p. 52) from three IPCC reports that demonstrate how modelers are increasingly becoming aware of model shortcomings.

R. Mendelsohn and J. E. Neumann (in *The Impact of Climate Change on the United States Economy* [Cambridge, U.K.: Cambridge University Press, 1999]) led a team of twenty-three economic experts who analyzed the impact of the putative warming accompanying a doubling of CO_2. Contrary to the IPCC conclusion, they found overall benefits rather than damages, with the important reversals for agricultural crops and timber resources (see pp. 18–19 of *HTCS*). Of particular relevance to economic impacts is the book by Thomas Gale Moore, *Climate of Fear: Why We Shouldn't Worry about Global Warming* (Washington, D.C.: Cato Institute, 1998).

IPPC WG-I, 1990: J. T. Houghton et al., eds., *Climate Change: The IPCC Scientific Assessment* (Cambridge, U.K.: Cambridge University Press, 1990). See esp. SPM, p. xii.

Richard Kerr has interviewed a number of IPCC scientists and published their opinions in "Greenhouse Forecasting Still Cloudy,"*Science* 276 (1997): 1042. See also p. 16 of *HTCS*.

It is frequently claimed that chapter 8, which gave rise to the major IPCC conclusion, is based on 130 peer-reviewed articles. Actually, the conclusion is

based mainly on two research papers by Santer et al., neither one of which had been published at the time the chapter was under review. One paper (B. D. Santer et al., "Towards the Detection and Attribution of an Anthropogenic Effect on Climate," *Climate Dynamics* 12 [1995]: 79-100) appeared only in December 1995, *after* the IPCC report was approved; the other paper (B. D. Santer et al., "A Search for Human Influences on the Thermal Structure of the Atmosphere," *Nature* 382 [1996]: 39-46) appeared in July 1996, after the IPCC report was printed (in May 1996). Now that the scientific community at large has scrutinized both of these papers, it is possible to discern their shortcomings:

Fig. 8.10(b) on p.433 of the 1996 IPCC report shows a time plot of a pattern correlation coefficient as a measure of the similarity between model-predicted and observed geographic patterns of (near-surface) temperature change. As stated in the figure caption, "there is a positive linear trend [in the coefficient] over the last fifty years [1943 to 1993], indicating that . . . the observed temperature-change patterns are becoming increasingly similar to the predicted signal pattern." But as pointed out (S. F. Singer, Eos 80 [1999]: 372), this "positive linear trend" shown in the IPCC report depends entirely on the choice of time period (HTCS, p. 9). The trend can also be zero or even negative, as clearly shown in the original research paper of Santer et al. in Climate Dynamics, 1995, but these (nonpositive) trend lines were edited out when the figure was reproduced in the IPCC report. It therefore gives the reader the misleading impression that there is indeed only a positive trend, and therefore, increasing agreement between calculated and observed temperature patterns—hence, "a discernible human influence on climate."

Indeed, model calculations that incorporate the effects of sulfate aerosols show a reduced warming in the Northern Hemisphere, with warming attaining maximum values in the mid-troposphere of the Southern Hemisphere. (See 1996 IPCC report, fig. 8.7b, p. 428.) Does this pattern exist in the observations? The IPCC report (in the caption for figure 8.7, p. 428) claims "a common pattern of hemispherically asymmetric warming in the low- to mid-troposphere, with reduced warming in the Northern Hemisphere [since aerosols are produced in the NH]." Yet, when finally published, it was discovered (P. J. Michaels and P.C Knappenberger, *Nature*384 [1996]: 522-23) that the data cover only the period of 1963 to 1988, when indeed there was a warming trend in the Southern Hemisphere following the Agung

volcanic eruption that cooled the atmosphere in 1963. The complete available radiosonde record of 1958 to 1995, however, shows no warming trend in the Southern Hemisphere. In fact, both surface data and satellite data show a strong warming trend in northern mid-latitudes, contrary to model predictions (*HTCS*, p. 15).

T. P. Barnett, B. D. Santer, P. D. Jones, R. S. Bradley, and K. R. Briffa, "Estimates of Low-Frequency Natural Variability in Near-Surface Air Temperature," *Holocene* 6 (1996): 255-65.

K. Hasselmann, "Are We Seeing Global Warming?" (*Science* 276 [1997]: 914-15). A recent article ("No Guilty Verdict Yet for Climate Change," *Frankfurter Allgemeine Zeitung*, December 15, 1999) comments on Hasselmann's transformation from global warming advocate to a less certain position about human influence on changing climate.

T. P. Barnett, K. Hasselmann, M. Chelliah, T. Delworth, G. Hegerl, P. Jones, E. Rasmusson, E. Roeckner, C. Ropelewski, B. Santer, and S. Tett, "Detection and Attribution of Recent Climate Change: A Status Report" *Bulletin of the American Meteorological Society* 80 (1999): 2631-59.

Wigley et al., "Anthropogenic Influence on the Autocorrelation Structure of Hemispheric-Mean Temperatures," *Science* 282 (1998): 1676-79. The authors found that the autocorrelation coefficients (for lags between one and twenty years) for observed hemispheric temperature data (from 1880 to 1995) differ markedly from those for unforced (control-run) simulations (i.e., without any greenhouse-gas increase). They then assert that this difference betrays a significant anthropogenic influence, and also yields a climate sensitivity in the IPCC range (i.e., 1.5–4.5°C for a doubling of greenhouse gases). I hypothesize that the Wigley et al. result is influenced by the unusual sustained temperature rise, from 1860 to 1940, generally identified with the recovery from the preceding Little Ice Age. To test this hypothesis, I divided the temperature record into two parts: (1) pre 1940 (when the human contribution to atmospheric GHG was minor) and (2) post 1940. When I then repeated their analysis, I found that the pre-1940 autocorrelation coefficients differed markedly from the unforced (i.e., non-GHG-enhanced) model simulations, while the post-1940 coefficients did not. If one were to interpret my results in the same fashion as Wigley et al., it would mean that there was an

anthropogenic influence before 1940 but not since then. Such an interpretation is, of course, unwarranted.

National Research Council, *Reconciling Observations of Global Temperature Change* (Washington, D.C.: National Academy Press, January 2000).

Wigley and Santer were lead authors of the notorious chapter 8 of the "Second Assessment Report" of the Intergovernmental Panel on Climate Change (IPCC). This chapter was changed surreptitiously after it was approved in December 1995; the changes and deletions were discovered only when the printed version appeared in May 1996. (For details, see www.sepp.org/ipcccont/ipcccont.html.) Among other critics, Professor Frederick Seitz (Wall Street Journal, June 12, 1996) states: "In my more than 60 years as a member of the American scientific community, including service as president of both the National Academy of Sciences and the American Physical Society, I have never witnessed a more disturbing corruption of the peer-review process than the events that led to this IPCC report."

See also F. Seitz, "Global Warming Report: Basic Rules Disregarded," Wall Street Journal, August 13, 1996; S. F. Singer, "Climate Debate," Nature 382 (1996): 392; P. Weiss, "Industry Group Assails Climate Chapter," Science 272 (1996): 1734.

Quoting from the Leipzig Declaration on the climate debate: "We believe that the dire predictions of a future warming have not been validated by the historic climate record, which appears to be dominated by natural fluctuations, showing both warming and cooling. These predictions are based on nothing more than theoretical models and cannot be relied on to construct far-reaching policies. As the debate unfolds, it has become increasingly clear that—contrary to the conventional wisdom—there does not exist today a general scientific consensus about the importance of greenhouse warming from rising levels of carbon dioxide. In fact, most climate specialists now agree that actual observations from both weather satellites and balloon-borne radiosondes show no current warming whatsoever—in direct contradiction to computer model results."

For the full text of the four statements, see the Internet at http://www.sepp.org. See also HTCS, pp. 40-42. For results of the 1991 survey of IPCC scientists,

see S. F. Singer "Warming Theories Need Warning Label," Bulletin of Atomic Scientists, June 1992, pp. 34-39, and "No Scientific Consensus on Greenhouse Warming," Wall Street Journal, September 23, 1991.

For a more detailed discussion, see M. S. Kirova, *Estimating the Costs of Kyoto: Uncertainties and Assumptions Driving the Model Results*, CSAB Policy Study No. 154 (St. Louis, Mo.: Washington University, 1999). The most optimistic cost estimates for Kyoto compliance stem from the White House Council of Economic Advisers (CEA). Their July 1998 report, The Kyoto Protocol and the President's Policies to Address Climate Change, pegs the cost at only 0.1 percent of GNP—or $14 for the right to emit a ton of carbon. (Details are given at www.whitehouse.gov/WH/New/html/kyoto.pdf.) The most pessimistic estimate, from the Energy Information Administration (EIA) study, pegs the cost at 4.2 percent of GNP, with a permit cost of $342 per ton of carbon emitted. The difference comes mainly from the assumed amount of international emission trading. Under the nearly cost-free CEA scenario, U.S. emissions are hardly reduced, while the EIA scenario with no emission trading envisages an effective cut in fossil-fuel use of some 30 percent. (Details of the EIA study *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity* can be found at www.eia.doe.gov/oiaf/kyoto/pdf/sroiaf9803.pdf.)

It is generally agreed that the Kyoto Protocol, even if punctiliously enforced, would not be effective in mitigation. Paul Portney, head of the respected policy institute Resources for the Future, expressed his view at a conference of the U.S. Energy Information Administration on March 22, 1999. He stated for the record that all environmentalists, politicians, and think-tank types were in private agreement that the Kyoto Protocol was a dead letter and it was time to move on.

The 1987 Montreal Protocol (MP) (for the protection of the ozone layer), which resulted in banning the production of CFCs, is often held to be a paradigm for the Kyoto Protocol. The analogy is not very strong—except insofar as they are both based on rather shaky science and do not place stringent requirements on developing nations—a fatal flaw for any global environmental issue. (In fact, enforcement of the MP is so poor that smuggling of foreign CFC production into the United States is second in importance only to the smuggling of drugs.) Perhaps more important, halocarbons constitute only a

minor percentage of the national economy; raising their cost saddles consumers with great expense but makes little impact on the GDP. Substitutes are mostly available, albeit at much higher cost. Not surprisingly, certain chemical companies holding patents for the manufacture of such substitutes are fully supportive of the MP.

"US Attacked for Failure to Fight Climate Change," *Financial Times*, February 19, 1997.

Despite all these problems, a number of organizations are lining up to become traders of emission permits. They hope to emulate the U.S. trading program in emission rights for sulfur dioxide and receive broker fees for such a service. Most recently, the World Bank has signed up financial supporters for starting a pilot program that may reach the scale of $150 million. Its Prototype Carbon Fund will finance projects in developing nations that would not be economic without subsidies and then assign the emission credits so gained to the financing group.

The Morelia Declaration was designed to influence the 1992 Rio de Janeiro U.N. Conference on Environment and Development (UNCED). Published in the *New York Times* (October 10, 1991), it predicts "at least three nuclear catastrophes on the scale of Chernobyl" by the year 2000, millions of environmental refugees from sea-level rise, and the loss of a quarter of all living species within the next 50 years. Its flavor can best be appreciated from its concluding sentence: "If the latter half of the 20th century has been marked by human liberation movements, the final decade of the second millennium will be characterized by liberation movements among species, so that one day we can attain genuine equality among all living things."

The Morelia statement finds an echo in Al Gore, *Earth in the Balance: Ecology and the Human Spirit* (Boston, Mass.: Houghton Mifflin, 1992). Gore's 1992 compendium of environmental alarms was reissued in April 2000, with an extensive new foreword. Far from softening his controversial views on the environment, Gore warns that, unless the warming trend is halted, sea levels could rise high enough to cause "a catastrophic mutation in our physical and human geography." In a postscript, Gore jauntily reaffirms perhaps the most controversial point in his book: that "completely eliminating" the internal combustion engine during his lifetime is not only possible but "needs to be

done." Failure to curb global warming will bring cataclysmic consequences, he warns.

In "Gore in the Balance," Jonathan Rauch (*National Journal*, September 18, 1999) writes:

> *Gore is hysterical. The environmental crisis is not merely a problem, it is an enemy. The adversary, moreover, is "nothing less than the current logic of world civilization," whose assault on the planet is morally equivalent to Hitler, the Holocaust, slavery, and Communism. "Consumptionism" and totalitarianism are both "examples of alienation and technology run amok," and both require the same sort of all-or-nothing struggle. "Either we move toward the light or we move toward the darkness." From now on, therefore, "we must make the rescue of the environment the central organizing principle for civilization." Every policy, institution, law, and alliance must be directed to that end. Marginal adjustments and moderate improvements "are all forms of appeasement."*
>
> *The extremism is troubling, even shocking, but it would be excusable as overheated rhetoric if not for Gore's attitude toward his own hysteria. The truth, he says in a characteristic locution, is "almost unbearably obvious." Why, then, are so many people unconvinced? Those who deny the obvious are cowardly or corrupt, "seeking to camouflage timidity or protect their vested interest in the status quo." Or they are addicts—of consumptionism—in a state of pathological denial. Fundamentalism, in its broadest sense, is the inability to take seriously the possibility that you might be wrong. Gore's book is a casebook example. It elevates hysteria to a virtue and regards doubt as a disease.*

Not much has changed since Gore ran for vice president in 1992. As George Will reports (*Washington Post*, November 18, 1999): Al Gore recently said, "There's not a statement in that book that I don't endorse." Will's essay concludes: "Never in recorded history have birth rates been as low, or per capita food production as high, as at the moment. Gore must pray for relief from the accumulating evidence that Earth is not really hanging in precarious balance."

Ironically, Gore's "global warming mentor" at Harvard, cited respectfully in the book, did not at all share Gore's alarmist views. For a sampling of Professor Roger Revelle's statements and writings, see *Environment News* (published by the Heartland Institute, Chicago) 3, no. 1 (January 2000): 9, or www.sepp.org/weekwas/1999/Oct2.html.