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GLOBAL CLIMATE CHANGE

HEARINGS BEFORE THE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE ONE HUNDRED FIFTH CONGRESS FIRST SESSION

ON

REVIEWING THE EFFECTS OF GREENHOUSE GASES ON GLOBAL
WEATHER CONDITIONS AND ASSESSING INTERNATIONAL POLICY
OPTIONS TO REDUCE THE NEGATIVE IMPACTS OF CLIMATE CHANGE

JULY 10 AND 17, 1997

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ties must first get the treaty structure right. We have a long way to go before that will happen.

In closing, I believe it is useful to look at previous examples for guidance that may provide a better perspective than the intense pre-Kyoto focus.

More than 12 years ago, negotiators were struggling to complete the Vienna Convention for protection of the ozone layer after more than 5 years of negotiation. These negotiations had taken on a bitter tone as parties, including the United States and the European Union tried to——

Senator CHAFEE. When you say these negotiations, you mean the ozone layer, the Vienna ones?

Mr. FAY. Yes. The United States and European Union tried to push for adoption of their own preferred policy approach to dealing with those depleting compounds. Instead, the parties agreed to that convention without the regulatory protocol and also agreed to establish a series of workshops and information-gathering devices to better understand each others' views.

When negotiations resumed, approximately 2 years later, the parties were much better informed and a treaty structure was adopted that has since proven very durable. The Montreal Protocol which was signed in 1987 has proven much more effective than most of us thought possible at the time.

We raise this as an example not because we believe the issues are identical. They are not and climate change is certainly far more complex. We raise it because as we reach this fevered pitch prior to Kyoto, we want to stress that an effective framework is what counts, not an expedient framework.

The climate treaty needs to be durable for the next 100 years. Our companies have determined that the current State of scientific understanding requires a prudent, long-term approach to address this issue. This view is equally applicable to the climate negotiations themselves.

We appreciate the opportunity to be here today.

Senator CHAFEE. Thank you very much, Mr. Fay.

Now, Mr. O'Keefe, chairman, Global Climate Coalition here in Washington.

STATEMENT OF WILLIAM O'KEEFE, CHAIRMAN, GLOBAL CLIMATE COALITION

Mr. O'KEEFE. Thank you, Mr. Chairman.

Mr. Chairman, members of the committee, I am William O'Keefe, chairman of the Global Climate Coalition. Our members form the backbone of the U.S. economy and encompass companies from manufacturing, agriculture, transportation, energy utilities and mining.

The GCC commends this committee for holding these hearings to discuss the scientific and economic realities of climate change and the implications of the Administration's negotiating strategy in a rational, logical, and open forum.

Recent Senate hearings have put a much needed spotlight on the compelling scientific uncertainties that should permeate every climate change policy discussion. A May 16 article in the respected journal, *Science*, demonstrated convincingly that based on our current State of knowledge, we do not face an imminent crisis and so

do not need to undertake precipitous actions that could badly damage our economy.

As scientific knowledge about climate change has improved, estimates of future temperature and sea level increases have moderated. In 1990, the Intergovernmental Panel on Climate Change estimated that the average global temperature would rise 4 degrees Celsius by 2100. In 1995, the IPCC reduced that estimate by 50 percent. More recent British and United States estimates reported in *Science* place it lower than that.

It is ironic that as estimates of the impacts have moderated, the Administration's policy has shifted from support of voluntary programs to legally binding commitments. Although the Administration has not specified for the Senate the critical details of what it might propose, Administration officials have alluded to cutting carbon dioxide emissions back to 1990 levels around 2010 and holding them there.

Such a goal would require more than a 25 percent reduction in projected fossil fuel use. They have not told you, but I will, there is simply no economically viable technology that can replace that amount of energy that quickly. By implication, the Administration may be planning to commit the United States to a severe form of energy rationing. Nor will we escape through allusions to an unproven and unworkable international trading scheme to counter-balance the damage of self-imposed energy rationing.

Other nations have already rejected such schemes. My written statement cites the estimated loss in income, jobs, and U.S. competitiveness that are likely to result from what the Administration has in mind.

MIT economics professor, Richard Schmallensee has stated the matter graphically, "The economic impacts would feel like the energy price hikes of the 1970's with a massive hangover." All of the sacrifice could be tolerated if significant benefits would be secured, but the plain fact is that the Berlin mandate, which is guiding the current round of negotiations, exempts developing countries such as China, India, Mexico, and Brazil, even though they will account for most of the future growth in carbon dioxide emissions in the next century.

Any defensible emissions goal requires participation of all nations. The 2,600 economists who signed a petition on climate change and the 65 Senators who have co-sponsored Senate Resolution 98, and virtually all others who have analyzed this issue emphasize that all countries must participate in any program that is to be beneficial. That program should be guided by the limits of knowledge, anticipate that surprises will occur and recognize the need to adapt as new knowledge is created.

Climate policy is simply not a dichotomy of action versus no action. We agree that action is justified but reject the course being pursued in international negotiations. It is an unjustified rush to judgment.

The major difference between the GCC and our understanding of the Clinton administration is over approach, not need. We believe that a wise policy on climate change is akin to driving in a thick fog. The prudent course of action is to proceed at a speed consistent with how well the car's headlights illuminate the road ahead.

The Administration approach appears akin to driving full speed on the Autobahn on a clear day with no reason for caution. That approach is flawed and risks a fatal crash.

By setting a pace that is consistent with the State of knowledge and economic realities, actions can be taken to achieve any justifiable, long-term goal at one-fifth the cost of the approach being embraced by international negotiators.

We should also invest in information to reduce the uncertainties and to better understand the implications of alternative courses of action.

Finally, we should take steps that will produce benefits under any set of circumstances. The GCC has developed several of these no or low regret actions and have shared them with the Administration. They are based on these points: No. 1, encourage the economic turnover of the capital stock; No. 2, focus investment and research to narrow the range of scientific uncertainties; No. 3, invest in the development of new technologies; No. 4, expedite diffusion of new technologies in developing countries; No. 5, facilitate the investment of U.S. private capital in countries with high emission levels; and finally, No. 6, continue promoting voluntary programs for reducing U.S. emissions.

As we make progress in reducing climate change uncertainties, we can anticipate that additional prudent steps will be revealed. By proceeding at a pace that scientific understanding allows, we can greatly reduce the cost of dealing with potential climate change.

It is a fact of life that precipitous actions driven by current technology and today's knowledge will be vastly more expensive and therefore, less effective than a balanced approach that does not undermine our remarkable record of economic growth and job creation.

Mr. Chairman, that concludes my statement.

Senator CHAFEE. Thank you very much, Mr. O'Keefe.

I'm not sure what you meant in the second of your points there at the end, let me start at the beginning. "The business community has shared these steps with the Administration which are based on these points: encourage an economic turnover of the capital stock." I'm just not sure what that means.

Mr. O'KEEFE. The existing inventory of plant and equipment represents long-lived investments. You should look for impediments to turning those over at the end of their economic life. Depreciation schedules, some provisions in Superfund law, some provisions of the Clean Air Act, new source performance standards and prevention of significant deterioration, all encourage keeping plants in operation longer than would otherwise be justified.

As they are replaced, those that replace them will be more energy efficient. And, anything that will advance, on an economic basis, greater energy efficiency will lead to lower emissions.

Senator CHAFEE. Mr. Fay, it seems to me what you're saying is that the position of your membership is that it accepts the science of climate change. You see a problem there and I guess it was Mr. O'Keefe that talked about the approach that you're concerned with. Was that in your testimony?

Mr. FAY. That's correct, yes, sir.

Senator CHAFEE. But Mr. Fay, as I understand it, you accept that the best scientific information suggests that the human component of climate change isn't small and that human activities already are producing climate change signals that we ought to pay attention to. Am I correct in that?

Mr. FAY. We would agree that the science requires us to pay attention to it, yes.

Senator CHAFEE. What would you do about that? You heard the Secretary's testimony a while ago about what will happen in the middle of the next century, the first part or the middle of the next century, and what do you say to that?

Mr. FAY. We've heard a lot of discussion. You need to cut up the science probably into three different regions of certainty. One is that our greenhouse gases are building up as a result of human activity, yes. There is the scientific consensus concerning temperature.

Senator CHAFEE. What's your answer to the first? Did you say yes, are they building up as a result of human activities?

Mr. FAY. Right, but in terms of the temperature range, we still think the temperature range and the sea level rise projections, there's a wide band there. We agree that the scientific consensus appears to have arrived at that range.

Much beyond that in terms of those other effects you get, whether it's disease spread or agricultural impacts, we think there is an awful lot of uncertainty associated with those, but recognizing that the buildup of the gases themselves, if you realize those effects, would take a long time to retreat from them, it requires you to take a longer term view toward working on that issue.

So we've acknowledged that it's appropriate to begin developing a means to work on this issue.

Senator CHAFEE. Mr. Fay, you mentioned the Montreal Protocol and as you recall, all the signatories had to agree to a phaseout of the use of the ozone-depleting substances. You cited that as something that worked well. What do you think about following that procedure here?

Mr. FAY. Well, I think that in those negotiations, the developing countries accepted the need for them to be participants. I'm afraid I haven't seen that kind of recognition from the developing countries in the current negotiations. There is a continuing insistence on their part with regard to climate change that they have no commitments, despite the fact that the Administration continues to argue they do have existing commitments which we welcome to be elaborated under the existing treaty.

We're very concerned. I think Mr. O'Keefe mentioned the fact that there is virtually unanimous agreement that you can't achieve any reasonable climate change goals if you don't have developing countries participating. You have to find a way to get them on board. I haven't seen where we've achieved the recognition by those countries, however, that they are willing to do that.

Senator CHAFEE. To get them on board, Secretary Wirth stressed we have to go first.

Mr. FAY. I think we already are going first, Senator. We're already implementing the programs voluntarily. It is our technology that is likely to lead us toward solutions on this issue.

What we have asked for is because of the fact a great majority of the investment made by developed countries and developed country industries is going into developing countries, that you have to reach some decision as to what their role is going to be in the treaty process, what their commitments are going to be before we get into any kind of binding period for our own countries and our own companies. That's a minimum of what would be acceptable.

As I said, we're still a long ways away from that recognition by the developing countries that while 80 percent of the emissions may have been associated with our economies over the last 100 years, 80 percent of the emissions over the next 100 years are going to come from their economies.

Senator CHAFEE. Yes, but we've got a situation as we pointed out before where we have I believe the statistic is 4 percent of the world's population and we emit 22 percent of the carbon dioxide.

If I were in China or India and somebody from the west came to me and said, you've got to reduce your CO₂ emissions, I'd say, look, you ought to go first, you keep wrecking the place, not us.

Mr. O'KEEFE. Mr. Chairman, could I comment on that?

Senator CHAFEE. Yes.

Mr. O'KEEFE. It is true that we account for 22 percent of the world's CO₂ emissions, but we also account for at least that much and probably more in terms of the generation of global wealth. CO₂ and other greenhouse gases are not typical pollutant. They are natural elements in nature and increases of CO₂ are the result of economic activity. So when we produce a good and export it to another country, the emission is attributed to us, while a benefit accrues to the importing country.

I think it's much more complex than suggested by a simple statistic.

It may sound good to say that we spoiled the nest or we account for the bulk of the emissions, but we also account for much of the wealth, the food production, the goods and services those countries are using and that ought to be taken into account as well.

Senator CHAFEE. That's a tough one to explain to somebody in India, isn't it?

Mr. O'KEEFE. I don't think anyone is saying that they have to have our technology tomorrow. We ought to do everything we can to aid the growth in their economies because it's the wealthier countries that have the technology that adapt and protect against unforeseen events. So the faster they can grow up the economic curve, the more efficient they will be in using energy. But, they have to participate or else we're not going to make any progress.

Mr. FAY. We have suggested, Senator, as a way of dealing with this through the entry into force requirements for the treaty that while perhaps our efforts may be more aggressive up front, may take place prior to theirs, that you certainly have to have a significant percentage of world greenhouse gas emissions, and that would include India and China, and that you have to have as parties to the treaty, a majority of developed countries, a majority of developing countries, that you try to negotiate a treaty that perhaps as there was in the Protocol, there was a delay in the implementation of the requirements for those countries, but we had them as parties.

What we're not seeing is an indication that they are willing to become parties in that sense. So it's a question of how we assist them in growing smart, not how we stop them from growing, how we get them to adopt the most efficient technologies just as we need to be adopting the most efficient technologies here.

Senator CHAFEE. As I understood the first part of your testimony, Mr. Fay, you were lamenting the fact that there didn't seem to be a dialog with the Administration with your organization and perhaps Mr. O'Keefe's organization. Am I correct in concluding that?

Mr. FAY. We have lots of talks, but it has been pretty barren in terms of specifics, aside from the general framework that they put out where they continue to emphasize the need to do this in a rational, economic way.

We've asked them to define their specific objectives; we've asked them to embrace the framework they put out there a year ago; and we've asked them to come to us and say what is their expectation of our industry sectors over the next two decades, what is it you want us to do better? We have not had those kinds of conversations. They've not defined a specific objective. They've defined a general framework which we're supportive of.

Now we want them to say that's the framework they have to have in the negotiations. We want them to tell them what their expectations are of our industries. Until we can get that, it's going to be difficult for us to sign onto some blank check Kyoto agreement where we don't know what they are expecting of us or what their implementation regime may be when they bring that agreement back to the United States.

These are reasonable questions for us to ask. We also think it's reasonable information for them to have. It was information we had as we were working through the Montreal Protocol negotiations. We had a better description of implementation schemes and those impacts.

Senator CHAFEE. It certainly seems to me that we should expect in any agreement we entered into that the developing nations are going to be a part of it. I can understand that perfectly well and I think that's a reasonable point you're making.

Mr. O'Keefe, in your testimony you talked about actions being considered by negotiators that would require us to suppress energy use by at least 25 percent in a little over a decade. Where do you get that figure from? Where is that? Is that being seriously considered by our negotiators, requiring a response like that?

Mr. O'KEEFE. Dr. Yellen used as the period 2010 to return to the 1990 levels. In the State Department's report on the voluntary programs, they talk about a 25 or 26 percent reduction. All the independent economic analyses that have been done on the subject assume that the most benign thing that's being considered, that might be agreed to, is returning to the 1990 levels by 2010.

The best estimate is that we would have to suppress, reduce energy consumption of fossil fuels by at least 25 percent below the level being estimated today by the Energy Information Administration.

Senator CHAFEE. From where we'd otherwise be?

Mr. O'KEEFE. Yes.

Senator CHAFEE. Even though that might be more than the 1990 level?

Mr. O'KEEFE. Oh, it will be. We don't have the technology to make that kind of reduction in that short a time period—13 years. I think that Mr. Fay has made the same point.

We need a process that is predictable, that is realistic. The Administration analysis is based on a trading program and some new technology. The technology hasn't been identified and other countries have rejected the trading scheme and many economists believe that it's not feasible. Quite simply, other nations will not agree to it.

Certainly, if it was going to be in place, it's going to take a long time to get an agreement. So it might be better in Kyoto to try and agree on a framework that all nations would embrace and then, at a future conference, decide what the target is and the time period for achieving it.

Senator CHAFEE. As I understand what both of you are saying, both of you recognize that there is a problem there and it's what to do about it where the contention comes. Is that a fair statement?

Mr. O'KEEFE. I think that there is a risk. I think there is legitimate scientific dispute over the problem and the hearing you had last week demonstrated that. The last page in Chapter 8 of the IPCC report, around page 439, makes it clear that there is not a scientific consensus that we have a problem. But that's not an excuse for inaction.

There is a potential risk and there is uncertainty and the uncertainty goes both ways. Given the uncertainty and the potential risk if we guess wrong, there is certainly a need for prudent action, but the people who have also studied this say we do have time to do it right. We do not face an imminent catastrophe that justifies the kind of crash program to reduce energy use that's being considered by the negotiators.

Senator CHAFEE. The problem we have with that is, and we encounter this all the time. I'm on the Finance Committee and we're dealing there with Medicare and we have come up with a proposal that eligibility age for Medicare be increased to 67 to correspond with the eligibility age for social security.

There is great objection to that from many saying no, no, no and we're doing it because there is a real problem out there with the future of Medicare. So those like myself who are proponents for doing something say there's always an excuse to wait and delay things and it's always attractive to postpone it. It seems to me there is a similar situation here.

I hardly think we've rushed into this, but your feeling is, I think you just said, let's wait and do it right. Who knows what right is?

Mr. O'KEEFE. Let me be clear. I'm not saying we should do nothing. There are hundreds of companies that are participating in the voluntary programs. The petroleum industry, which I also represent, is spending over \$10 billion a year on achieving environmental objectives. There is a lot of progress being made. It's not whether we act; it's the rate at which we force actions to be taken and the consequences of those.

By taking the time to do it right, and by that I mean the time to turn over the capital stock, get new plants and equipment in op-

eration; and incentives to accelerate our improvement of energy efficiency. We've reduced the energy component per dollar of GDP over the past two decades by 30 percent. Incentives to continue that. And to take our technology and get it in the hands of other nations all take time.

Senator CHAFEE. What are the incentives now? You must be doing it. Your companies aren't doing it because they're worrying about global warming; they must be doing it because being more fuel efficient saves them money. Hopefully that is an incentive.

Mr. O'KEEFE. Well, they learn with new knowledge. We find there are better ways to do it and people take into account potential changes in law and regulation and knowledge. I can't tell you what component of the decision may take into account climate change, but certainly the possibility is taken into decisions when you're making capital investments that will last 20 or 30 years.

Mr. FAY. I think that our companies do also take into account the environmental issues as well, Senator. Our problem is not so much that we've rushed into this that all of a sudden we have these negotiations; our biggest problem I think is that we're 5 months from the supposed deadline and we have some fairly basic issues that this Administration either hasn't talked to us about or hasn't made their own decisions on.

They've come in now after promising for a year this economic analysis and they've come back and said, it's hard. Well, we know it's hard. We have to make hard decisions every day in the private sector.

We need to know what basis are they going to use then to make their decisions. We think it's still possible to achieve a treaty in December, but it's getting harder and harder as the time grows shorter. We don't think a 2-day White House conference is going to help all of a sudden produce the magic answers of what we're going to do on climate change.

Mr. O'KEEFE. It also doesn't help the Senate that has to participate in the advice and consent process.

Senator CHAFEE. Thank you both very much for coming. Your testimony was very helpful and we appreciate you being here.

That concludes the hearing.

[Whereupon, at 12:55 p.m., the committee was adjourned, to reconvene at the call of the chair.]

[Additional statements submitted for the record follow:]

STATEMENT OF JANET YELLEN, CHAIR, COUNCIL OF ECONOMIC ADVISERS

Thank you, Mr. Chairman and members of the committee. I appreciate the opportunity to discuss with you today the economics of global climate change.

INTRODUCTION

In his speech to the United Nations Special Session on Environment and Development in June, President Clinton emphasized that the risks posed by global climate change are real and that sensible preventive steps are justified. This assessment accords with the views of the more than 2,300 economists, including 8 Nobel laureates, who signed a statement supporting measures to reduce the threat of climate change. The economists endorsed the conclusions from last year's report by the Intergovernmental Panel on Climate Change (IPCC), which said that governments should take steps to reduce the threat of damage from global warming, and went on to argue that market-based policies can slow climate change without harming the American economy.

STATEMENT OF WILLIAM F. O'KEEFE, CHAIRMAN, GLOBAL CLIMATE COALITION

Mr. Chairman and members of the committee, as chairman of the Global Climate Coalition (GCC), I appreciate the opportunity to testify before you on global climate negotiations. The GCC is the leading representative of business and industry on this issue with members that encompass manufacturing; agriculture; small and large businesses; air, rail and barge transportation companies; domestic and international vehicle manufacturers; oil, coal, natural gas and other natural resource companies; municipal, co-op, investor-owned and independent electric utilities; cement; iron and steel; forest and paper; and numerous producers of chemicals, plastics and other industrial and consumer products.

On behalf of this broad membership—the backbone of the U.S. economy—I would like to take this opportunity to set the record straight on five points that are key to the current public debate on climate change. First, the science is *not* “clear and compelling” as President Clinton claimed July 3 in his speech to the United Nations General Assembly, Special Session on Environment and Development. Instead, scientific uncertainties abound; enhanced global warming is still a hypothesis. Second, statements on scientific uncertainties by members of the GCC are consistent with those expressed in the May 16 issue of the respected journal *Science* [attached]. Advocates of precipitous curbs on greenhouse gas emissions are the ones who are unjustifiably representing climate science in promoting a rush to judgment. Third, curbs on greenhouse gas emissions—which mean suppressing energy use—will *not* be cheap and relatively painless as some advocates encourage Americans to believe. Instead, curbs would be brutally expensive in terms of lost income, lost jobs and lost U.S. competitiveness on world markets. Fourth, business does *not* oppose action as evidenced by its widespread participation in the Administration’s voluntary Climate Action programs. We support action that recognizes the state of knowledge, the extent of uncertainty, and balances the need for preserving robust economic growth with the requirement for a cleaner environment. Fifth, the climate issue does *not* represent a crisis requiring precipitous and dramatic actions to prevent an imminent ecological catastrophe.

PRECIPITOUS ACTION ON CLIMATE CHANGE SERVES AN ANTI-INDUSTRY AGENDA

Claims of imminent catastrophe are designed to create a crisis atmosphere helpful in promoting other agendas. This strategy is routinely used to advance ill-advised policies—the saccharin scare in 1977, predictions in the 1970’s of famine and the exhaustion of natural resources, the predicted cancer epidemic in the 1980’s, and the Alar, EDB and electromagnetic scares to name only a few.¹

When these scares proved to be unfounded, the quest continued to find the *ultimate* environmental problem that *will* require wholesale, radical change in American lifestyles.² The late Professor Aaron Wildavsky wrote that “warming (and warming alone) . . . is capable of realizing the environmentalist’s dream of an egalitarian society based on rejection of economic growth in favor of a smaller population’s eating lower on the food chain, consuming a lot less, and sharing a much lower level of resources more equally.”³ MIT Professor Richard Lindzen has added that “the great threat of warming fits in with a great variety of preexisting agendas—some legitimate, some less so: energy efficiency, reduced dependence on Middle Eastern oil, dissatisfaction with industrial society (neopastoralism), international competition, governmental desires for enhanced revenues (carbon taxes), and bureaucratic desires for enhanced power.”⁴

And so it is that climate change underpins the claims:

- That the automobile is a greater threat than any enemy we will ever face.
- That suburbia should be phased out.⁵

¹ For a more complete listing of scares, see: Adam J. Lieberman, *Facts Versus Fears: A Review of the 20 Greatest Unfounded Health Scares of Recent Times*, prepared for the American Council on Science and Health, May 1997.

² For instance, the president of the World Resources Institute wrote: “Climate change isn’t just any environmental issue. It’s bigger . . . it’s tied to almost every facet of contemporary economic life. How we travel, manufacture and ship goods, build buildings, farm, and spend our leisure time all influences the tempo of climate change.” [emphasis in original] See: Gus Speth, forward to *The Greenhouse Trap* (World Resources Institute, 1990).

³ Aaron Wildavsky, “Global Warming as a Means Of Achieving an Egalitarian Society: An Introduction,” introduction to Robert C. Balling, Jr., *The Heated Debate* (1992), xv.

⁴ Richard S. Lindzen, “Global Warming: The Origin and Nature of the Alleged Scientific Consensus,” *Regulation*, Vol. 15, No 2, (Spring 1992).

⁵ Worldwatch Institute, *Beyond the Petroleum Age: Designing a Solar Economy* (December 1990), 48.

- That human numbers must be drastically reduced.⁶

Obviously, evidence that climate change may not be an imminent catastrophe undermines such visions of America in the 21st Century. Indeed, unwavering allegiance to such agendas may explain why advocates of precipitous action deny with vehemence the logical implications of obvious scientific uncertainties.

True concern for the economic and environmental well-being of people in this and other countries would surely lead negotiators to balance their policy prescriptions with the state of scientific evidence. After all, carbon dioxide (CO₂) is not a pollutant but a natural element necessary for survival, with man-made emissions directly related to prosperity and economic progress. Curbing those emissions unnecessarily would mean fewer jobs and less income—and therefore less money for other health and environmental protection measures. A less prosperous United States means a nation less able to promote technological development which is essential to environmental progress and to our continued ability to adapt in a changing world.

THE SCIENCE IS NOT SETTLED

The hearings of this committee a week ago—and those of the Senate Subcommittee on International Economic Policy, Export and Trade Promotion chaired by Senator Hagel in June—have put a much-needed public spotlight on the compelling scientific uncertainties that should permeate every climate change discussion and negotiation. Climate scientists and modelers simply do not know enough about possible human impacts on the global climate system to justify taking near-term actions being considered by international negotiators that would require us to suppress energy use by at least 25 percent in little over a decade.

That opinion is shared by scientists who participated in the Intergovernmental Panel on Climate Change (IPCC) and wrote the 1995 *Second Assessment Report*, along with many other members of the scientific community. That report does state that “the balance of evidence suggests a discernible human influence on global climate” and the Administration repeatedly quotes that sentiment—out of context—in its statements that the “science is settled.” The May 16 issue of the journal *Science* pointed out that Dr. Benjamin Santer, a lead IPCC author, warned against such over-simplification when he stated that, “It’s unfortunate that many people read the media hype before they read the [IPCC] chapter [on greenhouse warming] . . . We say quite clearly that few scientists would say that the attribution issue was a done deal.” That same *Science* article also notes that “[s]ome scientists assert that developments since the IPCC completed its report have, if anything, magnified the uncertainties,” and quotes a noted scientist as saying, “There really isn’t a persuasive case being made” for detection of greenhouse warming. At the article’s end, the author refers to a climatologist and IPCC contributor who concluded that “while researchers are firming up the science, policy-makers could inaugurate ‘some cautious things’ to moderate any warming.”

Unquestionably, the concentration of CO₂ in the atmosphere has increased. It has gone from about 280 parts per million two centuries ago to about 360 parts per million today. It is generally agreed that this increase is due to human activity, especially combustion of fossil fuels. CO₂ like several other gases in the atmosphere, especially water vapor, traps heat. Without this greenhouse effect, the average global temperature would be about zero degrees and life as we know it would not be possible. In theory, if CO₂ is increasing, more heat might get trapped and the temperature might rise.

But theory is not fact until subjected to the acid test of scientific rigor to confirm or reject it. To date, no confirming evidence has withstood tough scrutiny—as the May 16 *Science* article explains. While it is a fact that there has been some warming over the past century, it is within the range of normal variability. Furthermore, most of it occurred before 1940, which was before any significant increase in CO₂ emissions. In particular, over the past 20 years, when high-quality satellite measurements of temperature began, no warming has been observed; and, in fact, there has been a slight downward trend.

Moreover, Dr. Bert Bolin, the chairman of the IPCC, has repeatedly said science has not established a link between human greenhouse gas emissions and particular severe weather events. Yet, Vice President Gore and other Administration officials made such an overstatement when they associated the flooding in North Dakota earlier this year with global warming. President Clinton made a similar overstatement when he said on June 30 in New York City that greenhouse gases have “led to the most disruptive weather patterns anybody can remember over the last 4 or 5 years.” Members of the GCC and of the business community are only being accu-

⁶ Bill McKibben, *The End of Nature* (1989), 191–192.

rate when they point out that such claims go beyond what can be supported by climate science.

EXEMPTING THE DEVELOPING COUNTRIES GUARANTEES FAILURE

Dr. Bolin has also cautioned against expecting global temperature benefits from emission reductions by developed countries alone. Yet, the Berlin Mandate agreed to by international negotiators in 1995 exempts developing countries from any new commitments to curb emissions. Dr. Bolin, during his February 25, 1997 presentation in Bonn to international negotiators, said that the proposals applicable only to the industrialized nations “would not be detectable on projected temperature increases.”

The 2,000 economists who signed a petition on climate change—and the 65 U.S. Senators who have signed Senate Resolution 98—emphasize that all countries must participate in any program to address “global” emissions. China, India and other developing countries will account for most of the future growth in carbon dioxide (CO₂) emissions in the next century but will be exempt from any meaningful treaty obligations. This will create powerful incentives to attract manufacturing investments and the jobs they create from the industrialized countries—and also create powerful economic and political constituencies for *never* curbing emissions. As Representative John Dingell asked rhetorically in his testimony of June 19 before the Senate Subcommittee on International Economic Policy, Export and Trade Promotion: “Does anyone seriously believe China, or any other country for that matter, will act on altruistic motives?” Without the active involvement of developing countries, the growth in global CO₂ emissions will not be reduced in any meaningful way.

THE ECONOMIC COSTS WOULD BE HIGH

The Administration suggests that curbing energy use will impose little economic sacrifice. Everett M. Ehrlich, former undersecretary of commerce for economic affairs, wrote in *The Washington Post* of June 15, 1997 that “the economic literature suggests that we could roll back our CO₂ emissions to their 1990 levels by 2010 for the equivalent of a 25 cent gas tax. It’s not free, but it’s not the end of the world.” Few consumers would share this benign view of such a hike in their energy bills. Some authors of the IPCC report even suggest that curbing greenhouse gas emissions could be free—the environmental equivalent of a free lunch—or even be economically beneficial!⁷

In fact, however, every credible, independent economic analysis confirms what common sense suggests: a substantial curb on the use of a key economic resource will impose substantial costs. From an Administration draft analysis circulated last May, one could reasonably conclude that U.S. negotiators want to cut CO₂ emissions back to 1990 levels by sometime around 2010, and hold them there. This would require more than a 25 percent reduction in projected fossil fuel use. The Administration is placing its blind faith in unidentified technological breakthroughs and an unproven—and probably unworkable—trading scheme to counterbalance the economic damage of self-imposed energy rationing.

However, economic studies more realistic about the probable contributions of existing and new technologies paint a more sobering picture. Studies by Charles River Associates, DRI, and the U.S. Energy Information Administration indicate that energy taxes of \$125 to \$200 per metric ton of carbon would be needed to return emissions to 1990 levels by 2010 (\$200 per ton is equivalent to an increase in the excise tax on gasoline of about 60 cents a gallon). The annual impact of a tax this size includes the following losses:

- \$100 billion to \$275 billion in gross domestic product (GDP).
- \$200,000 to \$500,000 U.S. jobs.
- \$65 billion to \$100 billion in fixed business investment.
- \$50 billion to \$110 billion in consumer purchases.

THE CLINTON ADMINISTRATION HAS BEEN SLOW TO RELEASE ITS ECONOMIC ANALYSIS

DOE released on July 11, 1997 a study contracted with Argonne National Laboratory early in 1996 to investigate “the potential effects (which may be either beneficial or adverse) on energy-intensive industries in the United States of alternative

⁷These authors wrote: “Despite significant differences in views, there is agreement that energy efficiency gains of perhaps 10 to 30% over baseline trends over the next two or three decades can be realized at negative or zero net cost (negative net cost means an economic benefit).” See: International Panel on “Climate Change, *Climate Change 1995: Economic and Social Dimensions of Climate Change*.” Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change (1996), 16.

scenarios for changes in world patterns of industrial energy prices that might result from new climate commitments.” Six industries were selected and the study results show that the impact on each industry would range from “significantly adverse” to “devastating” and produce little, if any, environmental benefit.⁸

The U.S. Department of Energy (DOE) has attempted to put these results in a favorable light by claiming that the study examines energy price scenarios based on *other* countries’ proposals “of large hypothetical energy price increases” rather than the “Administration’s basic approach.” However, the Administration has not explained how its own goals for curbing emissions could possibly avoid either high energy prices or highly restrictive regulatory curbs on energy use. At the very least, the DOE’s claim that the Argonne study results apply only to the climate change proposals of other countries is an open admission that this study lacks a direct analysis of the Administration’s own proposals. Hence, DOE’s claim that the study “confirms the wisdom of the Administration’s basic approach to climate change” is without foundation.

The delay in releasing this study and the release two days ago by the Administration of its long-promised analysis and assessment of its own post-2000 climate change proposals raises questions about its negotiating objectives.

In March 1995, as the Berlin Mandate began to take shape, President Clinton characterized U.S. objectives this way in a letter to Representative John Dingell:

“We have said this process must include thoughtful analysis and reflect the fact that global problems require global solutions. Furthermore, I assure you the U.S. delegation will not accept any outcome or agree to any process that adversely affects the United States and its industrial competitiveness.”

DOE and the Environmental Protection Agency (EPA) jointly held a workshop in Springfield, Virginia to unveil the Administration’s initial analysis. At a June 19, 1996 hearing before the House Commerce Committee, the DOE’s Acting Assistant Secretary for Policy—Marc Chupka—testified that the “U.S. strongly believes that analysis and assessment is central to the development of further commitments by Annex I Parties and to the furtherance of existing commitments of other parties to the Framework Convention on Climate Change.” When it was announced last summer that Dr. Everett Ehrlich would assume the role of directing and coordinating this analytic effort, he assured everyone that the results would be available this past January. Over the next several months, Under Secretary of State Tim Wirth repeatedly stated that the Administration’s analysis would be released soon. This did not occur and yet negotiations proceeded.

This state of affairs led Representative Dingell in his Senate testimony of June 19, 1997 to ask:

“Why are we [proceeding with negotiations] before we have the most basic information about how climate change policies will affect our economy? In short, has the Administration bothered to do its homework? We were supposed to have the vaunted analysis and assessment of the impact of climate change policies on the U.S. economy by the end of last year. It has not been completed yet, despite repeated promises to Congress and industry that it would be available before important policy decisions are made. But the State Department formally proposed a cap-and-trade negotiating position in January. In short, the analysis is self-evidently too late to inform the process, and likely will be used to justify what the Administration has already decided to do. Just as clearly, public participation and comment on the analysis and assessment is irrelevant.”

Representative Dingell’s remarks were insightful. Only two days ago did the Administration release a draft copy of its baseline economic analysis. While the GCC has not had time to examine this document thoroughly—and we would ask the committee for the opportunity to submit comments later—it is clear that the Administration still has not provided its *assessment* of specific policies now under consideration. It also has not explained how those policies would be implemented domestically and internationally nor has it quantified the impact of these policies on the U.S. economy, labor, industry and trade.

This slow and partial release of the Administration’s analysis and assessment has meant that the United States Senate has so far been unable to fulfill its Constitutional responsibility of “Advice and Consent.” Senate Resolution 98, introduced by Senators Byrd and Hagel—and now co-sponsored by 65 Senators reflects growing frustration with the Administration’s failure to consult and alarm over the con-

⁸ The six industries studied were: aluminum; chemicals and allied products; petroleum refining; cement; paper and allied products; and steel.

sequences for the U.S. economy that will result from the current negotiating strategy.

THE GCC SUPPORTS APPROPRIATE ACTION

In spite of major scientific uncertainties, inadequacies in climate models and the doubt that any enhanced warming will soon occur, it would be imprudent to presume “no problem.” Global warming could have serious consequences should nations make wrong choices in *either* direction.

Therefore, a proper framing of the problem recognizes uncertainty—as pointed out by the petition signed by 2,600 economists. The Administration frames climate change as devoid of significant uncertainty—an approach that is clearly flawed.

The basic structure for decision-making under conditions of significant uncertainty is relatively simple even though the global climate issue itself is complex. The first decision rule is to be slow rather than quick to commit to a single course of action. This is especially important when the costs of immediate action are known to be high—perhaps equal to our Nation’s current total annual environmental expenditures—but the many scientific uncertainties prevent any reliable estimate of the environmental benefits (if any) from that action. In the case of global warming, we have time to address these uncertainties. Nothing we do in the next 20 years will have any appreciable impact on the world’s average temperature in 2050 or 2100.

This fact is absolutely crucial, because costs are exceedingly sensitive to timing. Many capital investments, including those in the energy and automobile industries, are long term. If change can be deferred until current equipment reaches the end of its useful life, and until more efficient devices are on-line, costs can be substantially less. Over the past 22 years, new technologies have enabled us to reduce energy intensity per dollar of gross domestic product by about 32 percent. This progress should continue. Analysis by the Electric Power Research Institute and the Stanford Energy Modeling Forum concludes that an orderly, long-term strategy for achieving a scientifically justified CO₂ objective would cost only one-fifth as much as a program that requires near-term cuts.⁹

This leads to the second decision-making rule: invest in information to reduce the uncertainties and to better understand the implications of alternative courses of action. Indeed, the money already spent on improving climate models has increased our understanding of the climate system enormously with no indications yet that we have reached the point of diminishing returns in improving scientific knowledge and climate models.

Furthermore, as climate models have improved they have—so far—suggested that much of the 1°F increase in average global temperature over the past 130 years is due to natural variability and that any future warming is likely to be much less than earlier models have predicted. For instance, when the British Meteorological Office recently improved its modeling of the effects of clouds and precipitation, the model’s response to a doubling of CO₂ emissions was a *decline* in warming from 5.2 Celsius degrees to 1.9 degrees. The first results from the new climate model at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado suggest—according to the May 16 article in *Science*—that “future greenhouse warming may be milder than some other models have suggested—and could take decades to reveal itself.”

With improved information indicating that the problem may be less—rather than more—severe than originally thought, it seems only sensible to continue improving scientific knowledge before committing to expensive policies predicated on earlier estimates, as the Administration appears determined to do. Although assessments of potential future impacts have moderated over the past few years, the Administration’s policy has shifted from support of voluntary programs to legally-binding commitments.

The third rule for decision-making under uncertainty is called “no or low regrets.” Look for actions that will produce benefits under any set of circumstances. The GCC has developed a list of emission-reducing actions that would be worthwhile even if the threat of global warming turns out to be another wildly exaggerated environmental scare.

The business community has shared these steps with the Administration which are based on these points:

- Encourage an economic turnover of the capital stock.
- Focus investment in research to narrow the range of scientific uncertainties.
- Invest in the development of new technologies.

⁹ EPRI Journal, Nov./Dec. 1995.

- Expedite diffusion of new technologies in developing countries.
- Facilitate the investment of U.S. private capital in countries with high emissions levels.
- Continue promoting voluntary programs for reducing U.S. emissions.

These points establish that GCC members support an action-oriented policy on climate change.

The fourth decision rule is to consider alternatives. Only two decades ago, global cooling was the dominant concern. It is also possible that some warming will occur but not be harmful—or that developing adaptations to warming will greatly mitigate any harm. Sound policies must allow for these possibilities, and not be based on a single point estimate.

SUMMARY AND CONCLUSION

Many uncertainties about the climate system, and the current and future impact of human activities on it, have been well documented. Business has played a constructive role by drawing attention to these uncertainties and the serious ramifications they pose for the Administration's negotiating strategy.

Business agrees that action *should* be taken but rejects an unjustified rush to judgment. The major difference between the business community and the Clinton Administration is over approach, not the need for action. We support what can be called "Lewis and Clark" planning, after the famous explorers who successfully managed enormous uncertainty by gathering new information, taking a limited number of steps, reassessing and then repeating the process. In 1803, Lewis and Clark could not plan a detailed water route to the Pacific—President Jefferson's main goal. No one knew that the Rocky Mountains were in the way. Lewis and Clark were successful because they respected the limits of knowledge, anticipated surprises and recognized the need to adapt.

The Clinton Administration supports an approach that discounts uncertainty. Minimal uncertainty allows detailed planning comparable to an extended itinerary what can be called "Cooke's Tour planning" after the famous travel agency. The conditions for this type of policy planning do not exist, and a Kyoto agreement that presumes they do will be playing "Russian Roulette" with our economy.

Greenhouse Forecasting Still Cloudy

An international panel has suggested that global warming has arrived, but many scientists say it will be a decade before computer models can confidently link the warming to human activities

The headlines a year and a half ago positively brimmed with assurance: "Global Warming: No Longer in Doubt," "Man Adversely Affecting Climate, Experts Conclude," "Experts Agree Humans Have 'Discernible' Effect on Climate," "Climate Panel Is Confident of Man's Link to Warming." The official summary statement of the UN-sponsored Intergovernmental Panel on Climate Change (IPCC) report that had prompted the headlines seemed reasonably confident, too: "... the balance of evidence suggests that there is a discernible human influence on global climate." But as negotia-

What had inspired the media excitement was the IPCC's conclusion that the half-degree rise in global temperature since the late 19th century may bear a "fingerprint" of human activity. The patchy distribution of the warming around the globe looks much like the distinctive pattern expected if the heat-trapping gases being poured into the atmosphere were beginning to warm the planet, the report said. But IPCC scientists now say that neither the public nor many scientists appreciate how many if's, and's, and but's peppered the report. "It's unfortunate that many people read the media hype before they read the [IPCC] chapter" on the direction of greenhouse warming, says climate modeler Benjamin Santer of Lawrence Livermore National Laboratory in Livermore, California, the lead author of the chapter. "I think the caveats are there. We say quite clearly that few scientists would say the attribution issue was a done deal."

Santer and his IPCC colleagues' overriding reason for stressing the caveats is their understanding of the uncertainty inherent in

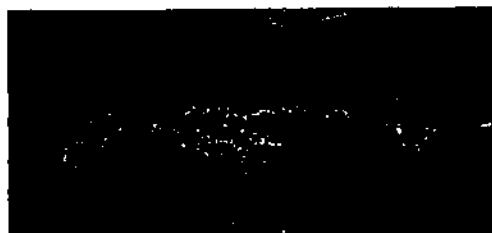
computer climate modeling. The models are key to detecting the arrival of global warming, because they enable researchers to predict how the planet's climate should respond to increasing levels of greenhouse gases. And while predicting climate has always been an uncertain business, some scientists assert that developments since the IPCC completed its report have, if anything, magnified the uncertainties. "Global warming is definitely a threat as greenhouse gas levels increase," says climate modeler David Rind of NASA's Goddard Institute for Space Studies (GISS) in New York City. "But I

"In the climate system, there are 14 orders of magnitude of scale, from the planetary scale—which is 40 trillion meters—down to the scale of one of the little aerosol particles on which water vapor can change phase to a liquid [cloud particle]—which is a fraction of a millionth of a millimeter."

Of these 14 orders of magnitude, notes Schlesinger, researchers are able to include in their models only the two largest, the planetary scale and the scale of weather disturbances: "To go to the third scale—which is [that of thunderstorms] down around 50-kilometers resolution—we need a computer a thousand times faster, a teraflops machine (that maybe we'll have in 5 years)." And including the smallest scales, he says, would require 10^{14} to 10^{17} more computer power. "So we're kind of stuck."

To get unstuck, modelers "parameterize" smaller scale processes known to affect climate, from the formation of clouds to the movement of ocean eddies. Because they can't model, say, every last cloud over North America, modelers specify the temperatures and humidities that will spawn different types of clouds. If those conditions hold within a single grid box—the horizontal square that represents the model's finest level of detail—the computer counts the entire area as cloudy. But as modelers point out, the grid used in today's models—typically a 300-kilometer square—is still very coarse. One over the state of Oregon, for instance, would take in the coastal ocean, the low coast ranges, the Willamette Valley, the high Cascades, and the desert of the Great Basin.

Having the computer power to incorporate into the models a more detailed picture of clouds wouldn't eliminate uncertainties, however, because researchers are still hotly debating the overall impact of clouds on future climate. In today's climate, the net effect of clouds is to cool the planet—although they trap some heat, they block even more by reflecting sunlight back into space. How that balance would change under greenhouse warming, no one knows. A few years ago, a



Rough approximation. Models can't reproduce clouds, but they incorporate some cloud effects, including those of water (white) in the atmosphere, seen in the above model output.

myself am not convinced that we have [gained] greater confidence" in recent years in our predictions of greenhouse warming. Says one senior climate modeler who prefers not to enter the fray publicly: "The more you learn, the more you understand that you don't understand very much." Indeed, most modelers now agree that the climate models will not be able to link greenhouse warming unambiguously to human actions for a decade or more.

The effort to simulate climate in a computer faces two kinds of obstacles: lack of computer power and a still very incomplete picture of how real-world climate works. The climate forecasters' basic strategy is to build a mathematical model that recreates global climate processes as closely as possible, let the model run, and then test it by comparing the results to the historical climate record. But even with today's powerful supercomputers, that is a daunting challenge, says modeler Michael Schlesinger of the University of Illinois, Urbana-Champaign:

Model Gets It Right—Without Fudge Factors

Climate modelers have been "cheating" for so long it's almost become respectable. The problem has been that no computer model could reliably simulate the present climate. Even the best simulations of the behavior of the atmosphere, ocean, sea ice, and land surface drift off into a climate quite unlike today's as they run for centuries. So climate modelers have gotten in the habit of fiddling with fudge factors, so-called "flux adjustments," until the model gets it right.

No one liked this practice (*Science*, 9 September 1994, p. 1528). "If you can't simulate the present without arbitrary adjustments, you have to worry," says meteorologist and modeler David Randall of Colorado State University (CSU) in Fort Collins. But now there's a promising alternative. Thirty researchers at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, have developed the first complete model that can simulate the present climate as well as other models do, but without flux adjustments. The new NCAR model, says Randall, "is an important step toward removing some of the uneasiness people have about trusting these models to make predictions of future climate" (see main text).

The NCAR modelers built a host of refinements into their new Climate System Model (CSM). But the key development, says CSM co-chair Byron Boville, was finding a better way to incorporate the effects of ocean eddies, swirling pools of water up to a couple of hundred kilometers across that spin off strong currents. Climate researchers have long known that the eddies, like atmospheric storms, help shape climate by moving heat around the planet. But modelers have had a tough time incorporating them into their simulations because they are too small to show up on the current models' coarse geographic grid.

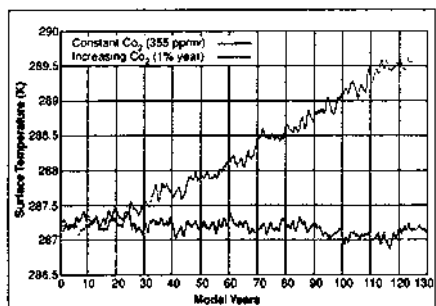
The CSM doesn't have a finer mesh, but it does include a new "parameterization" that passes the effects of these unseen eddies onto larger model scales, using a more realistic means of mixing heat through the ocean than any earlier model did, says Boville.

Even when run for 300 model "years," the CSM doesn't drift away from a reasonably realistic climate, says NCAR's Climate and Global Dynamics director Maurice Blackmon. "Being able to do this without flux corrections gives you more credibility," he says. "For better or worse, we're not biasing the results as was necessary before."

The first results from this still vastly simplified model imply that future greenhouse warming may be milder than some other models have suggested—and could take decades to reveal itself. Doubling atmospheric carbon dioxide concentrations in the model raised the global temperature 2 degrees Celsius, which puts

the model's sensitivity to greenhouse gases near the low end of current estimates. Based on an array of different models and other considerations, the UN-sponsored Intergovernmental Panel on Climate Change estimated in 1995 that a carbon dioxide doubling could raise global temperatures by as much as 4.5°C; their best guess was 2.5°C.

A 300-year run without any increase in greenhouse gases produced slow, natural variations in global temperature of about 0.5°C. If the real climate behaves the same way, "two-thirds to three-quarters of the [temperature variations of the] last 130 years



Drift-free. The NCAR model, which suggests that Earth will warm moderately (red), can reliably simulate present climate (blue).

can be explained as natural variation," says Blackmon. That would make the detection of a modest-size greenhouse warming all the more difficult.

The CSM is available on the Internet, but Blackmon warns that if you want to check out future climate scenarios, you'll "need the biggest supercomputer you can get." Indeed, even NCAR researchers haven't been able to experiment with the model on as large a computer as they would like. While their purchase of an NEC SX4 computer is tied up in a trade dispute with Japan (*Science*, 30 August 1996, p. 1177), they are making do with a leased Cray C-90 with perhaps 20% of the speed of the SX4. That worries some modelers. Americans have "been among the leaders of the field from the beginning," says CSU's Randall, but "if we can't get access to the most powerful machines, we are going to be left behind."

—R.A.K.

leading climate model—developed at the British Meteorological Office's Hadley Center for Climate Prediction and Research, in Bracknell—predicted that an Earth with twice the preindustrial level of carbon dioxide would warm by a devastating 5.2 degrees Celsius. Then Hadley Center modelers, led by John Mitchell, made two improvements to the model's clouds—how fast precipitation fell out of different cloud types and how sunlight and radiant heat interacted with

clouds. The model's response to a carbon dioxide doubling dropped from 5.2°C to a more modest 1.9°C.

Other models of the time also had a wide range of sensitivities to carbon dioxide, largely due to differences in the way their clouds behaved. That range of sensitivity has since narrowed, says modeler and cloud specialist Robert Cess of the State University of New York, Stony Brook, but "the [models] may be agreeing now simply because they're

all tending to do the same thing wrong. It's not clear to me that we have clouds right by any stretch of the imagination."

Nor are clouds the only question mark in researchers' picture of how climate works. Modelers saw for the first time the fingerprint of global warming when they folded an additional process into the models, the effect of pollutant hazes on climate. Wind-blown soil and dust, particles from the combustion of fossil fuels, and ash and soot from

agricultural burning all reflect sunlight— shading and cooling the surface beneath them. Including this aerosol effect in four independent climate models at three centers—Livermore, the Hadley Center, and the Max Planck Institute for Meteorology (MPI) in Hamburg, Germany—produced geographic patterns of temperature changes that resembled those observed in the real world over the past few decades, such as the greater warming of land than ocean.

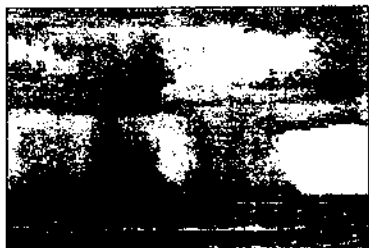
Fingerprinting work since then has only strengthened the confidence of IPCC's more confident scientists that greenhouse warming has arrived. "I've worked with the models enough to know they're not perfect, but we keep getting the same answer," says Tim P. Barnett, a climatologist at the Scripps Institution of Oceanography in La Jolla, California, and a co-author of the IPCC chapter. Another climatologist and IPCC contributor, Gerald North of Texas A&M University in College Station, is similarly heartened. "I'm pretty optimistic about climate modeling. ... I don't know anybody doing [fingerprinting] who is not finding the same result."

But the assumptions about how haze affects climate may have taken a hit recently from climatologist and modeler James Hansen of NASA's GISS—the man who told Congress in 1988 that he believed "with a high degree of confidence" that greenhouse warming had arrived. In a recent paper, Hansen and his GISS colleagues pointed out that recent measurements suggest that aerosols don't just cool; they also warm the atmosphere by absorbing sunlight. The net effect of this reflection and absorption, Hansen estimates, would be small—too small to have much effect on temperature.

Hansen and his colleagues conclude that aerosols probably do have a large effect on climate, but indirectly, through clouds. By increasing the number of droplets in a cloud, aerosols can amplify the reflectivity of clouds, and thus may have an overall cooling effect on the atmosphere. If true, this would greatly complicate the modelers' work, because meteorologists are only just starting to understand how efficiently particles of different sizes and compositions modify clouds. "I used to think of clouds as the Gordian knot of the problem," says cloud specialist V. Ramanathan of Scripps. "Now I think it's the aerosols. We are arguing about everything."

And the complications don't stop with the multiplication of aerosol effects, accord-

ing to Christopher Folland of the Hadley Center. Folland and his colleagues have been trying to sort out what was behind the intermittent warming of recent decades, which in the third quarter of the century was more rapid in the Southern than Northern Hemisphere. Earlier work by Santer and a dozen other colleagues showed an increasing resemblance between the observed pattern of warming through 1997, the end of their temperature record, and the results of a model run that incorporated aerosol effects. The researchers suggested that the North's more abundant pollutant aerosols could have been moderating the warming there from greenhouse gases. But when Folland



Cruel component. Thunderstorms like the one above help to shape climate by lofting heat and moisture.

compared the results of his model run with a longer, more recent temperature record, the resemblance that had been building into the 1980s faded by the early 1990s. Contrarian Patrick Michaels of the University of Virginia, Charlottesville, also has pointed out this trend.

The Hadley model suggests that "there appears to be more than one reason" for the variations, says Folland. The waning of aerosols as pollution controls took effect probably helped the North catch up, he says, but so did natural shifts in atmospheric circulation that tended to warm the continents (Science, 7 February, p. 734). Most provocatively, Folland and his colleagues are suggesting that a shift in North Atlantic Ocean circulation that has tended to warm the region also has contributed. "There's no doubt," says Santer, "that multiple natural and anthropogenic factors can contribute, and probably have, to the interhemispheric temperature contrast. ... We've learned something about detection."

All of which only adds to the skepticism of scientists who might be called the "silent doubters": meteorologists and climate modelers who rarely give voice to their concerns and may not have participated even peripherally in the IPCC. "There really isn't a per-

suasive case being made" for detection of greenhouse warming, argues Brian Farrell of Harvard University, who runs models to understand climate change in the geologic past. Farrell has no quarrel with the IPCC chapter on detecting greenhouse warming, but he says the executive summary did not "convey the real uncertainties the science has." He further contends that if IPCC scientists had had real confidence in their assertion that global warming had arrived, they would have stated with more precision how sensitive the climate system is to greenhouse gases. But the IPCC left the estimate of the warming from a doubling of carbon dioxide at 1.5°C to 4.5°C, where it has been for 20 years. "That's an admission that the error bars are as big as the signal," says Farrell.

Climate modeler Max Suarez of NASA's Goddard Space Flight Center in Greenbelt, Maryland, agrees that it's "iffy" whether the match between models and temperature records is close enough to justify saying that greenhouse warming is already under way. "Especially if you're trying to explain the very small [temperature] change we've seen already," he says, "I certainly wouldn't trust the models to that level of detail yet."

Rather than dwelling on model imperfections, IPCC co-author Barnett emphasizes some of the things that current models are doing fairly well—simulating present and past climates and the changing seasons, predicting El Niño a year ahead, and producing good simulations of decades-long climate variations. But he agrees that too much confidence has been read into the IPCC summary statement. "The next 10 years will tell; we're going to have to wait that long to really see," he says. Klaus Hasselmann of the MPI also sees a need to wait. He and his colleagues "think we can see the [greenhouse warming] signal now with 97% confidence." But, as North notes, "all that assumes you knew what you were doing to start with" in building the models. Hasselmann has faith in his model but recognizes that his faith is not universally shared. "The signal is not so much above the noise that you can convince skeptics," he observes. "It will take another decade or so to work up out of the noise."

That's no excuse for complacency, many climate scientists say. Basic theory, this century's warming, and geologic climate records all suggest that increasing carbon dioxide will warm the planet. "I'd be surprised if that went away," says Suarez, as would most climate researchers. North suggests that while researchers are firming up the science, policy-makers could inaugurate "some cautious things" to moderate any warming. The last thing he and his colleagues want is a rash of headlines saying the threat is over.

—Richard A. Kerr



Global Climate Coalition
1275 K St. N.W.
Suite 890
Washington, D.C. 20005
Tel: 202.682.9161
Fax: 202.638.1043

August 13, 1997

The Honorable John H. Chafee
Chairman
Committee on Environment and Public Works
United States Senate
407 Hart Senate Office Building
Washington, D.C. 20510

Dear Senator Chafee:

Thank you for providing me the opportunity to testify on July 17 before the Senate Committee on Environment and Public Works. The Global Climate Coalition ("GCC") commends you and your fellow committee members for holding hearings on the international negotiations to amend the Framework Convention on Climate Change. These negotiations have an established objective to impose upon the developed countries of the world binding targets and timetables to reduce greenhouse gas emissions. As you stated during the hearing, the environmental, economic and trade implications of such commitments would be enormous for the United States. Indeed, the passage on July 25 of Senate Resolution 98, by an overwhelming vote of 95-0, reflects the Senate's intensified concern that the Administration's negotiating positions will not advance our national environmental or economic interests.

Attached are my responses to the questions posed in your July 30 letter. I would emphasize that in your opening statement at the Committee hearing on July 10 you explained that you are "convinced that the science on this matter has and will continue to evolve." The GCC shares that view and has endorsed policies for further scientific research, evaluation, and open dialogue concerning the many outstanding issues regarding climate behavior and change, and the impacts of potential change. While the Administration has recently emphasized its "outreach" efforts, and a more constructive dialogue with the business community has begun, recent statements by Interior Secretary Babbitt and Vice-President Gore have proven counterproductive. As explained more fully in my response to your first question, which is attached, these statements have branded the business community, and by implication anyone else who raises questions about scientific uncertainty, with charges of "unethical" and "Un-American" behavior. To say the least, remarks such as these are inaccurate and ill-timed and undermine good-faith efforts to promote an informed and honest dialogue on this important issue of public policy. The GCC appreciates your efforts, and those of your fellow committee members,

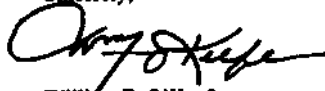


Letter to Senator Chafee
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to elicit and evaluate the best available scientific and economic evidence to guide our decisionmaking. Surely that process can not accommodate zealous advocacy which goes so far as to indict the patriotism of those with whom one does not agree.

Again, thank you for the opportunity to testify on behalf of the GCC. If I can be of any assistance to you or the committee in the future regarding the issue of climate change, please do not hesitate to call.

Sincerely,

A handwritten signature in black ink, appearing to read "W. F. O'Keefe", written in a cursive style.

William F. O'Keefe
Chairman

RESPONSES BY WILLIAM F. O'KEEFE TO ADDITIONAL QUESTIONS FROM SENATOR
CHAFEE

Question 1. Mr. O'Keefe, you say in your testimony that you support "appropriate action." You want to encourage economic turnover of capital stock, spur the development of new technologies, and expedite their diffusion in developing countries. You also want to "facilitate the investment of U.S. private capital in countries with *high emissions levels*."

I assume by that last point you mean that you are interested in spurring investment that reduces these high emissions, is that right? (If yes,) now why would you be interested in reducing these emissions?

Answer. As I responded at the hearing when asked if there is a climate change "problem", the GCC recognizes that there is a *risk* that deserves to be addressed. Until the uncertainty surrounding this issue is reduced by expanding our State of knowledge, we simply do not know whether there is a genuine and serious "problem." We do know that there is a very real risk that precipitous action will cause society's scarce resources to be wasted and our economic well being damaged. The *risk* of human-induced climate change warrants current efforts to ensure that we undertake emissions policies which are generally termed "no" or "low" regrets. Such a policy, which calibrates our national response to the still uncertain and evolving understanding of human impacts on the climate system, is what I meant when I urged "appropriate action" to reduce emissions. Such actions include promoting research leading to more energy-efficient technologies and their subsequent export to developing countries. The expanded use of current and future energy-efficient technologies in developing countries will contribute to their productivity improvements and economic strength and is therefore a desirable goal in itself. It also would limit GHG emissions growth in those countries and therefore diminish the risk associated with higher CO₂ concentration levels.

I would like to stress, however, that today there is an entirely legitimate scientific debate regarding the extent, if any, of human-induced climate change and of what the impacts of change might be—past, present, and future. Most regrettably, as the scientific community publicly acknowledges the uncertainty, and as warming predictions for the next century moderate substantially, the Administration has declared the debate to be over and attacked the patriotism and integrity of those who raise legitimate questions about their apocalyptic visions.

As your first hearing on July 11 amply demonstrated the utter lack of scientific consensus regarding human-induced climate change, I will not address that fact further. However, I would like to draw the committee's attention to the efforts by the Clinton Administration to stifle the important and legitimate debate about inferences that can be drawn from the current State of scientific knowledge and about policies that are consistent with those inferences. On June 25, Vice-President Gore spoke at Vanderbilt University on the topic of "global warming" and stated:

"There is a small group that likes to spread dissension and skepticism, just like the big tobacco companies spent huge amounts of money telling tobacco smokers smoking is not bad for you. . . . That's ridiculous and unethical." *The Tennessean* (June 26, 1997).

On July 21, Interior Secretary Bruce Babbitt appeared on the Diane Rehm Show, and stated:

"[I]t's an unhappy fact that the oil companies and the coal companies in the United States have joined in a conspiracy to hire pseudo scientists to deny the facts, and then begin raising political arguments that are essentially fraudulent, that we can't do this without damaging the economy . . . [T]he energy companies need to be called to account because what they're doing is un-American in the most basic sense."

This type of extreme statement makes it more difficult for the American people to gain a better understanding of the issue and for the Senate to gain the type of information necessary for it to discharge its constitutional responsibility. Very plainly, efforts to suppress the free exchange of information, evidence, and opinion undermine efforts to formulate a responsible national policy on climate change. The passage of Senate Resolution 98 by a vote of 95–0 will hopefully dissuade the Administration from continuing to pursue its "rush to judgment, cutoff debate" strategy. It is now clear that an open policy dialog—which necessarily includes an honest evaluation of the science of climate change—will occur and the Senate will independently distinguish the science from the pseudo-science.

Question 2. Since you support “appropriate action,” I assume that you would prefer smart action to dumb action. By “smart action” I mean action that reduces emissions at lower cost than action that is costly.

Well, the acid rain trading program under the 1990 Clean Air Act has proven itself to be a smart kind of action, since it is reducing emissions fast and cheaply, spurring innovation, and dramatically lowering the costs of technologies.

I am told that a recent M.I.T. study has demonstrated this. It sounds to me like you are making an argument in favor of the “cap-and-trade” approach, with joint implementation or trading with developing countries as a key component. That would address, in a smart way, all of the concerns for “appropriate action” that you have raised. Your thoughts?

Answer. Your assumption that my use of the term “appropriate action” implies “smart action [as opposed] to dumb action” is correct. Let me clarify, however, that determining “appropriate action” is a two-step, sequential process:

- (1) identify and substantiate the problem you are trying to solve and what result or target is necessary to solve it; and
- (2) how to achieve that result or target most cost-effectively.

The Administration has emphasized being “smart” solely with respect to the second step above, without being “smart” on the essential first step.¹ Unfortunately, being “dumb” with respect to the essential first step renders the entire two-step process “dumb”. Thus, joint implementation and emissions trading are options to be considered in the second step above. The GCC has long supported the concept of joint implementation, but questions the practicability and enforceability of an international “cap and trade” system for curtailing global greenhouse gas emissions. While “cap and trade” may seem like an attractive concept, a “cap” means rationing, which is a failed concept. However, the use of “smart”, market-based tools to achieve a result that is not, in fact, yet warranted by the evidence, is not “smart”. It is instead merely a “smart” way to address a dumb conclusion.

Your reference to the acid rain trading program of the Clean Air Act of 1990 is a useful one because it highlights the advantages of market mechanisms, the importance of serendipity, and the significant differences between the SO₂ trading program and an international tradable permits program for greenhouse gas emissions. First, the acid rain trading program did allow companies flexibility in meeting a performance goal, and that allowed cost savings compared to what would have occurred with a one-size-fits-all command and control program. Second, while the current market value of an SO₂ emission permit is below levels projected while the program was being devised, to a large extent this is the result of serendipity. For example, energy prices are lower than projected and deregulation in the transportation sector has allowed much greater use of low-sulfur coal. Third, there are immense differences between the United States SO₂ trading program and a program required for international tradable permits in greenhouse gases. The SO₂ program involved one gas, in one industry, in one country and the application of readily available technology. An international tradable permit program for greenhouse gases would involve multiple gases, multiple nations, plus every industry and every citizen in every country. Furthermore, short of suppressing energy use there is no practical technology for significantly reducing or sequestering CO₂ emissions. Obviously, an international tradable permits system would require a tremendous, unprecedented global monitoring and transactional infrastructure to ensure its integrity and enforceability. Whether political systems based upon national sovereignty could accommodate such an infrastructure is a serious question. Many, such as Dr. Richard Cooper (Harvard University) and Dr. Thomas Schelling (University of Maryland) have carefully considered these issues and concluded that “cap and trade” as well as joint implementation programs are simply not practical in any real sense. Cap and trade programs require allocation of the cap, and there is no generally accepted basis for such allocation. And to be cost-effective, both programs require major commitments by developing nations—commitments that are clearly not forthcoming. For these reasons, it is facile to suggest an easy parallel between the SO₂ trading permits program in the United States and a global emissions trading scheme for GHGs.

Question 3. You state in your testimony that, curbs on greenhouse gas emissions, “would be brutally expensive in terms of lost income, lost jobs and lost U.S. competitiveness on world markets.” Curbs of any kind?

¹ Testimony of Dr. Janet Yellen before the Committee on Environment and Public Works, July 17, 1997, p. 6: “[C]osts depend critically on how emission reduction policies are implemented. It boils down to this: if we do *it* dumb *it* could cost a lot, but if we do *it* smart *it* will cost much less . . .” (emphasis added). The GCC is still curious as to what the “it” is, as well as the justification for “it.” [Step One Above].

Answer. The GCC's consistent promotion of "no" or "low" regrets measures to constrain the growth in greenhouse gas emissions obviously implies that there are opportunities to reduce emissions that would be benign economically and perhaps even beneficial. Many such opportunities have been embraced by industry to support voluntary efforts to achieve the "aim" of returning 2000 greenhouse gas emissions to 1990 levels. The U.S. Climate Action Report, released in May, reveals that over 5,000 private sector organizations participate in voluntary Federal climate mitigation programs, which are projected to reduce emissions by an estimated 75 million metric tons by the year 2000; consumer and business savings are projected at \$10 billion by 2000 and \$50 billion by 2010. Importantly, the Report documents that 94 percent of the U.S. primary aluminum production capacity has joined the Voluntary Aluminum Industrial Partnership; electric utilities representing 69 percent of 1990 electric generation and utility carbon emissions have signed the Climate Wise agreements; 2,300 companies now participate in the Green Lights program; and the Gas Research Institute has pledged \$4 million of its annual budget to projects that reduce methane emissions. Widespread voluntary efforts such as these are an efficient, cost-effective way of speeding the adoption of economically viable energy efficient technologies. Such programs should help strengthen the already strong trend of increased U.S. energy efficiency.² In fact, the Energy Information Administration's 1997 reference case projection indicates annual decreases of 1 percent in energy consumption per dollar of GDP through 2015.

However, your quotation from my full Statement regarding "brutally expensive" curbs on greenhouse gas emissions appears as point 3 in the introductory summary. My detailed discussion of such costs relates to the Administration's intimation of agreeing to a legally binding U.S. commitment to stabilize emissions at 1990 levels in the next 12 years, by 2010.³ In that regard *all* credible, independent economic analyses of the costs of dramatically curbing near term emissions—to 1990 levels by 2010—indicate the same result: *brutal expense* to our economy and people. Studies by Charles River Associates, DRI/McGraw Hill, the U.S. Energy Information Administration and economists at our most prestigious universities indicate that energy taxes of \$125 to \$200 per metric ton of carbon would be needed to suppress demand sufficiently to return emissions to 1990 levels by 2010 (\$200 per ton is equivalent to an increase in the excise tax on gasoline of about 60 cents per gallon). A conservative estimate of the *annual* impact of a tax this size includes the following losses:

- \$100 billion to \$275 billion in GDP.
- 200,000 to 500,000 U.S. jobs.
- \$65 billion to \$100 billion in fixed business investment.
- \$50 billion to \$110 billion in consumer purchases.

On July 11, the Administration finally released a study by the Department of Energy (contracted through the Argonne National Laboratory). The study focused on "the potential effects on energy-intensive industries in the United States of alternative scenarios for changes in world patterns of industrial energy prices that might result from new climate commitments." The study results described the impacts on six industries (steel, cement, aluminum, paper, chemicals, and petroleum refining) as "significantly adverse" to "devastating," producing little, if any, environmental benefit.

In her testimony before the committee, Dr. Janet Yellen, Chair, Council of Economic Advisers, reported that the Administration's economic modeling efforts to predict the impacts of climate change policy were "futile." She stated that the Administration was left only with "a set of parameters and relationships that influence estimates of the impacts." It is, however, noteworthy that the May 30 Draft Report of the Interagency Analytical Team revealed that "[t]he starting point scenario [assuming stabilized emissions at 1990 levels by 2010] would raise the implicit price of carbon in the economy by about \$100 per ton of carbon." The Report then described that "[a] permit price of \$100 per ton is the equivalent of a price increase of 26 cents per gallon of refined petroleum product, \$1.49 per thousand cubic feet of natural

²Between 1973 and 1986, energy consumption per dollar of GDP declined 2.6 percent per year. Between 1986 and 1996, energy consumption per dollar of GDP declined 0.4 percent per year.

³Dr. Everett M. Ehrlich, who recently resigned his position as Undersecretary of Commerce for Economic Affairs, wrote in the *Washington Post* on June 15:

" . . . the economic literature suggests that we could roll back our CO₂ emissions to their 1990 levels by 2010 for the equivalent of a 25 cent gas tax. It's not free, but it's not the end of the world."

In addition, on July 15 the Administration released its May 30 draft interagency study on the economic impacts of stabilizing CO₂ emissions by 2010 at 1990 levels.

gas, \$52.52 per ton of coal, and 2 cents per kilowatt hour of electricity produced.” *Draft Report*, Page 8.

This important effort, before it was abandoned by the Administration, was tending to confirm the severely negative economic costs of a policy to drastically curtail emissions in the near term. In fact, Dr. Yellen emphasized in her testimony that “[t]he speed at which emissions reductions are required can have large effects on the estimated costs. It is important to allow sufficient lead-time for orderly investment in new equipment and technology.” This conclusion supports arguments made by the GCC in its July 1995 paper by David Montgomery, Charles River Associates, “Toward an Economically Rational Response to the Berlin Mandate.” Others, such as Wigley, Richels and Edmonds in their January 18, 1996 article in *Nature* come to similar conclusions, namely that “[u]nanticipated changes will be costly. Time is therefore needed to reoptimize the capital stock.” The GCC agrees and re-emphasizes that a 12-year period to return emissions to 1990 levels—requiring an approximate 25 percent reduction in projected fossil fuel use—would be brutally expensive. Even using Dr. Yellen’s “remaining tools,” we are unaware of any “parameters” or “relationships”—or existing technology for that matter—which avoids that result.

Question 4. Do you base your impacts assertions on the recent economic modeling done by the Charles River and Associates group? (If yes,) please talk some about the underlying assumptions in the Charles River Associate model, because a model as you know only *suggests* potential impacts. Does that particular model, for example, assume that the economy suffers *persistent* transitional inefficiencies (from actions to reduce emissions)?

Does it assume that there will be any energy source substitution? Does it assume inclusion of joint implementation or emissions trading, or any other flexibility instruments? Does it assume any benefits from averting climate change or other pollution damages? Is it reasonable to assume any of these at some level?

Answer. My statements regarding the economic impacts of policies to drastically limit greenhouse gas emissions and U.S. energy use are based on a broad spectrum of economic modeling efforts. In addition to work done by Charles River Associates, work by other groups such as MIT, the Energy Modeling Forum, DRI, and ABARE (Australian Bureau of Agricultural and Resource Economics) are also relevant and provide useful insights into the large impacts that should be expected from the targets and timetables proposed in the Berlin Mandate negotiations.

The question states that, “a model as you know only *suggests* potential impacts.” This applies to models that project climate and the impacts of a change in climate, as well as to economic models that focus more on the impacts of climate policy. There is an apparent inconsistency in the Administration’s confidence in modeling: why are economic models deemed “futile” in terms of projecting impacts in the next 20 years, while climate models predicting changes in the next 100 years are unquestioned? Thus, results of climate and climate impact models that are used to promote climate policies of the type being negotiated concern *suggested potential impacts* that *might* occur 100 or more years into the future. While some economic models cover a similar time horizon, most of the policy impact analysis done by the groups mentioned above focus on the next 20 or so years and evaluate the relatively near-term economic impact of proposed climate policies. It is very hard to deny that climate and impact models 100 years out are, by orders of magnitude, more unreliable than the economic models 10 or 20 years out. This is particularly true when you realize that the climate and impact models, for 100 years out, require inputs from economic models to even start their analysis. Assumptions regarding population, economic activity, technology, and lifestyles are all required before estimates of greenhouse gas emissions are generated for the next 100 years. Without that information, the climate models either have no emissions baseline to work with or are randomly picking scenarios that may have no relevance to the real world.

Regarding the CRA model, it assumes that market mechanisms would be used to create incentives for reducing energy use, thereby reducing carbon emissions, below baseline projected levels. These market mechanisms can be viewed either as carbon taxes or auctioned tradable permits, which are viewed by economists as being the least-cost way of reducing carbon emissions. Therefore, the model does not assume that the economy suffers persistent transitional inefficiencies specifically from actions to reduce emissions.

Transitional inefficiencies are more likely to be induced by the use of various command and control policies. In fact, since the model is of the type referred to as general equilibrium models, it arguably omits some transitional costs to the economy of moving to a lower-carbon trajectory, and therefore its impact estimates may be on the low side.

The CRA model does allow for substitution among different fossil fuels, as well as to non-carbon fuels. This substitution occurs depending on the relative prices of the fuels, including carbon taxes or tradable permit market values that raise the cost of carbon generating fuels. The CRA model, following the general structure of the Framework Convention on Climate Change as well as the Berlin Mandate language, assumes that each OECD country individually meets a proposed emission target.

The model is designed to help identify the economic costs of alternative emission reduction targets and timetables and does not attempt to address any possible benefits of lower carbon emission trajectories. While all policies should at least be evaluated with respect to likely costs and benefits, one difficulty with the climate change issue is that there are large near-term economic costs to reducing emissions substantially over the next two decades while it is unlikely that there would be any measurable benefits from reduced carbon emissions during that *same timeframe*, especially if developing countries are excluded from emission reduction requirements.

Returning to “transitional inefficiencies,” there is a recent tendency to mischaracterize how economic models address the issue—are consumers efficient in their energy use and how efficient are they in changing their energy use. The recent World Resources Institute study, *The Costs of Climate Protection: A Guide for the Perplexed* is a prime example. For example, one of the six criteria the WRI study used to characterize model results was “inefficient economic responses.” More specifically, it asked: “Is the model of the CGE type, which assumes that the economy adjusts efficiently in the long-run, or it is a macro model that assumes that the economy suffers persistent transitional inefficiencies?” This is a clear mischaracterization of the difference between model types, especially when the CGE results are labeled “optimistic” and the macromodel results are labeled “pessimistic.” In reality the two types of models address different questions: the former asks what are the economic consequences of different equilibrium conditions (one with large carbon taxes and one without), and the latter asks what sort of costs arise during a policy-induced transition from one equilibrium to another. The difference between the models is sort of like moving from Washington, DC. to either Seattle or San Diego. The CGE model asks what life is like after you moved, while the macromodel focuses more on how you get to either location. It’s like a vacation—getting there is at least half the fun, but if you cannot afford the travel portion, you do not take the trip.

Question 5. You talk about actions being considered by negotiators that would require us to “suppress energy use by at least 25 percent in little over a decade.” What actions or proposals, now being seriously considered by international negotiators, would “require” this sort of response?

Answer. With less than 4 months before the Kyoto Conference of the Parties, United States negotiators still have not revealed to Congress or the American people the specific targets and timetables they intend to endorse. Apparently, the U.S. position will not be settled until late in the Fall. However, U.S. Government officials have consistently discussed and analyzed a commitment to return to 1990 emissions levels by 2010.⁴ This past Spring, the European Union (EU) proposed a 15 percent reduction in 1990 emissions by 2010.

Comparing such goals with official U.S. Government projections of emissions clearly indicates that very large emissions reductions by the United States would be required. For example, Table A9 of the Energy Information Administration’s *International Energy Outlook 1997* reports that U.S. carbon emissions for 1990 were 1.34 billion metric tons. The reference case projection for 2010 is 1.72 billion metric tons. Thus, to limit emissions to 1990 levels by 2010 would require a 22 percent reduction in emissions from the baseline. To limit emissions to 15 percent below the 1990 level by 2010 would require a 34 percent reduction in emissions from the baseline. As a practical matter, it is difficult to comprehend how emissions could be reduced by $\frac{1}{3}$ off the baseline in little over a decade. Only very large carbon taxes, very high tradable permit prices, and/or an exceptionally long list of highly onerous command and control programs could suppress energy use sufficiently to achieve such emission reductions within that timeframe.

Question 6. If a treaty were signed that called for . . . let’s say, a return to 1990 emissions levels by the year 2015: is the *only* way to get to that goal (that your group would support) a requirement that *all* countries, regardless of poverty level or current emissions contribution, take identical action at the same time? That is, should Togo, for example, be required to take the same actions as the United States and other OECD nations, and China, at the same time?

⁴ See footnote 3 regarding statements by Dr. Ehrlich and the May 30 Draft Interagency Study.

Answer. Any impact GHGs have on climate is independent of whether they come from developed or developing countries, and developing countries' emissions are projected to grow rapidly in the next century, outstripping those of the developed world by 2015, according to the Energy Information Administration. The purposes of the ongoing negotiations to amend the Framework Convention on Climate Change ("FCCC") are ostensibly to limit emissions, thereby limiting the potential of climate change. The Berlin Mandate of 1995, which exempts the developing world from assuming any treaty obligations, guarantees that total global GHG emissions will increase in the next century. As of now, therefore, the Berlin Mandate guarantees failure in addressing the objective of the FCCC. In addition, the flight of capital, jobs, and economic strength from participating developed countries to the exempted developing world would be an inevitable consequence of the Berlin Mandate.

In light of those realities, the relative burden of nations in addressing a global environmental risk is a daunting challenge that was recognized in the Berlin Mandate. Economic equity must be an essential part of any treaty negotiation, in spite of the difficulty in pursuing it. Many Senators supporting the unanimous passage of Senate Resolution 98 expressed the view that the Berlin Mandate, to which the Administration agreed in 1995, was a "fundamental error." President Clinton himself stated on August 4: "I believe the [Kyoto] agreement has to be a global one. I think all nations, developed and developing, should be a part of this." On this point, the GCC agrees with the President and the 95 U.S. Senators who supported Senate Resolution 98.

Question 7. You State that unnecessarily curbing carbon emissions will mean fewer jobs and less income. Does this prediction include all the new jobs that will be created by the shift to new technologies and industries?

Answer. Absent any identification of the "new technologies" that will enable, at the least, a 22 percent reduction in our use of fossil fuels within 12 years, it would be highly speculative to assume related "new industries" and "jobs." If technology does not emerge to accommodate an international commitment to reduce our use of fossil fuels by at least 22 percent, then painful policies to ration that use would be necessary. Prudent policymaking should prompt the question: What is the risk that a technology will not emerge which will enable a 22 percent reduction in our fossil fuel use in 12 years? Economist Robert Samuelson wrote in the July 9 *Washington Post*:

"Without a breakthrough in alternative energy—nuclear, solar, something—no one knows how to lower emissions adequately without ultimately crushing the world economy."