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4/23/98 GOV. REFORM

Divider Title: _____

Oral Statement of Dan Reicher
Assistant Secretary for Energy Efficiency and Renewable Energy
Department of Energy
Before the
Committee on Government Reform and Oversight
Subcommittee on National Economic Growth, Natural Resources, and Regulatory Affairs

April 23, 1998

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GENERAL SERVICES ADMINISTRATION

Mr. Chairman and members of the Subcommittee, I appreciate the opportunity to appear before you to discuss how the Department of Energy's energy research and development programs can help the nation address climate change and at the same time reduce our dependence on foreign oil, increase our nation's competitiveness, and cut air pollution.

As the 21st century approaches, our nation faces huge energy, economic, and environmental challenges. Over the next few years, we will witness the restructuring of U.S. electricity markets; we will implement new federal and state clean air requirements; we will encounter a volatile global energy market; we will face increased economic competition in the global market for clean energy technologies; and, we will confront the threat of global climate change. Each of these challenges poses substantial risks to our nation with potentially high economic costs. However, there is a technology path that can help meet these challenges.

Research, development and accelerated use of energy efficiency and clean energy technologies, built upon a solid foundation of advanced science and basic research and coupled with policies that remove barriers to innovation, is a major part of the solution. In fact, this technology path is so important in meeting these challenges, that even without the threat of climate change, these investments would still be wise national policy. The threat of climate change simply makes the technology path all the more compelling.

There is no "silver bullet" that will address our future energy needs. A broad and balanced R&D portfolio -- one that builds on clean fossil, renewable and nuclear supplies and increased efficiency of energy use -- is essential. We must make better use of conventional energy sources through

energy efficiency while also investing in new energy supply technologies. A robust energy portfolio will provide many benefits, including reduced energy costs, increased energy security, improved air quality, greater U.S. competitiveness, and reduced greenhouse gas emissions.

That is why we are asking for funding for hydropower R&D to develop a fish friendly turbine that will help us preserve our large installed hydropower base that currently provides approximately 10 percent of U.S. electricity.

That is why we are asking for funding to develop technologies that improve the efficiency and extend the operating life of current nuclear power plants.

That is why we are asking for funding to develop super clean diesel engines that will be one-third more efficient than gasoline engines and meet equivalent emission standards.

That is why we are asking for funding for advanced gas turbines that can provide industrial and commercial buildings not only with their electricity, but with their heat, at system efficiencies of 70 percent and higher.

That is why we are asking for funding for R&D partnerships with the most energy-intensive U.S. industries -- like steel, chemicals, and forest products -- to develop technologies to save energy and jobs and increase industrial productivity.

That is why we are asking for funding for a new R&D collaboration with the agriculture industry

to use crops like corn and soybeans -- instead of oil -- to make everyday consumer items -- ranging from paints and plastics to carpets and car parts.

That is why we are asking for funding to study sequestration technologies to keep carbon from coal combustion out of the atmosphere.

These investment proposals are built on a solid record of DOE success in advancing energy technology.

In January, Chrysler, Ford, and GM stunned the world with their announcement of concept vehicles that promise two to three times greater fuel efficiency. This followed a DOE, Chrysler and A.D. Little announcement of a major breakthrough in powering a fuel cell electric car with gasoline.

Last week in Nevada we dedicated an advanced clean coal power plant that produces 20 percent less carbon emissions and 90 percent less sulfur and nitrogen oxide emissions.

Yesterday, Mayor Giuliani and Secretary Peña celebrated the first speculative office tower in Manhattan since 1988 -- a building already fully rented, powered in part by fuel cells and photovoltaic panels, and expected to emit 40 percent fewer greenhouse gases.

Next week, in Indiana, Bethlehem Steel and DOE will showcase an array of technologies that will significantly cut pollution and energy use in the largest integrated steel mill in the nation -- a mill

that spends about \$300,000 per day on energy -- that's more than \$100 million per year in a single plant.

And this year, DOE has pioneered a simple method for leveraging billions of private sector dollars for energy retrofits of some of the nation's 500,000 Federal buildings. In one recent example, New York's Consolidated Edison is investing \$6 million of its own money to retrofit a V.A. hospital that will save the V.A. and taxpayers \$1 million a year.

Clearly, the common ground in the climate change debate is technology. From Mobil Oil to the Sierra Club, there is agreement that substantial industry and government support for energy R&D is a key element of an effective response to climate change, independent of opinions about the science or diplomacy of the issue. Last year, a peer-reviewed study conducted by five national laboratories recognized that the United States can hold down the costs of meeting climate change goals by developing clean energy technologies. In fact, the study concluded that progress in reducing greenhouse gas emissions can be achieved without increasing the nation's total energy bill.

And, Mr. Chairman, technology is a key to unlocking the doors of developing nations' participation in a climate treaty. It is technology that will provide developing nations with the ability to grow their economies and at the same time limit their carbon emissions and reduce the traditional air pollutants choking many of their cities. And, it is with clean technology that developing countries become a business opportunity rather than a diplomatic challenge for the nation. Mr. Chairman, over the next four decades, developing countries alone will require new

electricity capacity worth more than \$3 trillion. In order to meet this explosive energy demand and reap the resulting technology sales and jobs, we must invest in the research, development, and deployment of energy technologies. U.S. companies and workers can have the largest piece of this huge market if we win the R&D race. But, if our commitment to clean energy technology R&D is stalled by finger-pointing about Kyoto "back-doors" and economic models, the U.S. economy, the U.S. citizens, and the global environment will be the real losers.

Statement of Dan Reicher
Assistant Secretary for Energy Efficiency and Renewable Energy
U.S. Department of Energy
Before the
Subcommittee on National Economic Growth, Natural Resources, and Regulatory Affairs
Committee on Government Reform and Oversight
U.S. House of Representatives

April 23, 1998

Mr. Chairman and members of the Subcommittee, I appreciate the opportunity to appear before you to discuss how the Department of Energy's enhanced energy research and development initiative can help the nation reduce our dependence on foreign oil, increase our nation's competitiveness, cut air pollution, help maintain our leadership in energy technology, and at the same time, address climate change.

As the 21st century approaches, our nation faces many energy, economic, and environmental challenges. Over the next few years, we will confront the threat of global climate change; restructure U.S. electricity markets; implement new federal and state clean air requirements; encounter a volatile global energy market; and face increased economic competition in the global market for clean energy technologies. There is a technology path that can help meet these challenges and turn them into opportunities.

Research, development and accelerated use of energy efficiency and clean energy technologies, built upon a solid foundation of advanced science and basic research, are major parts of the

solution. In fact, this technology path is so important in meeting these challenges, that even without the threat of climate change, these investments would still be wise national policy. This exact point was made last Fall by the President's Committee of Advisors on Science and Technology.

There is no "silver bullet" that will address all our future energy needs. A broad and balanced R&D portfolio -- one that builds on clean fossil, renewable and nuclear supplies and increased efficiency of energy use -- is essential. We must make better use of conventional energy sources through energy efficiency while also investing in new energy supply technologies. A robust energy portfolio will provide many benefits, including reduced energy costs, increased energy security, improved air quality, greater U.S. competitiveness, and reduced greenhouse gas emissions.

That is why we are asking for funding for the following:

- Hydropower R&D to develop a fish friendly turbine that will help us preserve our large installed hydropower base that currently provides approximately 10 percent of U.S. electricity;
- Technologies that improve the efficiency and extend the operating life of current nuclear power plants;
- Super clean diesel engines that will be one-third more efficient than comparable gasoline engines and meet equivalent emission standards;

- Advanced gas turbines that can provide industrial and commercial buildings not only with their electricity, but with their heat, at system efficiencies of 70 percent and higher;
- R&D partnerships with the most energy-intensive U.S. industries -- like steel, chemicals, and forest products -- to develop technologies to save energy and increase industrial productivity;
- A new R&D collaboration with the agriculture industry to use crops like corn and soybeans -- instead of oil -- to make everyday consumer items -- ranging from paints and plastics to carpets and car parts; and,
- Sequestration technologies to keep the carbon dioxide from coal combustion out of the atmosphere.

These investment proposals are built on a solid track record of DOE success in advancing energy technology.

In January, Chrysler, Ford, and GM stunned the world with their announcement of concept vehicles that promise two to three times greater fuel efficiency. This followed a DOE, Chrysler and A.D. Little announcement of a major breakthrough in powering a fuel cell electric car with gasoline.

Last week in Nevada we dedicated an advanced clean coal power plant that produces 20 percent fewer greenhouse gas emissions and 90 percent less sulfur and nitrogen oxide emissions. The advances in this plant result in part from our Fossil Energy R&D efforts.

Yesterday, Mayor Giuliani and Secretary Peña celebrated a new state-of-the-art office tower in Manhattan -- a building already fully rented, powered in part by fuel cells and photovoltaic panels, and expected to be 40 percent more energy efficient than the average building its size, with a similar reduction in associated greenhouse gas emissions. The technologies used in this building were developed by DOE in partnership with industry and the national laboratories.

Next week, in Indiana, Bethlehem Steel and DOE will showcase an array of technologies that will significantly cut pollution and energy use in the largest integrated steel mill in the nation -- a mill that spends about \$300,000 per day on energy -- or more than \$100 million per year.

And this year, DOE has pioneered a simple method for leveraging billions of private sector dollars for energy retrofits for the nation's Federal buildings. The Federal government occupies 500,000 structures and is the single largest energy user in America. In one recent example, New York's Consolidated Edison is investing \$6 million of its own money to retrofit a V.A. hospital that will save the V.A. and taxpayers \$1 million a year.

Clearly, the common ground in the climate change debate is technology. From Mobil Oil to the Sierra Club, there is agreement that substantial industry and government support for energy R&D is a key element of an effective response to climate change, independent of opinions about the

science or diplomacy of the issue. Last year, a peer-reviewed study conducted by five national laboratories recognized that the United States can hold down the costs of meeting climate change goals by developing clean energy technologies. In fact, the study concluded that significant progress in reducing greenhouse gas emissions can be achieved without increasing the nation's total energy bill. Just yesterday, eleven laboratory directors issued a study that outlined almost 50 separate technology pathways for reducing greenhouse gas emissions over the next 30 years while providing other benefits.

Finally, technology is a key to ensuring the meaningful participation of developing nations in a climate treaty. It is technology that will provide developing nations with the ability to grow their economies, and at the same time limit their greenhouse gas emissions and reduce the traditional air pollutants choking many of their cities. And, clean technology will help ensure that developing countries become a business opportunity rather than a diplomatic challenge for our nation. Mr. Chairman, over the next four decades, developing countries alone will require new electricity generating capacity worth more than \$3 trillion. In order to meet this explosive energy demand and reap the resulting technology sales and jobs, we must invest now in the research, development, and deployment of energy technologies. U.S. companies and workers can have the largest piece of this huge market if we win the R&D race. But, if our commitment to energy technology R&D is stalled by finger-pointing over Kyoto "back-doors" and economic models, then the U.S. economy, our citizens, and the global environment will be the real losers.

Thank you again, Mr. Chairman, and members of the Subcommittee for the opportunity to testify before you today.

TESTIMONY OF DR. EDWARD MONTGOMERY
CHIEF ECONOMIST, U.S. DEPARTMENT OF LABOR
BEFORE THE HOUSE SUBCOMMITTEE ON NATIONAL ECONOMIC
GROWTH, NATURAL RESOURCES, AND REGULATORY AFFAIRS
ON THE KYOTO PROTOCOL
APRIL 23, 1998

Thank you, Mr. Chairman and Members of the Committee. I am pleased to have this opportunity to appear before the Committee to elaborate on the Administration's views on global climate change policy.

The international agreement that was reached in Kyoto this past December is a crucial step forward in addressing global climate change. Global warming may be the most pressing environmental concern of the next century. The Intergovernmental Panel on Climate Change (IPCC), representing the world's climate change scientists, concluded 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.

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. The IPCC reports that a doubling of carbon dioxide levels would lead to additional deaths in the U.S. from higher summer temperatures, even after netting out the effects of warmer winters and assuming acclimatization. Researchers predict sea level increases, spread of tropical diseases, increased precipitation, and more violent storms due to increased concentrations of greenhouse gases.

While some of these effects may not be felt for several decades, it is important to begin to take action now in order to avoid leaving an even greater burden for future generations. We already face up to another 1.0 degree Fahrenheit temperature increase from emissions that have occurred. Delayed action will only increase the level of greenhouse gases accumulating in the atmosphere and magnify the future costs of addressing this issue. As CEA Chair Yellen recently noted, William Cline, then of the Institute for International Economics, estimated that the monetary damages expected from a 4.5 degree Fahrenheit average worldwide temperature increase would amount to about 1.1 percent of GDP per year for the U.S. economy — \$90 billion per year in today's terms. Responsible action today would seem a prudent form of insurance to protect the world for our children and grandchildren.

The President's plan represents a flexible and market-oriented approach to global climate change and is designed to insure that we reach our goals with the least cost and in the most efficient manner. It exploits the creativity and ingenuity of American companies and their workers rather than relying upon policies like taxing the use of fossil fuels. The plan emphasizes partnering with business by investing in the further development of win-win technologies which lower energy consumption (and costs) while reducing emissions. The \$6.3 billion program of increased R&D spending and tax credits that the President proposed is designed to harness the power of the market to seek reductions in greenhouse gases at the least cost possible.

Let me emphasize that at the core of the President's policy is the recognition that we must begin to address this real problem but that we must do it in such a way as to minimize any effect on the competitiveness of U.S. industry and workers. That is why the Administration has insisted upon international emissions trading, meaningful developing country participation, inclusion of land-use activities that absorb carbon ("sinks") and six categories of gases, as well as our domestic initiatives which can help ensure that reductions in global greenhouse gas emissions are consistent with continued strong economic growth. Our experience with the SO₂ program showed that when market flexibility is harnessed emission reductions can be achieved at costs 60 to 80 percent below what was originally thought possible. While success such as this is not guaranteed, it does illustrate the efficacy of using flexible market-based strategies to address the problem.

In trying to assess the potential costs of global climate change policy there are several points to keep in mind. First, the parameters of the international effort to reduce greenhouse gas emissions are still in some respects a work-in-progress so, despite the claims of some studies, it is not yet possible to provide a full authoritative analysis. Second, one only has to pick up the paper on a daily basis and read the range of forecasts for the economy over the next quarter to appreciate the high degree of uncertainty attached to economic forecasts over the short term, let alone over a decade. How many forecasters a year ago, let alone ten years ago, predicted that we would again be seeing gas prices around \$1.00 per gallon?

Despite the uncertainty surrounding economic forecasts a decade into the future, there is good reason to believe that the costs of this policy will be modest. As Chair Yellen noted in her recent testimony, features of the Kyoto Protocol that the President insisted upon such as international emissions trading, joint implementation, and the Clean Development Mechanism have all been found to significantly reduce the costs of abatement. With these features embodied in the Protocol, model estimates suggest that the costs could range between \$7 and \$12 billion per year in 2008-2012 or one tenth of one percent of GDP. These estimates may overstate actual costs as they do not include the benefits of climate change abatement as well as the effects of electric utility restructuring and the Administration Climate Change Initiative. In addition, lower energy costs are but one of many factors affecting competitiveness. In fact, energy prices account for only 2.2 percent of total costs to U.S. industry and already vary substantially across countries. Gas prices range from 8 cents per gallon in Venezuela to \$1.28 in the U.S. to \$4.41 in France. Despite high energy prices in Europe and Japan, neither they nor U.S. industry is moving en masse to Venezuela. Further, the Administration's proposed plan for electric utility restructuring may actually offset any energy price increase caused by efforts to limit greenhouse gases.

While we expect that the costs of global climate change policy to be modest, it is possible that some industries and workers may be adversely affected by a rise in energy prices. The President has stated that we have a moral obligation to help those who may be affected by any change in our economy which affects people through no fault of their own. The President

and the Department of Labor have demonstrated the strength of this commitment to helping today's workers manage change by doubling funding for programs that provide access to training and assistance to those workers when they need it.

Any layoff is a painful event for the workers and communities involved. By insisting upon flexible market-based solutions, the President's global climate change policies are designed to minimize any adverse effect on energy prices and the economy. Just as we do today, the Department of Labor is committed to helping any worker or community that may be affected. Rapid response teams have a proven track record of helping workers who are affected by any economic dislocation to look ahead and plan for their future. Working with locally-managed job training organizations, these teams set up worker assistance workshops that cover everything from resume writing to interviewing skills. Dislocated workers may also participate in job fairs, training (including community college courses), direct placement, and related skills and remedial assistance from federally-funded programs. The Secretary has repeatedly stated her commitment to further improving these programs by increasing job placement and wage replacement for workers who permanently lose their jobs in a plant closing or mass layoff.

Thank you Mr. Chairman for this opportunity to discuss global climate change policy and I welcome any questions you might have.

**TESTIMONY OF DAVID GARDINER
ASSISTANT ADMINISTRATOR
OFFICE OF POLICY, PLANNING, AND EVALUATION
ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON NATIONAL ECONOMIC GROWTH,
NATURAL RESOURCES, AND REGULATORY AFFAIRS
COMMITTEE ON GOVERNMENT REFORM AND OVERSIGHT
U.S. HOUSE OF REPRESENTATIVES
APRIL 23, 1998**

Thank you, Mr. Chairman and members of the committee, for giving me this opportunity to testify on the Kyoto Protocol. The United States agreed to the Protocol in December because the scientific evidence strongly supports our belief that a changing climate would pose very serious risks to public health and the environment. The framework for action that was negotiated in Kyoto would address those risks in a flexible, common-sense, and cost-effective way. The Kyoto Protocol would buy America an insurance policy to protect against a possible disaster in the future. Moreover, while protecting the future, it brings us substantial human health, environmental, and economic benefits in the near term.

It is difficult to predict with certainty what will happen in the future, but the risks are enormous. If emissions of greenhouse pollutants are not reduced worldwide, atmospheric concentrations are expected to double by the year 2060. That would cause global temperatures to rise by roughly two to six degrees by the year 2100, and global sea levels to rise 6 - 38 inches.

Climatic changes on that scale would pose very serious threats to public health and the environment. For example, a doubling of current atmospheric concentrations of greenhouse pollutants could contribute to more frequent and intense episodes of urban smog, thus increasing

rates of human illness and death. The projected increase in the duration and frequency of heat waves could increase mortality rates due to heat stress.

Climate change also could lead to increases in several infectious diseases, including malaria, dengue, and yellow fever, as the range of organisms that carry these diseases expands. It has been estimated, for example, that as global surface temperatures rise, by the end of the 21st century the global population will suffer an additional 50 - 80 million cases of malaria.

EPA's Report to Congress estimated that, by the year 2100, rising sea levels could submerge 15 - 60 percent of America's coastal wetlands. These wetlands are nature's kidneys; they cleanse and purify the waters that pass through them. Their loss would be a blow to the health of humans and wildlife alike.

Groundwater aquifers and surface waters could be rendered unfit for drinking by the saltwater intrusion that could be common as sea levels rise. Five thousand square miles of dry land in states like Louisiana and Florida could be inundated, with devastating effects on the quality of drinking water. Both droughts and floods are likely to become more frequent and severe as average temperatures rise, thus increasing personal and property damage.

In short, the potential consequences of climate change go far beyond a few degree rise in average global temperatures over the next century. Rising temperatures and related climate phenomena pose a distinct and serious threat to human health, the environment, and the quality of life on earth. The Intergovernmental Panel on Climate Change stated the problem succinctly: "Climate change is likely to have wide-ranging and mostly adverse impacts on human health, with significant loss of life."

In the face of this evidence, and because the effects of climate change would be so serious

and so costly, the United States negotiated an agreement that will allow participating nations to reduce greenhouse pollution in common sense, cost-effective, and flexible ways.

First, the Protocol sets realistic targets and timetables for reducing emissions of greenhouse pollutants. The United States would reduce its emissions 7 percent below 1990 levels, Japan 6 percent, and the European Union 8 percent.

Second, the Protocol ensures that countries can meet their obligations through the use of flexible market mechanisms, not mandatory policies or taxes. This flexibility will allow companies and countries to find the cheapest possible ways of hitting their emissions reduction targets. In fact, because emissions permits can be traded, there is a built-in incentive to develop advanced -- and cheaper -- methods of reducing emissions.

In this country we have several years of experience using the power of the free market to reduce pollution at the lowest cost. We've incorporated market trading mechanisms into programs to control acid rain, water pollution, lead in gasoline, criteria air pollutants, and the chemicals which deplete the ozone layer (chlorofluorocarbons). The results have been impressive. The lead trading program, for example, reduced control costs by about 20 percent. Acid rain control costs were 50 percent lower than expected. CFC phaseout costs were cut dramatically. We believe the flexible market mechanisms built into the Kyoto Protocol will be equally effective in reducing greenhouse pollutants at the lowest possible cost.

The United States entered the Kyoto negotiations with a third objective: securing the meaningful participation of developing countries. The Kyoto Protocol does not meet all our objectives in this area. But it makes a solid start by encouraging investments in developing countries that can be credited toward the Protocol's emissions reductions targets through the

Clean Development Mechanism.

The President's proposed Climate Change Technology Initiative also is part of our common-sense, cost-effective strategy. This initiative expands existing voluntary programs designed to reduce greenhouse pollutants. These voluntary programs bring economic benefits beyond those associated with the control of global warming. They provide incentives for American businesses and communities to cut greenhouse pollution now in ways that make economic sense now. They speed the adoption of today's cost-effective, energy-efficient, low-carbon technologies throughout the economy, and hasten the development of even more advanced technologies in the future.

And they work. By 1999 our goals are to reduce greenhouse pollutants by over 40 million tons a year, eliminate 90,000 tons of nitrogen oxides, a prime component of urban smog, and reduce U.S. energy consumption by over 45 billion kilowatt hours in 1999, providing \$3 billion in energy savings to consumers and businesses.

Let me give you just one example of how rewarding these kinds of actions can be for both the environment and the economy. In East Indiana, the Inland Steel Company is installing technology that will recapture coke gas emissions and use it to generate both electricity and steam heat. Any excess electricity not used at the steel mill will be sold to the local utility. Thus this new, state-of-the-art, cogeneration facility will save Inland money while it reduces the emissions of greenhouse gas and other pollutants from both the steel mill and the local utility.

Ideas like that help enhance the productivity of the American economy. They help American businesses compete more effectively in the global economy. And by reducing

One last point: every dollar we invest to improve energy efficiency and limit climate change will control pollutants besides greenhouse gases. Fossil fuel combustion is also a major source of conventional air pollutants like particulates, nitrogen oxides, volatile organic compounds, and carbon monoxide. These pollutants have been linked to heightened risks of mortality, chronic bronchitis, congestive heart failure, heart disease, and other serious illnesses. Children and the elderly are most vulnerable to these pollution-related illnesses.

In summary, the Kyoto Protocol lays the groundwork for a cost-effective, common-sense approach to controlling climate change. It is a work in progress, and the progress so far has been heartening. We have to do more to engage the developing countries, but the framework for future action is strong.

Most important, the need for action is clear. Let me close by quoting from an article by Stephen Wolf, the CEO of US Airways: "But in the long term, if we do not address this issue forcefully today, we and our children and our children's children will be penalized in ways we do not even want to contemplate." Thank you.

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**3/5/98 HOUSE SCIENCE
COMMITTEE**

Divider Title: _____

Statement of
Stuart E. Eizenstat
Under Secretary of State
for Economic, Business and Agricultural Affairs
before the
House Science Committee
March 5, 1998

Thank you, Mr. Chairman.

At the outset, let me thank those members of Congress, in this chamber and in the Senate, who participated with us in the Kyoto Conference and who lent their advice and support to our efforts there. Rarely has there been an environmental issue more important or complex than global warming, and rarely has there been a greater need for the Executive Branch and the Congress to work closely together.

It is with great pleasure that I appear here today to explain the Administration's position on global warming. To this end, I will divide my testimony into four parts: (1) a short discussion of the science – the driving force for all the efforts we have taken to date to mitigate a significant and growing global environmental problem; (2) a discussion of the results of the recent Kyoto Conference and key features of the Kyoto Protocol; (3) an effort to correct misperceptions; and (4) a brief review of the President's Climate Change Technology Initiative. I hope to leave you with a clear understanding of why we believe that it is necessary to act, of how we intend to proceed internationally, and of what the President plans to do here at home.

The Science

Human beings are changing the climate by increasing the global concentrations of greenhouse gases such as carbon dioxide, methane and nitrous oxide. Burning coal, oil and natural gas to heat our homes, power our cars and illuminate our cities produces carbon dioxide and other greenhouse gases as by-products – more than 6 billion metric tons worth of carbon in the form of carbon dioxide annually. Similarly, deforestation and land clearing also release significant quantities of such gases – another 1 to 2 billion tons a year. Over the last century, greenhouse gases have been released to the atmosphere faster than natural processes can remove them. There is no ambiguity in the data; since 1860, concentrations of carbon dioxide have risen 30 percent, from 280 parts per million (ppm) to 365 ppm.

In December 1995, the authoritative Intergovernmental Panel on Climate Change (IPCC), representing the work of more than 2,000 of the world's leading climate change

What Changes Have We Seen to Date?

The earth's temperature is increasing: Scientists from our National Oceanic and Atmospheric Administration (NOAA), the U.K. Meteorological Office and the National Aeronautics and Space Administration (NASA) all recently announced that 1997 was the warmest year on record. In fact, nine of the last 11 years are among the warmest ever recorded.

The water cycle of the planet may be speeding up: Since the beginning of the century, NOAA estimates that precipitation in the United States has increased by about 5 - 10 percent, while the frequency of heavy downpours (where more than 2 inches fall in a day) has increased by about 20 percent. The United States has had many recent reminders of how costly extreme events can be: the Mississippi flooding of 1993 led to damages of between \$10 and \$20 billion; the Southern Plains drought of 1996 was estimated to cost \$4 billion; and the Northwest floods of 1996-97 about \$3 billion. We have yet to learn what the current floods in California will cost. While no single event can be attributed to global warming, increases in floods and droughts are expected as global warming occurs.

Action Needed Now

Some have argued that we can wait to act until all the details of the climate system have been fully understood. The science tells us that this is a recipe for disaster. We will only fully confirm predictions when we experience them. At that point it will be too late. The concentrations of greenhouse gases in the atmosphere continue to rise each year, and because these gases will persist for many decades to centuries, this problem is only slowly reversed. The earth will continue to warm and the seas continue to rise as long as we continue to load the entire atmosphere of the earth with greenhouse gases. The problem has developed over the course of a century and it will take many decades to solve. Already, we have another 1.0 degree Fahrenheit of warming in the pipeline from emissions that have previously occurred, so some impacts will happen no matter what actions we take. Nevertheless, we can still forestall many others if we begin taking cost-effective actions now.

We should look at the Kyoto Protocol as an insurance policy against the potentially devastating and irreversible impacts of global warming. This insurance policy is fully justified today, based solely on our current understanding of the science. If we act now the premium will be far more reasonable than if we delay and hope the problem created by greenhouse gases will go away. It is like a life insurance policy whose costs grow significantly if we delay year after year insuring ourselves.

But there is a critical difference in the case of the climate system. In most insurance policies, the loser can be made whole -- restitution is possible; the building can be rebuilt, the stolen car replaced, the fire or flood damage repaired. In the case of global

warming, we will not have a second chance -- failure to act will lead to irreversible consequences. We will be committing ourselves, our children and our grandchildren to a very different planet, and they will never forgive us.

But the premium for this insurance policy must be reasonable. For this reason we rejected unrealistic targets in Kyoto; we insisted on full recourse to market-mechanisms; and we opposed mandatory policies and measures -- like carbon taxes.

The totality of our scientific information, including that on vulnerability and impacts of global warming, provides a compelling reason to act.

Let me now turn to the recent Kyoto Conference.

Kyoto Protocol

Last December in Kyoto, Japan, the nations of the world reached agreement on an historic step to control greenhouse gas emissions which cause global warming. No sooner had the negotiating session ended, however, than some critics on both ends of the political spectrum, without a full examination of the results achieved, denounced the agreement as either too little too late or too much too soon. In fact, the Kyoto Protocol, reached only through the exercise of vigorous American leadership, represents an important achievement in the best interests of the United States. But it is a framework for action, a work in progress, not a finished product ready for Senate consideration.

U.S. Negotiating Objectives

In order to secure an effective agreement that is environmentally strong and economically sound, while protecting the unique worldwide interests of the U.S. military, President Clinton and Vice President Gore established three major objectives. As a result of the Kyoto negotiations, we achieved the first two -- realistic targets and timetables for reducing greenhouse gas emissions among the world's major industrial nations, which fully protect the unique role of our military in its global reach; and flexible market-based mechanisms for achieving those targets cost-effectively. The third, meaningful participation of developing countries, will be the focus of our work in the coming months and years, but with the Kyoto Protocol we have made an important down payment.

Elements of the Kyoto Protocol and Related Decisions

Our first objective -- realistic targets and timetables among developed countries -- had to be a credible step in reducing the dangerous buildup of greenhouse gases, yet measured enough to safeguard U.S. prosperity at home and competitiveness abroad. In the end, we secured the key elements of the President's proposal on targets and timetables, often over the initial objections of the European Union and other developed countries. The agreement and related decisions include:

- The U.S. concept of a multi-year time frame for emissions reductions rather than a fixed, single-year target. The multi-year time frame will allow the United States, other nations and our industries greater flexibility in meeting our targets. 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.
- The U.S. specific time frame of 2008-2012, rather than earlier periods preferred by the European Union and others, giving us more time to phase in change gradually and deploy new technologies cost-effectively, and thereby to cushion the effects on our businesses and workers.
- Differentiated targets for the key industrial powers ranging from 6% to 8% below baseline levels (1990 and 1995) of greenhouse gas emissions, with the United States agreeing to a 7% reduction. When changes in the accounting rules for certain gases and offsets for activities that absorb carbon dioxide are factored in, the level of effort required of the United States is quite close to the President's original proposal to return emissions to 1990 levels by 2008-2012, representing at most a 3 percent real reduction below that proposal, and perhaps less.
- An innovative proposal shaped in part by the United States, allowing certain activities, such as planting trees, that absorb carbon dioxide – called “sinks” – to be offset against emissions targets. This will both promote cost-effective solutions to climate change and encourage good forestry practices. As a major forestry nation this will be of special benefit to the United States.
- As proposed by the United States, the Kyoto Protocol covers all six significant greenhouse gases even though the E.U. and Japan proposed and fought until the last moment to cover only three. This was an important environmental victory – also supported by many in our own industry – because gases that other countries wanted to omit and leave uncovered (including substitutes for the now banned chloro-fluorocarbons that endanger the ozone layer) are among the fastest growing and longest lasting greenhouse gases.

Flexible Market Mechanisms

Our second broad Presidential objective was to make sure that countries can use flexible market mechanisms to reach their targets rather than the mandatory “policies and measures,” such as carbon taxes, favored by the E.U. and many other developed countries.

The Kyoto Protocol enshrines a centerpiece of this U.S. market-based approach – the opportunity for companies and countries to trade emissions permits. In this way, companies or countries can purchase less expensive emissions permits from companies or countries that have more permits than they need (because they have met their targets with room to spare). This is not only economically sensible, but environmentally sound. By finding the least expensive way to reduce emissions, we will be providing a strong incentive for achieving the maximum level of emissions reductions at the least cost. The United States has had a very positive experience with permit trading in the acid rain program, reducing costs by 50 percent from what was expected, yet fully serving our environmental goals.

This was a new concept for developed and developing countries alike – some of whom fought it vigorously. But we have it firmly enshrined in the Kyoto Protocol and it is a critical way of ensuring cost-effective solutions. Its inclusion was a major victory for us.

We went even further by achieving a conceptual understanding with several countries, including Australia, Canada, Japan, New Zealand, Russia and Ukraine, to trade emissions rights with each other. This 'umbrella group' could further reduce compliance costs.

Ensuring that we can meet our target reductions cost-effectively will depend significantly on access to the flexibility mechanisms we fought hard to include in the Kyoto Protocol. Let me be very clear: The commitment we made in Kyoto would not have been made – could not have been made – were it not for the flexibility mechanisms that were also agreed there. Until we are satisfied with the rules and procedures yet to be established, the promise of Kyoto will never be realized. The importance of emissions trading was emphasized by CEA Chairman Yellen in her recent statements.

Meaningful Participation of Developing Countries

Our third objective was to secure meaningful participation of key developing countries, a concern that I know you, Mr. Chairman, and members of Congress obviously share, as evidenced by last summer's Byrd-Hagel resolution in the Senate. Global warming is, after all, a global problem which requires a global solution – not only from the developed world but also from key developing countries.

Per capita emission rates are low in the developing world and will remain so for some time, and over 70 percent of today's atmospheric concentrations of greenhouse gases attributable to human activities are the result of emissions by the industrialized world. At the same time, it is also true that by around 2015 China will be the largest overall emitter of greenhouse gases, and by 2025 the developing world will emit more

greenhouse gases in total than the developed world. So from an environmental perspective, this problem cannot be solved unless developing countries get on board.

We encountered significant resistance in Kyoto by some developing countries to meaningful participation in solving the global warming problem. For example, we had sought to include a specific process through which advanced developing or newly developed countries could take on quantified emission limitation commitments and thereby take part in the international emissions trading regime. While a number of developing countries expressed interest in our proposal and supported it in Kyoto, others rejected it, and it was not possible to include such a specific process in the Protocol. Still, developing countries may nevertheless, as a prerequisite for engaging in emissions trading, voluntarily assume binding emissions targets through amendment to the annex of the Protocol that lists countries with targets.

Some developing countries believe – wrongly – that the developed world is asking them to limit their capacity to industrialize, reduce poverty and raise their standard of living. We have made clear that we support an approach under which developing countries would continue to grow – but in a more environmentally sound and economically sustainable way, by taking advantage of technologies not available to countries that industrialized at an earlier time.

The Kyoto agreement does not meet our requirements for developing country participation. Nevertheless, a significant down payment was made in the form of a provision advanced by Brazil and backed by the United States and the Alliance of Small Island States. This provision defines a "Clean Development Mechanism," which embraces the U.S.-backed concept of "joint implementation with credit." The goal is to build a bridge – with incentives – between developed, industrialized countries, and developing nations. This new mechanism will allow companies in the developed world to invest in projects in countries in the developing world – such as the construction of high-tech, environmentally sound power plants – for the benefit of the parties in both worlds. The companies in the developed world will get emissions credits at lower costs than they could achieve at home, while countries in the developing world will share in those credits, and receive the kind of technology that can allow them to grow without ruining their environment.

The Clean Development Mechanism has great potential, but developing countries will need to do more in order to participate meaningfully in the effort to combat global warming. In determining what developing countries ought to do, we should be aware that the circumstances of developing countries vary widely, along a kind of continuum. Some today are very poor, their greenhouse gas emissions are negligible and are likely to remain so for the foreseeable future. Others, whose greenhouse gas emissions are not substantial, are relatively well off. Some are poor on a per capita basis, but their greenhouse gas emissions today rival or surpass those of the most advanced industrialized nations. Still others have already joined ranks with the industrialized world in the OECD

but have not yet fully accepted the added responsibility for protection of the global environment that comes with their new status.

Any 'one-size-fits-all' approach to the 'meaningful participation of developing countries' and to satisfy the Byrd-Hagel Resolution is thus unlikely to prevail. We found in Kyoto that even among the industrialized countries it was necessary to recognize the individual national circumstances faced by those differently situated in order to reach agreement, notwithstanding our common purpose. Similarly, any uniform, inflexible approach to the 'meaningful participation of developing countries' is unlikely to prevail.

As Senator Byrd said in his letter of December 15, 1997, to the President, and recently restated on January 29 in the Senate:

"...binding commitments for developing nations should be paced according to the ability of each country to achieve greenhouse gas emission limitations appropriate to its national circumstances and economic growth. These limitations could be gradually implemented. Whether such commitments are in fact appropriate and represent best effort by each nation, will not be difficult to discern. As the saying goes, we will know it when we see it."

Recognizing our "common but differentiated responsibilities and respective capabilities" it will be necessary to develop an approach that provides for a meaningful global response to the threat of global warming, while acknowledging the legitimate aspirations of developing countries to achieve a better life for their peoples. To succeed, we will need to ensure that those responsible for a significant share of global emissions accept their responsibility to protect the global environment. We will also need to ensure that those who are able to do so contribute according to their capacities and stage of development.

Some Misperceptions

Before moving on, Mr. Chairman, let me address a few specific points on which I believe there may be some misperceptions. The first of these is that the Kyoto Protocol will damage our national security or imperil the ability of our military to meet its worldwide responsibilities -- this is not true.

We took special pains working with the Defense Department and the uniformed military before and in Kyoto to protect the unique position of the United States as the world's only superpower with global military responsibilities. We achieved everything they outlined as necessary to protect military operations and our national security.

At the Kyoto Conference, uniformed military representatives from the Joint Chiefs of Staff and the Office of the Deputy Under Secretary of Defense for

Environmental Security provided guidance to the delegation as we considered this issue. In the end, the Parties took a decision to exempt key overseas military activities from emissions targets, including exemptions for "bunker fuels" (those used in international aviation and maritime transport) and for emissions resulting from a wide range of multilateral operations, such as peacekeeping and humanitarian relief. This exempts from our national targets not only multilateral operations expressly authorized by the U.N. Security Council (such as Desert Storm or Bosnia), but also multilateral operations that the United States initiates pursuant to the U.N. Charter without express authorization (such as Grenada). Countries may also decide among themselves how to account for emissions relating to multilateral operations (e.g., U.S. training in another NATO country) without going through emissions trading. If any other measures to preserve our national security interests are required, and there do not appear to be any, they can be addressed through future implementing legislation. As Secretary of Defense Cohen wrote in a letter of February 24, 1998, to Congressperson Bachus, "Based on achieving our international objectives, the Department is fully satisfied with the Kyoto results."

Second, it has been suggested that the Protocol will create a super U.N. Secretariat that will threaten U.S. sovereignty and national decision-making through alleged intrusive verification procedures and prior approval of individual emissions trades. That is not so. The review process contained in the Protocol largely codifies the existing practice under the 1992 Framework Convention, to which the United States is a Party. Under the Protocol, small expert review teams will continue to visit Annex I countries for brief periods to review implementation of the Convention and of the Protocol. The review process is intergovernmental, in that experts are nominated by governments. The review teams meet with government officials, and with others by invitation. In reviews under the Convention, the teams have met with Congressional staff, representatives of the private sector and representatives of environmental organizations – but only with their concurrence. Any other visits, such as site visits, would take place only if approved by the host country and, if the private sector is involved, the relevant interested persons. It is important to emphasize that no one can come onto the private property of a U.S. citizen without that individual's express approval and consent. To date under the Convention, no site visits have taken place.

In addition, let me be unmistakably clear – while trading rules must be established internationally to have emissions trading work – as our SEC must set rules for equity trading – we will not accept nor do we anticipate an approach that would require prior approval of individual emissions trades by an international body. Trading will be done between interested nations and their companies, based on market principles.

Concerns have also been raised that the Protocol is flawed, on the one hand because it will threaten U.S. sovereignty by dictating national decisions on implementation and, on the other hand, because it lacks mechanisms to verify compliance. In fact we believe that the Protocol strikes an appropriate balance between these two extremes.

- ◆ The United States firmly opposed mandatory, harmonized policies and measures that would be imposed upon us in order to reach our target. We prevailed. The Protocol leaves Parties entirely free to decide how best to meet their targets based on national circumstances.
- ◆ At the same time, we could not tolerate a free-for-all where Parties might or might not meet their commitments, particularly given the conscientious way the United States meets its international obligations. As a result, the Protocol calls for national measurement of emissions, detailed reporting, and in-depth reviews – on an intergovernmental basis.
- ◆ The one area where we believe more work needs to be done is in identifying appropriate consequences for non-compliance; the Protocol provides for elaborating such consequences, with any binding consequences to be done in amendment form, so that the Senate would have the opportunity to approve them.

Finally, some have suggested that the Protocol will result in a huge government transfer of foreign aid to Russia in which we will give away taxpayer money with no leverage on Russian policies with these funds. This also is not true. Under the Protocol's emissions trading provisions, we envision that U.S. private sector firms may choose to purchase international emissions credits in order to meet their emissions obligations. Indeed, the private purchase of emissions credits is one of the crucial ways to achieve cost-effective emissions reductions for U.S. firms.

As with any market transaction, purchases of these credits will have to comply with all U.S. legal and regulatory requirements. In addition, U.S. firms interested in international investment will have an incentive to ensure that other countries meet the international standards for adequate monitoring and reporting of their emissions of greenhouse gases. At the same time, Russia will have significant incentives to use the revenue generated to invest in the most modern, climate-friendly plants and equipment so that, as its economy recovers, it continues to produce emissions credits that it can sell on international markets.

Framework for Action

Where do we go from here? While historic, the Kyoto Protocol is only one step in a long process. It is, in essence, a framework for action, a work in progress, and a number of challenges still lie ahead. We anticipate signing the Protocol within the one-year period provided for in the agreement, which runs from March 1998 to March 1999. We have not, as yet, determined the precise timing due to tactical considerations. We will sign at a time that makes the most sense in terms of the overall diplomatic situation.

In that diplomatic context, rules and procedures must be adopted to ensure that emissions trading rights, joint implementation and the Clean Development Mechanism operate efficiently and smoothly. The Kyoto Protocol establishes emissions trading, but leaves open the specifics of operations. We will work hard to ensure that the rules and procedures adopted enable emissions trading, joint implementation and the Clean Development Mechanism to work smoothly and efficiently, thereby encouraging the private sector to engage.

We will also work closely with our industries to be sure they are satisfied that the emissions trading system which is developed is as efficient and effective as possible to meet their needs.

Most significant, we must work to secure the meaningful participation of key developing countries. We must be creative in initiating bilateral agreements. We have made a promising start with an agreement we reached with China during last fall's Summit. We must also use regional and multilateral fora to achieve our objectives — such as the Summit of the Americas process, in the Asian Partnership for Economic Cooperation (APEC) process, the President's forthcoming trip to Africa, and the G-8 Summit in the United Kingdom. We will put on a full court diplomatic press to bring developing nations into a meaningful role in helping solve the global climate challenge. We will accept nothing less, nor would we expect the United States Senate to do so. As the President has indicated, the United States should not assume binding obligations under the Protocol until key developing countries meaningfully participate in meeting the challenge of climate change. Although the Kyoto Protocol was an historic step forward, more progress is necessary with respect to participation of key developing countries. It would be premature to submit the treaty to the Senate for its advice and consent to ratification at this time.

The Administration also plans to continue to work with the international financial institutions to promote market-based energy sector policies in developing countries that will help reduce developing country greenhouse gas emissions. Multilateral development bank policies, including those of the Global Environment Facility, strongly influence international lending and private capital flows for energy, industrial and transportation investments. Policies that favor market pricing, privatization, clean technologies and environmentally-friendly approaches will make implementing the Kyoto Protocol easier and will speed the growth of markets for new technologies that help reduce emissions in developing countries. We will work with the international financial institutions themselves — from the World Bank to the regional development banks — and with other countries, especially developed countries, to achieve these goals in the coming years.

The Kyoto agreement does not solve the problem of global warming, but it represents an important step in dealing with a problem that we cannot wish away. A premature decision to reject the Protocol would deprive us of the opportunity to complete

its unfinished business. If we fail to take reasoned action now, our children and grandchildren will pay the price.

Mr. Chairman, before turning briefly to our domestic efforts, let me note two other key elements in this equation – the contributions that the United States provides to carry out work under the U.N. Framework Convention on Climate Change and in the Intergovernmental Panel on Climate Change (IPCC), as well as the contributions that we make to the Global Environment Facility (GEF). For FY 1999, the President has requested \$314 million for the International Organizations and Programs Account, a level that represents a 6.6 percent increase over FY 1998. This amount includes \$8 million for the Climate Stabilization Fund which supports the Framework Convention and the IPCC. Parties to the Convention have much work ahead of them, as I have already noted. In addition, the IPCC has now embarked on its Third Assessment Report of Climate Change, scheduled for completion in late 2000 or early 2001. These funds are vital to ensuring U.S. leadership in both of these organizations and to ensuring that our views and the work of our scientists are taken fully into account.

In addition, the President has requested \$300 million to meet our past and current pledges to help fund the Global Environment Facility (GEF). The GEF helps developing countries act to protect the global environment in several key focal areas including international waters, biodiversity, climate change and depletion of the stratospheric ozone layer. If we want to bring developing countries on board with real commitments to limit greenhouse gas emissions, we need to demonstrate that we are a reliable partner by supporting their concrete efforts with reliable resources. At this point, our GEF shortfall damages U.S. credibility in promising to help developing countries meet the climate change obligations we are urging that they undertake. I would therefore urge the Congress to fund fully our \$300 million request, to meet our current pledge and also clear our substantial shortfall of nearly \$200 million.

President's Climate Change Technology Initiative

In his State of the Union address, President Clinton said that global warming is "the gathering crisis that requires worldwide action." We need to begin now to launch the sensible, cost-effective efforts that will help us avoid the high future cost of inaction.

The President last October outlined a three-stage approach to addressing climate change at home. The first stage consists of immediate actions to stimulate development and use of technologies that can minimize the cost of meeting U.S. goals in reducing greenhouse gas emissions. Stage two will review options created through ongoing technology development and lead to detailed plans for a domestic, market-based permit trading system for carbon emissions. Stage three will begin to implement a market-based emissions-trading system.

As a first installment on this plan, President Clinton announced in his State of the Union message two weeks ago his proposal for a \$6.3 billion Climate Change Technology Initiative over five years to cut U.S. greenhouse gas emissions -- \$1.3 billion higher than the President announced in his initial plan in October. This vigorous initiative calls for tax cuts coupled with research and development (R&D) to take cost-effective, practical steps that will position us well to meet the challenge we face early in the next century.

This initiative consists of two parts -- \$3.6 billion in tax credits for energy-efficient purchases and renewable energy, and \$2.7 billion in new R&D spending over five years.

The tax package includes tax credits of \$3,000 to \$4,000 for consumers who purchase advanced technology, highly fuel efficient vehicles. It provides a 15 percent credit (up to \$2,000) for purchases of rooftop solar electricity and hot water systems to provide incentives for meeting the Million Solar Roofs goal. It also includes a 20 percent credit (subject to a cap) for purchasing energy-efficient building equipment, a \$2,000 credit for purchasing energy efficient new homes, extension of the wind and biomass tax credit, and a 10 percent investment credit for the purchase of combined heat and power systems.

The R&D component covers the four major carbon-emitting sectors of the economy (buildings, industry, transportation and electricity), plus carbon removal and sequestration, Federal facilities, and cross cutting analysis and research. Examples of this R&D effort include the Partnership for a New Generation of Vehicles (PNGV), a government-industry effort to develop affordable cars that meet all applicable safety and environmental standards and get up to three times the fuel efficiency of today's cars. In 1999, the President's budget for PNGV is \$277 million, up from \$227 million appropriated for 1998. Our PNGV effort is clearly paying off-- the developments about higher mileage cars announced by the Big Three last month were assisted by research supported under PNGV. It is exciting to see our U.S. automakers already planning for the cars of the future, not as pipe dreams but as achievable greenhouse gas friendly products.

As General Motors Chair and CEO John F. Smith said recently in announcing GM's plans to step up research spending and focus on bringing new products to market, "No car company will be able to thrive in the 21st century if it relies solely on internal combustion engines." And as William C. Ford, Jr., Chair of Ford's Finance Committee, also said in announcing that Ford will join with Daimler-Benz of Germany in developing cars with fuel-cell engines, "There's a compelling business case to be made."

Similar government-industry efforts are proposed to develop cleaner, more efficient diesel engines for both light trucks and heavy trucks. The R&D effort also includes expanded research partnerships for key renewable technologies such as wind, photovoltaics, geothermal, biomass, and hydropower to accelerate price reductions and

improve performance. The President's 1999 budget proposes a \$100 million increase in appropriations for solar and renewable energy R&D - a 37 percent increase over 1998.

We hope that the Congress will view the President's initiative favorably and appropriate the funds and enact the tax incentives that he has requested. We look forward to working with you to put the President's proposals into action.

The President and his Administration are committed to working with you in the Congress, both to realize the potential of the Climate Change Technology Initiative and to craft the ongoing U.S. approach to climate change. The United States has the power to lead the global effort, and Congress holds the key. What is done or not done today will determine the kind of world we will leave to future generations and the conditions of life they will face.

Sustained Effort Required

Mr. Chairman, I have mentioned that Kyoto produced a framework for future action, and I have listed a number of the steps that await us.

Coming to grips with the threat of global warming is no small task. We must tackle it in a vigorous, sober and determined manner, understanding that it represents a challenge but also an opportunity. And as we have always done in the face of global challenge, we must assume the responsibilities of American leadership.

Thank you.

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AGRICULTURE**

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*Congressional
Testimony 3/5*HEARING REPORT

March 5, 1998

COMMITTEE: Senate Agriculture, Nutrition, and
Forestry Committee

MEMBERS PRESENT: R--Lugar [IN, Chairman], Santorum [PA],
Roberts [KA], Grassley [IA], and Craig [ID]
D--Harkin [IA], Leahy [VT], and Kerrey [NE]

WITNESSES: SEE ATTACHED

SUBJECT: The Kyoto Protocol

This hearing was called today to discuss the Kyoto Treaty on Climate Change and its potential effects on the U.S. agricultural economy.

Chairman Lugar's opening remarks began with his statement that the treaty is highly unlikely to be ratified by the Senate in its present form. His statement is primarily based upon the treaty's failure to include emissions limitations on developing countries which would have potentially adverse economic consequences in the U.S. Senator Lugar recommended that the President should establish an Interagency Energy and Environmental Security Task Force to study and make recommendations to address those issues relative to reducing emissions; a new energy policy is crucial to enable the U.S. to cope with its pending environmental and energy security problems.

Senator Ron Wyden [D-OR] was invited by the Chairman to offer his views on how sustainable forestry practices could reduce carbon emissions. He indicated by planting additional trees, deferring state taxes on lands used for reforestation, paying for easements for private owners of uncleared land, the institution of a forestry incentives program, and the development of a carbon credits program could reduce carbon emission by 25%. Senator Grassley said there must be a long debate to thoroughly analyze the provisions of the treaty as it does not treat all countries equally which could result in the loss of U.S. jobs. Both Senators Roberts and Craig said that the Kyoto accord hampers agricultural growth and, therefore, a gradual approach toward treaty implementation is required. Senator Kerry supports the creation of an interagency task force as proposed by the Chairman but he believes that reducing energy consumption is at odds with the need for increased food production. Senator Santorum opined that the "solution" could create more problems than the current problem so that caution should be used in approving such an agreement. The Minority Leader, Senator Harkin, offered the last

statement. His main points were that doing nothing would be the

2

worst for agriculture, carbon sequestration by farmers could provide additional income, and utilizing alternative sources of energy is essential.

Chairman Lugar began the questions for the first panel by asking Under Secretary of State Eizenstat a number of questions relating to the estimates of atmospheric temperature rise during the next century, the control of wealth generated from the sale of carbon credits, and the cooperation of developing nations. Mr. Eizenstat said that the 1995 Report on Climate Change estimates a two and one half to six degree fahrenheit increase in atmospheric temperature during the next century. Also, he stated that there would be trading of carbon credits among nations governed by market forces; cooperation of developing nations will be gained by a variety of approaches, including education, as all of these countries are not the same. Senator Harkin was interested as to why Mexico and South Korea are considered to be "developed" by the OECD but not in accordance with Kyoto's definition and why Australia is exempt? The Under Secretary said that the Mexico and South Korea inconsistency must be worked out and the reason Australia is exempt is that it is entirely dependent on coal and it is a small emitter. Senator Craig asked what he would bring to the Senate for approval. Mr. Eizenstat said that it would be a document that would include the participation of the developing nations.

The Chairman concluded the questioning of this panel by asking what the interim plan has the Administration adopted. Mr. Eizenstat said that rules and procedures for emissions tracking are being developed in conjunction with intense diplomatic efforts to gain the cooperation of the developing countries. In addition, the President's budget includes provisions for energy conservation and r&d. Dr. Yellen added that the Administration is promoting energy efficiency and supports electricity restructuring. Finally, Senator Lugar asked the Under Secretary how the Kyoto agreement be amended. Mr. Eizenstat said that the protocol itself could not be amended in its current status although a supplemental could be drafted; after ratification, it could be amended under Article 20.

The questions directed to the second panel focused on the feasibility of the agriculture industry voluntarily cutting emissions now. The panelists were divided in their opinions with concerns raised about economic viability and credit not being forthcoming if the Kyoto accord is ratified. Mr. Kleckner strongly questioned the efficacy of the scientific data indicating a significant rise in atmospheric temperatures to offset economic and environmental concerns.

Prepared by: Phil Mandel

586-8820

WITNESS LIST

Panel 1

The Honorable Stuart E. Eizenstat
Under Secretary of State for Economic, Business
and Agricultural Affairs
U.S. Department of State
Washington, D.C.

The Honorable Richard Rominger
Deputy Secretary
U.S. Department of Agriculture
Washington, D.C.

The Honorable Janet L. Yellen
Chairperson
President's Council of Economic Advisors
Washington, D.C.

Panel 2

Dean Kleckner
President
American Farm Bureau Federation
Washington, D.C.

Fred Krupp
Executive Director
Environmental Defense Fund
New York, NY

Mary Novak
Senior Vice President
WEFA, Inc. [Wharton Econometrics]
Burlington, MA

Marty Strange
Senior Fellow
Center for Rural Affairs
Walthill, NE

Richard Rominger March 5, 1998

ORAL TESTIMONY--CLIMATE CHANGE

Mr. Chairman and members of the Committee, I welcome the opportunity to discuss the implications of global climate change and the Kyoto Protocol for U.S. agriculture and forests. A copy of my full statement has been submitted to the Committee for inclusion in the hearing record.

Climate is a major determinant of agricultural productivity, defining to a large extent where crops and forests are grown. Weather aberrations cause significant losses in agriculture and forests and can place a heavy burden on natural resources and the environment.

While the effects of climate change on agriculture have been estimated to be small in the aggregate for major crops, regional impacts could be quite large, and could be accompanied by significant increases in weather and yield variability. The most recent work shows that a doubling of CO₂ levels would result in a change in world cereal production on the order of +1 to -1 percent, assuming farmers and markets adjust to the changing climate. Without adaptation, cereal production could fall an estimated 18 to 29 percent. For the United States, recent studies show impacts ranging between +\$6 to -\$11 billion per year, with southern areas tending to

suffer from drier conditions while northern regions gain from longer growing seasons.

The effects on forests may be more significant than for agriculture, in part because effective climate adaptation is less possible due to longer growing cycles. Major displacements of current forest locations are projected, although there remains much uncertainty as to how fast climate will change and how that will shape regional impacts.

Under the Kyoto Protocol, the United States would be required to reduce greenhouse gas emissions by 7 percent from 1990 levels. Based on the Administration's initial estimates of an increase in energy prices of 3 to 5 percent, which excludes the positive effects of electricity deregulation, the likely impacts on U.S. agriculture will be modest. USDA plans to provide the Committee with a more complete analysis of the effects of the Kyoto Protocol on U.S. agriculture.

The Kyoto Protocol allows for a number of methods to lower the costs of achieving the targeted levels of greenhouse gas emissions. These include flexibility in what gasses are reduced, credit for actions that sequester carbon, international

trading of emissions, joint implementation and the Clean Development Mechanism. Costs can also be reduced with meaningful developing country participation, electric power deregulation, and various actions that improve technology and conserve energy. In my written statement, I illustrate some of the types of opportunities for U.S. agriculture that are likely to be generated by the Kyoto Protocol's flexible approach to reducing greenhouse gas emissions, notably carbon sequestration in forests and soils and the production of biomass as a substitute for fossil fuels.

USDA's current annual spending for climate change research is \$58 million. This supports a variety of research initiatives across many program areas, including the Forest Service, the Natural Resources Conservation Service, the Agricultural Research Service, the Cooperative State Research Education and Extension Service and the Economic Research Service. USDA's FY 1999 budget proposal requests an additional \$10 million for climate change research, of which \$6 million is for biomass research. While USDA has done work over the years on biomass, much of it has been financed by the Department of Energy's (DOE) ambitious program. The focus of USDA's initiative, developed in partnership with DOE, will be on improving the productivity of biomass crops such as herbaceous grasses and fast growing trees, harvest and processing systems, and conversion of cellulosic material

to fuels.

The enormous risks posed by climate change and the substantial challenge presented by Kyoto make it clear that USDA must escalate its level of activity in the area of global climate change. Consequently, the Department will soon advise the House and Senate Appropriations Committees that we are reorganizing our Global Change Program Office. The new Office will be located under the Office of the Chief Economist which reports directly to the Secretary and me. The new Director of the office will be Dr. Margot Anderson, a prominent natural resource economist. The Office will be responsible for coordinating the wide range of climate change activities across the Department, supporting the activities of the executive branch and working with the agricultural and rural communities to help them address the challenges of climate change and realize the opportunities that Kyoto will present.

Our goal is to ensure U.S. agriculture is well represented in climate change activities both within and outside of government. We will work closely with you and your staff on this important issue. That completes my testimony and I would be pleased to respond to questions.

**STATEMENT OF RICHARD ROMINGER
DEPUTY SECRETARY OF AGRICULTURE
BEFORE THE U.S. SENATE
COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY
March 5, 1998**

Mr. Chairman and members of the Committee, I welcome the opportunity to discuss the implications of global climate change and the Kyoto Protocol for U.S. agriculture and forests. I would like to begin with a discussion of how global climate change will likely affect U.S. agriculture and forests. I will then discuss the Kyoto Protocol's implications for agriculture and forests and the potential flexibility offered through carbon sequestration of forests and soils. I will also describe the Administration's FY 1999 budget proposal for climate change, with emphasis on the so-called biomass initiative. Finally, I will outline the Department's recent organizational actions to address climate change issues in the future.

The Impacts of Climate Change on U.S. Agriculture and Forests

Climate is a major determinant of agricultural productivity, defining to a large extent where crops are grown. Weather aberrations, floods, and droughts cause significant losses in agriculture and can place a heavy burden on natural resources and the environment. Federal agricultural programs fund research to develop and assess new practices and technologies, develop programs and know-how to reduce soil loss and erosion. Part of the Federal response is to offer crop insurance as a means to cope with financial losses when practices and technology fail to prevent physical losses. USDA and the National Weather Service (NWS) have also been intensely interested in ensuring availability of meteorological data, providing better monitoring and forecasts of short-term weather events. The NWS is attempting to develop the ability to provide useful forecasts in the 6-18 month range.

There are contradictory views about how long-term climate change may affect agriculture in the United States and around the world. One view is that the expected changes in temperature, as estimated by the Intergovernmental Panel on Climate Change, are small relative to what farmers see from day-to-day and season-to-season. Further, the change will occur slowly so choices among new farming practices and crop varieties will adjust to gradually changing climate with minimal disruption. The other view is, given that almost all of agriculture is sensitive to weather and climate and locally tuned to the long-term climatic average, any change in climate will necessarily be disruptive and costly.

While studies differ on the severity of impacts, the consensus is that climate change impacts are not likely to seriously disrupt the overall ability of the U.S. to be a major agricultural producer. However, some regional effects could be quite severe with dislocations in rural communities and relocation of production to other areas. There are likely to be winners and losers, but at this point we cannot identify who they might be. The risk of climate variability and extreme weather events are a potential threat to agriculture and efforts to mitigate greenhouse gas emissions can be seen as insurance for agriculture against these risks.

There is a connection between climate and forests as well. Climate defines forest and range systems in the long run. As climate changes, forest components change in response. Climate is known to have changed in the past with resultant changes in forest cover, type and location. All current climate model projections will result in significant migration of forests.

The greatest economic impacts on forest management result from weather occurrences grouped over periods of time, from days to weeks to months to years. For example, the severity and cost of forest fires are mainly determined by weather and fuel conditions. Vegetation

desiccated by drought and weather bringing low humidities and high winds combine to cause our most costly, severe and dangerous forest fires. Almost every aspect of forest management is heavily affected by climate variability and change.

Climate variability increases forest disturbances. After disturbances occur, forests may not return to their previous condition if the climate has changed or if invasive species gain a foothold and out-compete native vegetation. Regional variability in climate and resultant forest impacts will determine the environmental, social, and economic impacts, which may be positive in the long run but negative during rapid climate change. Unlike agricultural systems, forests grow over much longer time periods and are not amenable to year-to-year changes in species. Moreover, the economics of forest management prohibits some of the safeguards available to agriculture, such as irrigation.

A key determinant for the future of our forests will be the importance of growth and carbon sequestration enhancement from elevated carbon dioxide levels relative to negative impacts resulting from water and other climate-related stresses. Carbon, nitrogen, and other elements are cycled through forests and the atmosphere and are the primary indicator of forest productivity and health. Many processes important to forest health occur below ground, where 60 percent of forest carbon is stored. Forests and forest soils are the major terrestrial sink for actively sequestering carbon and removing carbon dioxide from the atmosphere. Healthy, well managed forests are a key factor in mitigation of carbon dioxide increases in the atmosphere. Conversely, negative climate change impacts on forests have the potential of limiting sequestration and increasing the release of stored carbon.

Forests and grasslands are of great economic, environmental and social importance. They react to many stresses and change constantly, with changes often occurring rapidly as a result of weather and climate impacts. Although forests are global in extent, they are basically regional in their make-up, history, use and value. We will require a regional perspective to understand the impacts of climate change in forests and to manage those impacts.

Despite the significant research effort on agricultural and forest impacts of climate change, there are several areas of remaining uncertainty. For example, while there is a strong consensus that human activities are affecting the global climate, scientists cannot provide a precise forecast of how climate will change at regional levels or over time. Also, more work is needed to understand and model the complex relationships of climate and carbon dioxide effects on biological functions of plants, soil microorganisms, insect prey and predators, and pathogens, as well as effects on physical resources, such as soil structure, river flows and snow melt, coastal inundation due to sea level rise. In addition, investigating in a comprehensive and compelling way the ability of farmers, plant breeders, water managers, forest managers and others to adapt and adjust to changing climate is an ongoing research effort. For example, how can farmers adapt when it is difficult to determine whether weather-related events such as the floods of the Red River last spring were part of normal variability or evidence of the onset of a period of more frequent and intense floods?

Quantitative studies have investigated the impacts of global warming based on widely available scenarios of climate change as modeled by 4 major general circulation models. A brief summary of the basic results follows.

Aggregate Effects

Agriculture. World production of cereals and of agricultural goods in general change very little, assuming that farmers and markets adapt to the changing climate, although regional effects could be quite different. The most recent work shows world cereal production to change on the order of +1 to -1 percent, without the direct effects of carbon dioxide which generally enhances crop growth. Without adaptation, cereal production falls an estimated 18 to 29 percent. Tropical agriculture is more severely affected than temperate agriculture, and developing countries would likely be more affected as adaptation is likely be more difficult than in developed countries. The poorest countries, those with per capita annual incomes below \$500, suffer the largest economic losses.

Forests. Major displacements of current forest locations are projected by all models. Impacts will vary by region, some positive, some negative. The biggest uncertainty is how fast climate will change and how that will shape regional impacts. Adaptation is not as hopeful for forests as agriculture. Forests grow over longer periods and are managed less intensively. Unlike crops planted and harvested annually, trees planted today must adapt to climatic conditions over the next 50 to 300 years. Temperate and boreal forests are likely to be more strongly affected than tropical forests. Climate change will be greater at the higher latitudes and the role of fire, insect outbreaks and other disturbances will be greater in those forests. Balancing this will be the greater potential for longer growing seasons and elevated carbon dioxide levels.

Regional Effects

Agriculture. At smaller scales, such as individual countries, states, or substate regions, there is not a consistent set of winners or losers across different climate scenarios, but as the scale

is reduced, the effects can be much larger than indicated by more aggregate scales. For example, crop studies show that wheat yields at some U.S. sites would essentially fail completely but could increase sharply in other areas. So while global food availability in the world does not appear threatened, the livelihoods of some farmers and regional economies are vulnerable without alternative economic opportunities. Moreover, adaptation would be particularly difficult in developing countries where producers would be limited in their ability to apply alternative technologies, crops and cropping systems. For the United States, recent studies show impacts ranging between +\$6 to -\$11 billion per year, with southern areas tending to suffer from drier conditions while northern regions gain from longer growing seasons.

Forests. Regional scale forest impacts also vary widely, with changes in water regimes the primary determinant in changing forest productivity. High elevation forests will be driven from their current habitats and will find migration difficult. Forests of regional importance, such as Vermont sugar maples, could migrate out of their current range.

Additional Effects

Agriculture and forests. Increasing carbon dioxide in the atmosphere directly benefits plant growth, but there is much scientific uncertainty about how large this gain will be under commercial production conditions. At doubled carbon dioxide levels, many crops register a 30-percent increase in yields under controlled conditions where there are no nutrient limitations. The realized productivity gain may be more on the order of 5 to 12 percent. We can also expect many physical changes but research has not quantified them or their economic impact. Insect pests and diseases may increase, water resources for irrigation will decline in some areas even as demand for water is increasing, flooding and severe weather may increase, intensity of droughts may increase,

soil erosion may increase due to more intense rainfall, coastal inundation or saltwater intrusion due to sea level rise may endanger production near coastal areas.

The above results reflect the best attempt to describe impacts quantitatively. Because of the uncertainties in the climate scenarios and the complex ways in which climate affects agricultural and forest production capacity--from effects on pests and soils to water resources and direct effects on plant growth--the quantitative impacts are illustrative of what could happen rather than forecasts of likely impacts.

Likely Effects of the Kyoto Protocol on Agriculture

USDA has not conducted an analysis of the effects of the Kyoto Protocol on U.S. agriculture. Based on the Administration's illustrative estimates of an energy price effect of 3 to 5 percent, which excludes the positive effects of electricity deregulation, the likely impacts on U.S. agriculture will be modest. Direct expenses on fuel and electricity account for about 5 percent of total farm production costs, while adding in indirect energy costs in fertilizers and chemicals raises energy costs to roughly 10 percent of total farm production costs. American farmers have become more energy efficient as new technologies and farming methods are developed. Since 1975, the amount of agricultural output produced by a unit of energy input has increased by more than 50 percent. Farmers use less fuel than they did 20 years ago because they use farming methods like no-till to reduce machinery use, and because farm equipment is more fuel efficient.

Forests are a prominent factor in the Kyoto protocol as an offset to carbon emissions. When trees and other biomass are removed from forests and new trees take their place, the net benefit for carbon sequestration depends on how much carbon is emitted by removal procedures, how long the carbon in the removed fiber remains out of the atmosphere, and how long the

regrown forest is left intact to sequester carbon. Forests become a source when carbon is rapidly lost to the atmosphere through fires and when forests are converted to other uses that are less effective at carbon sequestration. Forests are also a significant potential factor in both the joint implementation, Clean Development Mechanism and emissions trading arenas. Because forests are a key factor in overall carbon sequestration, opportunities to maintain or increase sequestration by forests are many.

Opportunities to Mitigate Greenhouse Gas Emissions

The Kyoto Protocol allows for a number of methods to lower the costs of achieving the targeted levels of greenhouse gas emissions. These include flexibility in what gasses are reduced, credit for certain actions that sequester carbon, international trading of emissions, joint implementation and the Clean Development Mechanism. Costs can also be reduced with meaningful developing country participation, electric power deregulation, and various actions that improve technology and conserve energy. I would like to illustrate some of the types of opportunities for U.S. agriculture that are likely to be generated by actions to reduce greenhouse gas emissions, notably carbon sequestration and the production of biomass as a substitute for fossil fuels.

Carbon Sequestration—Forests. Under the Kyoto agreement, certain forestry-related activities--afforestation, reforestation and deforestation--will be used to offset emissions targets. By way of perspective on the scope of the opportunity, increases in biomass and organic matter on U.S. forest lands over the past 40 years have stored the equivalent of 25 percent of U.S. carbon emissions during the period. Reforestation of harvested acres continues the sequestration process. Not only do forests sequester carbon while growing, many timber products continue to

sequester carbon. Of the carbon harvested in trees, most has been burned for energy or emitted to the atmosphere without producing energy for consumption, but an estimated 25 percent has remained in products and landfills.

The area of forest land has stabilized and there is every expectation that our forest resource will continue to be a net sink for carbon. We expect that future sequestration by U.S. forests will be substantial, but forest cover can also be increased and altered through forest management and thereby increase the role of forests in achieving the targeted reduction in emissions.

An obvious way of increasing carbon sequestration by forests is to increase tree planting. For example, converting 22 million acres of marginal cropland and pasture land in the South to forest would increase carbon accumulation by about 32 million metric tons per year--enough to offset about 3 percent of U.S. emissions of carbon dioxide. Other management practices that would contribute to carbon sequestration include:

- Replanting in order to fully stock poorly stocked forest land.
- Applying intermediate stand treatments to improve stand growth rates.
- Managing for longer rotation lengths.

Carbon Sequestration—Soils. Consensus has not been reached on the role of carbon sequestration in soils for the first reporting period under the Kyoto agreement. For agriculture, sequestration in soils is an important issue that needs more work because soil is a key storehouse for carbon. The principal strategy for increasing the use of soil as a carbon sink is to enhance and maintain high soil quality. Increases in soil carbon, commonly referred to as organic carbon, improve soil quality.

Soil conservation practices increase the soil organic matter content. Principal conservation strategies which sequester carbon include converting marginal lands to compatible land use systems, restoring degraded soils, adopting best management practices. For example, removing agriculturally marginal land from production and adopting an ecologically compatible land use, such as wildlife habitat, can lead to increases in total biomass production and an increase in carbon content in the soil.

USDA programs such as the Conservation Reserve Program (CRP), the Wetland Reserve Program (WRP) and the Secretary's conservation buffer strip initiative all help to improve soil quality and decrease atmospheric carbon. More importantly, though, are the advances in agricultural technologies for sustainable management of the soil, such as (1) conservation tillage, (2) management of crop residue and other organic materials, (3) soil fertility enhancements through site-specific management and nutrient cycling techniques, (4) elimination of summer fallow, (5) use of winter cover crops, and (6) other techniques that improve crop yields. The carbon sequestration potential of these practices in the United States is substantial.

USDA's conservation programs and many conservation practices available to and being used by farmers today represent a multifaceted opportunity in light of climate change. Adoption of appropriate conservation strategies lead to (1) carbon sequestration in soil, helping to mitigate greenhouse gas emissions, (2) improvement in soil quality, raising agronomic productivity and contributing to sustainable land use, and (3) enhancement of overall environmental quality, providing benefits of improved wildlife habitat, water quality and erosion reduction.

The President's Climate Change Budget Initiative—USDA's Role. The President's Climate Change Initiative is a \$6.3 billion dollar program of tax cuts and research and

development activities. Farmers will be able to benefit from the \$3.6 billion in tax reductions for purchases that reduce energy use and utilize renewable energy sources. In addition, USDA's climate change research program will identify a range of new opportunities for farmers and rural areas. Current annual spending for climate change research is \$58 million. This supports a variety of research initiatives across many program areas, including the Forest Service, the Natural Resources Conservation Service, the Agricultural Research Service, the Cooperative State Research, Education, and Extension Service and the Economic Research Service. USDA's FY 1999 budget proposal requests an additional \$10 million for climate change research, of which \$6 million is for biomass research. While USDA has done work over the years on biomass, much of it has been financed by the Department of Energy's (DOE) ambitious program. The focus of USDA's initiative, developed in partnership with DOE, will be on improving the productivity of biomass crops such as herbaceous grasses and fast growing trees, harvest and processing systems, and conversion of cellulosic material to fuels.

Biomass crops are being promoted as feedstocks for the production of electric power, liquid fuels, and other bioproducts, such as chemicals. Biomass feedstocks have environmental advantages compared with fossil fuels. For example, they would not add greenhouse gasses to the atmosphere during their life cycle. These crops might be grown on fragile lands and could perform other environmental tasks such as the filtration of fertilizer and pesticide runoff. Research suggests that yields of biomass crops such as poplar, willow, and switchgrass could be increased significantly. If new generation efficient gasification systems and turbines were developed for power production and cellulosic conversion technologies to make ethanol, biomass might become competitive with fossil fuels as an energy source. Such a development would

benefit farmers by adding energy crops to traditional food and fiber production. Rural communities would benefit from jobs created by biomass production and utilization.

Initial feasibility work by DOE, USDA, and the Environmental Protection Agency examined the long-run domestic prospects for the use of commercial biomass energy crops in electricity generation, using a unique set of optimization models of the agriculture, forestry, and electricity utility sectors. In the most optimistic scenario, it was assumed that, through research and development, energy crop yields could be dramatically improved and biomass-fired electricity generation technologies could be engineered to compete favorably against fossil technologies, and that fossil fuel prices rise modestly over the next 25 years. Under these assumptions, it was estimated that biomass grown on some 40 million acres could account for some 10 percent of all fuel used in electricity generation, displacing about 90 million metric tons of carbon emissions annually by 2025. A domestic biomass industry of this magnitude could provide roughly 20 percent of the cumulative reductions needed to stabilize emissions at 1990 levels over the entire 2000-2025 period.

Some low-cost biomass production and biomass wastes, such as wood, make a niche biomass power industry possible now. Successful biomass research programs, rising fossil fuel prices, or biomass incentive policies could expand the biomass industry. However, our optimistic U.S. biomass analysis assumes that improved production, harvesting, delivery, and utilization systems are in place. Much hard engineering, organizational, and research work will be required to demonstrate the workability of these systems. Future biomass farmers and processors need to see practical and successful demonstration projects on the ground before they begin to participate

on a large scale. That is why the Department is cooperating with DOE on "Biomass Power for Rural Development" projects in Iowa, Minnesota, and New York to do just that.

One agriculturally based renewable fuel already contributing to the environment today is ethanol, which reduces greenhouse gasses relative to petroleum use. The Administration supports extension of the ethanol tax exemption to 2007. Extension would foster development of biomass ethanol technology, helping to increase the emission reduction benefits of ethanol.

Global Climate Change Program Office

The enormous risks posed by climate change and the substantial challenge presented by Kyoto make it clear that USDA must escalate its level of activity in the area of global climate change. Consequently, the Department will soon advise the House and Senate Appropriations Committees that we will be reorganizing our Global Change Program Office. The new Office will be located under the Office of the Chief Economist which reports directly to the Secretary and me. The new Director of the office will be Dr. Margot Anderson, a prominent natural resource economist. The Office will be responsible for coordinating the wide range of climate change activities across the Department, supporting the activities of the executive branch and working with the agricultural and rural communities to help them address the challenges of climate change and realize the opportunities that Kyoto will present.

Our goal is to ensure U.S. agriculture is well represented in climate change activities both within and outside of government. Our new office plans to work closely with you and your staff. That completes my testimony, and I would be pleased to respond to questions.

Statement of
Stuart E. Eizenstat
Under Secretary of State
for Economic, Business and Agricultural Affairs
before the
House Science Committee
March 5, 1998

Thank you, Mr. Chairman.

At the outset, let me thank those members of Congress, in this chamber and in the Senate, who participated with us in the Kyoto Conference and who lent their advice and support to our efforts there. Rarely has there been an environmental issue more important or complex than global warming, and rarely has there been a greater need for the Executive Branch and the Congress to work closely together.

It is with great pleasure that I appear here today to explain the Administration's position on global warming. To this end, I will divide my testimony into four parts: (1) a short discussion of the science – the driving force for all the efforts we have taken to date to mitigate a significant and growing global environmental problem; (2) a discussion of the results of the recent Kyoto Conference and key features of the Kyoto Protocol; (3) an effort to correct misperceptions; and (4) a brief review of the President's Climate Change Technology Initiative. I hope to leave you with a clear understanding of why we believe that it is necessary to act, of how we intend to proceed internationally, and of what the President plans to do here at home.

The Science

Human beings are changing the climate by increasing the global concentrations of greenhouse gases such as carbon dioxide, methane and nitrous oxide. Burning coal, oil and natural gas to heat our homes, power our cars and illuminate our cities produces carbon dioxide and other greenhouse gases as by-products – more than 6 billion metric tons worth of carbon in the form of carbon dioxide annually. Similarly, deforestation and land clearing also release significant quantities of such gases – another 1 to 2 billion tons a year. Over the last century, greenhouse gases have been released to the atmosphere faster than natural processes can remove them. There is no ambiguity in the data; since 1860, concentrations of carbon dioxide have risen 30 percent, from 280 parts per million (ppm) to 365 ppm.

In December 1995, the authoritative Intergovernmental Panel on Climate Change (IPCC), representing the work of more than 2,000 of the world's leading climate change

scientists from more than 50 countries, concluded that "the balance of evidence suggests that there is a discernible human influence on global climate."

The IPCC Assessment represents the best synthesis of the science of climate change. It concludes:

- Concentrations of greenhouse gases could exceed 700 ppm by 2100 under "business as usual" — levels not seen on the planet for 50 million years. The projected temperature increase of 2 to 6.5 degrees Fahrenheit over the next 100 years, could exceed rates of change for the last 10,000 years. For perspective, while there is some uncertainty, tropical sea surface temperatures in the last ice age were anywhere from 2 to 9 degrees Fahrenheit cooler than today.
- Increased temperatures are expected to speed up the global water cycle and exacerbate weather extremes. Faster evaporation will lead to a drying of soils and in some areas increased drought. Overall, however, due to the faster global cycling of water, there will be an increase in precipitation.
- Sea levels are expected to rise between 6 and 37 inches over the next century. A 20 inch sea level rise could double the global population at risk from storm surges — from roughly 45 million to over 90 million, even if coastal populations do not increase. Low-lying areas are particularly vulnerable (e.g., much of coastal Louisiana and the Florida Everglades).
- Human health is likely to be affected. Warmer temperatures will increase the chances of heat waves (like the Chicago event in 1995 that killed over 400 people) and can exacerbate air quality problems such as smog, and lead to an increase in allergic disorders. Diseases that thrive in warmer climates, such as dengue fever, malaria, yellow fever, encephalitis, and cholera are likely to spread due to the expansion of the range of disease carrying organisms. By 2100, there could be an additional 50-80 million cases of malaria each year.
- Agriculture, forests, and natural ecosystems are also likely to be affected. The poorest countries, already subject to food production and distribution problems, will likely suffer the greatest agricultural impacts. Doubling current carbon dioxide concentrations could lead to a dramatic change in the geographic distribution of one-third of the Earth's forests. (For example, the ideal range of some North American forest species would shift by as much as 300 miles to the north in the next 100 years — far faster than their ability to migrate on their own.) Such changes could have profound effects on parks and wildlife refuges, and lead to a reduction in species diversity.

What Changes Have We Seen to Date?

The earth's temperature is increasing: Scientists from our National Oceanic and Atmospheric Administration (NOAA), the U.K. Meteorological Office and the National Aeronautics and Space Administration (NASA) all recently announced that 1997 was the warmest year on record. In fact, nine of the last 11 years are among the warmest ever recorded.

The water cycle of the planet may be speeding up: Since the beginning of the century, NOAA estimates that precipitation in the United States has increased by about 5 - 10 percent, while the frequency of heavy downpours (where more than 2 inches fall in a day) has increased by about 20 percent. The United States has had many recent reminders of how costly extreme events can be: the Mississippi flooding of 1993 led to damages of between \$10 and \$20 billion; the Southern Plains drought of 1996 was estimated to cost \$4 billion; and the Northwest floods of 1996-97 about \$3 billion. We have yet to learn what the current floods in California will cost. While no single event can be attributed to global warming, increases in floods and droughts are expected as global warming occurs.

Action Needed Now

Some have argued that we can wait to act until all the details of the climate system have been fully understood. The science tells us that this is a recipe for disaster. We will only fully confirm predictions when we experience them. At that point it will be too late. The concentrations of greenhouse gases in the atmosphere continue to rise each year, and because these gases will persist for many decades to centuries, this problem is only slowly reversed. The earth will continue to warm and the seas continue to rise as long as we continue to load the entire atmosphere of the earth with greenhouse gases. The problem has developed over the course of a century and it will take many decades to solve. Already, we have another 1.0 degree Fahrenheit of warming in the pipeline from emissions that have previously occurred, so some impacts will happen no matter what actions we take. Nevertheless, we can still forestall many others if we begin taking cost-effective actions now.

We should look at the Kyoto Protocol as an insurance policy against the potentially devastating and irreversible impacts of global warming. This insurance policy is fully justified today, based solely on our current understanding of the science. If we act now the premium will be far more reasonable than if we delay and hope the problem created by greenhouse gases will go away. It is like a life insurance policy whose costs grow significantly if we delay year after year insuring ourselves.

But there is a critical difference in the case of the climate system. In most insurance policies, the loser can be made whole -- restitution is possible; the building can be rebuilt, the stolen car replaced, the fire or flood damage repaired. In the case of global

warming, we will not have a second chance -- failure to act will lead to irreversible consequences. We will be committing ourselves, our children and our grandchildren to a very different planet, and they will never forgive us.

But the premium for this insurance policy must be reasonable. For this reason we rejected unrealistic targets in Kyoto; we insisted on full recourse to market-mechanisms; and we opposed mandatory policies and measures -- like carbon taxes.

The totality of our scientific information, including that on vulnerability and impacts of global warming, provides a compelling reason to act.

Let me now turn to the recent Kyoto Conference.

Kyoto Protocol

Last December in Kyoto, Japan, the nations of the world reached agreement on an historic step to control greenhouse gas emissions which cause global warming. No sooner had the negotiating session ended, however, than some critics on both ends of the political spectrum, without a full examination of the results achieved, denounced the agreement as either too little too late or too much too soon. In fact, the Kyoto Protocol, reached only through the exercise of vigorous American leadership, represents an important achievement in the best interests of the United States. But it is a framework for action, a work in progress, not a finished product ready for Senate consideration.

U.S. Negotiating Objectives

In order to secure an effective agreement that is environmentally strong and economically sound, while protecting the unique worldwide interests of the U.S. military, President Clinton and Vice President Gore established three major objectives. As a result of the Kyoto negotiations, we achieved the first two -- realistic targets and timetables for reducing greenhouse gas emissions among the world's major industrial nations, which fully protect the unique role of our military in its global reach; and flexible market-based mechanisms for achieving those targets cost-effectively. The third, meaningful participation of developing countries, will be the focus of our work in the coming months and years, but with the Kyoto Protocol we have made an important down payment.

Elements of the Kyoto Protocol and Related Decisions

Our first objective -- realistic targets and timetables among developed countries -- had to be a credible step in reducing the dangerous buildup of greenhouse gases, yet measured enough to safeguard U.S. prosperity at home and competitiveness abroad. In the end, we secured the key elements of the President's proposal on targets and timetables, often over the initial objections of the European Union and other developed countries. The agreement and related decisions include:

- The U.S. concept of a multi-year time frame for emissions reductions rather than a fixed, single-year target. The multi-year time frame will allow the United States, other nations and our industries greater flexibility in meeting our targets. 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.
- The U.S. specific time frame of 2008-2012, rather than earlier periods preferred by the European Union and others, giving us more time to phase in change gradually and deploy new technologies cost-effectively, and thereby to cushion the effects on our businesses and workers.
- Differentiated targets for the key industrial powers ranging from 6% to 8% below baseline levels (1990 and 1995) of greenhouse gas emissions, with the United States agreeing to a 7% reduction. When changes in the accounting rules for certain gases and offsets for activities that absorb carbon dioxide are factored in, the level of effort required of the United States is quite close to the President's original proposal to return emissions to 1990 levels by 2008-2012, representing at most a 3 percent real reduction below that proposal, and perhaps less.
- An innovative proposal shaped in part by the United States, allowing certain activities, such as planting trees, that absorb carbon dioxide – called “sinks” – to be offset against emissions targets. This will both promote cost-effective solutions to climate change and encourage good forestry practices. As a major forestry nation this will be of special benefit to the United States.
- As proposed by the United States, the Kyoto Protocol covers all six significant greenhouse gases even though the E.U. and Japan proposed and fought until the last moment to cover only three. This was an important environmental victory – also supported by many in our own industry – because gases that other countries wanted to omit and leave uncovered (including substitutes for the now banned chloro-fluorocarbons that endanger the ozone layer) are among the fastest growing and longest lasting greenhouse gases.

Flexible Market Mechanisms

Our second broad Presidential objective was to make sure that countries can use flexible market mechanisms to reach their targets rather than the mandatory “policies and measures,” such as carbon taxes, favored by the E.U. and many other developed countries.

The Kyoto Protocol enshrines a centerpiece of this U.S. market-based approach – the opportunity for companies and countries to trade emissions permits. In this way, companies or countries can purchase less expensive emissions permits from companies or countries that have more permits than they need (because they have met their targets with room to spare). This is not only economically sensible, but environmentally sound. By finding the least expensive way to reduce emissions, we will be providing a strong incentive for achieving the maximum level of emissions reductions at the least cost. The United States has had a very positive experience with permit trading in the acid rain program, reducing costs by 50 percent from what was expected, yet fully serving our environmental goals.

This was a new concept for developed and developing countries alike – some of whom fought it vigorously. But we have it firmly enshrined in the Kyoto Protocol and it is a critical way of ensuring cost-effective solutions. Its inclusion was a major victory for us.

We went even further by achieving a conceptual understanding with several countries, including Australia, Canada, Japan, New Zealand, Russia and Ukraine, to trade emissions rights with each other. This 'umbrella group' could further reduce compliance costs.

Ensuring that we can meet our target reductions cost-effectively will depend significantly on access to the flexibility mechanisms we fought hard to include in the Kyoto Protocol. Let me be very clear: The commitment we made in Kyoto would not have been made – could not have been made – were it not for the flexibility mechanisms that were also agreed there. Until we are satisfied with the rules and procedures yet to be established, the promise of Kyoto will never be realized. The importance of emissions trading was emphasized by CEA Chairman Yellen in her recent statements.

Meaningful Participation of Developing Countries

Our third objective was to secure meaningful participation of key developing countries, a concern that I know you, Mr. Chairman, and members of Congress obviously share, as evidenced by last summer's Byrd-Hagel resolution in the Senate. Global warming is, after all, a global problem which requires a global solution – not only from the developed world but also from key developing countries.

Per capita emission rates are low in the developing world and will remain so for some time, and over 70 percent of today's atmospheric concentrations of greenhouse gases attributable to human activities are the result of emissions by the industrialized world. At the same time, it is also true that by around 2015 China will be the largest overall emitter of greenhouse gases, and by 2025 the developing world will emit more

greenhouse gases in total than the developed world. So from an environmental perspective, this problem cannot be solved unless developing countries get on board.

We encountered significant resistance in Kyoto by some developing countries to meaningful participation in solving the global warming problem. For example, we had sought to include a specific process through which advanced developing or newly developed countries could take on quantified emission limitation commitments and thereby take part in the international emissions trading regime. While a number of developing countries expressed interest in our proposal and supported it in Kyoto, others rejected it, and it was not possible to include such a specific process in the Protocol. Still, developing countries may nevertheless, as a prerequisite for engaging in emissions trading, voluntarily assume binding emissions targets through amendment to the annex of the Protocol that lists countries with targets.

Some developing countries believe – wrongly – that the developed world is asking them to limit their capacity to industrialize, reduce poverty and raise their standard of living. We have made clear that we support an approach under which developing countries would continue to grow – but in a more environmentally sound and economically sustainable way, by taking advantage of technologies not available to countries that industrialized at an earlier time.

The Kyoto agreement does not meet our requirements for developing country participation. Nevertheless, a significant down payment was made in the form of a provision advanced by Brazil and backed by the United States and the Alliance of Small Island States. This provision defines a "Clean Development Mechanism," which embraces the U.S.-backed concept of "joint implementation with credit." The goal is to build a bridge – with incentives – between developed, industrialized countries, and developing nations. This new mechanism will allow companies in the developed world to invest in projects in countries in the developing world – such as the construction of high-tech, environmentally sound power plants – for the benefit of the parties in both worlds. The companies in the developed world will get emissions credits at lower costs than they could achieve at home, while countries in the developing world will share in those credits, and receive the kind of technology that can allow them to grow without ruining their environment.

The Clean Development Mechanism has great potential, but developing countries will need to do more in order to participate meaningfully in the effort to combat global warming. In determining what developing countries ought to do, we should be aware that the circumstances of developing countries vary widely, along a kind of continuum. Some today are very poor; their greenhouse gas emissions are negligible and are likely to remain so for the foreseeable future. Others, whose greenhouse gas emissions are not substantial, are relatively well off. Some are poor on a per capita basis, but their greenhouse gas emissions today rival or surpass those of the most advanced industrialized nations. Still others have already joined ranks with the industrialized world in the OECD

but have not yet fully accepted the added responsibility for protection of the global environment that comes with their new status.

Any 'one-size-fits-all' approach to the 'meaningful participation of developing countries' and to satisfy the Byrd-Hagel Resolution is thus unlikely to prevail. We found in Kyoto that even among the industrialized countries it was necessary to recognize the individual national circumstances faced by those differently situated in order to reach agreement, notwithstanding our common purpose. Similarly, any uniform, inflexible approach to the 'meaningful participation of developing countries' is unlikely to prevail.

As Senator Byrd said in his letter of December 15, 1997, to the President, and recently restated on January 29 in the Senate:

"...binding commitments for developing nations should be paced according to the ability of each country to achieve greenhouse gas emission limitations appropriate to its national circumstances and economic growth. These limitations could be gradually implemented. Whether such commitments are in fact appropriate and represent best effort by each nation, will not be difficult to discern. As the saying goes, we will know it when we see it."

Recognizing our "common but differentiated responsibilities and respective capabilities" it will be necessary to develop an approach that provides for a meaningful global response to the threat of global warming, while acknowledging the legitimate aspirations of developing countries to achieve a better life for their peoples. To succeed, we will need to ensure that those responsible for a significant share of global emissions accept their responsibility to protect the global environment. We will also need to ensure that those who are able to do so contribute according to their capacities and stage of development.

Some Misperceptions

Before moving on, Mr. Chairman, let me address a few specific points on which I believe there may be some misperceptions. The first of these is that the Kyoto Protocol will damage our national security or imperil the ability of our military to meet its worldwide responsibilities - this is not true.

We took special pains working with the Defense Department and the uniformed military before and in Kyoto to protect the unique position of the United States as the world's only superpower with global military responsibilities. We achieved everything they outlined as necessary to protect military operations and our national security.

At the Kyoto Conference, uniformed military representatives from the Joint Chiefs of Staff and the Office of the Deputy Under Secretary of Defense for

Environmental Security provided guidance to the delegation as we considered this issue. In the end, the Parties took a decision to exempt key overseas military activities from emissions targets, including exemptions for "bunker fuels" (those used in international aviation and maritime transport) and for emissions resulting from a wide range of multilateral operations, such as peacekeeping and humanitarian relief. This exempts from our national targets not only multilateral operations expressly authorized by the U.N. Security Council (such as Desert Storm or Bosnia), but also multilateral operations that the United States initiates pursuant to the U.N. Charter without express authorization (such as Grenada). Countries may also decide among themselves how to account for emissions relating to multilateral operations (e.g., U.S. training in another NATO country) without going through emissions trading. If any other measures to preserve our national security interests are required, and there do not appear to be any, they can be addressed through future implementing legislation. As Secretary of Defense Cohen wrote in a letter of February 24, 1998, to Congressperson Bachus, "Based on achieving our international objectives, the Department is fully satisfied with the Kyoto results."

Second, it has been suggested that the Protocol will create a super U.N. Secretariat that will threaten U.S. sovereignty and national decision-making through alleged intrusive verification procedures and prior approval of individual emissions trades. That is not so. The review process contained in the Protocol largely codifies the existing practice under the 1992 Framework Convention, to which the United States is a Party. Under the Protocol, small expert review teams will continue to visit Annex I countries for brief periods to review implementation of the Convention and of the Protocol. The review process is intergovernmental, in that experts are nominated by governments. The review teams meet with government officials, and with others by invitation. In reviews under the Convention, the teams have met with Congressional staff, representatives of the private sector and representatives of environmental organizations – but only with their concurrence. Any other visits, such as site visits, would take place only if approved by the host country and, if the private sector is involved, the relevant interested persons. It is important to emphasize that no one can come onto the private property of a U.S. citizen without that individual's express approval and consent. To date under the Convention, no site visits have taken place.

In addition, let me be unmistakably clear – while trading rules must be established internationally to have emissions trading work – as our SEC must set rules for equity trading – we will not accept nor do we anticipate an approach that would require prior approval of individual emissions trades by an international body. Trading will be done between interested nations and their companies, based on market principles.

Concerns have also been raised that the Protocol is flawed, on the one hand because it will threaten U.S. sovereignty by dictating national decisions on implementation and, on the other hand, because it lacks mechanisms to verify compliance. In fact we believe that the Protocol strikes an appropriate balance between these two extremes.

- ◆ The United States firmly opposed mandatory, harmonized policies and measures that would be imposed upon us in order to reach our target. We prevailed. The Protocol leaves Parties entirely free to decide how best to meet their targets based on national circumstances.
- ◆ At the same time, we could not tolerate a free-for-all where Parties might or might not meet their commitments, particularly given the conscientious way the United States meets its international obligations. As a result, the Protocol calls for national measurement of emissions, detailed reporting, and in-depth reviews – on an intergovernmental basis.
- ◆ The one area where we believe more work needs to be done is in identifying appropriate consequences for non-compliance; the Protocol provides for elaborating such consequences, with any binding consequences to be done in amendment form, so that the Senate would have the opportunity to approve them.

Finally, some have suggested that the Protocol will result in a huge government transfer of foreign aid to Russia in which we will give away taxpayer money with no leverage on Russian policies with these funds. This also is not true. Under the Protocol's emissions trading provisions, we envision that U.S. private sector firms may choose to purchase international emissions credits in order to meet their emissions obligations. Indeed, the private purchase of emissions credits is one of the crucial ways to achieve cost-effective emissions reductions for U.S. firms.

As with any market transaction, purchases of these credits will have to comply with all U.S. legal and regulatory requirements. In addition, U.S. firms interested in international investment will have an incentive to ensure that other countries meet the international standards for adequate monitoring and reporting of their emissions of greenhouse gases. At the same time, Russia will have significant incentives to use the revenue generated to invest in the most modern, climate-friendly plants and equipment so that, as its economy recovers, it continues to produce emissions credits that it can sell on international markets.

Framework for Action

Where do we go from here? While historic, the Kyoto Protocol is only one step in a long process. It is, in essence, a framework for action, a work in progress, and a number of challenges still lie ahead. We anticipate signing the Protocol within the one-year period provided for in the agreement, which runs from March 1998 to March 1999. We have not, as yet, determined the precise timing due to tactical considerations. We will sign at a time that makes the most sense in terms of the overall diplomatic situation.

In that diplomatic context, rules and procedures must be adopted to ensure that emissions trading rights, joint implementation and the Clean Development Mechanism operate efficiently and smoothly. The Kyoto Protocol establishes emissions trading, but leaves open the specifics of operations. We will work hard to ensure that the rules and procedures adopted enable emissions trading, joint implementation and the Clean Development Mechanism to work smoothly and efficiently, thereby encouraging the private sector to engage.

We will also work closely with our industries to be sure they are satisfied that the emissions trading system which is developed is as efficient and effective as possible to meet their needs.

Most significant, we must work to secure the meaningful participation of key developing countries. We must be creative in initiating bilateral agreements. We have made a promising start with an agreement we reached with China during last fall's Summit. We must also use regional and multilateral fora to achieve our objectives -- such as the Summit of the Americas process, in the Asian Partnership for Economic Cooperation (APEC) process, the President's forthcoming trip to Africa, and the G-8 Summit in the United Kingdom. We will put on a full court diplomatic press to bring developing nations into a meaningful role in helping solve the global climate challenge. We will accept nothing less, nor would we expect the United States Senate to do so. As the President has indicated, the United States should not assume binding obligations under the Protocol until key developing countries meaningfully participate in meeting the challenge of climate change. Although the Kyoto Protocol was an historic step forward, more progress is necessary with respect to participation of key developing countries. It would be premature to submit the treaty to the Senate for its advice and consent to ratification at this time.

The Administration also plans to continue to work with the international financial institutions to promote market-based energy sector policies in developing countries that will help reduce developing country greenhouse gas emissions. Multilateral development bank policies, including those of the Global Environment Facility, strongly influence international lending and private capital flows for energy, industrial and transportation investments. Policies that favor market pricing, privatization, clean technologies and environmentally-friendly approaches will make implementing the Kyoto Protocol easier and will speed the growth of markets for new technologies that help reduce emissions in developing countries. We will work with the international financial institutions themselves -- from the World Bank to the regional development banks -- and with other countries, especially developed countries, to achieve these goals in the coming years.

The Kyoto agreement does not solve the problem of global warming, but it represents an important step in dealing with a problem that we cannot wish away. A premature decision to reject the Protocol would deprive us of the opportunity to complete

its unfinished business. If we fail to take reasoned action now, our children and grandchildren will pay the price.

Mr. Chairman, before turning briefly to our domestic efforts, let me note two other key elements in this equation – the contributions that the United States provides to carry out work under the U.N. Framework Convention on Climate Change and in the Intergovernmental Panel on Climate Change (IPCC), as well as the contributions that we make to the Global Environment Facility (GEF). For FY 1999, the President has requested \$314 million for the International Organizations and Programs Account, a level that represents a 6.6 percent increase over FY 1998. This amount includes \$8 million for the Climate Stabilization Fund which supports the Framework Convention and the IPCC. Parties to the Convention have much work ahead of them, as I have already noted. In addition, the IPCC has now embarked on its Third Assessment Report of Climate Change, scheduled for completion in late 2000 or early 2001. These funds are vital to ensuring U.S. leadership in both of these organizations and to ensuring that our views and the work of our scientists are taken fully into account.

In addition, the President has requested \$300 million to meet our past and current pledges to help fund the Global Environment Facility (GEF). The GEF helps developing countries act to protect the global environment in several key focal areas including international waters, biodiversity, climate change and depletion of the stratospheric ozone layer. If we want to bring developing countries on board with real commitments to limit greenhouse gas emissions, we need to demonstrate that we are a reliable partner by supporting their concrete efforts with reliable resources. At this point, our GEF shortfall damages U.S. credibility in promising to help developing countries meet the climate change obligations we are urging that they undertake. I would therefore urge the Congress to fund fully our \$300 million request, to meet our current pledge and also clear our substantial shortfall of nearly \$200 million.

President's Climate Change Technology Initiative

In his State of the Union address, President Clinton said that global warming is "the gathering crisis that requires worldwide action." We need to begin now to launch the sensible, cost-effective efforts that will help us avoid the high future cost of inaction.

The President last October outlined a three-stage approach to addressing climate change at home. The first stage consists of immediate actions to stimulate development and use of technologies that can minimize the cost of meeting U.S. goals in reducing greenhouse gas emissions. Stage two will review options created through ongoing technology development and lead to detailed plans for a domestic, market-based permit trading system for carbon emissions. Stage three will begin to implement a market-based emissions-trading system.

As a first installment on this plan, President Clinton announced in his State of the Union message two weeks ago his proposal for a \$6.3 billion Climate Change Technology Initiative over five years to cut U.S. greenhouse gas emissions -- \$1.3 billion higher than the President announced in his initial plan in October. This vigorous initiative calls for tax cuts coupled with research and development (R&D) to take cost-effective, practical steps that will position us well to meet the challenge we face early in the next century.

This initiative consists of two parts -- \$3.6 billion in tax credits for energy-efficient purchases and renewable energy, and \$2.7 billion in new R&D spending over five years.

The tax package includes tax credits of \$3,000 to \$4,000 for consumers who purchase advanced technology, highly fuel efficient vehicles. It provides a 15 percent credit (up to \$2,000) for purchases of rooftop solar electricity and hot water systems to provide incentives for meeting the Million Solar Roofs goal. It also includes a 20 percent credit (subject to a cap) for purchasing energy-efficient building equipment, a \$2,000 credit for purchasing energy efficient new homes, extension of the wind and biomass tax credit, and a 10 percent investment credit for the purchase of combined heat and power systems.

The R&D component covers the four major carbon-emitting sectors of the economy (buildings, industry, transportation and electricity), plus carbon removal and sequestration, Federal facilities, and cross cutting analysis and research. Examples of this R&D effort include the Partnership for a New Generation of Vehicles (PNGV), a government-industry effort to develop affordable cars that meet all applicable safety and environmental standards and get up to three times the fuel efficiency of today's cars. In 1999, the President's budget for PNGV is \$277 million, up from \$227 million appropriated for 1998. Our PNGV effort is clearly paying off-- the developments about higher mileage cars announced by the Big Three last month were assisted by research supported under PNGV. It is exciting to see our U.S. automakers already planning for the cars of the future, not as pipe dreams but as achievable greenhouse gas friendly products.

As General Motors Chair and CEO John F. Smith said recently in announcing GM's plans to step up research spending and focus on bringing new products to market, "No car company will be able to thrive in the 21st century if it relies solely on internal combustion engines." And as William C. Ford, Jr., Chair of Ford's Finance Committee, also said in announcing that Ford will join with Daimler-Benz of Germany in developing cars with fuel-cell engines, "There's a compelling business case to be made."

Similar government-industry efforts are proposed to develop cleaner, more efficient diesel engines for both light trucks and heavy trucks. The R&D effort also includes expanded research partnerships for key renewable technologies such as wind, photovoltaics, geothermal, biomass, and hydropower to accelerate price reductions and

improve performance. The President's 1999 budget proposes a \$100 million increase in appropriations for solar and renewable energy R&D - a 37 percent increase over 1998.

We hope that the Congress will view the President's initiative favorably and appropriate the funds and enact the tax incentives that he has requested. We look forward to working with you to put the President's proposals into action.

The President and his Administration are committed to working with you in the Congress, both to realize the potential of the Climate Change Technology Initiative and to craft the ongoing U.S. approach to climate change. The United States has the power to lead the global effort, and Congress holds the key. What is done or not done today will determine the kind of world we will leave to future generations and the conditions of life they will face.

Sustained Effort Required

Mr. Chairman, I have mentioned that Kyoto produced a framework for future action, and I have listed a number of the steps that await us.

Coming to grips with the threat of global warming is no small task. We must tackle it in a vigorous, sober and determined manner, understanding that it represents a challenge but also an opportunity. And as we have always done in the face of global challenge, we must assume the responsibilities of American leadership.

Thank you.

**TESTIMONY OF DR. JANET YELLEN
CHAIR, COUNCIL OF ECONOMIC ADVISERS
BEFORE THE U.S. SENATE
COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY
ON THE ECONOMICS OF THE KYOTO PROTOCOL
MARCH 5, 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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**ORAL TESTIMONY OF DR. JANET YELLEN
CHAIR, COUNCIL OF ECONOMIC ADVISERS
BEFORE THE HOUSE COMMERCE COMMITTEE
ON THE ECONOMICS OF THE KYOTO PROTOCOL
MARCH 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 long 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. In my testimony today, I will attempt to identify key elements of the agreement and the Administration's policy, such as international emissions permit trading, meaningful developing country participation, the inclusion of land-use activities that absorb carbon ("sinks") and six categories of gases, as well as domestic initiatives, that can ensure that reductions in global greenhouse gas emissions are consistent with continued strong economic growth.

Effects of Climate Change

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. As a result of the increased concentration of greenhouse gases, 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. The IPCC reports that a doubling of carbon dioxide

levels would lead to approximately 10,000 additional deaths per year for the current U.S. population from higher summer temperatures, even after netting out the effects of warmer winters and acclimatization. The IPCC also predicts sea level increases of about 20 inches by 2100, with greater increases in subsequent years. Despite the difficulties of deriving quantitative assessments of the damages from climate change, researchers have nonetheless developed monetary estimates of damages that prompt substantial concern, and range in tens of billions of dollars per year for temperature changes projected to occur in the next century. If left uncontrolled, disruption of the Earth's climate may thus pose substantial costs in terms of harm to commerce and the environment alike. These costs--and they are significant--provide the primary motivation for actions to reduce greenhouse gas emissions.

These estimates do not, and cannot, accurately reflect the value of reducing the unknown risk of large-scale and potentially irreversible events with potentially catastrophic consequences, such as warming of the Northern tundra sufficient to release very large amounts of methane from the permafrost and thereby leading to accelerated warming. There is thus a strong argument for the Kyoto Protocol as a form of insurance against a serious environmental threat.

Kyoto Protocol

To address climate change, 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. 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.

In taking action to reduce emissions, economic analysis suggests that two elements are absolutely essential: the effort must be flexible and market-based, to ensure that we reduce emissions in the most efficient way; and the effort must be global, for without global emissions reductions the effort would be ineffective. The nature of the climate change problem--that

greenhouse gas emissions have the same effect on the climate regardless of how, where, and, within limits, when they occur--suggests three basic approaches to lower the cost of achieving given levels of environmental protection. We term these "when", "what", and "where" flexibility.

As a result of U.S. diplomatic efforts, all three forms of flexibility are broadly reflected in the Kyoto Protocol. The choice of a multi-year budget period, ending later than many countries proposed, with allowance for "banking" of emissions reductions, constitute key elements of "when flexibility." These provisions mitigate costs by permitting reductions at times when they are less rather than more costly. The inclusion of all six greenhouse gases and certain sink activities that promote removal of carbon from the atmosphere provide substantial "what flexibility". The U.S. succeeded in having the Kyoto Protocol stipulate that countries with binding targets are to reduce total greenhouse gas emissions by certain percentages, but does not require specific reductions for specific gases. Moreover, sinks can be used to offset emissions targets. The inclusion of international emissions trading among countries that take on binding targets, coupled with an agreement allowing industrial countries to receive emissions reduction credit for certified investments in "clean development" projects in the developing world, are the critical forms of "where" flexibility incorporated in the Kyoto Protocol. Although details of these provisions need to be finalized in negotiations in Buenos Aires later this year, we believe that these mechanisms can produce substantial reductions in the costs of attaining our environmental objectives.

The problem of climate change is global and so requires a global solution. Around 2030, under a continuation of business as usual, a majority of world emissions are projected to come from developing countries. Without developing country participation we cannot achieve adequate climate protection. In addition, developing country participation would permit relatively low-cost emissions reductions to be internationally recognized as a substitute for more expensive reductions in many industrial countries. 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).

Economic Effects

An economic analysis of climate change faces three broad categories of difficulties. First are the uncertainties that still remain over the terms of the ultimate treaty. Second are the inherent limitations of available models to analyze even short-term costs and benefits. And finally is the impossibility of putting a single monetary number on the long-term benefits of climate change mitigation.

Mindful of the limitations of any single model as a tool for evaluating the economic impact of the Kyoto Protocol, we have employed a broad array of techniques to assess the various possible costs and non-climate benefits of the Administration's emissions reduction policy. Ignoring the benefits of mitigating climate change itself, our conclusion is that the net costs of our policies to reduce emissions are likely to be small if 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 clean-development mechanisms in future negotiations. As I explain in my written testimony, this conclusion is not entirely dependent on, but is fully consistent with, formal model results. For example, given the factors, such as trading, delineated above, but excluding the benefits of acting and the impact of electricity restructuring, estimates derived using Battelle's Second Generation Model suggest that the resource costs of attaining the Kyoto targets for emission reductions might amount to just \$7 to \$12 billion per year in 2008 to 2012 -- or just 0.1 percent of projected GDP. That small net premium, in effect, purchases a partial insurance policy against a serious environmental threat.

A comprehensive economic evaluation of the Administration's climate change policies must also take into account the potential payoffs from the full package of proposed Administration climate change initiatives. As you know, the President's FY 1999 budget includes a \$6.3 billion package of tax cuts and R&D over the next 5 years; this package makes good sense in terms of energy policy and will jumpstart our efforts. A second responsible step entails

industry-by-industry consultations to prepare emission reduction plans in key industrial sectors. 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 offering modest reductions in greenhouse gas emissions.

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 effects of reducing greenhouse gas emissions.

I welcome your questions.

**TESTIMONY OF DR. JANET YELLEN
CHAIR, COUNCIL OF ECONOMIC ADVISERS
BEFORE THE HOUSE COMMERCE COMMITTEE
ON THE ECONOMICS OF THE KYOTO PROTOCOL
MARCH 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 nonlinearities 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. 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 efforts to reduce global greenhouse gas emissions reductions 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 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.

**Statement of
Stuart E. Eizenstat
Under Secretary of State
for Economic, Business and Agricultural Affairs
before the
Subcommittee on Energy and Power
House Commerce Committee
March 4, 1998**

Thank you, Mr. Chairman.

At the outset, let me thank those members of Congress, in this chamber and in the Senate, who participated with us in the Kyoto Conference and who lent their advice and support to our efforts there. Rarely has there been an environmental issue more important or complex than global warming, and rarely has there been a greater need for the Executive Branch and the Congress to work closely together.

It is with great pleasure that I appear here today to explain the Administration's position on global warming. To this end, I will divide my testimony into four parts: (1) a short discussion of the science – the driving force for all the efforts we have taken to date to mitigate a significant and growing global environmental problem; (2) a discussion of the results of the recent Kyoto Conference and key features of the Kyoto Protocol; (3) an effort to correct misperceptions; and (4) a brief review of the President's Climate Change Technology Initiative. I hope to leave you with a clear understanding of why we believe that it is necessary to act, of how we intend to proceed internationally, and of what the President plans to do here at home.

The Science

Human beings are changing the climate by increasing the global concentrations of greenhouse gases such as carbon dioxide, methane and nitrous oxide. Burning coal, oil and natural gas to heat our homes, power our cars and illuminate our cities produces carbon dioxide and other greenhouse gases as by-products – more than 6 billion metric

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tons worth of carbon in the form of carbon dioxide annually. Similarly, deforestation and land clearing also release significant quantities of such gases -- another 1 to 2 billion tons a year. Over the last century, greenhouse gases have been released to the atmosphere faster than natural processes can remove them. There is no ambiguity in the data; since 1860, concentrations of carbon dioxide have risen 30 percent, from 280 parts per million (ppm) to 365 ppm.

In December 1995, the authoritative Intergovernmental Panel on Climate Change (IPCC), representing the work of more than 2,000 of the world's leading climate change scientists from more than 50 countries, concluded that "the balance of evidence suggests that there is a discernible human influence on global climate."

The IPCC Assessment represents the best synthesis of the science of climate change. It concludes:

- Concentrations of greenhouse gases could exceed 700 ppm by 2100 under "business as usual" -- levels not seen on the planet for 50 million years. The projected temperature increase of 2 to 6.5 degrees Fahrenheit over the next 100 years, could exceed rates of change for the last 10,000 years. For perspective, while there is some uncertainty, tropical sea surface temperatures in the last ice age were anywhere from 2 to 9 degrees Fahrenheit cooler than today.
- Increased temperatures are expected to speed up the global water cycle and exacerbate weather extremes. Faster evaporation will lead to a drying of soils and in some areas increased drought. Overall, however, due to the faster global cycling of water, there will be an increase in precipitation.
- Sea levels are expected to rise between 6 and 37 inches over the next century. A 20 inch sea level rise could double the global population at risk from storm surges -- from roughly 45 million to over 90 million, even if coastal populations do not increase. Low-lying areas are particularly vulnerable (e.g., much of coastal Louisiana and the Florida Everglades).
- Human health is likely to be affected. Warmer temperatures will increase the chances of heat waves (like the Chicago event in 1995 that killed over 400

people) and can exacerbate air quality problems such as smog, and lead to an increase in allergic disorders. Diseases that thrive in warmer climates, such as dengue fever, malaria, yellow fever, encephalitis, and cholera are likely to spread due to the expansion of the range of disease carrying organisms. By 2100, there could be an additional 50-80 million cases of malaria each year.

- Agriculture, forests, and natural ecosystems are also likely to be affected. The poorest countries, already subject to food production and distribution problems, will likely suffer the greatest agricultural impacts. Doubling current carbon dioxide concentrations could lead to a dramatic change in the geographic distribution of one-third of the Earth's forests. (For example, the ideal range of some North American forest species would shift by as much as 300 miles to the north in the next 100 years -- far faster than their ability to migrate on their own.) Such changes could have profound effects on parks and wildlife refuges, and lead to a reduction in species diversity.

What Changes Have We Seen to Date?

The earth's temperature is increasing: Scientists from our National Oceanic and Atmospheric Administration (NOAA), the U.K. Meteorological Office and the National Aeronautics and Space Administration (NASA) all recently announced that 1997 was the warmest year on record. In fact, nine of the last 11 years are among the warmest ever recorded.

The water cycle of the planet may be speeding up: Since the beginning of the century, NOAA estimates that precipitation in the United States has increased by about 5 - 10 percent, while the frequency of heavy downpours (where more than 2 inches fall in a day) has increased by about 20 percent. The United States has had many recent reminders of how costly extreme events can be: the Mississippi flooding of 1993 led to damages of between \$10 and \$20 billion; the Southern Plains drought of 1996 was estimated to cost \$4 billion; and the Northwest floods of 1996-97 about \$3 billion. We have yet to learn what the current floods in California will cost. While no single event can be attributed to global warming, increases in floods and droughts are expected as global warming occurs.

Action Needed Now

Some have argued that we can wait to act until all the details of the climate system have been fully understood. The science tells us that this is a recipe for disaster. We will only fully confirm predictions when we experience them. At that point it will be too late. The concentrations of greenhouse gases in the atmosphere continue to rise each year, and because these gases will persist for many decades to centuries, this problem is only slowly reversed. The earth will continue to warm and the seas continue to rise as long as we continue to load the entire atmosphere of the earth with greenhouse gases. The problem has developed over the course of a century and it will take many decades to solve. Already, we have another 1.0 degree Fahrenheit of warming in the pipeline from emissions that have previously occurred, so some impacts will happen no matter what actions we take. Nevertheless, we can still forestall many others if we begin taking cost-effective actions now.

We should look at the Kyoto Protocol as an insurance policy against the potentially devastating and irreversible impacts of global warming. This insurance policy is fully justified today, based solely on our current understanding of the science. If we act now the premium will be far more reasonable than if we delay and hope the problem created by greenhouse gases will go away. It is like a life insurance policy whose costs grow significantly if we delay year after year insuring ourselves.

But there is a critical difference in the case of the climate system. In most insurance policies, the loser can be made whole -- restitution is possible; the building can be rebuilt, the stolen car replaced, the fire or flood damage repaired. In the case of global warming, we will not have a second chance -- failure to act will lead to irreversible consequences. We will be committing ourselves, our children and our grandchildren to a very different planet, and they will never forgive us.

But the premium for this insurance policy must be reasonable. For this reason we rejected unrealistic targets in Kyoto; we insisted on full recourse to market-mechanisms; and we opposed mandatory policies and measures -- like carbon taxes.

The totality of our scientific information, including that on vulnerability and impacts of global warming, provides a compelling reason to act.

Let me now turn to the recent Kyoto Conference.

Kyoto Protocol

Last December in Kyoto, Japan, the nations of the world reached agreement on an historic step to control greenhouse gas emissions which cause global warming. No sooner had the negotiating session ended, however, than some critics on both ends of the political spectrum, without a full examination of the results achieved, denounced the agreement as either too little too late or too much too soon. In fact, the Kyoto Protocol, reached only through the exercise of vigorous American leadership, represents an important achievement in the best interests of the United States. But it is a framework for action, a work in progress, not a finished product ready for Senate consideration.

U.S. Negotiating Objectives

In order to secure an effective agreement that is environmentally strong and economically sound, while protecting the unique worldwide interests of the U.S. military, President Clinton and Vice President Gore established three major objectives. As a result of the Kyoto negotiations, we achieved the first two – realistic targets and timetables for reducing greenhouse gas emissions among the world's major industrial nations, which fully protect the unique role of our military in its global reach; and flexible market-based mechanisms for achieving those targets cost-effectively. The third, meaningful participation of developing countries, will be the focus of our work in the coming months and years, but with the Kyoto Protocol we have made an important down payment.

Elements of the Kyoto Protocol and Related Decisions

Our first objective – realistic targets and timetables among developed countries – had to be a credible step in reducing the dangerous buildup of greenhouse gases, yet measured enough to safeguard U.S. prosperity at home and competitiveness abroad. In the end, we secured the key elements of the President's proposal on targets and timetables, often over the initial objections of the European Union and other developed countries. The agreement and related decisions include:

- The U.S. concept of a multi-year time frame for emissions reductions rather than a fixed, single-year target. The multi-year time frame will allow the United States, other nations and our industries greater flexibility in meeting

our targets. 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.

- The U.S. specific time frame of 2008-2012, rather than earlier periods preferred by the European Union and others, giving us more time to phase in change gradually and deploy new technologies cost-effectively, and thereby to cushion the effects on our businesses and workers.
- Differentiated targets for the key industrial powers ranging from 6% to 8% below baseline levels (1990 and 1995) of greenhouse gas emissions, with the United States agreeing to a 7% reduction. When changes in the accounting rules for certain gases and offsets for activities that absorb carbon dioxide are factored in, the level of effort required of the United States is quite close to the President's original proposal to return emissions to 1990 levels by 2008-2012, representing at most a 3 percent real reduction below that proposal, and perhaps less.
- An innovative proposal shaped in part by the United States, allowing certain activities, such as planting trees, that absorb carbon dioxide – called “sinks” – to be offset against emissions targets. This will both promote cost-effective solutions to climate change and encourage good forestry practices. As a major forestry nation this will be of special benefit to the United States.
- As proposed by the United States, the Kyoto Protocol covers all six significant greenhouse gases even though the E.U. and Japan proposed and fought until the last moment to cover only three. This was an important environmental victory – also supported by many in our own industry – because gases that other countries wanted to omit and leave uncovered (including substitutes for the now banned chloro-fluorocarbons that endanger the ozone layer) are among the fastest growing and longest lasting greenhouse gases.

Flexible Market Mechanisms

Our second broad Presidential objective was to make sure that countries can use flexible market mechanisms to reach their targets rather than the mandatory "policies and measures," such as carbon taxes, favored by the E.U. and many other developed countries.

The Kyoto Protocol enshrines a centerpiece of this U.S. market-based approach -- the opportunity for companies and countries to trade emissions permits. In this way, companies or countries can purchase less expensive emissions permits from companies or countries that have more permits than they need (because they have met their targets with room to spare). This is not only economically sensible, but environmentally sound. By finding the least expensive way to reduce emissions, we will be providing a strong incentive for achieving the maximum level of emissions reductions at the least cost. The United States has had a very positive experience with permit trading in the acid rain program, reducing costs by 50 percent from what was expected, yet fully serving our environmental goals.

This was a new concept for developed and developing countries alike -- some of whom fought it vigorously. But we have it firmly enshrined in the Kyoto Protocol and it is a critical way of ensuring cost-effective solutions. Its inclusion was a major victory for us.

We went even further by achieving a conceptual understanding with several countries, including Australia, Canada, Japan, New Zealand, Russia and Ukraine, to trade emissions rights with each other. This 'umbrella group' could further reduce compliance costs.

Ensuring that we can meet our target reductions cost-effectively will depend significantly on access to the flexibility mechanisms we fought hard to include in the Kyoto Protocol. Let me be very clear: The commitment we made in Kyoto would not have been made -- could not have been made -- were it not for the flexibility mechanisms that were also agreed there. Until we are satisfied with the rules and procedures yet to be established, the promise of Kyoto will never be realized. The importance of emissions trading is emphasized by CEA Chairman Yellen's economic analysis and testimony.

Meaningful Participation of Developing Countries

Our third objective was to secure meaningful participation of key developing countries, a concern that I know you, Mr. Chairman, and members of the House and the Senate obviously share, as evidenced by last summer's Byrd-Hagel resolution. Global warming is, after all, a global problem which requires a global solution – not only from the developed world but also from key developing countries.

Per capita emission rates are low in the developing world and will remain so for some time, and over 70 percent of today's atmospheric concentrations of greenhouse gases attributable to human activities are the result of emissions by the industrialized world. At the same time, it is also true that by around 2015 China will be the largest overall emitter of greenhouse gases, and by 2025 the developing world will emit more greenhouse gases in total than the developed world. So from an environmental perspective, this problem cannot be solved unless developing countries get on board.

We encountered significant resistance in Kyoto by some developing countries to meaningful participation in solving the global warming problem. For example, we had sought to include a specific process through which advanced developing or newly developed countries could take on quantified emission limitation commitments and thereby take part in the international emissions trading regime. While a number of developing countries expressed interest in our proposal and supported it in Kyoto, others rejected it, and it was not possible to include such a specific process in the Protocol. Still, developing countries may nevertheless, as a prerequisite for engaging in emissions trading, voluntarily assume binding emissions targets through amendment to the annex of the Protocol that lists countries with targets.

Some developing countries believe – wrongly – that the developed world is asking them to limit their capacity to industrialize, reduce poverty and raise their standard of living. We have made clear that we support an approach under which developing countries would continue to grow – but in a more environmentally sound and economically sustainable way, by taking advantage of technologies not available to countries that industrialized at an earlier time.

The Kyoto agreement does not meet our requirements for developing country participation. Nevertheless, a significant down payment was made in the form of a provision advanced by Brazil and backed by the United States and the Alliance of Small Island States. This provision defines a "Clean Development Mechanism," which embraces the U.S.-backed concept of "joint implementation with credit." The goal is to build a bridge – with incentives – between developed, industrialized countries, and developing nations. This new mechanism will allow companies in the developed world to invest in projects in countries in the developing world – such as the construction of high-tech, environmentally sound power plants – for the benefit of the parties in both worlds. The companies in the developed world will get emissions credits at lower costs than they could achieve at home, while countries in the developing world will share in those credits, and receive the kind of technology that can allow them to grow without ruining their environment.

The Clean Development Mechanism has great potential, but developing countries will need to do more in order to participate meaningfully in the effort to combat global warming. In determining what developing countries ought to do, we should be aware that the circumstances of developing countries vary widely, along a kind of continuum. Some today are very poor; their greenhouse gas emissions are negligible and are likely to remain so for the foreseeable future. Others, whose greenhouse gas emissions are not substantial, are relatively well off. Some are poor on a per capita basis, but their greenhouse gas emissions today rival or surpass those of the most advanced industrialized nations. Still others have already joined ranks with the industrialized world in the OECD but have not yet fully accepted the added responsibility for protection of the global environment that comes with their new status.

Any 'one-size-fits-all' approach to the 'meaningful participation of developing countries' and to satisfy the Byrd-Hagel Resolution is thus unlikely to prevail. We found in Kyoto that even among the industrialized countries it was necessary to recognize the individual national circumstances faced by those differently situated in order to reach agreement, notwithstanding our common purpose. Similarly, any uniform, inflexible approach to the 'meaningful participation of developing countries' is unlikely to prevail.

As Senator Byrd said in his letter of December 15, 1997, to the President, and recently restated on January 29 in the Senate:

“...binding commitments for developing nations should be paced according to the ability of each country to achieve greenhouse gas emission limitations appropriate to its national circumstances and economic growth. These limitations could be gradually implemented. Whether such commitments are in fact appropriate and represent best effort by each nation, will not be difficult to discern. As the saying goes, we will know it when we see it.”

Recognizing our “common but differentiated responsibilities and respective capabilities” it will be necessary to develop an approach that provides for a meaningful global response to the threat of global warming, while acknowledging the legitimate aspirations of developing countries to achieve a better life for their peoples. To succeed, we will need to ensure that those responsible for a significant share of global emissions accept their responsibility to protect the global environment. We will also need to ensure that those who are able to do so contribute according to their capacities and stage of development.

Some Misperceptions

Before moving on, Mr. Chairman, let me address a few specific points on which I believe there may be some misperceptions. The first of these is that the Kyoto Protocol will damage our national security or imperil the ability of our military to meet its worldwide responsibilities – this is not true.

We took special pains working with the Defense Department and the uniformed military before and in Kyoto to protect the unique position of the United States as the world’s only superpower with global military responsibilities. We achieved everything they outlined as necessary to protect military operations and our national security.

At the Kyoto Conference, uniformed military representatives from the Joint Chiefs of Staff and the Office of the Deputy Under Secretary of Defense for Environmental Security provided guidance to the delegation as we considered this issue.

In the end, the Parties took a decision to exempt key overseas military activities from emissions targets, including exemptions for "bunker fuels" (those used in international aviation and maritime transport) and for emissions resulting from a wide range of multilateral operations, such as peacekeeping and humanitarian relief. This exempts from our national targets not only multilateral operations expressly authorized by the U.N. Security Council (such as Desert Storm or Bosnia), but also multilateral operations that the United States initiates pursuant to the U.N. Charter without express authorization (such as Grenada). Countries may also decide among themselves how to account for emissions relating to multilateral operations (e.g., U.S. training in another NATO country) without going through emissions trading. If any other measures to preserve our national security interests are required, and there do not appear to be any, they can be addressed through future implementing legislation. As Secretary of Defense Cohen wrote in a letter of February 24, 1998, to Congressperson Bachus, "Based on achieving our international objectives, the Department is fully satisfied with the Kyoto results."

Second, it has been suggested that the Protocol will create a super U.N. Secretariat that will threaten U.S. sovereignty and national decision-making through alleged intrusive verification procedures and prior approval of individual emissions trades. That is not so. The review process contained in the Protocol largely codifies the existing practice under the 1992 Framework Convention, to which the United States is a Party. Under the Protocol, small expert review teams will continue to visit Annex I countries for brief periods to review implementation of the Convention and of the Protocol. The review process is intergovernmental, in that experts are nominated by governments. The review teams meet with government officials, and with others by invitation. In reviews under the Convention, the teams have met with Congressional staff, representatives of the private sector and representatives of environmental organizations -- but only with their concurrence. Any other visits, such as site visits, would take place only if approved by the host country and, if the private sector is involved, the relevant interested persons. It is important to emphasize that no one can come onto the private property of a U.S. citizen without that individual's express approval and consent. To date under the Convention, no site visits have taken place.

In addition, let me be unmistakably clear – while trading rules must be established internationally to have emissions trading work – as our SEC must set rules for equity trading – we will not accept nor do we anticipate an approach that would require prior approval of individual emissions trades by an international body. Trading will be done between interested nations and their companies, based on market principles.

Concerns have also been raised that the Protocol is flawed, on the one hand because it will threaten U.S. sovereignty by dictating national decisions on implementation and, on the other hand, because it lacks mechanisms to verify compliance. In fact we believe that the Protocol strikes an appropriate balance between these two extremes.

- ◆ The United States firmly opposed mandatory, harmonized policies and measures that would be imposed upon us in order to reach our target. We prevailed. The Protocol leaves Parties entirely free to decide how best to meet their targets based on national circumstances.
- ◆ At the same time, we could not tolerate a free-for-all where Parties might or might not meet their commitments, particularly given the conscientious way the United States meets its international obligations. As a result, the Protocol calls for national measurement of emissions, detailed reporting, and in-depth reviews – on an intergovernmental basis.
- ◆ The one area where we believe more work needs to be done is in identifying appropriate consequences for non-compliance; the Protocol provides for elaborating such consequences, with any binding consequences to be done in amendment form, so that the Senate would have the opportunity to approve them.

Finally, some have suggested that the Protocol will result in a huge government transfer of foreign aid to Russia in which we will give away taxpayer money with no leverage on Russian policies with these funds. This also is not true. Under the Protocol's emissions trading provisions, we envision that U.S. private sector firms may choose to purchase international emissions credits in order to meet their emissions obligations.

Indeed, the private purchase of emissions credits is one of the crucial ways to achieve cost-effective emissions reductions for U.S. firms.

As with any market transaction, purchases of these credits will have to comply with all U.S. legal and regulatory requirements. In addition, U.S. firms interested in international investment will have an incentive to ensure that other countries meet the international standards for adequate monitoring and reporting of their emissions of greenhouse gases. At the same time, Russia will have significant incentives to use the revenue generated to invest in the most modern, climate-friendly plants and equipment so that, as its economy recovers, it continues to produce emissions credits that it can sell on international markets.

Framework for Action

Where do we go from here? While historic, the Kyoto Protocol is only one step in a long process. It is, in essence, a framework for action, a work in progress, and a number of challenges still lie ahead. We anticipate signing the Protocol within the one-year period provided for in the agreement, which runs from March 1998 to March 1999. We have not, as yet, determined the precise timing due to tactical considerations. We will sign at a time that makes the most sense in terms of the overall diplomatic situation.

In that diplomatic context, rules and procedures must be adopted to ensure that emissions trading rights, joint implementation and the Clean Development Mechanism operate efficiently and smoothly. The Kyoto Protocol establishes emissions trading, but leaves open the specifics of operations. We will work hard to ensure that the rules and procedures adopted enable emissions trading, joint implementation and the Clean Development Mechanism to work smoothly and efficiently, thereby encouraging the private sector to engage.

We will also work closely with our industries to be sure they are satisfied that the emissions trading system which is developed is as efficient and effective as possible to meet their needs.

Most significant, we must work to secure the meaningful participation of key developing countries. We must be creative in initiating bilateral agreements. We have made a promising start with an agreement we reached with China during last fall's

Summit. We must also use regional and multilateral fora to achieve our objectives -- such as the Summit of the Americas process, in the Asian Partnership for Economic Cooperation (APEC) process, the President's forthcoming trip to Africa, and the G-8 Summit in the United Kingdom. We will put on a full court diplomatic press to bring developing nations into a meaningful role in helping solve the global climate challenge. We will accept nothing less, nor would we expect the United States Senate to do so. As the President has indicated, the United States should not assume binding obligations under the Protocol until key developing countries meaningfully participate in meeting the challenge of climate change. Although the Kyoto Protocol was an historic step forward, more progress is necessary with respect to participation of key developing countries. It would be premature to submit the treaty to the Senate for its advice and consent to ratification at this time.

The Administration also plans to continue to work with the international financial institutions to promote market-based energy sector policies in developing countries that will help reduce developing country greenhouse gas emissions. Multilateral development bank policies, including those of the Global Environment Facility, strongly influence international lending and private capital flows for energy, industrial and transportation investments. Policies that favor market pricing, privatization, clean technologies and environmentally-friendly approaches will make implementing the Kyoto Protocol easier and will speed the growth of markets for new technologies that help reduce emissions in developing countries. We will work with the international financial institutions themselves -- from the World Bank to the regional development banks -- and with other countries, especially developed countries, to achieve these goals in the coming years.

The Kyoto agreement does not solve the problem of global warming, but it represents an important step in dealing with a problem that we cannot wish away. A premature decision to reject the Protocol would deprive us of the opportunity to complete its unfinished business. If we fail to take reasoned action now, our children and grandchildren will pay the price.

Mr. Chairman, before turning briefly to our domestic efforts, let me note two other key elements in this equation -- the contributions that the United States provides to

carry out work under the U.N. Framework Convention on Climate Change and in the Intergovernmental Panel on Climate Change (IPCC), as well as the contributions that we make to the Global Environment Facility (GEF). For FY 1999, the President has requested \$314 million for the International Organizations and Programs Account, a level that represents a 6.6 percent increase over FY 1998. This amount includes \$8 million for the Climate Stabilization Fund which supports the Framework Convention and the IPCC. Parties to the Convention have much work ahead of them, as I have already noted. In addition, the IPCC has now embarked on its Third Assessment Report of Climate Change, scheduled for completion in late 2000 or early 2001. These funds are vital to ensuring U.S. leadership in both of these organizations and to ensuring that our views and the work of our scientists are taken fully into account.

In addition, the President has requested \$300 million to meet our past and current pledges to help fund the Global Environment Facility (GEF). The GEF helps developing countries act to protect the global environment in several key focal areas including international waters, biodiversity, climate change and depletion of the stratospheric ozone layer. If we want to bring developing countries on board with real commitments to limit greenhouse gas emissions, we need to demonstrate that we are a reliable partner by supporting their concrete efforts with reliable resources. At this point, our GEF shortfall damages U.S. credibility in promising to help developing countries meet the climate change obligations we are urging that they undertake. I would therefore urge the Congress to fund fully our \$300 million request, to meet our current pledge and also clear our substantial shortfall of nearly \$200 million.

President's Climate Change Technology Initiative

In his State of the Union address, President Clinton said that global warming is "the gathering crisis that requires worldwide action." We need to begin now to launch the sensible, cost-effective efforts that will help us avoid the high future cost of inaction.

The President last October outlined a three-stage approach to addressing climate change at home. The first stage consists of immediate actions to stimulate development and use of technologies that can minimize the cost of meeting U.S. goals in reducing greenhouse gas emissions. Stage two will review options created through ongoing

technology development and lead to detailed plans for a domestic, market-based permit trading system for carbon emissions. Stage three will begin to implement a market-based emissions-trading system.

As a first installment on this plan, President Clinton announced in his State of the Union message his proposal for a \$6.3 billion Climate Change Technology Initiative over five years to cut U.S. greenhouse gas emissions -- \$1.3 billion higher than the President announced in his initial plan in October. This vigorous initiative calls for tax cuts coupled with research and development (R&D) to take cost-effective, practical steps that will position us well to meet the challenge we face early in the next century.

This initiative consists of two parts -- \$3.6 billion in tax credits for energy-efficient purchases and renewable energy, and \$2.7 billion in new R&D spending over five years.

The tax package includes tax credits of \$3,000 to \$4,000 for consumers who purchase advanced technology, highly fuel efficient vehicles. It provides a 15 percent credit (up to \$2,000) for purchases of rooftop solar electricity and hot water systems to provide incentives for meeting the Million Solar Roofs goal. It also includes a 20 percent credit (subject to a cap) for purchasing energy-efficient building equipment, a \$2,000 credit for purchasing energy efficient new homes, extension of the wind and biomass tax credit, and a 10 percent investment credit for the purchase of combined heat and power systems.

The R&D component covers the four major carbon-emitting sectors of the economy (buildings, industry, transportation and electricity), plus carbon removal and sequestration, Federal facilities, and cross cutting analysis and research. Examples of this R&D effort include the Partnership for a New Generation of Vehicles (PNGV), a government-industry effort to develop affordable cars that meet all applicable safety and environmental standards and get up to three times the fuel efficiency of today's cars. In 1999, the President's budget for PNGV is \$277 million, up from \$227 million appropriated for 1998. Our PNGV effort is clearly paying off -- the developments about higher mileage cars announced by the Big Three last month were assisted by research

supported under PNGB. It is exciting to see our U.S. automakers already planning for the cars of the future, not as pipe dreams but as achievable greenhouse gas friendly products.

As General Motors Chair and CEO John F. Smith said recently in announcing GM's plans to step up research spending and focus on bringing new products to market, "No car company will be able to thrive in the 21st century if it relies solely on internal combustion engines." And as William C. Ford, Jr., Chair of Ford's Finance Committee, also said in announcing that Ford will join with Daimler-Benz of Germany in developing cars with fuel-cell engines, "There's a compelling business case to be made."

Similar government-industry efforts are proposed to develop cleaner, more efficient diesel engines for both light trucks and heavy trucks. The R&D effort also includes expanded research partnerships for key renewable technologies such as wind, photovoltaics, geothermal, biomass, and hydropower to accelerate price reductions and improve performance. The President's 1999 budget proposes a \$100 million increase in appropriations for solar and renewable energy R&D – a 37 percent increase over 1998.

We hope that the Congress will view the President's initiative favorably and appropriate the funds and enact the tax incentives that he has requested. We look forward to working with you to put the President's proposals into action.

The President and his Administration are committed to working with you in the Congress, both to realize the potential of the Climate Change Technology Initiative and to craft the ongoing U.S. approach to climate change. The United States has the power to lead the global effort, and Congress holds the key. What is done or not done today will determine the kind of world we will leave to future generations and the conditions of life they will face.

Sustained Effort Required

Mr. Chairman, I have mentioned that Kyoto produced a framework for future action, and I have listed a number of the steps that await us.

Coming to grips with the threat of global warming is no small task. We must tackle it in a vigorous, sober and determined manner, understanding that it represents a challenge but also an opportunity. And as we have always done in the face of global challenge, we must assume the responsibilities of American leadership. Thank you.

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**2/11/98 SENATE FOREIGN
RELATIONS**

Divider Title: _____

**Statement of
Stuart E. Eizenstat
Under Secretary of State
for Economic, Business and Agricultural Affairs
before the
Senate Foreign Relations Committee
February 11, 1998**

Thank you, Mr. Chairman.

At the outset, let me thank those members of Congress, in this chamber and in the House of Representatives, who participated with us in the Kyoto Conference and who lent their advice and support to our efforts there. In particular I wish to thank Senators Hagel, Baucus, Chafee, Enzi, Kerry and Lieberman for taking the time to be present. I must also thank Senator Byrd, who could not be with us in Kyoto, for his interest and leadership. Rarely has there been an environmental issue more important or complex than global warming, and rarely has there been a greater need for the Executive Branch and the Congress to work closely together.

It is with great pleasure that I appear here today to explain the Administration's position on global warming. To this end, I will divide my testimony into four parts: (1) a short discussion of the science - the driving force for all the efforts we have taken to date to mitigate a significant and growing global environmental problem; (2) a discussion of the results of the recent Kyoto Conference and key features of the Kyoto Protocol; (3) an effort to correct misperceptions; and (4) a brief review of the President's Climate Change Technology Initiative. I hope to leave you with a clear understanding of why we believe that it is necessary to act, of how we intend to proceed internationally, and of what the President plans to do here at home.

The Science

Human beings are changing the climate by increasing the global concentrations of greenhouse gases such as carbon dioxide, methane and nitrous oxide. Burning coal, oil and natural gas to heat our homes, power our cars and illuminate our cities produces carbon dioxide and other greenhouse gases as by-products – more than 6 billion metric tons worth of carbon in the form of carbon dioxide annually. Similarly, deforestation and land clearing also release significant quantities of such gases -- another 1 to 2 billion tons a year. Over the last century, greenhouse gases have been released to the atmosphere faster than natural processes can remove them. There is no ambiguity in the data; since 1860, concentrations of carbon dioxide have risen 30 percent, from 280 parts per million (ppm) to 365 ppm.

In December 1995, the authoritative Intergovernmental Panel on Climate Change (IPCC), representing the work of more than 2,000 of the world's leading climate change scientists from more than 50 countries, concluded that “the balance of evidence suggests that there is a discernible human influence on global climate.”

The IPCC Assessment represents the best synthesis of the science of climate change. It concludes:

- Concentrations of greenhouse gases could exceed 700 ppm by 2100 under “business as usual” -- levels not seen on the planet for 50 million years. The projected temperature increase of 2 to 6.5 degrees Fahrenheit over the next 100 years, could exceed rates of change for the last 10,000 years. For perspective, while there is some uncertainty, tropical sea surface temperatures in the last ice age were anywhere from 2 to 9 degrees Fahrenheit cooler than today.
- Increased temperatures are expected to speed up the global water cycle. Faster evaporation will lead to a drying of soils and in some areas increased drought. Overall, however, due to the faster global cycling of water, there will be an increase in precipitation.

- Sea levels are expected to rise between 6 and 37 inches over the next century. A 20 inch sea level rise could double the global population at risk from storm surges -- from roughly 45 million to over 90 million, even if coastal populations do not increase. Low-lying areas are particularly vulnerable (e.g., much of coastal Louisiana and the Florida Everglades).
- Human health is likely to be affected. Warmer temperatures will increase the chances of heat waves (like the Chicago event in 1995 that killed over 400 people) and can exacerbate air quality problems such as smog, and lead to an increase in allergic disorders. Diseases that thrive in warmer climates, such as dengue fever, malaria, yellow fever, encephalitis, and cholera are likely to spread due to the expansion of the range of disease carrying organisms. By 2100, there could be an additional 50-80 million cases of malaria each year.
- Agriculture, forests, and natural ecosystems are also likely to be affected. The poorest countries, already subject to food production and distribution problems, will likely suffer the greatest agricultural impacts. Doubling current carbon dioxide concentrations could lead to a dramatic change in the geographic distribution of one-third of the Earth's forests. (For example, the ideal range of some North American forest species would shift by as much as 300 miles to the north in the next 100 years -- far-faster than their ability to migrate on their own.) Such changes could have profound effects on parks and wildlife refuges, and lead to a reduction in species diversity.

What Changes Have We Seen to Date?

The earth's temperature is increasing: Scientists from our National Oceanic and Atmospheric Administration (NOAA), the U.K. Meteorological Office and the National Aeronautics and Space Administration (NASA) all recently announced that 1997 was the warmest year on record. In fact, nine of the last 11 years are among the warmest ever recorded.

The water cycle of the planet may be speeding up: Since the beginning of the century, NOAA estimates that precipitation in the United States has increased by about 5 - 10 percent, while the frequency of heavy downpours (where more than 2 inches fall in a day) has increased by about 20 percent. The United States has had many recent reminders of how costly extreme events can be: the Mississippi flooding of 1993 led to damages of between \$10 and \$20 billion; the Southern Plains drought of 1996 was estimated to cost \$4 billion; and the Northwest floods of 1996-97 about \$3 billion. We have yet to learn what the current floods in California will cost. While no single event can be attributed to global warming, increases in floods and droughts are expected as global warming occurs.

Action Needed Now

Some have argued that we can wait to act until all the details of the climate system have been fully understood. The science tells us that this is a recipe for disaster. We will only fully confirm predictions when we experience them. At that point it will be too late. The concentrations of greenhouse gases in the atmosphere continue to rise each year, and because these gases will persist for many decades to centuries, this problem is only slowly reversed. The earth will continue to warm and the seas continue to rise as long as we continue to load the entire atmosphere of the earth with greenhouse gases. The problem has developed over the course of a century and it will take many decades to solve. Already, we have another 1.0 degree Fahrenheit of warming in the pipeline from emissions that have previously occurred, so some impacts will happen no matter what actions we take. Nevertheless, we can still forestall many others if we begin taking cost-effective actions now.

We should look at the Kyoto Protocol as an insurance policy against the potentially devastating and irreversible impacts of global warming. This insurance policy is fully justified today, based solely on our current understanding of the science. If we act now the premium will be far more reasonable than if we delay and hope the problem created by greenhouse gases will go away. It is like a life insurance policy whose costs grow significantly if we delay year after year insuring ourselves.

But there is a critical difference in the case of the climate system. In most insurance policies, the loser can be made whole -- restitution is possible; the building can be rebuilt, the stolen car replaced, the fire or flood damage repaired. In the case of global warming, we will not have a second chance -- failure to act will lead to irreversible consequences. We will be committing ourselves, our children and our grandchildren to a very different planet, and they will never forgive us.

But the premium for this insurance policy must be reasonable. For this reason we rejected unrealistic targets in Kyoto; we insisted on full recourse to market-mechanisms; and we opposed mandatory policies and measures -- like carbon taxes.

The totality of our scientific information, including that on vulnerability and impacts of global warming, provides a compelling reason to act.

Let me now turn to the recent Kyoto Conference.

Kyoto Protocol

Last December in Kyoto, Japan, the nations of the world reached agreement on an historic step to control greenhouse gas emissions which cause global warming. No sooner had the negotiating session ended, however, than some critics on both ends of the political spectrum, without a full examination of the results achieved, denounced the agreement as either too little too late or too much too soon. In fact, the Kyoto Protocol, reached only through the exercise of vigorous American leadership, represents an important achievement in the best interests of the United States. But it is a framework for action, a work in progress, not a finished product ready for Senate consideration.

U.S. Negotiating Objectives

In order to secure an effective agreement that is environmentally strong and economically sound, while protecting the unique worldwide interests of the U.S. military, President Clinton and Vice President Gore established three major objectives. As a result of the Kyoto negotiations, we

achieved the first two – realistic targets and timetables for reducing greenhouse gas emissions among the world's major industrial nations, which fully protect the unique role of our military in its global reach; and flexible market-based mechanisms for achieving those targets. The third, meaningful participation of developing countries, will be the focus of our work in the coming months and years, but with the Kyoto Protocol we have made an important down payment.

Elements of the Kyoto Protocol and Related Decisions

Our first objective – realistic targets and timetables among developed countries – had to be a credible step in reducing the dangerous buildup of greenhouse gases, yet measured enough to safeguard U.S. prosperity at home and competitiveness abroad. In the end, we secured the key elements of the President's proposal on targets and timetables, often over the initial objections of the European Union and other developed countries. The agreement and related decisions include:

- The U.S. concept of a multi-year time frame for emissions reductions rather than a fixed, single-year target. The multi-year time frame will allow the United States, other nations and our industries greater flexibility in meeting our targets. 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.
- The U.S. specific time frame of 2008-2012, rather than earlier periods preferred by the European Union and others, giving us more time to phase in change gradually and deploy new technologies cost-effectively, and thereby to cushion the effects on our businesses and workers.
- Differentiated targets for the key industrial powers ranging from 6% to 8% below baseline levels (1990 and 1995) of greenhouse gas emissions, with the United States agreeing to a 7% reduction.

When changes in the accounting rules for certain gases and offsets for activities that absorb carbon dioxide are factored in, the level of effort required of the United States is quite close to the President's original proposal to return emissions to 1990 levels by 2008-2012, representing at most a 3 percent real reduction below that proposal, and perhaps less.

- An innovative proposal shaped in part by the United States, allowing certain activities, such as planting trees, that absorb carbon dioxide – called “sinks” – to be offset against emissions targets. This will both promote cost-effective solutions to climate change and encourage good forestry practices. As a major forestry nation this will be of special benefit to the United States.
- As proposed by the United States, the Kyoto Protocol covers all six significant greenhouse gases even though the E.U. and Japan proposed and fought until the last moment to cover only three. This was an important environmental victory – also supported by many in our own industry – because gases that other countries wanted to omit and leave uncovered (including substitutes for the now banned chloro-fluorocarbons that endanger the ozone layer) are among the fastest growing and longest lasting greenhouse gases.

Flexible Market Mechanisms

Our second broad Presidential objective was to make sure that countries can use flexible market mechanisms to reach their targets rather than the mandatory “policies and measures,” such as carbon taxes, favored by the E.U. and many other developed countries.

The Kyoto Protocol enshrines a centerpiece of this U.S. market-based approach – the opportunity for companies and countries to trade emissions permits. In this way, companies or countries can purchase less expensive emissions permits from companies or countries that have more permits than they need (because they have met their targets with room to spare). This is not only economically sensible, but environmentally sound. By finding the least expensive way to reduce emissions, we will be providing a strong

incentive for achieving the maximum level of emissions reductions at the least cost. The United States has had a very positive experience with permit trading in the acid rain program, reducing costs by 50 percent from what was expected, yet fully serving our environmental goals.

This was a new concept for developed and developing countries alike – some of whom fought it vigorously. But we have it firmly enshrined in the Kyoto Protocol and it is a critical way of ensuring cost-effective solutions. Its inclusion was a major victory for us.

We went even further by achieving a conceptual understanding with several countries, including Australia, Canada, Japan, New Zealand, Russia and Ukraine, to trade emissions rights with each other. This ‘umbrella group’ could further reduce compliance costs.

Ensuring that we can meet our target reductions cost-effectively will depend significantly on access to the flexibility mechanisms we fought hard to include in the Kyoto Protocol. Let me be very clear: The commitment we made in Kyoto would not have been made -- could not have been made -- were it not for the flexibility mechanisms that were also agreed there. Until we are satisfied with the rules and procedures yet to be established, the promise of Kyoto will never be realized.

Meaningful Participation of Developing Countries

Our third objective was to secure meaningful participation of key developing countries, a concern that the Senate obviously shares, as evidenced by last summer's Byrd-Hagel Resolution. Global warming is, after all, a global problem which requires a global solution – not only from the developed world but also from key developing countries.

Per capita emission rates are low in the developing world and will remain so for some time, and over 70 percent of today's atmospheric concentrations of greenhouse gases attributable to human activities are the result of emissions by the industrialized world. At the same time, it is also true that by around 2015 China will be the largest overall emitter of greenhouse gases, and by 2025 the developing world will emit more greenhouse gases in total than the developed world. So from an

environmental perspective, this problem cannot be solved unless developing countries get on board.

We encountered significant resistance in Kyoto by some developing countries to meaningful participation in solving the global warming problem. For example, we had sought to include a specific process through which advanced developing or newly developed countries could take on quantified emission limitation commitments and thereby take part in the international emissions trading regime. While a number of developing countries expressed interest in our proposal and supported it in Kyoto, others rejected it, and it was not possible to include such a specific process in the Protocol. Still, developing countries may nevertheless, as a prerequisite for engaging in emissions trading, voluntarily assume binding emissions targets through amendment to the annex of the Protocol that lists countries with targets.

Some developing countries believe – wrongly – that the developed world is asking them to limit their capacity to industrialize, reduce poverty and raise their standard of living. We have made clear that we support an approach under which developing countries would continue to grow – but in a more environmentally sound and economically sustainable way, by taking advantage of technologies not available to countries that industrialized at an earlier time.

The Kyoto agreement does not meet our requirements for developing country participation. Nevertheless, a significant down payment was made in the form of a provision advanced by Brazil and backed by the United States and the Alliance of Small Island States. This provision defines a “Clean Development Mechanism,” which embraces the U.S.-backed concept of “joint implementation with credit.” The goal is to build a bridge – with incentives – between developed, industrialized countries, and developing nations. This new mechanism will allow companies in the developed world to invest in projects in countries in the developing world – such as the construction of high-tech, environmentally sound power plants – for the benefit of the parties in both worlds. The companies in the developed world will get emissions credits at lower costs than they could achieve at home, while countries in the developing world will share in those credits, and receive the kind of technology that can allow them to grow without ruining their environment.

The Clean Development Mechanism has great potential, but developing countries will need to do more in order to participate meaningfully in the effort to combat global warming. In determining what developing countries ought to do, we should be aware that the circumstances of developing countries vary widely, along a kind of continuum. Some today are very poor; their greenhouse gas emissions are negligible and are likely to remain so for the foreseeable future. Others, whose greenhouse gas emissions are not substantial, are relatively well off. Some are poor on a per capita basis, but their greenhouse gas emissions today rival or surpass those of the most advanced industrialized nations. Still others have already joined ranks with the industrialized world in the OECD but have not yet fully accepted the added responsibility for protection of the global environment that comes with their new status.

Any 'one-size-fits-all' approach to the 'meaningful participation of developing countries' and to satisfy the Byrd-Hagel Resolution is thus unlikely to prevail. We found in Kyoto that even among the industrialized countries it was necessary to recognize the individual national circumstances faced by those differently situated in order to reach agreement, notwithstanding our common purpose. Similarly, any uniform, inflexible approach to the 'meaningful participation of developing countries' is unlikely to prevail.

As Senator Byrd said in his letter of December 15, 1997, to the President, and recently restated on January 29 here in the Senate:

"...binding commitments for developing nations should be paced according to the ability of each country to achieve greenhouse gas emission limitations appropriate to its national circumstances and economic growth. These limitations could be gradually implemented. Whether such commitments are in fact appropriate and represent best effort by each nation, will not be difficult to discern. As the saying goes, we will know it when we see it."

Recognizing our "common but differentiated responsibilities and respective capabilities" it will be necessary to develop an approach that provides for a meaningful global response to the threat of global warming,

while acknowledging the legitimate aspirations of developing countries to achieve a better life for their peoples. To succeed, we will need to ensure that those responsible for a significant share of global emissions accept their responsibility to protect the global environment. We will also need to ensure that those who are able to do so contribute according to their capacities and stage of development.

Some Misperceptions

Before moving on, Mr. Chairman, let me address a few specific points on which I believe there may be some misperceptions. The first of these is that the Kyoto Protocol will damage our national security or imperil the ability of our military to meet its worldwide responsibilities – this is not true.

We took special pains working with the Defense Department and the uniformed military before and in Kyoto to protect the unique position of the United States as the world's only superpower with global military responsibilities. We achieved everything they outlined as necessary to protect military operations and our national security.

At the Kyoto Conference, the Parties took a decision to exempt key overseas military activities from emissions targets, including exemptions for "bunker fuels" (those used in international aviation and maritime transport) and for emissions resulting from a wide range of multilateral operations, such as peacekeeping and humanitarian relief. This exempts from our national targets not only multilateral operations expressly authorized by the U.N. Security Council (such as Desert Storm or Bosnia), but also multilateral operations that the United States initiates pursuant to the U.N. Charter without express authorization (such as Grenada). Countries may also decide among themselves how to account for emissions relating to multilateral operations (e.g., U.S. training in another NATO country) without going through emissions trading.

Second, it has been suggested that the Protocol will create a super U.N. Secretariat that will threaten U.S. sovereignty and national decision-making through alleged intrusive verification procedures and prior approval of individual emissions trades. That is not so. The review process contained in the Protocol largely codifies the existing practice under the 1992

Framework Convention, to which the United States is a Party. Under the Protocol, small expert review teams will continue to visit Annex I countries for brief periods to review implementation of the Convention and of the Protocol. The review process is intergovernmental, in that experts are nominated by governments. The review teams meet with government officials, and with others by invitation. In reviews under the Convention, the teams have met with Congressional staff, representatives of the private sector and representatives of environmental organizations – but only with their concurrence. Any other visits, such as site visits, would take place only if approved by the host country and, if the private sector is involved, the relevant interested persons. To date under the Convention, no site visits have taken place.

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Concerns have also been raised that the Protocol is flawed, on the one hand because it will threaten U.S. sovereignty by dictating national decisions on implementation and, on the other hand, because it lacks mechanisms to verify compliance. In fact we believe that the Protocol strikes an appropriate balance between these two extremes.

- ◆ The United States firmly opposed mandatory, harmonized policies and measures that would be imposed upon us in order to reach our target. We prevailed. The Protocol leaves Parties entirely free to decide how best to meet their targets based on national circumstances.
- ◆ At the same time, we could not tolerate a free-for-all where Parties might or might not meet their commitments, particularly given the conscientious way the United States meets its international obligations. As a result, the Protocol calls for national measurement of emissions, detailed reporting, and in-depth reviews – on an intergovernmental basis.

- ◆ The one area where we believe more work needs to be done is in identifying appropriate consequences for non-compliance; the Protocol provides for elaborating such consequences, with any binding consequences to be done in amendment form, so that the Senate would have the opportunity to approve them.

Finally, some have suggested that the Protocol will result in a huge government transfer of foreign aid to Russia in which we will give away taxpayer money with no leverage on Russian policies with these funds. This also is not true. Under the Protocol's emissions trading provisions, we envision that U.S. private sector firms may choose to purchase international emissions credits in order to meet their emissions obligations. Indeed, the private purchase of emissions credits is one of the crucial ways to achieve cost-effective emissions reductions for U.S. firms.

As with any market transaction, purchases of these credits will have to comply with all U.S. legal and regulatory requirements. In addition, U.S. firms interested in international investment will have an incentive to ensure that other countries meet the international standards for adequate monitoring and reporting of their emissions of greenhouse gases. At the same time, Russia will have significant incentives to use the revenue generated to invest in the most modern, climate-friendly plants and equipment so that, as its economy recovers, it continues to produce emissions credits that it can sell on international markets.

Framework for Action

Where do we go from here? While historic, the Kyoto Protocol is only one step in a long process. It is, in essence, a framework for action, a work in progress, and a number of challenges still lie ahead.

Rules and procedures must be adopted to ensure that emissions trading rights, joint implementation and the Clean Development Mechanism operate efficiently and smoothly. The Kyoto Protocol establishes emissions trading, but leaves open the specifics of operations. We will work hard to ensure that the rules and procedures adopted enable emissions trading, joint

implementation and the Clean Development Mechanism to work smoothly and efficiently, thereby encouraging the private sector to engage.

We will also work closely with our industries to be sure they are satisfied that the emissions trading system which is developed is as efficient and effective as possible to meet their needs.

Most significant, we must work to secure the meaningful participation of key developing countries. We must be creative in initiating bilateral agreements. We have made a promising start with an agreement we reached with China during last fall's Summit. We must also use regional and multilateral fora to achieve our objectives -- such as the Summit of the Americas process, in the Asian Partnership for Economic Cooperation (APEC) process, the President's forthcoming trip to Africa, and the G-8 Summit in the United Kingdom. We will put on a full court diplomatic press to bring developing nations into a meaningful role in helping solve the global climate challenge. We will accept nothing less, nor would we expect the United States Senate to do so. As the President has indicated, the United States should not assume binding obligations under the Protocol until key developing countries meaningfully participate in meeting the challenge of climate change. Although the Kyoto Protocol was an historic step forward, more progress is necessary with respect to participation of key developing countries. It would be premature to submit the treaty to the Senate for its advice and consent to ratification at this time.

The Administration also plans to continue to work with the international financial institutions to promote market-based energy sector policies in developing countries that will help reduce developing country greenhouse gas emissions. Multilateral development bank policies, including those of the Global Environment Facility, strongly influence international lending and private capital flows for energy, industrial and transportation investments. Policies that favor market pricing, privatization, clean technologies and environmentally-friendly approaches will make implementing the Kyoto Protocol easier and will speed the growth of markets for new technologies that help reduce emissions in developing countries. We will work with the international financial institutions themselves -- from the World Bank to the regional development banks -- and

with other countries, especially developed countries, to achieve these goals in the coming years.

The Kyoto agreement does not solve the problem of global warming, but it represents an important step in dealing with a problem that we cannot wish away. A premature decision to reject the Protocol would deprive us of the opportunity to complete its unfinished business. If we fail to take reasoned action now, our children and grandchildren will pay the price.

Mr. Chairman, before turning briefly to our domestic efforts, let me note two other key elements in this equation – the contributions that the United States provides to carry out work under the U.N. Framework Convention on Climate Change and in the Intergovernmental Panel on Climate Change (IPCC), as well as the contributions that we make to the Global Environment Facility (GEF). For FY 1999, the President has requested \$314 million for the International Organizations and Programs Account, a level that represents a 6.6 percent increase over FY 1998. This amount includes \$8 million for the Climate Stabilization Fund which supports the Framework Convention and the IPCC. Parties to the Convention have much work ahead of them, as I have already noted. In addition, the IPCC has now embarked on its Third Assessment Report of Climate Change, scheduled for completion in late 2000 or early 2001. These funds are vital to ensuring U.S. leadership in both of these organizations and to ensuring that our views and the work of our scientists are taken fully into account.

In addition, the President has requested \$300 million to meet our past and current pledges to help fund the Global Environment Facility (GEF). The GEF helps developing countries act to protect the global environment in several key focal areas including international waters, biodiversity, climate change and depletion of the stratospheric ozone layer. If we want to bring developing countries on board with real commitments to limit greenhouse gas emissions, we need to demonstrate that we are a reliable partner by supporting their concrete efforts with reliable resources. At this point, our GEF shortfall damages U.S. credibility in promising to help developing countries meet the climate change obligations we are urging that they undertake. I would therefore urge the Congress to fund fully our \$300

million request, to meet our current pledge and also clear our substantial shortfall of nearly \$200 million.

President's Climate Change Technology Initiative

In his State of the Union address, President Clinton said that global warming is "the gathering crisis that requires worldwide action." We need to begin now to launch the sensible, cost-effective efforts that will help us avoid the high future cost of inaction.

The President last October outlined a three-stage approach to addressing climate change at home. The first stage consists of immediate actions to stimulate development and use of technologies that can minimize the cost of meeting U.S. goals in reducing greenhouse gas emissions. Stage two will review options created through ongoing technology development and lead to detailed plans for a domestic, market-based permit trading system for carbon emissions. Stage three will begin to implement a market-based emissions-trading system.

As a first installment on this plan, President Clinton announced in his State of the Union message two weeks ago his proposal for a \$6.3 billion Climate Change Technology Initiative over five years to cut U.S. greenhouse gas emissions -- \$1.3 billion higher than the President announced in his initial plan in October. This vigorous initiative calls for tax cuts coupled with research and development (R&D) to take cost-effective, practical steps that will position us well to meet the challenge we face early in the next century.

This initiative consists of two parts -- \$3.6 billion in tax credits for energy-efficient purchases and renewable energy, and \$2.7 billion in new R&D spending over five years.

The tax package includes tax credits of \$3,000 to \$4,000 for consumers who purchase advanced technology, highly fuel efficient vehicles. It provides a 15 percent credit (up to \$2,000) for purchases of rooftop solar electricity and hot water systems to provide incentives for meeting the Million Solar Roofs goal. It also includes a 20 percent credit (subject to a cap) for purchasing energy-efficient building equipment, a

\$2,000 credit for purchasing energy efficient new homes, extension of the wind and biomass tax credit, and a 10 percent investment credit for the purchase of combined heat and power systems.

The R&D component covers the four major carbon-emitting sectors of the economy (buildings, industry, transportation and electricity), plus carbon removal and sequestration, Federal facilities, and cross cutting analysis and research. Examples of this R&D effort include the Partnership for a New Generation of Vehicles (PNGV), a government-industry effort to develop affordable cars that meet all applicable safety and environmental standards and get up to three times the fuel efficiency of today's cars. In 1999, the President's budget for PNGV is \$277 million, up from \$227 million appropriated for 1998. Our PNGV effort is clearly paying off - the developments about higher mileage cars announced by the Big Three last month were assisted by research supported under PNGB. It is exciting to see our U.S. automakers already planning for the cars of the future, not as pipe dreams but as achievable greenhouse gas friendly products.

As General Motors Chair and CEO John F. Smith said recently in announcing GM's plans to step up research spending and focus on bringing new products to market, "No car company will be able to thrive in the 21st century if it relies solely on internal combustion engines." And as William C. Ford, Jr., Chair of Ford's Finance Committee, also said in announcing that Ford will join with Daimler-Benz of Germany in developing cars with fuel-cell engines, "There's a compelling business case to be made."

Similar government-industry efforts are proposed to develop cleaner, more efficient diesel engines for both light trucks and heavy trucks. The R&D effort also includes expanded research partnerships for key renewable technologies such as wind, photovoltaics, geothermal, biomass, and hydropower to accelerate price reductions and improve performance. The President's 1999 budget proposes a \$100 million increase in appropriations for solar and renewable energy R&D - a 37 percent increase over 1998.

We hope that the Congress will view the President's initiative favorably and appropriate the funds and enact the tax incentives that he has requested. We look forward to working with you to put the President's proposals into action.

The President and his Administration are committed to working with you in the Congress, both to realize the potential of the Climate Change Technology Initiative and to craft the ongoing U.S. approach to climate change. The United States has the power to lead the global effort, and Congress holds the key. What is done or not done today will determine the kind of world we will leave to future generations and the conditions of life they will face.

Sustained Effort Required

Mr. Chairman, I have mentioned that Kyoto produced a framework for future action, and I have listed a number of the steps that await us.

Coming to grips with the threat of global warming is no small task. We must tackle it in a vigorous, sober and determined manner, understanding that it represents a challenge but also an opportunity. And as we have always done in the face of global challenge, we must assume the responsibilities of American leadership.

Thank you.

**Remarks by Ambassador Stuart E. Eizenstat
Under Secretary of State for Economic, Business
and Agricultural Affairs
Japan American Society of Washington
Public Affairs Dinner
Wednesday, February 11, 1998**

Thank you for the opportunity to address you this evening and discuss elements of what has become one of our most important and significant bilateral relationships. It is truly an honor to speak about this important relationship in front of such a distinguished audience. I would like to recognize some individuals who have been so instrumental in shaping and strengthening U.S.-Japan relations over the years.

Two former U.S. Ambassadors to Japan, Mike Mansfield and Armin Meyer, have made an invaluable contribution to the development of our relationship and our productive and beneficial economic and security ties to the region. Ambassador Saito has been a good friend, an outstanding representative and played a key role in so many important issues in our bilateral relationship. Under the leadership of your co-chairs Bill Frenzel and Takashi Chiba, the Japan American Society has been instrumental in not only strengthening the ties between our two countries, but also in educating and informing Washington and the rest of the country on the key aspects and emerging issues which help shape and define this relationship. I would also like to thank Takashi Chiba for his kind introduction. Finally, I would like to recognize key members of Congress who are in the audience this evening -- Senator Rod Grams, Senator Max Baucus and Congressman Robert Filner and former Congressman Norman Mineta.

The United States and Japan have a relationship based on shared interests and mutual responsibility. It is based on a shared vision of a stable, peaceful and prosperous Asia-Pacific region. It requires that we work together to meet the challenges to our security, our environment and our economic well being. This is especially true these past few months as together we face one of the most serious economic challenges Asia has seen. The Asian Financial Crisis underscores how interconnected we are and how important our bilateral relationship is not only to both of our countries, but also to the region, and to the rest of the world.

Ours is a post-World War II relationship built on a proud record of cooperation in a variety of fields. In the past five decades, the United States and Japan have forged a security alliance which has enabled the countries of East Asia to grow and to prosper in ways never thought possible. Our leaders recognize that, although the Cold War is over, the potential for instability persists in the Asia-Pacific region. The U.S.-Japan security alliance remains indispensable for ensuring the region's peace and stability. The new Guidelines for U.S.-Japan Defense Cooperation, which were approved by both governments in September 1997, demonstrate the visionary leadership necessary to

ensure that this crucial security alliance will maintain its strength and vigor on into the 21st century. Our old defense guidelines were designed to address scenarios created by the Cold War. Our new guidelines reflect the world of today. They not only enhance our cooperation in the event of a direct attack on Japan, the new defense guidelines now allow us to cooperate in the event of a regional contingency as well as to work together in cases of humanitarian assistance and peacekeeping operations.

We are working together to address serious global problems as well. Japan's leadership and hospitality was instrumental in the success we achieved last December at the International Conference on Climate Change in Kyoto. As head of the U.S. delegation at the Kyoto Conference, I witnessed firsthand the cooperation demonstrated by the Japanese delegation that enabled us to work together to address the problems of global warming. We achieved what was a historic step in Kyoto, and while much work remains on this issue, the agreement we reached in Kyoto was a crucial step and would have been impossible without consultation, cooperation and coordination at the highest levels in Washington and Tokyo.

We must sustain the spirit of cooperation that was so critical to our achievements in Kyoto. Together, we must continue to work cooperatively in a number of areas that will permit more flexibility and enable us to reach our shared goals and objectives. We must lock in treaty rules that permit more flexibility; we must ensure that trading rights and a "clean development mechanism" which will enable companies in the developed world to enter into projects with the developing world work efficiently and smoothly; we must pursue inclusion of activities, called "sinks," that absorb carbon dioxide, such as planting trees, to be offset against emissions targets; and most significantly, we must work together to secure the meaningful participation of developing countries.

We look forward to continued collaboration between our scientists, our energy specialists and our financial experts in the coming years as we work together to address this most crucial challenge to our environment.

While security and environmental matters are crucial in their own right, our relationship and the challenges we face are mostly defined and driven by economics. Tonight I will address this critical economic relationship and our need to work together to ensure the economic well being of our two countries in this increasingly dynamic and integrated global economy and at this critical time in East Asia's economic history.

Japan's economic miracle, which began after the war, still stands as a remarkable achievement of growth and a rightful source of Japanese pride. No other nation, before or since, has been able to quadruple its standard of living in less than 20 years. In less than a generation, Japan became an economic powerhouse -- the world's second largest -- and its economy today, worth three trillion dollars, accounts for eight percent of the world's output. The economic model created by Japan to help it recover from the devastation of World War II was one that included high degrees of regulation, protected markets and a

lack of transparency. In today's Japan, this model has increasingly come to be seen as outmoded in the integrated global economy of today.

Our economic relationship has been mutually beneficial. The relationship is important to Japan: the United States is Japan's largest trading partner and most important single export market. Japanese exports to the United States are responsible for tens of thousands of Japanese jobs. American exports to Japan provide the Japanese with thousands of quality products and services at lower prices. It is in both of our interests to expand our relationship, to resolve our disagreements amicably and to work together to increase our mutual prosperity.

The relationship is also important to the United States: Japan is our third largest trading partner and our largest export market in Asia (30 percent of U.S. Asia exports) supporting millions of U.S. jobs. This is especially true in the west coast states of California, Oregon and Washington, where more than fifty per cent of exports are to Asia. Japanese investment in the United States, while often misunderstood and wrongly criticized, is responsible for thousands of American jobs and as well as providing a wide variety of quality products.

Today's era of economic interdependence in the Pacific Rim also poses great challenges for American and Japanese leadership. In the United States, where most newspapers and news programs report the Nikkei average and the dollar-yen rate daily with the baseball scores, fluctuations in Asian currencies and stock exchanges have a profound affect on investors.

The Clinton Administration is working with Japan and other key friends to address the immediate affects of the present Asian financial crisis as well as efforts to modernize Asian financial markets and regulatory regimes and to bring relationships between government and business into the twenty-first century.

In dealing with the recent crisis, the United States has worked with Japan and other countries, forging an international response involving the International Monetary Fund, the G-7, the World Bank, and the Asian Development Bank. As Secretary of the Treasury Rubin recently explained, the programs we have supported focus on four key elements: supporting reform programs in individual nations; providing temporary financial assistance when needed; encouraging strong action by Japan and other major economic powers to promote global growth; and fostering policies in other developing countries and emerging economies to reduce the risk of contagion.

Let me stress the important role Japan has played in this crisis and the level of cooperation between the U.S. and Japan have been key elements in our coordinated response to this crisis. Japan's substantial financial contribution demonstrates the level of commitment to addressing the needs of troubled Asian economies. Since September 1997, Japan has promised at least \$29.7 billion in balance of payments assistance, targeted overseas development assistance, commodity loans and trade insurance to Asian

nations affected by the current financial crisis. This amount represents more than that pledged by any other nation.

As we work with Japan to address the immediate crisis to the financial system in Asia, Japan must make an additional important contribution to the restoration of stability and resumed growth in the region by addressing fundamental problems with its own financial and trading systems. Japan is the economic engine for Asia. It cannot grow its way out of its recession by export-led growth. Domestic-demand led growth will create more demand for East Asian exports necessary to help their recovery. We realize that reform can be a long, complex and sometimes painful process, yet it is essential for Japan's own long term prosperity and will send a strong message to other Asian countries seeking to improve their own economies and financial systems.

Japan's leadership role in Asia should not be understated. It is obvious that Japan's domestic and international economic policies have an enormous effect on its trading partners, especially on its Asian neighbors. Recovery of other Asian economies requires a dynamic growing Japanese economy. Japan can and must do more. We urge Japan to demonstrate its leadership by stimulating domestic demand-led growth, deregulating its economy and opening its markets. This will benefit Japan, its neighbors and the global economy.

To discuss the issue of reform in Japan, it is helpful to analyze Japan's current economic condition. Since the puncturing of the economic bubble of the late 1980s and early 1990s, Japan's economy has grown only 1.4 percent per year, on average. Conventional economics suggests several reasons for the persistence of low growth:

- Japan's macro economic policy including recent tax increases waged on a weakened economy;
- the existence of a large amount of bad debt that has weakened banks and tied up real assets. There has never been full disclosure of the extent of bad loans held by Japanese banks. Greater transparency would increase the pressure to resolve these matters;
- a pattern of domestic economic regulation that raises costs and discourages innovation, investment and market competition;
- Japan's bilateral and global current account surplus;
- the high cost of Japanese labor and lack of mobilizing of Japanese workers.

Japan's Economic Planning Agency forecasts GDP growth of 1.9 percent in 1998, but many private observers expect growth to be virtually flat. Obviously, Japan would have the most to gain by more vigorous growth. So too would the countries of Asia and the United States benefit through greater export opportunities in a more rapidly growing Japan.

In December, the Hashimoto Government announced a number of fiscal stimulus measures for inclusion in a fiscal year 1997 supplementary budget that is now before the

Diet. We believe these proposals were a constructive first step by senior Japanese policy makers to offset some of the contraction in the 1997 budget and they have fueled market expectations for additional stimulus. I might note that, on the strength of these expectations, the Nikkei and the yen both have risen.

The Japanese Government also announced in December a 30 trillion yen package of measures to ensure the stability of the banking system. The announcement of Japan's plan to commit public funds to protect depositors was constructive. Protection of depositors, institutional reform to improve bank governance, closure of insolvent institutions and improved transparency and disclosure are all important steps in strengthening the financial system. We welcome the Japanese announcement last November an effort to open their financial services market, which should make it more efficient.

Fundamentally, by implementing deregulation and the other reforms proposed last year by Prime Minister Hashimoto, Japan will remove inconsistencies in its financial model and demonstrate the leadership necessary during this time of crisis. While there are attendant social costs to deregulation as inefficient companies are streamlined and new industries are born, we know firsthand from our own experiences with airlines, trucking, energy and financial services that deregulation can and will unleash growth over the long term. I recognize that undertaking deregulation in Japan, which places a high premium on job security, is a daunting task. But heavy regulation leads to stagnation. Today, a few years after U.S. deregulation efforts began, our unemployment rate is the lowest in decades, our economy has expanded for over 70 consecutive months and real wages are increasing. Japan's unemployment rate is growing and economic growth has been stagnant since 1992. If the Government of Japan is attendant to the social needs due to displacement, there is no reason why deregulation needs to be as disruptive as some fear -- quite the contrary, it is indispensable to Japan's recovery in a fiercely competitive world.

One need not look only at American models to see the benefits of deregulation. Japanese industry itself is filled with examples. Those industries in the export sector that were self-reliant and that were more willing to face international competition are world leaders. Japanese labor productivity in automaking and in consumer electronics, for example, are among the highest anywhere. Those industries are among the most innovative on earth and praised as leaders in quality.

Unfortunately, too many Japanese industries where most Japanese are employed are overregulated and frequently uncompetitive. Key sectors such as agriculture, services, and transportation are inefficient by world standards. For example, in food processing and textiles, Japanese productivity is about only one-third that of the United States. Wholesale and retail sales, employing 11 million people or about 20 percent of Japan's entire workforce, is only 44 percent as efficient as its American counterpart. Shielded from direct foreign investment and local competition, this sector makes Japanese

consumers pay too much for products and serves to drain capital and labor from more productive sectors of the economy.

This waste in certain sectors induces efficient Japanese companies to relocate offshore with a corresponding loss in good high-wage Japanese jobs. In 1996, for the first time ever, Japan's multinationals sold more through overseas affiliates than through exports from Japan. This hollowing out can only be reversed if Japan becomes a consumer led economy, more open to the world.

Japanese leaders seem to understand what must be done. As Prime Minister Hashimoto has said, in a rapidly integrated world where people, products, capital and information flow freely, it is clear that Japan's current economic framework, replete with over-regulation, non-tariff barriers, a lack of transparency and a lack of mobility, created thirty years ago to protect nascent industries, is now an obstacle to vigorous development. As a result, he has proposed an ambitious series of reforms which are urgently needed.

Last year, Japan's Economic Planning Agency warned that, unless the Prime Minister's proposed reform of institutions and policies is implemented, Japan will be lucky to achieve an average two percent annual growth over the next five years. MITI, the Ministry of International Trade and Industry, in a report issued before the present downturn in the Japanese economy, projects that without reform, growth will steadily decline: from 2.5 percent in the next few years, to 1.8 percent in 2000-2010 to only 0.8 percent afterwards -- a stronger and more urgent validation of the Japanese EPA's warnings.

We believe that the way to spur growth in Japan is through deregulation and greater encouragement of imports and foreign investment and this conforms with the Japanese government's own prescriptions. The collusive practices, cartels and anti-competitive regulations which hinder long-term growth would not be able to survive if imports were able to enter Japan and compete more freely. As reform economist Yukio Noguchi has pointed out, unless agriculture and small companies rationalize and their markets are opened to foreign competition, Japanese living standards are unlikely to improve.

We understand that this is no easy task. It will require immense determination and courage. But, in the interest of Japan's and East Asia's future prosperity, and the well-being of its consumers -- Japan's own government believes at the highest levels it must be done. It must be done not only because it will encourage domestic industries and service providers to become more efficient, fuel domestic growth and give Japanese consumers more choice, but also because these reforms will serve as a catalyst for Asia's economic recovery.

There are signs of progress towards openness. The recently concluded civil aviation agreement is the latest example. The U.S.-Japan Agreement, announced less than two weeks ago, will provide significant additional opportunities for access to the Japanese market for U.S. airlines, giving travelers to Japan more flights at lower costs and opening

the door to U.S. and Japanese companies to codeshare. This will lower prices for consumers and improve efficiency. The agreement includes our first ever code sharing agreement allowing U.S. airlines to serve other Asian markets and to enter into alliances with Japanese and third country airlines to serve other cities in Asia.

Before our civil aviation agreement, we worked together to resolve an impasse over non-competitive practices at Japanese ports. I was involved in long and tense negotiating sessions with my Japanese counterparts to broker a deal satisfactory to both the U.S. and Japanese steamship carriers. This agreement among the carriers and the Japanese Harbor Transportation Association, should benefit consumers in Japan and exporters from other parts of the world by making it easier to fight corrupt and inefficient practices at Japanese ports and to bring down the cost of shipping goods to Japan.

Over the past five years, we have negotiated over 20 trade agreements with Japan, more than under any previous Administration. From financial services to telecommunications, we have opened markets which were closed and watched as U.S. exports to Japan have grown twice as fast as our exports to the European Union. According to the 1997 national trade estimate report on trade barriers, in those sectors covered by recent trade agreements with Japan, exports have grown by more than 85 percent since President Clinton took office. This is three times as fast as other U.S. exports to Japan. These agreements prove that, working together, we can tackle difficult issues successfully.

The U.S. Government is committed to remain engaged with Japan. We will continue to negotiate with the Japanese Government to open markets. Our recent successes convince us that we can tackle other issues successfully. We will continue to have deregulation talks with Japan and are encouraged that Japanese trade experts who share our belief in the benefits of open competition are being heard more and more. In fact, Deputy U.S. Trade Representatives Fisher and Lang have demonstrated leadership in setting up our Enhanced Initiative on Deregulation (EID). This dialogue is a productive mechanism to share ideas and to coordinate efforts promoting deregulation. We will continue to suggest the Japanese to permit more foreign direct investment and to reform their financial system. Likewise, Japan must show responsible leadership for the rest of Asia. As time will tell, this will benefit both of our countries and will help us lead other economies to greater prosperity and success.

Although I have focused on our economic differences, I do not want to leave anyone with the impression that I view our relationship as adversarial. It is not. Many viewed with suspicion and mistrust Japanese direct investment in the United States and its purchases of U.S. debt years ago -- when in fact these investments and purchases were and are important to the U.S. economy. A few years ago, the popular media and fiction writers took great efforts to portray our two countries as destined to be adversaries. This is nonsense. Our alliance is strong, we are friends. We both realize our economies are interconnected, our interests are intertwined and we share leadership responsibilities to ensure a peaceful and prosperous Asia-Pacific region. We will continue to work together.

But within this spirit of cooperation and partnership, there should be a commitment to open markets and a recognition of the political dynamics that shape our relationship. There are protectionist forces in this country, based on fear and based on misinformation. These sentiments are fueled by a growing trade and current account deficit which will be further aggravated by further growth in the U.S.-Japan bilateral trade deficit. To reduce protectionist pressures here at home, Japan can help by promoting market opening and domestic demand-led growth.

We hold high expectations for Japan. No higher than Japan holds for itself. Our expectations are high because we recognize Japan is a great nation with a great and productive economy and a bright future. We admire the hard work and determination the Japanese have shown to create a peaceful, dynamic society. We expect Japan will continue to grow and play a key role in world affairs. As we rapidly approach the new millennium, we must continue our tradition of working together to meet the challenges and fulfill the promise of a dynamic new era. Our shared vision and future prosperity depend on it.

Thank you.