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THE CHAIRMAN

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

July 31, 1998

Dear Representative Moran:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

The international agreement that was reached in Kyoto, Japan last year was a crucial step forward in addressing global climate change. The President has said that we can work to avert the grave dangers of climate change while maintaining the strength of our economy. This analysis provides the analytical underpinnings of the Administration's conclusions that the United States can reach its Kyoto target at a relatively modest cost and that the benefits of taking action are likely to be substantial.

We appreciate your leadership and interest in this issue. If you are interested in discussing the results of our analysis, I would be happy to meet with you. Please have your staff contact my Chief of Staff, Michele Jolin at 395-5084.

Sincerely,

Janet L. Yellen

The Honorable James P. Moran
U.S. House of Representatives
Longworth House Office Building, Room 1214
Washington, D.C. 20515

Enclosure



THE CHAIRMAN

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

July 31, 1998

Dear Representative Obey:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

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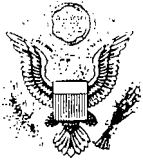
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Sincerely,

Janet L. Yellen

The Honorable David R. Obey
U.S. House of Representatives
Rayburn House Office Building, Room 2462
Washington, D.C. 20515

Enclosure



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

THE CHAIRMAN

July 31, 1998

Dear Representative Pallone:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

The international agreement that was reached in Kyoto, Japan last year was a crucial step forward in addressing global climate change. The President has said that we can work to avert the grave dangers of climate change while maintaining the strength of our economy. This analysis provides the analytical underpinnings of the Administration's conclusions that the United States can reach its Kyoto target at a relatively modest cost and that the benefits of taking action are likely to be substantial.

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Sincerely,


Janet L. Yellen

The Honorable Frank E. Pallone
U.S. House of Representatives
Cannon House Office Building, Room 420
Washington, D.C. 20515

Enclosure



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

THE CHAIRMAN

July 31, 1998

Dear Representative Pelosi:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

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Sincerely,

Janet L. Yellen

The Honorable Nancy Pelosi
U.S. House of Representatives
Rayburn House Office Building, Room 2457
Washington, D.C. 20515

Enclosure



THE CHAIRMAN

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

July 31, 1998

Dear Representative Porter:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

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Sincerely,

Janet L. Yellen

The Honorable John Edward Porter
U.S. House of Representatives
Rayburn House Office Building, Room 2373
Washington, D.C. 20515

Enclosure



THE CHAIRMAN

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

July 31, 1998

Dear Representative Regula:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

The international agreement that was reached in Kyoto, Japan last year was a crucial step forward in addressing global climate change. The President has said that we can work to avert the grave dangers of climate change while maintaining the strength of our economy. This analysis provides the analytical underpinnings of the Administration's conclusions that the United States can reach its Kyoto target at a relatively modest cost and that the benefits of taking action are likely to be substantial.

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Sincerely,

Janet L. Yellen

The Honorable Ralph Regula
U.S. House of Representatives
Rayburn House Office Building, Room 2309
Washington, D.C. 20515

Enclosure



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

THE CHAIRMAN

July 31, 1998

Dear Representative Rivers:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

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Sincerely,

Janet L. Yellen

The Honorable Lynn Rivers
U.S. House of Representatives
Longworth House Office Building, Room 1724
Washington, D.C. 20515

Enclosure



THE CHAIRMAN

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

July 31, 1998

Dear Representative Roemer:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

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Sincerely,

Janet L. Yellen

The Honorable Timothy J. Roemer
U.S. House of Representatives
Rayburn House Office Building, Room 2348
Washington, D.C. 20515

Enclosure



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

THE CHAIRMAN

July 31, 1998

Dear Representative Sawyer:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

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Sincerely,

Janet L. Yellen

The Honorable Thomas C. Sawyer
U.S. House of Representative
Longworth House Office Building, Room 1414
Washington, D.C. 20515

Enclosure



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

THE CHAIRMAN

July 31, 1998

Dear Representative Schaefer:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

The international agreement that was reached in Kyoto, Japan last year was a crucial step forward in addressing global climate change. The President has said that we can work to avert the grave dangers of climate change while maintaining the strength of our economy. This analysis provides the analytical underpinnings of the Administration's conclusions that the United States can reach its Kyoto target at a relatively modest cost and that the benefits of taking action are likely to be substantial.

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Sincerely,

Janet L. Yellen

The Honorable Daniel Schaefer
U.S. House of Representatives
Rayburn House Office Building, Room 2160
Washington, D.C. 20515

Enclosure



THE CHAIRMAN

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

July 31, 1998

Dear Representative Sensenbrenner:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

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Sincerely,

Janet L. Yellen

The Honorable F. James Sensenbrenner, Jr.
U.S. House of Representatives
Rayburn House Office Building, Room 2332
Washington, D.C. 20515

Enclosure



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

THE CHAIRMAN

July 31, 1998

Dear Representative Smith:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

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Sincerely,

Janet L. Yellen

The Honorable Robert F. Smith
U.S. House of Representatives
Longworth House Office Building, Room 1126
Washington, D.C. 20515

Enclosure



THE CHAIRMAN

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

July 31, 1998

Dear Representative Stenholm:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

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Sincerely,

Janet L. Yellen

The Honorable Charles W. Stenholm
U.S. House of Representatives
Longworth House Office Building, Room 1211
Washington, D.C. 20515

Enclosure



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

THE CHAIRMAN

July 31, 1998

Dear Representative Stupak:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

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Sincerely,

Janet L. Yellen

The Honorable Bart Stupak
U.S. House of Representatives
Longworth House Office Building, Room 1410
Washington, D.C. 20515

Enclosure



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

THE CHAIRMAN

July 31, 1998

Dear Representative Talent:

Knowing of your interest in the issue of climate change, please find enclosed a copy of the Administration's economic analysis of the costs and benefits of taking action to mitigate the threat of global warming.

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Sincerely,

Janet L. Yellen

The Honorable James M. Talent
U.S. House of Representatives
Longworth House Office Building, Room 1022
Washington, D.C. 20515

Enclosure



THE CHAIRMAN

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

July 31, 1998

Dear Representative Tierney:

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Sincerely,

Janet L. Yellen

The Honorable John F. Tierney
U.S. House of Representatives
Cannon House Office Building, Room 120
Washington, D.C. 20515

Enclosure



THE CHAIRMAN

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

July 31, 1998

Dear Representative Upton:

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Sincerely,

Janet L. Yellen

The Honorable Frederick S. Upton
U.S. House of Representatives
Rayburn House Office Building, Room 2333
Washington, D.C. 20515

Enclosure



THE CHAIRMAN

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

July 31, 1998

Dear Representative Velazquez:

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Sincerely,

Janet L. Yellen

The Honorable Nydia M. Velazquez
U.S. House of Representatives
Longworth House Office Building, Room 1221
Washington, D.C. 20515

Enclosure



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

THE CHAIRMAN

July 31, 1998

Dear Representative Waxman:

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Sincerely,

Janet L. Yellen

The Honorable Henry A. Waxman
U.S. House of Representatives
Rayburn House Office Building, Room 2204
Washington, D.C. 20515

Enclosure



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

THE CHAIRMAN

July 31, 1998

Dear Representative Young:

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Sincerely,

Janet L. Yellen

The Honorable Don Young
U.S. House of Representatives
Rayburn House Office Building, Room 2111
Washington, D.C. 20515

Enclosure

**TESTIMONY OF DR. JANET YELLEN
CHAIR, COUNCIL OF ECONOMIC ADVISERS
BEFORE THE
U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SMALL BUSINESS**

JUNE 4, 1998

Thank you, Mr. Chairman. The President has said that we can work to avert the grave dangers of climate change, while at the same time maintaining the strength of our economy. I agree and am pleased to have this opportunity to appear before the Committee to elaborate on the Administration's views on these issues.

The international agreement that was reached in Kyoto this past December is a crucial step forward in addressing global climate change. But it is only one step in a journey. Since the international effort to reduce greenhouse gas emissions is still in some respects a work-in-progress, it is not yet possible to provide a full authoritative analysis of it. Many of the specifics in several crucial areas are not completely resolved in the diplomatic arena, forcing analysts to make a variety of assumptions about the ultimate form of the international regime. In my testimony today, I will attempt to identify key elements of the agreement and the Administration's policy, such as international emissions trading, meaningful developing country participation, inclusion of land-use activities that absorb carbon ("sinks") and six categories of gases, as well as domestic initiatives, that together can ensure that reductions in global greenhouse gas emissions are consistent with continued strong economic growth. I will explain the reasoning underlying our conclusion that, under these conditions, economic impacts are likely to be modest.

The Administration is strongly committed to ensuring that these key elements are reflected in our domestic and international climate change policies. We are firmly committed to meaningful developing country participation, the use of sinks to offset emissions requirements, and emissions trading both domestically and internationally. And as you know, the President's FY 1999 budget includes a \$6.3 billion package of tax cuts and R&D investments over the next 5 years; this package makes good sense in terms of energy policy and will jumpstart our efforts. A final component of the President's climate change policy is his support for electricity restructuring in a manner that will offer approximately \$20 billion in cost savings to electricity consumers, while reducing greenhouse gas emissions.

I. Basic Economic Rationale of the Kyoto Treaty

To begin our analysis, it may be worth stepping back and examining the larger question of the basic rationale, from an economist's perspective, for the Kyoto Protocol.

The earth's surface appears to be warming from the accumulation of greenhouse gases from myriad sources worldwide. None of these emitters presently pays the cost to others of warming's adverse effects -- a classic externality in the language of economists. As a result of these distorted incentives, disruption of the Earth's climate is likely to proceed at an excessive pace and if left uncontrolled may pose substantial costs in terms of harm to commerce and the environment alike. The fundamental economic logic of the Kyoto Protocol is thus that without such an international agreement, individual nations will not have the proper incentives to address the threats from global climate change.

II. Costs of Climate Change

In evaluating efforts to mitigate global warming, the first step is to consider the costs of inaction. These costs --and they are significant-- provide the primary motivation for actions to reduce greenhouse gas emissions.

The Intergovernmental Panel on Climate Change (IPCC) jointly established by the World Meteorological Organization and the United Nations Environment Programme, concluded in 1995 that "the balance of evidence suggests that there is a discernible human influence on global climate." Current concentrations of carbon dioxide, methane, nitrous oxide, and the other so-called greenhouse gases have reached levels well above those of preindustrial times. Of these, carbon dioxide (CO₂) is the most important: net cumulative CO₂ emissions resulting from the burning of fossil fuels and deforestation account for about two-thirds of potential warming from changes in greenhouse gas concentrations related to human activity.

Climatic Impact

If growth in global emissions continues unabated, the atmospheric concentration of CO₂ will likely double relative to its preindustrial level by midway through the next century and continue to rise thereafter. As a result of the increased concentration of CO₂, the IPCC estimates that global temperatures will increase by between 2 to 6 degrees Fahrenheit in the next 100 years, with a best guess of about 3.5 degrees Fahrenheit. While scientists believe that human activities are leading to a gradual warming of the *average* temperature of the earth, the change in temperature in a given region at a given time may differ substantially from this average. Indeed, models predict warming will be greater in high latitudes than in the tropics, and greater over land than ocean.

Potential consequences associated with this shift in climate include a rise in sea levels, greater frequency of severe weather events, shifts in agricultural growing conditions from changing weather patterns, threats to human health from increased range and incidence of diseases, changes in availability of freshwater supplies, and damage to ecosystems and biodiversity.

Economic and Monetary Damages

The derivation of quantitative or monetary estimates of the damages from such a change in the climate is extremely difficult given the capacity of today's models. Estimates of the economic damages from climate change fall into the following broad areas: agriculture, sea-level rise, air conditioning and heating, water supply, human life and health, air pollution, and other costs (hurricanes, relocation costs, human amenity, construction, leisure activities, urban infrastructure, and ecological damages such as forest loss and species loss). Although the quantification of these effects is quite demanding, researchers have developed estimates that prompt substantial concern. The IPCC reports that a doubling of carbon dioxide levels would lead to approximately 10,000 estimated additional deaths per year for the current U.S. population from higher summer temperatures, even after netting out the effects of warmer winters and assuming acclimatization. Other researchers have predicted sea level increases of about 20 inches by 2100, with greater increases in subsequent years.

Despite the difficulties, respected researchers have developed estimates of the monetary damages expected from an average worldwide temperature increase. For example, William Cline, then of the Institute for International Economics, estimated that a temperature change of 4.5 degrees Fahrenheit would impose annual damages of about 1.1 percent of GDP per year on the U.S. economy. That amounts to \$89 billion in today's terms. (Cline's original estimate is quoted in 1990 dollars. The figure given above translates this number into 1997 terms by scaling it to current GDP.) William Nordhaus of Yale University has likewise computed estimates of the dollar loss attributable to a doubling of greenhouse gas concentrations. Although he uses methods that differ from Cline's in several respects, Nordhaus estimates that a slightly larger temperature change of 5.4 degrees Fahrenheit would impose losses equal to about 1 percent of GDP. A third independent estimate reported by Nordhaus is close to Cline's. It must be noted, however, that this similarity among aggregated estimates masks the true uncertainty associated with forecasts of the damages from given increases in global warming -- the estimates are all fundamentally based on extrapolations from current and past experience, and may not fully incorporate effects that will unfortunately become apparent only with future experience.

One key difficulty in interpreting and monetizing these estimates of damages is uncertainty over the extent that they should be discounted because they occur in the distant future. Since the benefits of stemming future climate change accrue over not only decades but centuries, small changes in the discount rate can produce substantial changes in the results. But the precise discount rate that should be used to evaluate questions as important as the future climate of the planet remains a subject of intense debate. It is safe to say that there is, as yet, no professional consensus on the issue. Indeed there can be no technical answer to the ethical question how we should value the welfare of future generations.

A similar difficulty with such estimates is that they do not include potential non-linearities in the relationships between greenhouse gas concentrations and temperature, between temperature and economic damages, or in the various other complicated relationships governing interactions between greenhouse gas emissions, the climate, and the economy. Current estimates of damages do not, and cannot, accurately reflect the value of reducing the unknown risk of large-scale and potentially irreversible discrete events with potentially catastrophic consequences.

Two such possibilities serve as illustrations. Warming of Northern tundra may release huge amounts of methane from the permafrost, thereby leading to accelerated warming. We do not know at what point, if any, such potentially unstable activity would be triggered. Second, evidence from climate models suggests that some types of climate change may lead to changes in ocean currents, including weakening of the Gulf Stream that warms Western Europe. Scientific evidence suggests that abrupt seawater temperature shifts have occurred over periods as short as decades.

To what extent are we willing to take such chances with our planet? There is a strong argument for the Kyoto Protocol as a form of planet insurance. But what numerical weight should one assign to these catastrophic risks? In other words, what is the value of the insurance policy? Although it is difficult for an economist, or anyone, to know, reductions in the risk of such catastrophic outcomes must be considered in addition to the costs and benefits that can be reasonably quantified. Since human beings are typically averse to risk, such catastrophic risks are especially important in evaluating whether the benefits of a particular climate control policy justify the costs. One must have at least some sympathy with those who criticize economists on the grounds that the effects of climate change are extremely difficult to quantify in a single monetary number.

III. Addressing Global Climate Change in an Efficient Manner

The costs of unabated climate change may thus be difficult to quantify, but they are nonetheless real and provide the motivation for reducing greenhouse gas emissions. In taking action to reduce those emissions, economic analysis suggests that two elements are absolutely essential:

- The effort must be global, to address the global externality inherent in the nature of the problem.
- The effort must be flexible and market-based, to ensure that we achieve our objectives in the most efficient manner possible.

Need for Global Action

Climate change is a global problem requiring a global solution. As I mentioned earlier, no single country has an incentive to reduce emissions sufficiently to protect the global environment against climate change. Each has an economic incentive to “free ride” on the efforts of others. Even if the United States sharply reduced its emissions unilaterally without an international agreement limiting emissions abroad, greenhouse gas emissions from all other countries would continue to grow, and the risks posed by climate change would not be significantly reduced. It is important to emphasize that emissions of different gases anywhere in the world have very similar effects on global climate.

The threat of disruptive climate change has led to coordinated international efforts to reduce the risks of global warming by reducing emissions of greenhouse gases. A landmark international agreement to address global warming was the Framework Convention on Climate Change signed during the Earth Summit in Rio de Janeiro in 1992. This convention established an objective of limiting greenhouse gas concentrations and called upon industrial countries to return their emissions to 1990 levels by 2000. Since then, it has become clear that the United States and many other participating countries will not meet this voluntary goal; quite the contrary, emission levels have continued to rise not fall among both developed and developing countries.

To address the lack of progress among many industrialized countries toward meeting the Rio objective, the United States and approximately 160 other nations agreed in negotiations held in Kyoto, Japan, last December, to reduce emissions of greenhouse gases. The Kyoto Protocol, which requires the advice and consent of the Senate, would place binding limits on each industrial country's combined emissions of the six principal categories of greenhouse gases: carbon dioxide (CO₂), nitrous oxide (N₂O), methane, sulfur hexafluoride, perfluorocarbons, and hydrofluorocarbons. These limits apply to the 38 so-called Annex I countries, which are the industrialized countries, defined to include Russia, Ukraine, and most Eastern European countries.

Under the Kyoto Protocol, each industrial country's baseline is its 1990 emissions of CO₂, methane, and N₂O and its choice of 1990 or 1995 levels of the other three categories of gases. The United States agreed to a target of 7 percent below this baseline by the period between 2008 and 2012. Given the changes in the definition of the baseline for the three long-lived chemical compounds (HFCs, PFCs and SF₆) from 1990 to 1995 combined with a change in the way sinks are accounted for in the baseline, the actual reduction required in the U.S. is no more than 2-3% more than the President originally proposed as the U.S. negotiating position. The targets for the European Union and Japan are 8 percent and 6 percent below 1990 levels, respectively. Australia, New Zealand, Norway, Russia, and Ukraine all have limits somewhat less ambitious when phrased as cuts relative to their 1990 levels. In sum, over the period from 2008 to 2012, the industrial countries are expected to reduce their average emissions of greenhouse gases to about 5 percent below their 1990 levels.

The President has made clear that he will not submit the Kyoto Protocol to the Senate without meaningful participation from key developing countries (who are not included in Annex I).

There are several reasons why meaningful participation from developing countries is essential. First, developing countries are projected to contribute a majority of world emissions around 2030 under a continuation of business-as-usual. Without the participation of developing economies, efforts by the industrialized countries to limit emissions will therefore not provide adequate protection from climate change.

Second, developing country participation is crucial because it would permit relatively low-cost emissions reductions to be internationally recognized as a substitute for more expensive emissions reductions that might otherwise be achieved domestically by U.S. companies and those in other industrialized countries. Since greenhouse gas emissions have the same basic impact on the climate regardless of where they occur, emission reductions in developing countries have the same environmental benefit as reductions in the U.S. But these reductions are much less costly than reductions in the U.S. or in other developed nations, because of the very inefficient and carbon-intensive uses of energy in these countries today. It thus makes sense, from both an environmental and an economic perspective, to incorporate emissions reductions in developing countries into the international system.

Third, principles of basic fairness suggest all countries should do their part, depending, in part, on their ability to contribute to the solution. Thus even poor countries should participate, although the lack of resources in such countries may limit the extent of their participation.

Some have expressed fears that the Kyoto Protocol might adversely affect the competitive position of American industry. Evaluating how the Kyoto Protocol could affect competitiveness of a few specific manufacturing industries -- especially those that are especially energy-intensive, such as aluminum and chemicals -- is complex. The answer depends, in part, on the impact of the agreement on energy prices, which we will shortly address. In general it is difficult to undergo a structural change in the economy without having the effect of expanding some sectors and contracting others. But to provide some perspective on this issue, consider the following facts. First, on average, energy constitutes only 2.2 percent of total costs to U.S. industry. Second, energy prices already vary significantly across countries. According to the *1997 Statistical Abstract*, for example, in 1996 premium gasoline cost \$1.28 per gallon in the United States -- but only 8 cents per gallon in Venezuela. Similarly, gas prices were \$3.71 per gallon in Switzerland and \$4.41 per gallon in France. Electricity prices also vary significantly: in the U.S., for industry, they were 5 cents per kilowatt hour in 1995, a fraction of prices in Switzerland of 13 cents per kilowatt hour. Yet U.S. industry is not moving en masse to Venezuela, nor is Swiss industry moving to the United States. Third, roughly two-thirds of all emissions are not in manufacturing at all, but in transportation and buildings, sectors which, by their very nature, are severely limited in their ability to relocate to other countries. We therefore believe we need developing country participation because the problem is global and cost-effective solutions are essential, than to avoid adverse effects on competitiveness.

Flexibility and Market Mechanisms

A global solution is thus critical to the global problem of climate change. Globalizing the solution is not, however, enough by itself. We must also ensure that our reductions in global greenhouse gas emissions are attained in the most efficient manner possible. The nature of the climate change problem suggests three basic methods to lower costs of achieving given levels of environmental protection. They can be characterized in terms of three categories of flexibility: (1) "when" flexibility; (2) "what" flexibility; and (3) "where" flexibility, which may be the most important of all. Such methods have long been championed by economists interested in increasing the efficiency of protection. Indeed, over 2,500 economists from academia, industry, and government alike urged such approaches in a letter they signed last year advocating action on climate change:

"Economic studies have found that there are many potential policies to reduce greenhouse gas emissions for which the total benefits outweigh the total costs...The most efficient approach to slowing climate change is through market-based policies."

1. "When flexibility" (timing)

First is "when flexibility" or timing. Since climate change is a long-term problem, the exact timing of emissions reductions is, within some range, not of primary importance. Thus the freedom to delay or accelerate reductions within an agreed upon time frame -- while ensuring credibility of emissions reductions -- lowers costs.

As a result of U.S. leadership, the Kyoto Protocol incorporates this principle of "when flexibility" in four ways:

- First, the initial emissions reductions are less severe, and the period over which they occur ends much later than what had been proposed by many other countries. By adopting a gradual and credible path of reductions in the early years, we can greatly reduce costs such as those from prematurely scrapping coal-fired electricity plants, while attaining the same ultimate environmental goals.
- Second, under the Kyoto Protocol, the emissions target is not specified in terms of a specific year, but rather in terms of an average over a five-year period (2008-2012). Averaging over five years, instead of requiring countries to meet a specific target each year, can lower costs, especially given an uncertain future. The averaging can smooth out the effects of short-term events such as fluctuations in the business cycle and energy demand, or hard winters and hot summers that would increase energy use and emissions.

- Third, there is allowance for “banking” emission reductions within the 2008-2012 commitment period, for use in a subsequent commitment period [although the emission targets of the subsequent periods have not yet been specified].
- Fourth, CDM credits achieved between 2000 and 2008 may be banked until 2008 to 2012.

2. “What flexibility” (gases and sinks)

The second type of flexibility is “what flexibility”, along two dimensions. The first is the inclusion in the agreement of all six greenhouse gases. Emissions of different kinds of gases, not just carbon dioxide, contribute to the greenhouse effect. Since the IPCC has developed conversion factors for all greenhouse gases by estimating their global warming potentials, reductions in emissions of one gas can be used to substitute for increases in emissions of another by an amount that has equivalent environmental effects. Again at U.S. urging, all six gases are included, while Japan and the EU had insisted until the end on covering only three. Thus the U.S. succeeded in having the Kyoto Protocol stipulate that countries with binding targets are to reduce their *total* greenhouse gas emissions by certain percentages, but does not require specific reductions for specific gases. Since a molecule of sulfur hexafluoride is 23,900 times more potent over 100 years than a molecule of CO₂, it may be cheaper to achieve the same environmental benefit by eliminating one molecular unit of SF₆ than nearly 24,000 units of CO₂.

Some initial analysis indicates that a strategy of reducing non-CO₂ greenhouse gas emissions by a greater percent than CO₂ emissions could lower emissions permit prices by as much as 10 percent. Thus allowing countries flexibility in what gases they reduce -- essentially trading emissions reductions across gases -- can help lower significantly the costs of meeting their targets.

The second source of “what flexibility” is the treatment of sinks, i.e., land use activities that promote the removal of carbon from the atmosphere through the growth of plants. At the urging of the U.S. delegation, sinks can be used to offset emissions targets. Promoting such sinks through afforestation and reforestation may reduce atmospheric concentrations of CO₂ at much lower costs than reducing emissions of greenhouse gases.

3. “Where flexibility” (international)

The third type of flexibility, and perhaps the most important, is “where flexibility” (international). As I have already emphasized, emissions have the same environmental consequences regardless of where in the world they occur. Therefore, the least-cost approach to controlling climate change is to reduce emissions wherever such reductions are cheapest. The Kyoto Protocol, because of U.S. insistence and persistence, includes three important cost-saving provisions of this nature.

- First, it provides the opportunity for countries that take on binding targets to trade rights to emit greenhouse gases with each other. This market in emissions permits could ensure that emissions reductions occur where they are least expensive within the industrial countries. In particular, U.S. companies could purchase emissions reductions in other participating countries when doing so would reduce their costs -- thus lowering costs without affecting the level of environmental protection. While currently only industrialized countries have emissions caps, this mechanism also offers an incentive for developing countries to take on emissions targets.
- Second, the agreement provides for Joint Implementation by Annex I countries. Thus if some countries do not develop programs to trade permits internationally, U.S. firms could nonetheless implement projects in those countries for which they could receive emissions reductions credits in the U.S.
- Third, the agreement allows industrial countries to invest in "clean development" projects in the developing world and use these projects' certified emissions reductions toward meeting their targets. Many such clean development projects may be quite cheap in terms of the cost per ton of emissions avoided, as has been illustrated by the Joint Implementation pilot program that is already in place in the U.S.

Details of how these provisions will operate will be discussed in future negotiations such as the one in Buenos Aires later this year. Nonetheless, effective international trading of emission credits, Joint Implementation, and the Clean Development Mechanism can lead to substantial reductions in costs relative to alternative policies that do not exploit the power of market incentives. To illustrate briefly the ability of U.S. industry to perform beyond expectations when given appropriate economic incentives, consider further EPA's highly acclaimed sulfur dioxide (SO₂) program, which relies, among other things, on a system of tradeable permits to reduce emissions of SO₂ from electric utilities. The SO₂ program has been successful in several ways: a large number of utilities participate, SO₂ emissions and ambient concentrations have fallen and the costs of reducing emissions are considerably lower than originally forecast.

As has been frequently noted, the average cost of SO₂ emissions reductions has recently been significantly lower than was originally forecast, in part due to the role of incentives in fostering innovation. Emission permit prices, currently at approximately \$100 per ton of SO₂, are well below earlier estimates of around \$250 to \$400 per ton.

Trading programs may not always bring cost savings as large as those achieved by the SO₂ program; trading programs will not always be accompanied by the discovery of much cheaper control strategies. However, the SO₂ experience demonstrates clearly how programs like international permit trading, Joint Implementation, and the Clean Development Mechanism will lead firms to find cheaper ways of reducing emissions that can lead to unexpectedly low costs.

IV. Difficulties of Economic Analysis of the Kyoto Protocol

Now that we have a Protocol -- even if it is not yet fully complete nor ready for the President's submission to the Senate -- it is possible to examine it in somewhat more detail from an economic perspective. But, once again the inherent limitations of any such estimates deserve emphasis. Such limitations should not be surprising to you: economists have a difficult enough time projecting the behavior of the economy over the next quarter or year, let alone over the next two decades. The scale of the forecasting exercise is therefore daunting, and any specific results should be treated with substantial caution.

The difficulties associated with economic analysis of climate change fall into three broad categories. First are the uncertainties that still remain over the terms of the ultimate treaty, necessitating assumptions on which the analysis is predicated. Second are the inherent limitations of available models to analyze even short-term costs and benefits. And finally is a topic discussed earlier: the impossibility of putting a single monetary number on the long-term benefits of climate change mitigation, although there will clearly be economic benefits of emission reductions.

Uncertainties in the International Effort to Combat Climate Change

The Kyoto Protocol was an historic accomplishment, delineating the broad terms of the international effort to address climate change. But although we know a lot more than we did before Kyoto about how that international system can work, and that informs our analysis, there is still much that we do not know.

First, some provisions raise complex implementation issues. At issue here is the treatment of so-called sinks -- activities that affect the rate at which carbon is removed from the atmosphere and "sequestered," e.g., by the planting of trees.

Second, the details of a number of items -- primarily concerning international trading, the Clean Development Mechanism, and developing countries -- are the subject of further discussions including future negotiations in Buenos Aires next fall, because they had not been definitively settled by the end of the Kyoto talks.

Finally, and most importantly, we have not yet negotiated international agreements to limit emissions beyond the 2012 window. The emission cuts agreed upon at Kyoto are only a first step on a long journey. The first step that we propose to take over the next 15 years is critical. But the reason it is critical is *not* that, by itself, it will solve the climate change problem -- emissions during any given decade are small compared to the cumulative concentrations in the atmosphere. Rather, the first step is critical because we can not take the second and third steps until we have taken the first. At the same time, any analysis is complicated by the lack of knowledge over what the subsequent steps will be.

Inherent Limitations of Models

In addition to these uncertainties about the details of the international effort to address climate change, are the inherent limitations of the models used to evaluate that effort. Even within a given model, answers depend critically on the precise nature of the question asked. For example, the costs of emissions reductions depend critically on the extent of global participation and international trading that a treaty is assumed to feature. But in addition to the dependence of the results from a given model on the precise assumptions, different models can give different answers even when all the assumptions are specified to be the same -- a concrete illustration of the range of uncertainty to which we must assign the predictions of any one individual model.

One area in which the uncertainty is particularly large is the pace of technological progress --especially the diffusion of existing energy-efficient technologies, but also the development of new technologies -- and the extent to which the pace will accelerate in response to government programs. Models and experts on climate change policy tend to have a wider range of disagreement on the scope for speeding the diffusion of existing energy-efficient technologies than on any other single issue.

Furthermore, each model has strengths and weaknesses; each has questions to which it is better or worse suited to answer. Some, for example, model the energy sector in detail. Some allow for the fact that a coal-fired power plant cannot costlessly be converted to one that runs on natural gas. Some show the effects of hypothetical tax cuts made possible by the new revenues earned through the auction of emissions permits. Some are capable of showing recessions and booms. Others include a long-term "carbon cycle" model that can keep track of the accumulation of greenhouse gas concentrations in the atmosphere and their climatological effects. Some break down the rest of the world into regions and so can model international trade. No one model does everything, and therefore we must not rely blindly on the results of any one model or set of models. Professional judgement and economic intuition, along with diplomatic assessments, are also crucial.

Benefits of Averting Climate Change

As discussed above, it is evident that the benefits of averting climate change are potentially immense. But we have chosen not to try to quantify them in monetary terms, in light of the difficulties we have enumerated. These include the uncertainty of these benefits, their timing and therefore the extreme sensitivity of the results to the chosen discount rate, and the dependence of benefits on emissions paths after the 2008 to 2012 budget period specified in Kyoto.

V. Assessing the Kyoto Protocol

In order to evaluate the likely net economic impact of the Kyoto Protocol, *excluding the benefits of mitigating climate change itself*, we have drawn upon a variety of tools to assess the various possible costs and non-climate benefits of the Administration's emissions reduction policy. To give away the punch line, our conclusion is as follows: the net costs of our policies to reduce emissions are likely to be small, assuming those reductions are undertaken in an efficient manner and we are successful in securing meaningful developing country participation as well as effective international trading, and the Clean Development Mechanism in future negotiations. That potential small net premium, even excluding the benefits of mitigating climate change, in effect, purchases a partial insurance policy against a serious environmental threat.

Because the results from any model must be treated with caution, the Administration has employed a broad set of economic tools to assess the Kyoto Protocol. We have drawn on the insights of a wide range of models of the energy sector and economy over the next 25 years, including but not limited to the results of the Stanford Energy Modeling Forum exercises, the IPCC's review of the economic and social dimensions of climate change, the work of the OECD on Economic Dimensions and Policy Responses to Global Warming, and the staff-level Interagency Analytical Team analysis produced last year. Other tools include simple relevant statistics, "meta-analyses" such as work by the World Resources Institute, models, and basic economic reasoning. Drawing on this broad array of analytical tools is crucial to an intelligent evaluation of the policy alternatives.

To our knowledge, no model -- whether used inside the government or not -- has yet been set up to analyze the implications of the Kyoto Protocol, since this agreement is only a few months old and remains unfinished. In particular, no model is currently designed to assess Kyoto's treatment of sinks, or all six greenhouse gases. Some model-builders outside the government tend to take as long as several years to incorporate changes in policy parameters into their models.

Our thinking has been informed, however, by simulations conducted with the Second Generation Model of Battelle Laboratories, one of the leading models in the field. The SGM is one of the models best positioned to analyze the role of international trade in emission permits, which we consider to be a critical element of the Kyoto Treaty. However, the SGM does not cover all six gases included in the Kyoto Protocol or include a role for sinks. We have used the SGM model as one input into our overall assessment of the Kyoto treaty, but have attempted to supplement its results with additional analysis to account for such special features of the agreement as the inclusion of six gases, a possible trading arrangement that could include a subset of the Annex I countries and the Clean Development Mechanism. We will share with you today some preliminary results of this analysis. To the extent possible, we have compared results obtained with the SGM model with those of other modelling efforts.

Mindful of the limitations of any single model, we are eager to see features of the Kyoto Protocol assessed by other models to obtain a better feel for the range of possible effects. This work is just beginning and much of it will continue to go on outside the government. For example, the Energy Modeling Forum, based at Stanford University, is a long-running model comparison exercise involving many of the leading climate models. EMF is currently studying how features of the Kyoto legal language can be translated into terms recognizable to economic modelers. We expect that the group will conduct a full scale analysis of the Kyoto Protocol. The Energy Modeling Forum believes that its members will need at least until mid-year to update their results.

VI. Assessing the Potential Costs of Emissions Reductions

I said in Congressional testimony last July that we can do this smart or we can do this dumb. I was referring to the point that the costs of cutting emissions can be much reduced if flexible, market-based mechanisms are used. Our economic analysis highlighted the importance of such flexible, market-based mechanisms -- which are therefore reflected, at the President's insistence, in the Kyoto Protocol and our ongoing diplomatic strategy.

Within the Kyoto Protocol, this means an insistence on international trading, Joint Implementation, the Clean Development Mechanism, and, ultimately, on meaningful developing country participation. Domestically, this means that we implement any emissions reductions through a market-based system of *tradeable* emissions permits, which ensures that we achieve reductions wherever they are least expensive. But this also means taking serious and responsible steps in the short run to prepare us to meet our obligations in the longer term.

The first such step is the inclusion in this year's budget of an aggressive, \$6.3 billion program of tax cuts and R&D investments -- \$1.3 billion more than the \$5 billion package the President promised in his October 22 speech on this issue. The goal is both to stimulate the development of new energy-saving and carbon-saving technologies and to encourage the dissemination of those that exist already. The proposed package contains \$3.6 billion over the next 5 years in tax cuts for energy efficient purchases and renewable energy, including tax credits of \$3,000 to \$4,000 for consumers who purchase highly fuel efficient vehicles, a 15 percent credit (up to \$2,000) for purchases of rooftop solar equipment, a 20 percent credit (subject to a cap) for purchasing energy-efficient building equipment, a credit up to \$2,000 for purchasing energy-efficient new homes, an extension of the wind and biomass tax credit, and a 10 percent investment credit for the purchase of combined heat and power systems. The package also contains \$2.7 billion over the next 5 years in additional research and development investments -- covering the four major carbon-emitting sectors of the economy (buildings, industry, transportation, and electricity), plus carbon removal and sequestration, Federal facilities, and cross-cutting analyses and research. One example of the R&D effort is the Partnership for a New Generation of Vehicles (PNGV). PNGV is a government-industry effort to develop attractive, affordable cars that meet all applicable safety and environmental standards and get up to three times the fuel efficiency of today's cars. In FY99, the combined proposal for PNGV is \$277 million, up from \$227 million appropriated in FY98. Similar government-industry efforts are proposed to develop more efficient diesel engines for both light trucks and heavy trucks.

A second responsible step entails industry-by-industry consultations to prepare emission reduction plans in key industrial sectors. The Administration will work in partnership with industry to identify ways in which the Federal government might remove regulatory hurdles that discourage energy efficiency. In addition, DOE will spearhead a comprehensive effort to improve the energy efficiency of the Federal government's own operations and purchases.

The third step is the promotion of an environmentally-responsible electricity restructuring bill, which the President identified as part of his domestic climate change package in his address to the National Geographic Society on October 22. An electricity sector freed from government regulation would be a more efficient energy sector. Costs to consumers would fall. In addition, stronger incentives for improved generation efficiency in conjunction with appropriate market based provisions could achieve modest reductions in emissions. A reasonable overall estimate of the contribution of federal electricity restructuring to the rest of the President's program to address climate change is that it would make further progress to the same emission reduction goals at a cost saving of roughly \$20 billion per year. These steps should be taken regardless of Kyoto, because they make sense in terms of energy efficiency. But they have the added benefit of preparing us for Kyoto.

Estimated Reduction in Costs from Annex I Trading

In the language of the treaty, "Annex I," is the set of countries that have agreed to take on binding limitations in emissions of greenhouse gases. Even without meaningful developing country participation -- which, again, the President has emphasized is essential before the treaty would be submitted for ratification -- costs could be reduced substantially by emission trading among the Annex I countries. To provide some indication of the possible efficiency improvements, Russia and Ukraine consume six times as much energy per dollar of output as does the United States. Such large international differences in energy efficiency suggest that adoption of existing U.S. technology would yield very large emissions reductions in these countries.

Estimates derived from the SGM model confirm that emissions trading among Annex I countries can reduce the cost to the United States of achieving its targets for 2008-2012 emissions by about half relative to a situation in which such trading was not available. This concept of costs is meant to capture aggregate resource costs to the US economy, including the cost to domestic firms of purchasing emission permits from other countries where emission reductions may be cheaper than in the United States. Although these estimates reflect idealized international trading in efficient markets, the overall conclusion is clear. The dramatic reduction in costs potentially available from Annex I trading within the SGM model -- cutting the costs involved by half -- highlights why the President insisted that international trading be part of the Kyoto Protocol; and why its achievement by our negotiators in Kyoto was such an important accomplishment.

Estimated reduction in costs from umbrella trading

One possibility that emerged in Kyoto, which none of us foresaw, was the idea developed there by the U.S. delegation, that the United States might undertake trading with a subset of Annex I countries, dubbed the “umbrella”. Countries that have expressed interest in the umbrella include the United States, Australia, Canada, New Zealand and Russia, with strong indications of interest from some others. This subset of Annex I countries shares a common interest in promoting market-based mechanisms, most specifically, fully flexible rules for international trading of emissions permits.

It is too early to state the precise form the umbrella will take. But we can envision a number of potential benefits. The umbrella could, for example greatly reduce costs to the U.S. Results that we have derived from various SGM simulations of efficient international trading suggest that, relative to the situation in which there is no trading at all, the umbrella can reduce costs by an estimated 60-75 percent, depending on whether the former Warsaw Pact countries fall within the umbrella. The Kyoto Protocol classifies these countries outside of the EU bubble for the first budget period 2008-2012.

Estimated reduction in costs from developing country participation

The next consideration is participation by developing countries. The President has said that he will not submit the treaty for ratification without meaningful participation by key developing countries. Such participation would further reduce the costs involved.

The substantial potential gains from meaningful developing country participation are highlighted by the significant benefits that will likely accrue from the limited role that the developing countries have already agreed to: the Clean Development Mechanism (CDM), modeled after the U.S. joint implementation concept. The CDM cannot realistically be expected to yield all the gains of binding targets for developing countries, but it might shave costs by roughly another 20 to 25 percent from the reduced costs that result from trading among Annex I countries.

Another possibility is that we persuade some of the key developing countries that are the largest emitters to commit to targets, and allow us to buy emission reductions from those paths. Simulations with the SGM model suggest that full participation by non Annex I countries could cut roughly 55 percent off the reduced costs that result from Annex I trading. The actual cost reduction would depend on the extent of developing country participation that is ultimately obtained, as well as the effectiveness of international trading arrangements. The more developing countries that take on modest binding targets and trade in international permit markets, the lower will be costs.

These cost-saving opportunities are fundamental tenets of the U.S. position. The promise of Kyoto cannot be achieved without effective emissions trading. Moreover, if we do not get meaningful participation by key developing countries, we won't submit the treaty for ratification to the Senate. So, while our analysis may be predicated on some ambitious conditions concerning trading and developing country participation, it is exactly those conditions that form the foundation of the U.S. position in international negotiations including those at Buenos Aires.

Accounting for Carbon Sinks

The preceding discussion has emphasized the importance of trading arrangements and the CDM. In reaching an overall economic assessment, it is also important to factor in the potential role of carbon sinks. Again, the U.S. delegation obtained a novel concept, that carbon absorbing activities called sinks could be used to offset emissions. The arrangements concerning carbon sinks in the Kyoto Protocol have received less attention than they merit. The Kyoto Protocol specifies that removals of CO₂ by sinks count toward meeting the target. The Kyoto Protocol counts the net emissions effects of three sink activities --afforestation, reforestation, and deforestation. Very preliminary estimates of the implications for the United States of the Kyoto provision on sinks indicate that carbon sinks could comprise a significant portion of the total required emissions reductions. Moreover, decreasing the required emissions reduction by, for example, 10% would likely result in cost-savings greater than 10%.

Even this estimate of the effect of sinks is conservative in one respect: it is based on an assumption for sink activity in the U.S. over the 2008-2012 period, and no assumed benefits from sinks elsewhere in the world. Very preliminary estimates suggest that incorporating the gains from sinks *throughout the world* can substantially reduce the costs of meeting the Kyoto target, on top of the gains from trading among Annex I countries. (Furthermore, no model has yet even tried to take into account that government policies can help increase the activities qualifying as allowable sinks, like some tree-planting.) Because the quantitative uncertainty is so large, we do not yet have an estimate with which we are comfortable. But we expect that complete modelling of the Kyoto provision pertaining to sinks will likely have favorable and potentially large effects on projected costs.

Accounting for the role of improvements in energy efficiency

Another issue in analyzing the Kyoto protocol concerns future improvements in energy efficiency due to innovation and diffusion of existing technology. The parameter that figures most prominently in analysis of energy efficiency is the rate of improvement in the so-called Autonomous Energy Efficiency Index (AEEI), that is the rate at which the total use of energy falls relative to GDP. A plausible assumption on the AEEI is an improvement of 1.0 percent per year. Reflecting a conservative interpretation of the 15-year impact of various climate change initiatives, this is only a small increase above the 0.9 percent number in the Energy Information Administration's Annual Energy Outlook. That assumption is not the most

optimistic outcome that might occur. Some authorities in the field of energy policy forecast more rapid technological progress. Experts at five national laboratories managed by the Department of Energy, using an engineering approach rather than an economic paradigm, found that a third of the emissions reductions necessary to return to 1990 levels by 2010 could be achieved through the adoption of existing energy-efficient technologies at no net resource cost, or even some savings. The National Academy of Sciences reached qualitatively similar conclusions in a 1992 report.

The President's FY 1999 budget, as I have noted, includes a \$6.3 billion package of tax cuts and R&D investments intended to spur the discovery and adoption of new technologies. If the Administration is successful in this effort, the rate of improvement in energy efficiency could rise and such improvements would lower the cost of meeting our Kyoto target. For example, published results based on SGM model simulations with different assumed rates of AEEI suggest that an increase in the AEEI of 25 percent could lead to declines in the permit price of approximately 40 percent.

Our justification for incorporating into our assessment a small assumed impact of Administration technology policies is somewhat analogous to the Administration's rationale for employing mainstream economic assumptions in our budget forecasts: in the presence of uncertainty, we are conservative in our estimates of the speed with which the economy will grow, tax receipts will rise, and the budget will improve. That way, any revisions or surprises that occur are likely to be in the pleasant direction. In this instance, we prudently and conservatively assume that there will be substantial delays between investments in new technology or the diffusion of existing technology, and the returns to such investments.

Moreover, at the recent automobile show in Detroit, General Motors announced that it has developed a hybrid-based vehicle that can achieve fuel efficiency of 80 miles per gallon, and that this car could be in commercial production within a few years. Ford also exhibited a prototype of a light-weight highly fuel efficient sedan that could be in commercial production by the middle of the next decade. These announcements followed an earlier breakthrough announced by DOE and its partners of a fuel cell that could run on gasoline and double current fuel economy while reducing conventional air pollution emissions by 90 percent. These technological advances have been made possible through the efforts of the Partnership for a New Generation of Vehicles between the Administration and the U.S. auto companies and their suppliers.

Such progress may be replicated in other sectors. VCRs and TVs, while switched off, consume about \$1 billion worth of electricity annually. EPA has established a partnership with major manufacturers that has a goal of achieving up to a 70 percent reduction in energy use by VCRs and TVs while they are switched off, without sacrificing product quality, usefulness, or increasing costs. This partnership offers promise of substantial improvements in energy efficiency.

Non-Climate Benefits

A final factor that should be included in any comprehensive assessment of the economic implications of the Kyoto protocol are the benefits of the agreement. The literature has emphasized that any relative price shifts that prove necessary to reduce emissions should produce non-climate benefits in three areas: traffic congestion, highway accidents, and air pollution unrelated to climate change. These benefits are hard to quantify precisely but are potentially significant: our rough estimates suggest that these three benefits could offset approximately a quarter of the resource cost of the climate change policy.

Synthesis

A comprehensive evaluation of the economic impact of the Kyoto Protocol must integrate all of the factors described above: reliance on flexible market-based mechanisms domestically; international trading and Joint Implementation among Annex I countries; the Clean Development Mechanism; meaningful developing country participation; the potential cost-mitigating role of including six gases and carbon sinks; the benefits of electricity restructuring; and emissions reductions achieved as a consequence of other proposed Administration climate change initiatives. Assuming that effective mechanisms for international trading, Joint Implementation and the Clean Development Mechanism are established, and assuming also that the U.S. achieves meaningful developing country participation, our overall assessment is that the economic cost to the United States in aggregate and to typical households of attaining the targets and timetables specified in the Kyoto Protocol, will be modest.

This conclusion that the impact will be modest is not entirely dependent upon, but is fully consistent with, formal model results. I have previously emphasized the limitations of relying on any single model in assessing the economic impact of the Kyoto Protocol, and continue to view any such results as just one input into an overall analysis. But it is worth emphasizing that model results reflecting the details of the Kyoto Protocol are consistent with our conclusion. For example, under the assumptions of either trading under the umbrella or within Annex I, the CDM and permit trading with developing countries, estimates derived using the SGM model, which adjust for the inclusion of six gases and assume little banking of credits beyond 2012, suggest that the resource costs of attaining the Kyoto targets for emission reductions might amount to \$7 to \$12 billion per year in 2008 to 2012. This implies that overall costs, excluding not only climate and non-climate benefits, but also such cost mitigating factors as sinks and payoffs from the President's electricity restructuring and climate change initiatives, would reach roughly one tenth of one percent of projected GDP in 2010.

A more tangible measure of costs is the estimated effects on energy prices. Excluding the impact of electricity restructuring and the ancillary benefits of mitigation and better forest management, the SGM-based estimate, corresponding to the gross resource cost estimate cited above, is an emissions price in the range of \$14 to \$23 per ton of carbon equivalent. This translates into an increase in energy prices between 2008 and 2012 at the household level of

between 3 and 5 percent, an increase in fuel oil prices of about 5 to 9 percent, natural gas prices of 3 to 5 percent, gasoline prices of 3 to 4 percent (or around 4 to 6 cents per gallon), and electricity prices of 3 to 4 percent. This increase in energy prices at the household level would raise the average household's energy bill in ten years by between \$70 and \$110 per year, although such predictions may not be observable because they would be small relative to typical energy price changes, and nearly fully offset by electricity price declines from Federal electricity restructuring. In particular, this increase in energy prices is small relative to the average of *year to year* real energy price changes experienced by U.S. consumers since 1960: such *annual* changes have averaged 3.8 percent. In addition, by 2008-2012, the anticipated 10 percent decline in electricity prices from the restructuring that is part of our climate change agenda is projected to lead to expenditure reductions of about \$90 per year for the average household.

As highlighted earlier, there are substantial but unavoidable uncertainties surrounding estimates like these. For example, the estimate just discussed is predicated, among other things, on the developing country participation that we are insisting upon as a condition for our ratifying the Kyoto Protocol, but which is not yet part of that Protocol, and on effective international trading. Moreover, other models will yield other answers and much work remains to be done by the modeling community to test the robustness of these results. Preliminary comparisons of the SGM model to the few other models that have attempted to evaluate the Kyoto accord, suggest that its predictions concerning the impact of the Kyoto Protocol on carbon permit prices are neither the most conservative nor the most optimistic of the models that have been developed. The predictions of the SGM model are robust in the sense that virtually all energy models reveal the potency of effective, flexible, domestic and international trading mechanisms to reduce substantially the cost and energy price impact of meeting the Kyoto targets.

Of course, the most important factor that has been left out of the above assessment is the benefit of mitigating climate change itself. A full cost-benefit analysis would include mitigation in the benefits column. The only reason we have not done so, explained repeatedly above, is the difficulty in coming up with a number to capture the monetary benefits. But nobody should lose sight of our ultimate objective -- keeping our planet the hospitable home that we enjoy today.

Effects on employment and aggregate output

So far we have said nothing about job losses resulting from climate change policy. Although there may be job gains in some sectors and job losses in others, we do not anticipate any significant aggregate employment effect if we achieve the conditions we have discussed. The effects on energy prices described above will occur only 10 to 14 years in the future. Not only are these effects small relative to historical variations in energy prices, and offset by other policies like electricity restructuring, they would occur sufficiently far in the future to enable monetary policy to keep the economy operating at its potential. In energy-intensive sectors some employment reduction could occur, although given the very small predicted change in energy prices, impacts in most such sectors are apt to be minimal. Furthermore, a large number of jobs will be created in other sectors -- many of them high-tech jobs paying high wages. The President is firmly committed to assisting any workers who are adversely affected during the transition to a climate-friendly economy.

VII. Conclusion

In conclusion, the Kyoto Protocol and the President's general approach to climate change reflect the insight of economic analysis. The Kyoto Protocol includes key provisions on international trading and Clean Development projects. The President's approach relies on market incentives -- first, with a system of tax cuts and R&D investments, and then later with a market-based system of tradeable permits -- to ensure that our objectives are achieved as efficiently as possible.

Our overall conclusion is that the economic impact of the Protocol will be modest under the conditions we have identified. The purpose of this testimony has been to explain the reasoning underlying this conclusion, which draws insights from not only the forecasts of individual models, any one of which has its own strengths and limitations, but also a broad variety of additional analyses.

I look forward to continuing to work with members of this Committee, as well as other interested parties, in further analyzing the Kyoto Protocol and evaluating the net effects of reducing greenhouse gas emissions. It is my hope that economic analysis will continue to play a key role in designing policies in this area.

I welcome your questions.

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EXECUTIVE SUMMARY

The primary purpose of this analysis is to examine costs and benefits of taking action to mitigate the threat of global warming. In particular, we examine costs and benefits of complying with the emissions reduction target for the United States set forth in the Kyoto Protocol on Climate Change, negotiated in December 1997. For reasons discussed at length in this paper, it is our conclusion that, with the flexibility mechanisms included in the treaty, and by pursuing sound domestic policies, the United States can reach its Kyoto target at a relatively modest cost. Moreover, the benefits of mitigating climate change are likely to be substantial.

Before considering the economics of taking action, however, we ought to step back and ask the threshold question -- whether taking action to mitigate global climate change is necessary in the first place.

The Rationale for Taking Action

The great weight of scientific authority suggests that climate change is a serious problem and that prudent steps to mitigate it are in order. In essence, we need to take out an insurance policy with reasonably priced premiums. As long ago as 1992, the National Academy of Sciences, in a study entitled *Policy Implications of Greenhouse Warming*, concluded that "...even given the considerable uncertainties in our knowledge of the relevant phenomena, greenhouse warming poses a potential threat sufficient to merit prompt responses....Investment in mitigation measures acts as insurance protection against the great uncertainties and the possibility of dramatic surprises" (p. 68).

What the science tells us is that greenhouse gases are rapidly building up in the atmosphere as a result of the burning of fossil fuels and deforestation; that the concentration of these gases is 30 percent higher than it was at the beginning of the industrial revolution; and that this concentration is expected to reach almost twice current levels by 2100 -- a level not seen in 50 million years. Theory and computer models suggest that this increased concentration of greenhouse gases could warm the Earth by about 1.8 to 6.3° F by 2100. By way of comparison, the last ice age was only about 9° F colder than today. Moreover, much evidence suggests that warming is already underway. For example, we know from ice cores and other data that we are living in the hottest century since at least 1400, that the nine hottest years since records were first kept in the late 19th century have all occurred since 1987, and that 1997 is the hottest year on record.

Scientists predict a range of likely effects from global warming. For example, the rate of evaporation is expected to increase as the climate warms, leading to increasingly frequent and intense floods and droughts. Sea level is projected to rise 6-37 inches by 2100. A 20-inch rise could inundate about 7,000 square miles of U.S. territory. Warmer temperatures would be expected to increase the risk of mortality from heat stress, aggravate respiratory disease, and increase the range and rates of transmission of some infectious diseases.

Scientific opinion is not unanimous on these points, but most independent climate scientists believe that global climate change poses real risks. A few scientists contest the notion that increasing concentrations of greenhouse gases will warm the planet, while a few others concede that the earth is indeed getting warmer, but argue that this is a good thing -- "a wonderful...gift from the industrial revolution," in the words of one. But these are distinctly minority views. The prevailing view is that the risks of climate change warrant prudent and prompt action. Prompt because to wait for greater scientific certainty could have very large costs. Greenhouse gases are long-lived and the decisions being made by governments and firms in the next decade with respect, for example, to the kinds of power plants to build or the kinds of energy sources to develop, are likely to have significant consequences for our ability to limit the buildup of greenhouse gases.

Consequently, there is a substantial rationale for acting now. Our task is to act in a manner that responds appropriately to the scope of the risk while at the same time being economically sensible.

Domestic Policy

In October 1997, the President announced a domestic program designed to reduce greenhouse gas emissions. In essence, the program contemplated (a) a set of activities that made sense as good energy and environmental policy irrespective of whether an agreement were reached in Kyoto, and (b) a mandatory domestic emissions trading system that would take effect in the 2008-2012 period if an agreement in Kyoto were reached and approved by the U.S. Senate.

The Kyoto Protocol

The Kyoto Protocol, which requires the advice and consent of the Senate, commits industrialized nations to take on binding targets for greenhouse gas emissions, and includes three basic kinds of flexibility provisions that were proposed by the United States. These provisions -- commonly referred to as "when", "what", and "where" flexibility -- have great potential to significantly lower the costs of meeting the Kyoto

targets. "When" flexibility appears in the form of a multi-year commitment period (2008-2012), and allowance for "banking" of emissions reductions. The freedom for countries or companies to delay or accelerate reductions within an agreed upon time frame can help lower costs. "What" flexibility is provided by both the inclusion of all six greenhouse gases -- enabling reductions in emissions of one gas to be used to substitute for increases in emissions of another -- and the coverage of certain "sink" activities, such as afforestation or reforestation, that absorb carbon. Most important, the Protocol incorporates "where" flexibility in the form of international emissions trading and joint implementation among countries that take on binding targets, coupled with a "clean development mechanism" allowing industrial countries or firms to earn credits for projects in the developing world that reduce emissions. These mechanisms can provide opportunities for industrial countries and firms to secure low-cost reductions and for developing countries to achieve sustainable growth.

Developing countries did not take on binding emissions targets at Kyoto, although they did agree to provisions for the Clean Development Mechanism. The President has said that he will not submit the Protocol to the Senate without meaningful participation from key developing countries. While the Clean Development Mechanism provides a down payment on such participation, the Administration is actively seeking greater developing country engagement.

Costs and Benefits of Mitigation

Analyzing the costs and benefits of mitigating climate change is a difficult undertaking for three reasons. First, uncertainties remain about significant details of certain provisions in the Protocol. Second, available models have inherent limitations in their abilities to analyze even short-term costs and benefits. Third, it is extremely difficult to quantify the long-term economic benefits of climate change mitigation. Thus, while we have summarized the literature, we have not calculated a monetary value of these benefits.

Recognizing these difficulties, our conclusion is that the costs for the United States to meet its Kyoto emissions target are likely to be modest if those reductions are undertaken in an efficient manner employing the flexibility measures of emissions trading (both domestic and international), joint implementation, and the Clean Development Mechanism. This would be so even without considering the direct benefits of mitigating climate change or the impact that key additional factors -- such as the President's domestic climate change proposals, the ancillary benefits of improved air quality, or the inclusion of sinks -- could have on lowering the net costs of mitigation.

Our conclusion concerning the costs of complying with the Kyoto Protocol is not entirely dependent upon, but is fully consistent with, formal model results. For example, given the flexibility measures noted above, with key developing countries participating in trading, and *excluding* both the benefits of mitigating climate change and the key additional factors just noted, estimates derived using Battelle's Second Generation Model (SGM) suggest that the resource costs of attaining the Kyoto targets for emission reductions might amount to \$7-12 billion per year in 2008 to 2012, or just 0.1 percent of projected GDP. The same model predicts that emission permits in 2010 would cost between \$14 and \$23 per ton of carbon equivalent -- which would translate into an increase of about 4 to 6¢ per gallon of gasoline. The increase in energy prices would raise the average household's energy bill in 2010 by between \$70 and \$110 per year -- a relatively small amount compared to typical energy price changes. Moreover, this increase would be substantially offset by the decline in electricity prices resulting from the Administration's electricity restructuring proposal.

These numbers are instructive. They demonstrate the importance of flexibility measures like emissions trading and the potential for meeting our Kyoto target at a relatively modest cost. However, it is just as important to understand what these numbers do *not* say. They do not tell us about either (a) the economic *benefits* of mitigating climate change or (b) the potential for any other domestic policy measures (aside from emissions trading) to reduce costs further and/or to increase the percentage of greenhouse gas reductions we can accomplish at home. The reason is that the SGM model we used to generate these numbers does *not*, by its terms, account for either of these factors.

Benefits of mitigating climate change. There are substantial long-term benefits of mitigating global climate change. Monetary estimates of damages from the environmental, health, and economic impacts of global warming during the next century range in the tens of billions of dollars per year. One noted economist, William Cline, has estimated that a doubling of pre-industrial concentrations of greenhouse gases would cost the U.S. economy about 1.1% of GDP annually -- some \$89 billion a year in today's terms. Moreover, these estimates do not reflect the potential costs of so-called "non-linearities" -- the risk that global warming will lead not to gradual and predictable problems, but to relatively abrupt, unforeseen, and potentially catastrophic consequences. Although we do not think the benefits of mitigating climate change are, at this stage, quantifiable with adequate precision, they are nonetheless likely to be real and large in the long run.

There are also ancillary benefits of reducing greenhouse gas emissions -- in particular, the corresponding reductions in conventional air pollutants like sulfur dioxide or nitrogen oxides. These benefits alone could produce savings equal to about a quarter of the costs of meeting our Kyoto target.

The impact of policies not included in illustrative analysis. Following on the President's October 1997 policy announcement, the Administration is pursuing a number of domestic initiatives that will help reduce greenhouse gas emissions. These initiatives -- all of which are consistent with our commitments under the 1992 Framework Convention on Climate Change, which the Senate approved that same year -- could reduce costs and/or increase the amount of reductions accomplished through domestic action. First, the Administration's \$6.3 billion budget proposal to promote energy efficiency and renewable energy should help increase the rate of technology development and diffusion. Many of the components of this initiative reflect recommendations made in an October 1997 report by the President's Committee of Advisors on Science and Technology (PCAST), which concluded that "the inadequacy of current energy R&D is especially acute in relation to the challenge of responding prudently and cost-effectively to the risk of global climatic change...." (PCAST 1997, p. i).

Second, the Administration's electricity restructuring proposal is estimated to reduce greenhouse gas emissions in the United States by about 25 to 40 million metric tons per year. Competition would provide a direct profit incentive for generators to produce more electricity with less fuel and improve energy efficiency. Several specific provisions in the Administration's proposal would yield further emissions reductions.

Third, the Administration is conducting industry consultations aimed at promoting voluntary agreements with major energy-intensive industries, energy providers, and others to yield further emissions reductions. One such agreement, the Partnership for Advancing Technology in Housing (PATH), announced in May, established goals for voluntary improvements in home energy use that would reduce emissions in 2010 by about 24 million metric tons of greenhouse gas emissions.

Fourth, the Administration is pursuing an active program to reduce emissions produced by the federal government, the nation's largest consumer of energy.

As noted above, models like SGM, while well equipped to assess policies such as a tradable permit program, do not assess policies like these. To the extent that policies like these boost the rate at which energy efficiency improves, the United States could lower the cost of mitigation and increase the amount of reductions made domestically.

Finally, our illustrative analysis, based on the SGM model, did not account for the effects of carbon sinks in reducing net greenhouse gas emissions. Opportunities to reduce net emissions through carbon sinks could further reduce the costs of achieving the Kyoto target and increase domestic reductions.

Conclusion

The current state of the science provides a powerful rationale to take prompt, prudent action to mitigate climate change. The agreement negotiated in Kyoto includes flexibility mechanisms that will allow the United States to meet its Kyoto target at a modest cost. Additional factors not included in the modeling effort -- such as the President's domestic climate change policies, the inclusion of sinks and the ancillary benefit of improving air quality -- could lower costs even further and increase the percentage of reductions made through domestic action. The benefits of mitigating long-term impacts of global climate change, while not precise enough to quantify at this stage, are likely to be very important. In short, this is an insurance policy we should buy and it is one we can buy for reasonably priced premiums.

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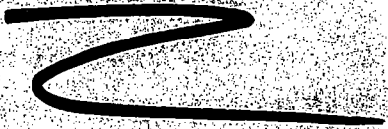
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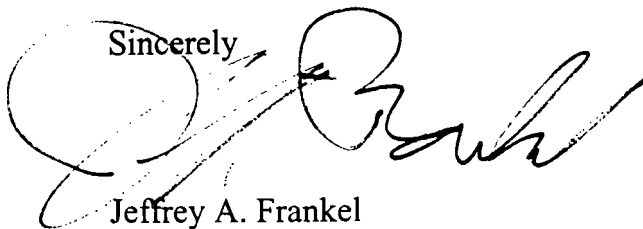
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The report spells out in more detail the logic behind the Congressional testimony that Janet Yellen presented this past spring. (I enclose also a copy of her testimony.) It explains how the costs of our climate change policy will be modest if all the envisioned flexibility provisions are successfully put into place.

We would be happy to elaborate further, or to answer any questions you may have. I may have already contacted you by phone by the time you receive this, or may do so shortly. But please do not hesitate to call me if you wish to discuss the analysis further. My phone number is 202 395-5046. (The number for Joe Aldy, on our staff, is 202 395-1455.)

Sincerely



Jeffrey A. Frankel

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Sincerely

Jeffrey A. Frankel

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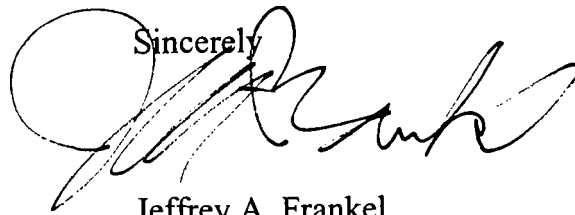

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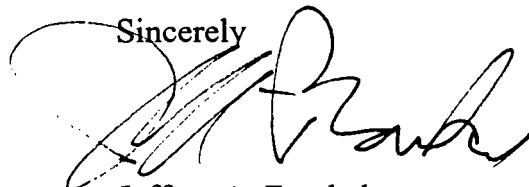
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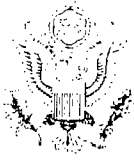
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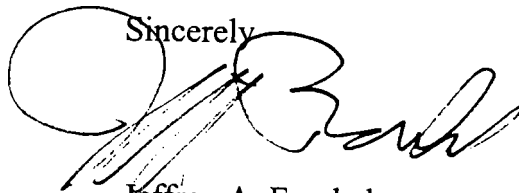

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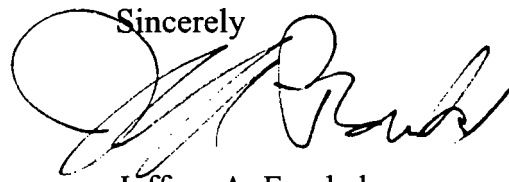
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THE KYOTO PROTOCOL
AND THE
PRESIDENT'S POLICIES TO
ADDRESS
CLIMATE CHANGE:

ADMINISTRATION
ECONOMIC ANALYSIS

July 1998

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS

July 22, 1998

TO: Todd Stern

FROM: Jeff Frankel

Here is the list of validators to whom we are FedExing the document. Janet has already spoken with Alan Blinder, and I have already spoken with Jeff Sachs. We will try to contact the rest by phone over the next day or two.

Attachment

Validators

Alan Blinder
Tom Casten
Bill Cline
Stephen DeCanio
Jae Edmonds
Henry Jacoby
Paul Portney
Robert Repetto
Richard Richels
Jeff Sachs
Richard Sandor
Rob Stavins
Joseph Stiglitz
Mike Toman
John Weyant

Affiliation

Princeton University
Trigen Energy
Institute for International Finance
University of California at Santa Barbara
Batelle/Pacific Northwest Lab
Massachusetts Institute of Technology
Resources for the Future
World Resources Institute
Electric Power Research Institute (EPRI)
Harvard University
Chicago Board of Trade
Harvard University
The World Bank
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EXECUTIVE OFFICE OF THE PRESIDENT
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*note to file
OK'd by
michele*

Date:

7-22-98

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Martha Wofford
WHCC TF

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Telephone number of addressee:

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From:

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FAX number of sender:

(202) 395-6958

Telephone number of sender:

(202) 395-5084

Number of pages, including cover sheet:

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Message:

Per Your Request

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Jae Edmonds
Henry Jacoby
Paul Portney
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Richard Richels
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Date:

7-22-98

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Bill Krawczewicz

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Telephone number of addressee:

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Sandy
Council of Economic Advisers

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Message:

Bill - Is there any
way you can make
the XX'd area
all black to
match the
border strip?

**THE KYOTO PROTOCOL
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CLIMATE CHANGE:**

Sandy

*ADMINISTRATION
ECONOMIC ANALYSIS*

July 1998

EXECUTIVE OFFICE OF THE PRESIDENT
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Council of Economic Advisers

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Message:

Thanks,
Bill

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move text down

Bottom of
1st line of
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Increase
point size
slightly
(2 points larger)

move this text down

July 1998

*The Kyoto Protocol
and the
President's Policies to Address
Climate Change:*

Administration Economic Analysis

July 1998

*The Kyoto Protocol
and the
President's Policies to Address
Climate Change:*

**Administration Economic
Analysis**

July 1998

*The Kyoto Protocol
and the
President's Policies to Address
Climate Change:*

**ADMINISTRATION
ECONOMIC ANALYSIS**



July 1998



Joseph E. Aldy
07/20/98 09:00:07 PM

Record Type: Record

To: Mary Fibich/CEA/EOP, Sandra F. Daigle/CEA/EOP

cc:

Subject: climate change document

The text of the climate change document should be finalized tomorrow morning. A couple of questions:

- 1) How important is it that we put it in 11 point font? I had a request to keep it in 12 point, unless that would look really bad.
- 2) If we use 1 1/2 inch margins, what size should the left margin be to accomodate the binding?
- 3) Have we heard from EOP graphics about what colors they have available for a cover?

I will put the document into a version closer to what we would like to publish, and then Sandy, I may come by and talk with you about how to improve it. Thanks,

Joe



Mary Fibich
07/15/98 10:44:14 AM

Record Type: Record

To: Joseph E. Aldy/CEA/EOP
cc: Sandra F. Daigle/CEA/EOP
Subject: Climate Change Document

I met with Bill McIntosh of OA's Graphics Section yesterday afternoon. He made a number of suggestions which he thought would give it an overall cleaner, more professional look. When I returned, I went over the suggestions with Sandy. She believes that all are technically possible without a great deal of trouble. However, she will need some training on how to manipulate the charts and code the file to import any .wpg files.

Bill's suggestions follow. Please look them over and let me know which way to go on each comment.

1. The Times Roman typeface is fine. If we would like to try something different he would *probably* still stay with a typeface in the serif line like the Times Roman you are currently using, with type ending as it does with flares on some letters like the "p". Others to consider are Pallatino and Century. *Palatino has quotation marks*

2. He'd change the type size to nothing larger than 11 for the text. It's currently 12 point. The type size for the headings is fine. Sandy did not have Palletino and Century typefaces available. She's checking now with the help desk, and if they can provide them, she'll provide samples of 11 and 12 pt type in all three typefaces. If not, we should just stick to Times Roman.

3. It should be printed back to back.

4. The line is a little too long to comfortably read. He suggests making the margins wider by at least 1/2" left and right. (Sandy pointed out that when it is bound, we'll need a wider margin anyway in order to be able to comfortably read the text that would otherwise disappear into the "gutter".) We should experiment and see if 1-1/2" margins will work or if we need to make them wider.

5. We should begin each major section on a new odd page as we do in the ERP. treating each section as a Chapter, e.g., Introduction; Trends in....; The Risks of; Overview of U.S. Strategy, etc. *insert back page, but they'll be #1 & 2, so will have to remove*

6. In printing you rarely do both spacing between paragraphs and indenting. He recommends the double line spacing and no indent for this job. *& sub w blanks*

7. Using the smaller charts with text to the left results in what printers term "rivers" of white space because of the short line and resultant inability to fill line with text, so as it justifies left, and right, there are large spaces between words. Regardless of that problem, he doesn't feel that this particular style gives the document a clean, professional look. Recommends centering chart, regardless of size we decide upon, but he suggested blowing up charts to fit margins.

I like the way

8. White space isn't necessarily bad; it can be good. He recommends adding some white space around the charts (above and below).

9. In order to improve layout and eliminate short pages, reference figures and tables, and let whatever text follows continue to fill up page (if chart or table will not fit on page on which it is referenced). Then place chart on next page. It is acceptable to reference something that does not appear until later. Don't place it before the reference. *I like anyway*

10. Use a simple header: title of document centered on left page; chapter title centered on right page, with line underneath. No header appears on new odd page for beginning of chapter/section .

11. Could leave page numbers centered on bottom of page.

12. Figure 19. He would not use key like that. Photocopy is hard to determine between black and gray. He'd blow up chart, turn sideways, eliminate key, and type description over each bar.

13. Table of Contents -- looks okay. He suggested Bolding the major headings. Sandy's working on a sample.

14. Bullets -- he suggested moving indent back a few spaces to look more professional (the way we do in ERP). Word processing documents use preset tabs and leave about 5 spaces between bullet and text, whereas printed documents close it up a little. Sandy knows how to change the default and get this result.

15. Executive Summary and consecutive numbering (as you do) through table of contents is fine.

16. Blow up appendix charts. Do you want 2 on a page? Using three pages for each country?

If you have any questions, please call. I'll be happy to bring document down, and go over these suggestions.

Heading: Times New Roman, 18 point, bold

Text: Times New Roman, 12 point

Margins: left: 2" Right 1.5"

INTRODUCTION

The earth's surface appears to be warming as a result of the accumulation of greenhouse gases from myriad sources worldwide. None of the emitters of these gases presently pays the cost to others of the adverse effects of warming. No individual firm, nor any single country, has an incentive to reduce emissions sufficiently to protect the global environment against climate change. Each has an economic incentive to "free ride" on the efforts of others. Without an international agreement limiting emissions abroad, even if one country sharply reduces its emissions unilaterally, greenhouse gas emissions from all other countries would continue to grow, and the risks posed by climate change would not be significantly reduced. The complex nature of the climate change problem requires global cooperation and a long-term solution.

In June of 1992, the Framework Convention on Climate Change, the first international agreement to address the risks of climate change, was signed during the Earth Summit in Rio de Janeiro. This treaty, ratified by the United States with the advice and consent of the Senate in October 1992, established the following ultimate objective:

"[To achieve] stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent the dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner" (Framework Convention on Climate Change, Article 2).

The Framework Convention laid the foundation for international cooperation to reduce emissions of greenhouse gases to achieve this objective. The treaty encouraged industrial countries to return their greenhouse gas emissions to their 1990 levels by 2000.

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Since the Framework Convention entered into force, the world's scientists have continued to warn of the potential negative environmental and economic effects of climate change. In 1995, the Intergovernmental Panel on Climate Change (IPCC), jointly established by the World Meteorological Organization and the United Nations Environment Programme, and representing the work of more than

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Text: Palatino 12

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TABLE OF CONTENTS

	Page
Introduction	1
Trends in Greenhouse Gas Emissions	4
Historical Emissions	4
Projected Emissions	6
The Risks of Climate Change	9
Overview of U.S. Strategy in Kyoto Negotiations and Beyond	13
Realistic Targets and Timetables	14
Flexibility and Market Mechanisms	15
Developing Countries	28
Assessing the Costs and Benefits of Reducing Greenhouse Gas Emissions	30
Preliminary Assessment	30
Difficulties of an Economic Analysis of Climate Change	31
Illustrative Calculations: Methodology	34
Summary of Assumptions of Illustrative Analysis	41
Economic Cost of the Administration's Policies to Reduce Greenhouse Gas Emissions in the Illustrative Analysis	42
Additional Cost Mitigating Factors	50
International Impacts Associated with Reducing Greenhouse Gas Emissions	56
References	58
Appendices	
A: Annex I and Non-Annex I Countries	
B: Construction of Non-Carbon Dioxide Emissions Baselines	
C: Potential Electricity Restructuring Cost-Savings	
D: Historical Trends in U.S. Energy Prices	
E: Country Specific Energy and Emissions Data	

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Times New Roman
12 pt

Draft 13, Do Not Cite, 6/23/98

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2"

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1.5"

In June of 1992, the Framework Convention on Climate Change, the first international agreement to address the risks of climate change, was signed during the Earth Summit in Rio de Janeiro. This treaty, ratified by the United States with the advice and consent of the Senate in October 1992, established the following ultimate objective:

"[To achieve] stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent the dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner" (Framework Convention on Climate Change, Article 2).

The Framework Convention laid the foundation for international cooperation to reduce emissions of greenhouse gases to achieve this objective. The treaty encouraged industrial countries to return their greenhouse gas emissions to their 1990 levels by 2000.

Since the Framework Convention entered into force, the world's scientists have continued to warn of the potential negative environmental and economic effects of climate change. In 1995, the Intergovernmental Panel on Climate Change (IPCC), jointly established by the World Meteorological Organization and the United Nations Environment Programme, and

representing the work of more than 2,000 scientists, concluded that "the balance of evidence suggests that there is a discernible human influence on global climate" (Houghton et al. 1996, p. 5). Without measures to abate the expected increase in greenhouse gas emissions over the next century, the IPCC projected that average global temperatures would increase by 1.8 to 6.3° F (1 to 3.5° C), resulting in coastal damage from rising sea levels, greater frequency of severe weather events, shifts in agricultural growing conditions from changing weather patterns, threats to human health from increased range and incidence of diseases, changes in availability of freshwater supplies, and damage to ecosystems and biodiversity.

To address these climate change risks better and to build on the existing treaty, approximately 160 countries met in Kyoto, Japan in December of 1997 and agreed to take substantial steps toward meeting the Convention's ultimate objective. The Kyoto Protocol, which requires the advice and consent of the Senate, would place binding limits on industrial countries' emissions of the six principal types of greenhouse gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulfur hexafluoride (SF₆), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs). The Protocol embraces several flexible, market-based approaches to allow for the emissions targets to be achieved at least cost. While the Protocol includes some participation by developing countries -- for example, through the Clean Development Mechanism¹ -- it does not include adequate participation by key developing countries, and the Administration is working to promote such participation.

Independent of the agreement reached in Japan, the Administration has proposed a suite of measures to reduce emissions domestically.

- Corresponding to the first stage of the three stage domestic strategy that the President announced in October 1997, the Administration has proposed a five-year \$6.3 billion package of tax incentives and R&D investments to improve energy efficiency and spur the development of renewable energy; commenced a set of consultations with our energy-intensive sectors aimed at achieving voluntary agreements on how, with government support where needed, including the provision of credit for early action they can most effectively reduce greenhouse gas emissions; submitted a proposal for electricity restructuring; and

¹ For a discussion of the Clean Development Mechanism, see to p. 25.

commenced an intensive review of how to improve the Federal government's own energy use and procurement. At the close of the first stage, the first economic review would be undertaken.

- The second stage will include a review of our program and an evaluation of next steps as we prepare for a market-based trading system for greenhouse gas emissions. The details of the domestic trading system would be refined and possibly tested. The second economic review would occur near the end of the second stage.
- In the final stage, emissions reductions would occur through the domestic trading program, integrated with international flexibility mechanisms, including international trading of emissions allowances, the Clean Development Mechanism, and joint implementation.

Complementing these domestic efforts, the Administration will continue its efforts to promote meaningful participation by key developing countries and will work for effective implementation rules for international trading, the Clean Development Mechanism, and joint implementation. The risks of climate change are global and thus they require a global effort. The Administration will not submit the Kyoto Protocol to the Senate for advice and consent until key developing countries agree to participate meaningfully.

The international agreement that was reached in Kyoto this past December is a crucial step forward in addressing global climate change. But it is only one step in a journey. Since the international effort to reduce greenhouse gas emissions is still in some respects a work-in-progress, it is not yet possible to provide a full authoritative analysis of it. However, key elements of the Kyoto Protocol and the Administration's policy, such as international emissions trading, meaningful developing country participation, inclusion of carbon sinks and six categories of gases, as well as domestic initiatives, can ensure that reductions in global greenhouse gas emissions are consistent with continued strong economic growth.

This report provides the reasoning underlying the Administration's conclusion that, under these conditions, the economic impacts of complying with the Kyoto Protocol are likely to be modest. First, the report provides a discussion of trends in greenhouse gas emissions, both in the United States and internationally. Second, it presents a brief survey of the scientific literature on the risks of climate change. Third, it provides an overview of the Kyoto Protocol, with emphasis on its flexibility mechanisms, and the