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Introduction

Three months ago, the President directed a Cabinet-level review of U.S. climate change policy. Members of the Cabinet, the Vice President, and senior White House staff have been meeting to examine the science, technologies, current U.S. efforts, and a wide range of innovative options for addressing concentrations of greenhouse gases in the atmosphere.

During that time, the Cabinet-level climate change working group has held regular and intensive sessions and has heard from many experts representing a wide range of views. To obtain the most recent information and a balanced view of what we know and do not know about the science of climate change, the working group requested a report from the National Academy of Sciences. The report outlines areas supported by the science and significant gaps in our knowledge of climate change.

The following material contains the initial findings of the working group: summaries of current U.S. actions, an analysis of the Kyoto Protocol, and proposals to advance the science, advance technologies, and create partnerships in the Western Hemisphere and throughout the world to address climate change.

The President has directed the Cabinet-level climate change working group to press forward and develop innovative approaches in accordance with several basic principles. These approaches should: (1) be consistent with the long-term goal of stabilizing greenhouse gas concentrations in the atmosphere; (2) be measured, as we learn more from science and build on it; (3) be flexible to adjust to new information and take advantage of new technology; (4) ensure continued economic growth and prosperity; (5) pursue market-based incentives and spur technological innovation; and (6) be based on global participation, including developing countries.

The Cabinet-level climate change working group will continue its review consistent with these principles.

CURRENT U.S. ACTIONS TO ADDRESS CLIMATE CHANGE

"The earth's well-being is also an issue important to America – and it's an issue that should be important to every nation and in every part of the world. My Administration is committed to a leadership role on the issue of climate change. We recognize our responsibility and we will meet it, at home, in our hemisphere, and in the world."

--President George W. Bush

Executive Summary

The United States government is currently pursuing a broad range of strategies to reduce emissions of greenhouse gases in the major greenhouse gas emitting sectors of our economy:

- **Electricity** -- Federal programs promote greenhouse gas reductions through the development of cleaner, more efficient technologies for electricity generation and transmission. The government is also supporting the development of renewable resources, such as solar energy, wind power, geothermal energy, hydropower, bio-energy, and hydrogen.
- **Transportation** -- The United States is currently promoting the development of fuel-efficient motor vehicles and trucks, researching options for producing cleaner fuels, and implementing programs to reduce the number of vehicle miles traveled.
- **Industry** -- The United States is implementing many partnership programs with industry to reduce emissions of carbon dioxide (CO_2) and other greenhouse gases, to promote source reduction and recycling, and to increase the use of combined heat and power.
- **Buildings** -- Federal voluntary partnership programs promote energy efficiency in the nation's commercial, residential, and government buildings (including schools) by offering technical assistance as well as the labeling of efficient products, efficient new homes, and efficient office buildings.
- **Agriculture and Forestry** -- The Federal government is implementing conservation programs that have the benefit of sequestering carbon in soils and off-setting agricultural emissions of greenhouse gases.
- **The Federal Government** – The Federal Government has taken steps to reduce greenhouse gas emissions from energy use in Federal buildings and in the Federal transportation fleet.
- **The National Energy Policy** – The National Energy Policy includes new recommendations to promote energy efficiency, conservation, increased use of natural gas and renewable energy, and the new construction of nuclear capacity.

United States government climate change programs are achieving real results, helping to reduce greenhouse gas emissions by 66 million metric tons of carbon equivalent in 2000. United States carbon intensity – the amount of CO2 emitted per unit of GDP – declined 15% from 1990 to 1999.

In addition, **businesses, state and local governments, and non-governmental organizations are addressing global climate change** – by improving the measurement and reporting of greenhouse gas emission reductions; through voluntary reductions, including emissions trading; and actions to sequester carbon through tree planting and forest preservation, restoration and management.

The Federal Government

The U.S. government is currently pursuing a broad range of strategies to reduce emissions of greenhouse gases, including:

- Voluntary public-private partnership programs that promote energy efficiency and the broader use of renewable energy;
- Research and development (R&D) investments and tax incentives to increase energy efficiency and the broader use of renewable energy;
- Appliance standards that increase the minimum level of efficiency of products on the market;
- Financial incentives such as grants to states and localities; and
- Programs to reduce greenhouse gas emissions from Federal buildings and transportation fleets.

These programs are achieving real reductions in greenhouse gas emissions – the U.S. government estimates that its existing climate change programs reduced emissions by 66 million metric tons of carbon equivalent (MMTCE) in 2000[1], approximately 2.7% of total emissions. The amount of CO2 emitted per unit of GDP declined 15% from 1990 to 1999.[2]

The following sections highlight **illustrative** programs in the major greenhouse gas emitting sectors of the economy: the electric power industry (32% of total U.S. greenhouse gas emissions); transportation (27%); other industry (21%); residential and commercial buildings (13%); and agriculture and forestry (net 7%) (unlike other sectors of the economy, agricultural and forestry activities can actively remove carbon dioxide from the atmosphere).[3]

Electricity

Federal programs promote greenhouse gas reductions through the development of cleaner, more efficient technologies for electricity generation and transmission. For example, the Environmental Protection Agency/Department of Energy *Combined Heat and Power Challenge*

[1] Office of Management and Budget, based on estimates from Federal agencies including the Environmental Protection Agency and Department of Energy.
[2] Energy Information Agency, *Emissions of Greenhouse Gases in the U.S. 1999* (October 31, 2000) Report SAI/DOE-0573 (99).
[3] USEPA #236-R-01-001, *Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1999* (January 2001).

program has the goal of doubling U.S. combined heat and power capacity by 2010 by providing technical assistance and addressing regulatory issues where possible.

The Federal government is also supporting renewable resources such as solar energy, wind power, geothermal energy, hydropower, bio-energy, and hydrogen. For example, the Department of Energy supports the development of a wide range of solar and renewable energy technology, seeking to improve their reliability, expand their applicability, and reduce their costs. These activities have been very successful in bringing down technology costs. The cost of producing photo-voltaic modules has decreased 50 percent since 1991, and the cost of wind power has decreased 85 percent since 1980. Commercial success has been achieved for both of these areas in certain applications.

Transportation

The U.S. is currently promoting the development of fuel-efficient motor vehicles and trucks, researching options for producing cleaner fuels, and implementing programs to reduce the number of vehicle miles traveled. For example, through the *Partnership for a New Generation of Vehicles (PNGV)* program, the research has directly led to the commercial introduction of new hybrid vehicles and soon hydrogen as well. Commercialization of such vehicles could cut fuel use and carbon emissions for individual vehicles significantly and could lay the foundation for large, long-term fuel and carbon benefits. If 10% of the on-road vehicle fleet utilized PNGV technologies, the aggregate emission reductions could be approximately 20 million metric tons of carbon equivalent per year. The program is being extended to sport utility vehicles and other light trucks which, because of their lower baseline fuel economies, have the potential for even greater overall fuel and carbon savings per vehicle.

Industry

The U.S. government is implementing many partnership programs with industry to reduce emissions of carbon dioxide (CO_2) and other greenhouse gases, to promote source reduction and recycling, and to increase the use of combined heat and power. For example, current voluntary partnerships directed toward eliminating market barriers to the profitable collection and use of methane that otherwise would be released to the atmosphere are expected to hold methane emissions at or below 1990 levels through 2010. Since the launch of EPA's *Voluntary Aluminum Industrial Partnership* in 1995, the program's membership has grown to include 22 of the nation's 23 aluminum smelters, representing 94% of U.S. production capacity. As of 2000, program partners cumulatively achieved a 45% reduction in perfluorocarbon (a high global warming potential gas) emissions from 1990 levels.[4]

Commercial and Residential Buildings

Partnership programs promote energy efficiency in the nation's commercial, residential, and government buildings (including schools) by offering technical assistance as well as the labeling of efficient products, efficient new homes, and efficient office buildings. As one example, the

[4] *The Power of Partnerships: Energy Star and Other Voluntary Programs*, 2000 Annual Report of the Climate Protection Partnerships Division, U.S. EPA, Summer 2001.

EPA/DOE *Energy Star* program collaborates with a wide range of building owners and users -- retailers, real estate investors, small businesses, governments and schools. Each partner commits to improve the energy performance of its facilities and the most efficient buildings are awarded the *Energy Star* label. More than 16% of the U.S. commercial, public, and industrial building market is enrolled in *Energy Star*. Nationwide, *Energy Star* has eliminated the need for over 10,000 megawatts of peak generating capacity – equivalent to 20 large (50 MW) power plants.[5]

Agriculture and Forestry

The Federal government is conducting research into methods to reduce emissions of methane and nitrous oxide from agriculture, and is implementing conservation programs that have the benefit of sequestering carbon in soils and forests. For example, USDA's *Conservation Reserve Program* (CRP) has taken over 36 million acres of environmentally sensitive crop land out of production. CRP provides long-term environmental benefits, including the offset of up to 12 MMTCE each year.[6]

The Federal Government

The Federal Government has taken steps to reduce greenhouse gas emissions from energy use in Federal buildings and in the Federal transportation fleet by:

- Requiring all Federal agencies to take steps to cut greenhouse gas emissions from energy use in buildings by 30% below 1990 levels by 2010.
- Directing Federal agencies in Washington, D.C. to offer to their employees up to $65 per month in transit and van pool benefits.
- Requiring Federal agencies to implement strategies to reduce their fleet's annual petroleum consumption by 20% relative to 1999 consumption levels and to use alternative fuels a majority of the time.

Businesses, States and Communities, and Non-Governmental Organizations

Businesses, states and local governments, and non-governmental organizations are also moving forward to address global climate change -- through programs to improve the measurement and reporting of emission reductions; through voluntary programs, including emissions trading programs; and through sequestration programs. For example:

- Under the *Voluntary Reporting of Greenhouse Gases* program, provided by Section 1605(b) of the Energy Policy Act of 1992, more than 200 companies voluntarily reported to the Department of Energy their voluntary measures to reduce, avoid or sequester greenhouse gas emissions, principally carbon dioxide.[7] These companies undertook 1,715 projects and

[5] *The Power of Partnerships: Energy Star and Other Voluntary Programs*, 2000 Annual Report of the Climate Protection Partnerships Division, U.S. EPA, Summer 2001.
[6] Marlen Eve, Ron Follett, and Kieth Paustian. "Carbon Storage in Agricultural Soils of the United States: Estimating Emissions and Sequestration." U.S. Government Presentation at UNFCCC SBSTA13. Lyon, France. 2000.
[7] 1999 report, issued January 19, 2001

achieved greenhouse gas emission reductions and carbon sequestration equivalent to 61.5 MMTCE, or about 3.4 percent of 1999 total U.S. greenhouse gas emissions.[8]

- Electric Utilities: Several companies have committed to reducing greenhouse gas emissions. Measures include:

  - ✓ Improved generation efficiency (seasonal use of natural gas, hydroelectric turbine replacements, expanded capacity, shortened outage schedules at nuclear plants);
  - ✓ Improved pipeline, transmission and distribution equipment efficiencies (including reducing leaks);
  - ✓ Increased use of renewables (wind, biomass and solar);
  - ✓ Improved home and office energy efficiencies (low-income weatherization, home energy audits, inefficient refrigerator and freezer removal and recycling, installation of advanced energy management systems, planting trees, and retrofitting energy efficient lighting in company buildings); and
  - ✓ Investments in more efficient technologies (programs to install geothermal heat pumps, commercialize emerging energy efficient and renewable energy technologies, accelerate introduction of electric vehicles into the marketplace, and enhance carbon sequestration).

- Oil and Gas: Some oil and gas companies have added greenhouse gas reductions to their list of corporate priorities. One company intends to reduce its greenhouse gases by 10% by 2002 (over 1990 levels), and another company is seeking to reduce by 10% by 2010. To do this, the company is adopting an internal system of company-wide emissions trading to meet its goal in the most cost-effective way possible. Significant gains can be made from such measures as reducing flaring and leaking.

- Auto Manufacturers: Auto manufacturers have announced production plans for hybrid gas and electric vehicles in 2003 or 2004 and have pledged to increase their sport utility vehicles' fuel economy by 25% by 2005.

- Chemicals: A chemicals trade association supports voluntary programs and its members' actions to improve energy efficiency and reduce greenhouse gases. For example, one company says it will reduce its greenhouse gas emissions by 65% (by 2010, over 1990 levels). It already has cut its global emissions by 45% by making major process-change investments (reducing nitrous oxides), by holding energy consumption flat even with tremendous production growth (with powerhouse and process efficiencies), and increased use of renewable energy. Another company is working to reduce energy use by 20% per unit of production by 2005.

- Non-Governmental Organizations. Several non-governmental organizations and coalitions have initiated partnership programs with large global corporations to reduce emissions of greenhouse gases, and promote the use of energy conservation, renewable energy sources, and efficient technologies. Non-governmental organizations also are working with companies to support forestry projects that sequester carbon through tree planting and forest preservation, restoration and management.

[8] DOE/EIA-0608 (1999), *Annual Report of the Voluntary Reporting of Greenhouse Gases*, February 12, 2001.

- States. More than 25 states have initiated state-based action plans to reduce greenhouse gas emissions. Some states are using market-based mechanisms to achieve reductions. For example, the State of New Jersey has established a 3.5% statewide reduction goal and is developing voluntary agreements with various businesses.

The National Energy Policy

The National Energy Policy includes numerous recommendations to promote energy efficiency and conservation and to reduce emissions of greenhouse gases through the use of alternative, renewable, and cleaner forms of energy.[9] These recommendations include:

Efficiency and Conservation Measures

- **Tax incentives and other initiatives to promote the use of combined heat and power.**

  The NEPD Group recommended that the President direct the Secretary of the Treasury to work with Congress to encourage increased energy efficiency through combined heat and power (CHP) projects by shortening the depreciation life for CHP projects or providing an investment tax credit.

  The NEPD Group also recommended that the President direct the Administrator of the Environmental Protection Agency (EPA) to work with local and state governments to promote the use of well-designed CHP and other clean power generation at brownfields sites, consistent with the local communities' interests. EPA will also work to clarify liability issues if they are raised at a particular site.

  The NEPD Group recommended that the President direct the EPA Administrator to promote CHP through flexibility in environmental permitting.

- **Reviewing and providing recommendations on establishing CAFE standards as well as other market-based approaches to increase the national average fuel economy of new motor vehicles.**

  The NEPD Group recommended that the President direct the Secretary of Transportation to:

  - ✓ Review and provide recommendations on establishing Corporate Average Fuel Economy (CAFE) standards with due consideration of the National Academy of Sciences study to be released in July 2001. Responsibly crafted CAFE standards should increase efficiency without negatively impacting the U.S. automotive industry. The determination of future fuel economy standards must therefore be addressed analytically and based on sound science.

[9] *National Energy Policy: Report of the National Energy Policy Development Group,* May 2001.

- ✓ Consider passenger safety, economic concerns, and disparate impact on the U.S. versus foreign fleets of automobiles.
- ✓ Look at other market-based approaches to increasing the national average fuel economy of new motor vehicles.

- **Directing all agencies to use technological advances to better protect our environment.**

The Administration remains committed to investing in Intelligent Transportation Systems (ITS) and encourages the private sector to invest in ITS applications. This Department of Transportation (DOT) program funds the development of improved transportation infrastructure that will reduce congestion, such as traveler information/navigation systems, freeway management, and electronic toll collection. ITS applications reduce fuel associated with travel.

The Administration remains committed to the DOT's fuel-cell-powered transit bus program, authored by the Transportation Equity Act for the 21st Century (TEA-21). This program demonstrates the viability of fuel-cell power plants for transit bus applications.

The Administration remains committed to the Clean Buses program. TEA-21 establishes a new clean fuel formula grant program, which provides an opportunity to accelerate the introduction of advanced bus propulsion technologies into the mainstream of the nation's transit fleet.

- **Promoting energy efficiency, including expanding the *Energy Star* program.**

The NEPD Group recommended that the President direct the Secretary of Energy to conduct a review of current funding and historic performance of energy efficiency research and development programs in light of the recommendations of this report. In addition, the NEPD Group recommended that the President direct the Office of Science and Technology Policy and the President's Council of Advisors on Science and Technology to review and make recommendations on using the nation's energy resources more efficiently.

The NEPD Group recommended that the President direct the Secretary of Energy to promote greater energy efficiency:

- ✓ Expand the *Energy Star* program beyond office buildings to include schools, retail buildings, health care facilities, and homes.
- ✓ Extend the *Energy Star* labeling program to additional products, appliances, and services.
- ✓ Strengthen Department of Energy public education programs relating to energy efficiency.

The NEPD Group recommended that the President direct the EPA Administrator to develop and implement a strategy to increase public awareness of the sizable savings that energy efficiency offers to homeowners across the country.

The NEPD Group recommended that the President direct the Secretary of Energy to establish a national priority for improving energy efficiency. The priority would be to improve the

energy intensity of the U.S. economy as measured by the amount of energy required for each dollar of economic productivity. This increased efficiency should be pursued through the combined efforts of industry, consumers, and federal, state, and local governments.

- **Conserving energy at federal facilities.**

  The NEPD Group recommended that the President direct heads of executive departments and agencies to take appropriate actions to conserve energy use at their facilities to the maximum extent consistent with the effective discharge of public responsibilities.

- **Improving and expanding appliance standards.**

  The NEPD Group recommended that the President direct the Secretary of Energy to improve the energy efficiency of appliances:

  - ✓ Support the appliance standards program for covered products, setting higher standards where technologically feasible and economically justified.
  - ✓ Expand the scope of the appliance standards program, setting standards for additional appliances where technologically feasible and economically justified.

- **Promoting congestion mitigation technologies.**

  The NEPD Group recommended that the President direct the Secretary of Transportation to review and promote congestion mitigation technologies and strategies and work with Congress on legislation to implement these strategies.

- **Reducing demand for transportation fuels by establishing a ground freight management program.**

  The NEPD Group recommended that the President direct the EPA and DOT to develop ways to reduce demand for petroleum transportation fuels. These agencies will work with the trucking industry to establish a program to reduce emissions and fuel consumption from long-haul trucks at truck stops by implementing alternatives to idling, such as electrification and auxiliary power units at truck stops along interstate highways. EPA and DOT will develop partnership agreements with trucking fleets, truck stops, and manufacturers of idle-reducing technologies *(e.g*., portable auxiliary packs, electrification) to install and use low-emission-idling technologies.

Alternative, Renewable, and Clean Forms of Energy

- **Increasing America's use of renewable and alternative energy**

  The NEPD Group recommended that the President direct the Secretaries of the Interior and Energy to re-evaluate access limitations to federal lands in order to increase renewable energy production, such as biomass, wind, geothermal, and solar.

The NEPD Group supported the increase of $39.2 million in the FY 2002 budget amendment for the Department of Energy's Energy Supply account that would provide increased support for research and development of renewable energy resources.

The NEPD Group recommended that the President direct the Secretary of Energy to **conduct a review of current funding and historic performance of renewable energy and alternative energy research and development programs.** Based on this review, the Secretary of Energy is then directed to propose appropriate funding of those research and development programs that are performance-based and are modeled as public-private partnerships.

The NEPD Group recommended that the President direct the Secretary of the Treasury to work with Congress to **develop legislation to provide for a temporary income tax credit available for the purchase of new hybrid or fuel-cell vehicles** between 2002 and 2007.

The NEPD Group recommended that the President direct the Secretary of the Treasury to work with Congress on legislation **to expand the section 29 tax credit to make it available for new landfill methane projects.** The credit could be tiered, depending on whether a landfill is already required by federal law to collect and flare its methane emissions due to local air pollution concerns.

The NEPD Group recommended that the President direct the Secretary of the Interior to determine ways to **reduce the delays in geothermal lease processing** as part of the permitting review process.

The NEPD Group recommended that the President direct the Secretary of the Treasury to work with Congress on legislation to **extend and expand tax credits for electricity produced using wind and biomass.** The President's budget request extends the present 1.7 cents per kilowatt hour tax credit for electricity produced from wind and biomass; expands eligible biomass sources to include forest-related sources, agricultural sources, and certain urban sources; and allows a credit for electricity produced from biomass co-fired with coal.

The NEPD Group recommended that the President direct the Secretary of the Treasury to work with Congress on legislation **to provide a new 15 percent tax credit for residential solar energy property**, up to a maximum credit of $2,000.

The NEPD Group recommended that the President direct the Secretary of the Treasury to work with Congress to **continue the ethanol excise tax exemption**.

The NEPD Group recommended that the President direct the Secretary of Energy to develop next-generation technology—including hydrogen and fusion:

- ✓ Develop an education campaign that communicates the benefits of alternative forms of energy, including hydrogen and fusion.

- ✓ Focus research and development efforts on integrating current programs regarding hydrogen, fuel cells, and distributed energy.
- ✓ Support legislation reauthorizing the Hydrogen Energy Act.

- **Promoting new construction of nuclear capacity that could significantly reduce future greenhouse gas emissions.**

  The NEPD Group recommended that the President support the expansion of nuclear energy in the United States as a major component of our national energy policy. Following are specific components of the recommendation:

  - ✓ Encourage the Nuclear Regulatory Commission (NRC) to ensure that safety and environmental protection are high priorities as they prepare to evaluate and expedite applications for licensing new advanced-technology nuclear reactors.
  - ✓ Encourage the NRC to facilitate efforts by utilities to expand nuclear energy generation in the United States by uprating existing nuclear plants safely.
  - ✓ Encourage the NRC to relicense existing nuclear plants that meet or exceed safety standards.
  - ✓ Direct the Secretary of Energy and the Administrator of the Environmental Protection Agency to assess the potential of nuclear energy to improve air quality.
  - ✓ Increase resources as necessary for nuclear safety enforcement in light of the potential increase in generation.
  - ✓ Use the best science to provide a deep geologic repository for nuclear waste.
  - ✓ Support legislation clarifying that qualified funds set aside by plant owners for eventual decommissioning will not be taxed as part of the transaction.
  - ✓ Support legislation to extend the Price–Anderson Act.

- **Market-based three pollutant strategy**

  The NEPD Group recommended that the President direct the EPA Administrator to work with Congress to propose legislation that would establish a flexible, market-based program to significantly reduce and cap emissions of sulfur dioxide, nitrogen oxides, and mercury from electric power generators. Such a program (with appropriate measures to address local concerns) would provide significant public health benefits, including ancillary carbon benefits, even as we increase electricity supplies.

  - ✓ Establish mandatory reduction targets for emissions of three main pollutants: sulfur dioxide, nitrogen oxides, and mercury.
  - ✓ Phase in reductions over a reasonable period of time, similar to the successful acid rain reduction program established by the 1990 amendments to the Clean Air Act.
  - ✓ Provide regulatory certainty to allow utilities to make modifications to their plants without fear of new litigation.

- ✓ Provide market-based incentives, such as emissions trading credits to help achieve the required reductions.

- **Increasing research in clean coal technologies.**

  The NEPD recommended that the President direct the Department of Energy to continue to develop advanced clean coal technology:

  - ✓ Investing $2 billion over 10 years to fund research in clean coal technologies.
  - ✓ Supporting a permanent extension of the existing research and development tax credit.
  - ✓ Directing federal agencies to explore regulatory approaches that will encourage advancements in environmental technology.

An Analysis of the Kyoto Protocol

> "The Kyoto Protocol was fatally flawed in fundamental ways. But the process used to bring nations together to discuss our joint response to climate change is an important one."
>
> – President George W. Bush

The Kyoto Protocol is fundamentally flawed The Kyoto Protocol fails to establish a long-term goal based on science, poses serious and unnecessary risks to the U.S. and world economies, and is ineffective in addressing climate change because it excludes major parts of the world.

The Kyoto Protocol is ineffective in addressing climate change because it excludes developing countries. The Kyoto Protocol's emission reduction requirements apply only to industrialized countries. Developing countries can continue business as usual under the Kyoto Protocol, despite their rapidly growing emissions:

- Current data indicate that developing countries' net emissions (including emissions and uptake from land use activities) have already exceeded those of the developed world.[10]

- Moreover, annual developing country emissions of CO_2 will double between 1990 and 2010 – an increase that represents over twice as many tons as all of the reductions the United States would be required to take under the Kyoto Protocol.[11]

The Kyoto Protocol's targets are not based on science. Its targets and timetables were arrived at arbitrarily as a result of political negotiations, and are not related to any specific scientific information or long-term objective.

The Kyoto Protocol targets are precipitous. Under the Kyoto Protocol, the emission reduction target for the United States is 7% from 1990 levels for each year from 2008-2012. However, the figure of 7% is misleading, because it does not take into account growth in emissions between 1990 and 2012. The actual reduction from the U.S. current emissions trajectory for this period is over 30%.[12] In other words, meeting its target would require the United States to reduce its output of greenhouse emissions by one third in less than seven years. This would require U.S. firms to retire large amounts of capital stock prematurely, imposing substantial and unnecessary costs on the U.S. economy. The Kyoto Protocol also does not allow countries to count legitimate mitigation activities. In fact, it restricts the use of carbon sequestration as a means of achieving its objectives. Moreover, it does not address substances that impact climate change, such as black carbon and tropospheric ozone, reductions of which would also have significant health benefits.

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[10] IPCC Special Report on Emission Scenarios, International Energy Agency data (www.iea.org) and Land-use data from Oak Ridge Laboratory Carbon Dioxide Information Analysis Center (cdiac.esd.ornl.gov).

[11] International Energy Outlook 2001, Energy Information Administration (www.eia.doe.gov/oiaf/ieo)

[12] United States submission to the UNFCCC, 2001

The Kyoto Protocol risks significantly harming the U.S. and global economies. The Kyoto Protocol would require the United States to meet its target no matter what the cost, which could be substantial:

- Most models suggest a reduction in U.S. GDP of 1% to 2% by 2010 as a result of Kyoto without emissions trading.[13] A 2% reduction is comparable to the impact of the oil shock of the 1970s.

- A U.S. Department of Energy model suggests a reduction of as much as 4%[14] in GDP under a scenario in which the United States does not establish implementing regulations before 2005 and does not engage in emissions trading. Under such a scenario, the U.S. economy could be transformed from one of strong growth to recession, with potentially significant repercussions for the global economy.

Other major industrial countries also have very stringent targets. The difficulties many countries will have in meeting their targets raises serious questions about the viability of the Kyoto Protocol framework.

The Kyoto Protocol would leave the United States dangerously dependent on other countries to meet its emission targets. Under the Kyoto Protocol's emissions trading system, countries are allowed to buy and sell part of their emissions allowances. Most economic models indicate that achieving reductions through emissions trading with other countries may cost about half of what it would cost to achieve the same reductions domestically under the Kyoto Protocol.[15] Many analysts have pointed to trading as the only way that the United States could meet its Kyoto target. Yet few countries will have many excess tons to sell other than Russia and several other Eastern European countries that negotiated targets well above their expected emissions during the period 2008-2012. There is no guarantee that these allowances would be available:

- In order to sell allowances, countries must meet measuring and monitoring requirements. Some countries with excess emissions are far from meeting these requirements now, and it is likely that the United States and other countries would not know until at least 2007 whether they could meet their requirements. This creates enormous uncertainty about the cost of meeting the Kyoto Protocol until well after the United States has assumed its obligations.

- Even if these countries met their requirements and were allowed to sell their emission allowances, U.S. purchases of allowances would amount to many billions of dollars of financial transfers annually – without achieving any meaningful greenhouse gas emission reductions or climate benefit.

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[13] Energy Modeling Forum results reported in IPCC Working Group III Third Assessment Report, Ch. 18, p. 70 (Final Government Distribution version)

[14] Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity, US Energy Information Administration, 2000

[15] Energy Modeling Forum results reported in IPCC Working Group III Third Assessment Report, Ch. 18, p. 70 (Final Government Distribution version)

Advancing Technology to Address Climate Change

"America is a leader in technology and innovation. We all believe technology offers great promise to significantly reduce emissions. So we are creating the 'National Climate Change Technology Initiative.' "

– President George W. Bush

Executive Summary

New technologies hold the promise of increasing our supply of energy more efficiently and more cleanly. **Technology has also played and will continue to play an important role in reducing greenhouse gas emissions and controlling costs.** Because greenhouse gas emissions come from many sectors of the economy, a wide variety of technologies will be needed. A portfolio of technologies to address climate change could include energy efficient technologies; lower carbon-emitting technologies; carbon capture, storage and sequestration technologies; and new technological discoveries yet to be made.

To advance the technology across each of these areas, President Bush will create the **National Climate Change Technology Initiative**. The President is charging the Secretaries of Commerce and Energy, working with other agencies, to:

- **Evaluate the current state of U.S. climate change technology research and development** and make recommendations for improvements.
- **Provide guidance on strengthening basic research** at universities and national laboratories, including the development of the advanced mitigation technologies that offer the greatest promise for low-cost reductions of greenhouse gas emissions.
- **Develop opportunities to enhance private-public partnerships** in applied research and development to expedite innovative and cost-effective approaches to reduce greenhouse gas emissions.
- **Make recommendations for funding demonstration projects** for cutting-edge technologies.
- **Develop improved technologies for measuring and monitoring** gross and net greenhouse gas emissions.

The National Climate Change Technology Initiative also will enhance coordination across federal agencies, and among the federal government, universities, and the private sector.

The Importance of Technology to Mitigate Climate Change

Technology will continue to play an important role in reducing greenhouse gas emissions and controlling costs. The long-term objective of the 1992 Framework Convention on Climate Change – to stabilize greenhouse gas concentrations in the atmosphere – can be addressed in two ways. First, by reducing emissions of greenhouse gases. Because greenhouse gases are emitted so broadly across society, no single technology appears to be sufficient to stabilize the increasing atmospheric greenhouse gas concentrations. Rather, **a portfolio of technologies aimed at improving energy efficiency, and increasing the use of low carbon fuels will help to reduce greenhouse gas emissions and ultimately to stabilize concentrations.**

Second, greenhouse gas concentrations can be addressed by means of capturing and sequestering gases, either at the source or after they have been released into the atmosphere. Limited carbon capture is occurring today, using currently available technologies. **Continued research and development is needed to explore advanced chemical and biological mechanisms to remove carbon dioxide from the atmosphere**.

General Investment Criteria

The Presidents of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine have provided some general principles for government investment in technology. In "Preparing for the 21st Century: Science and Technology Policy in a New Era" (October 23, 1997), the Presidents of the Academies offered criteria for such investment, including:

- Direct government investments in science and technology should be focused on long-range, broadly useful research in basic technology and science, both of which produce benefits far in excess of what private sector entities can capture for themselves.

- The federal government should cooperate with the private sector so that the United States maintains a position of leadership in those technologies that promise to have a major and continuing impact on broad areas of industrial and economic performance.

- But the government need not invest in fields in which the private sector already has programs of development in place. Private firms have the primary responsibility for product development, but federal and state governments play an important role in enhancing the civilian technology base and its adoption through their economic, regulatory, and trade policies, their support for research and development, and their own procurement of technology.

- Maintaining U.S. leadership in science and technology despite budget constraints will require discipline in the allocation of resources for federal investments. Within the general constraints determined by national priorities, the selection of individual projects must reflect the highest standards of the scientific and technical community.

Assessing the Current State of U.S. Climate Change Technology Research

The U.S. government has funded research to develop several technologies that mitigate climate change. In general, these technologies are aimed at: increasing energy efficiency to reduce the amount of energy consumed for goods produced in the economy; creating opportunities to switch to fuels and products that emit relatively lower amounts of greenhouse gases; enhancing carbon removal and storage in terrestrial, ocean, and geological sinks; and exploring innovative concepts along unconventional paths to discover new ways to reduce greenhouse gas emissions, such as advanced biotechnology concepts.

In order to advance climate change technology research, President Bush will:

- **Charge the Secretary of Commerce, the Administrator of the Environmental Protection Agency, and the Secretary of Energy to evaluate the current state of U.S. climate change technology research and development** and make recommendations for improvements.

Strengthening Basic Climate Change Technology Research

The development of certain climate change mitigation technologies may be impractical for the private sector. Such technologies have some unique characteristics, including instances where the:

- Benefits are too widely spread for any one company to recover its investment at a profit;
- Cost or risk is too great for any individual company to bear alone; or
- Potential benefits are too far in the future to pass the threshold of private investment criteria.

Yet these advanced concepts may have the greatest potential to reduce greenhouse gas emissions at very low cost. For example, **technological advances in areas such as biotechnology offer the potential for dramatic innovations in many areas**. An important technology is the development of bioreactors that can harness the potential of microbial communities, such as photosynthetic bacteria, to produce clean fuels such as hydrogen. These bioreactors can exploit our increasing understanding of the biochemical pathways of microbial communities. While these biotechnologies are currently producing higher value products, like pharmaceuticals, significant new scientific research will be required for the direct production of fuels.

Similarly, **scientists have begun work on promising new technologies for the cost-effective capture and sequestration of carbon in terrestrial and marine ecosystems**. These opportunities may provide other environmental benefits as well, such as improved soil quality, better retention of moisture and nutrients, and reduced soil erosion. Researchers at the Department of Energy, for example, are studying "mineral carbonization," a technique for turning gaseous CO_2 into an environmentally-benign mineral that could be used to refill mine pits in land reclamation efforts.

Research and development efforts to date show promise for several options. However, many options are still emerging concepts both in the United States and internationally. Estimates of their potential for mitigating climate change are large, but highly uncertain. Markets for these or other technologies will be developed if buyers have some assurance about the quantity and quality of the product they are purchasing. In addition, there are many scientific and technological challenges regarding costs, environmental impacts, and public acceptability that must be resolved before these climate mitigation technologies can reach their potential. How and how much to invest in these areas are questions that must be answered to ensure that we as a society can harness our technological resources and capabilities and find the most cost-effective and environmentally sound solutions to the risks posed by increasing atmospheric concentrations of greenhouse gases.

Therefore, President Bush has directed that the National Climate Change Technology Initiative will:

- **Provide guidance on strengthening basic research** at universities and national laboratories, including the development of the advanced mitigation technologies that offer the greatest promise for low-cost reductions of greenhouse gas emissions.

Enhancing Private-Public Partnerships

It is important to effectively use the technologies that are and will soon become available. For example, technologies designed to increase energy efficiency, such as industrial applications of combined heat and power (CHP), enable both the local generation of electricity and the efficient use of the byproduct heat. When the quantities of the heat and power produced are well matched to the requirements of an industrial plant or facility, total efficiency of the fuel utilization can reach 90 percent, avoiding significant emissions of CO_2.

Similarly, the United States can achieve significant reductions of energy consumption and the related emissions of greenhouse gases through building systems with integrated electronic sensors, “smart” windows, and computers to monitor, maintain, and manage building operations. Also, one of the most challenging and important elements of a comprehensive strategy to address long-term greenhouse gas emission reductions is to improve the efficiency of our transportation fleet. The development of higher efficiency, hybrid passenger vehicles is an important first step.

In addition to energy efficiency, there are opportunities to increase the use of fuels that emit fewer greenhouse gases. For example, increased use of biomass residues and development of herbaceous crops, like native American prairie switchgrass, can mitigate greenhouse gases from coal-fired power plants and reduce air toxic emissions. Similarly, biomass can be converted into simple chemicals and plastic substitutes from which a new chemical industry can be formed.

Currently, the Federal government has established partners in the private sector to advance these technologies. It is critical to enhance this role and ensure that partnerships with industry are directed toward the most mutually beneficial outcomes.

Therefore, President Bush has directed that the National Climate Change Technology Initiative will:

- **Develop opportunities to enhance private-public partnerships** in applied research and development to expedite innovative and cost-effective approaches to reduce greenhouse gas emissions.

Promoting Cutting Edge Technology

Cutting-edge technologies hold the promise of helping to reduce emissions of greenhouse gases. For instance, geothermal power plants have a proven record of performance for producing reliable base-load power with minimal environmental effects. However, substantial known resources have not been tapped. Advanced technology is being developed to make more geothermal resources economical over a larger portion of the country. In response to the electricity shortages in the West, a demonstration of the economic and environmental benefits of the next generation of geothermal power plant technology, such as improved condensers and heat exchangers, will spur new development. As much as 100 to 300 megawatts of additional geothermal power to replace combustion-fired facilities will become available at new and existing plants within the next two years.

Fuel cells, a product of America's space program, hold great promise for reducing emissions. As noted in the National Energy Policy, the first generation fuel cells for stationary power applications entered commercial markets in 1995 and the second generation is currently in the demonstration phase. Innovative demonstration projects will reduce the high cost of this technology and offer a great potential to meet our energy needs.

Therefore, President Bush has directed that the National Climate Change Technology Initiative will:

- **Make recommendations for funding demonstration projects** for cutting-edge technologies.

Technology for Measuring and Monitoring Gross and Net Emissions

A fundamental challenge in attracting private sector investment to land-based greenhouse gas emission reduction or carbon sequestration projects is the ability to accurately quantify the net changes. Private sector investors are reluctant to participate in projects without reliable and credible quantification of the uncertainties associated with different land management practices. Cost effective measurement systems will not only increase the attractiveness of agricultural greenhouse gas projects to investors, but can also provide valuable information to individual farmers and ranchers in optimizing the use of fuel, fertilizers and other substances.

Significant advances in the science of remote sensing, coupled with land-based measurements, create new opportunities to monitor and verify greenhouse gas emissions. New and improved sensors that can be mounted on earth observing satellites and high altitude aircraft can deliver a unique capability to regularly monitor greenhouse gases with high accuracy, including carbon dioxide, methane, and ozone. This effort requires collaboration between the federal government and the private sector.

Therefore, President Bush has directed that the National Climate Change Technology Initiative will:

- **Develop improved technologies for measuring and monitoring** gross and net greenhouse gas emissions.

ADVANCING THE SCIENCE OF CLIMATE CHANGE

"MY CABINET-LEVEL WORKING GROUP HAS MET REGULARLY FOR THE LAST TEN WEEKS TO REVIEW THE MOST RECENT, MOST ACCURATE, AND MOST COMPREHENSIVE SCIENCE. THEY HAVE HEARD FROM SCIENTISTS OFFERING A WIDE SPECTRUM OF VIEWS; THEY HAVE REVIEWED THE FACTS, AND THEY HAVE LISTENED TO MANY THEORIES AND SUPPOSITIONS. THE WORKING GROUP ASKED THE HIGHLY RESPECTED NATIONAL ACADEMY OF SCIENCES TO PROVIDE US THE MOST UP-TO-DATE INFORMATION ABOUT WHAT IS KNOWN – AND WHAT IS NOT KNOWN – ON THE SCIENCE OF CLIMATE CHANGE…THE UNITED STATES [WILL] HELP LEAD THE WAY BY ADVANCING THE SCIENCE ON CLIMATE CHANGE."

-- PRESIDENT GEORGE W. BUSH

Executive Summary

The United States leads the world in climate change research, spending more than the 15 nations of the European Union and Japan combined. Over the past decade, the United States has invested nearly $18 billion in such research and has increased our understanding of changes in climate, human links to these changes, and possible consequences.

To have the most up-to-date information of what is known and unknown about the science of climate change, the Cabinet-level climate change working group requested a report from the National Academy of Sciences (NAS). **The NAS report identified substantial uncertainty in critical areas,** such as:

- The feedbacks in the climate system that determine the magnitude and rate of temperature increases;
- The future usage of fossil fuels and the future emissions of methane;
- How much carbon is sequestered by oceans and other sinks and how much remains in the atmosphere;
- The details of regional climate change resulting from global climate change;
- The nature and causes of the natural variability of climate, its interactions with forced changes, and the direct and indirect effects of aerosols.

The National Academy of Sciences concluded, "[m]aking progress in reducing the large uncertainties in projections of future climate will require addressing a number of fundamental scientific questions relating to the buildup of greenhouse gases in the atmosphere and the behavior of the climate system."

To ensure that policies are shaped, and continue to be shaped, by the best science, President Bush will work aggressively to advance the science of climate change**. Today, the President is announcing the U.S. Climate Change Research Initiative**, which:

- Directs the Secretary of Commerce, **working with other agencies**, **to set priorities for additional investments in climate change research, to review such investments, and to maximize coordination among federal agencies;**
- Fully funds all priority research areas **that the Secretary of Commerce's**

review finds are underfunded or need to be accelerated relative to other research;

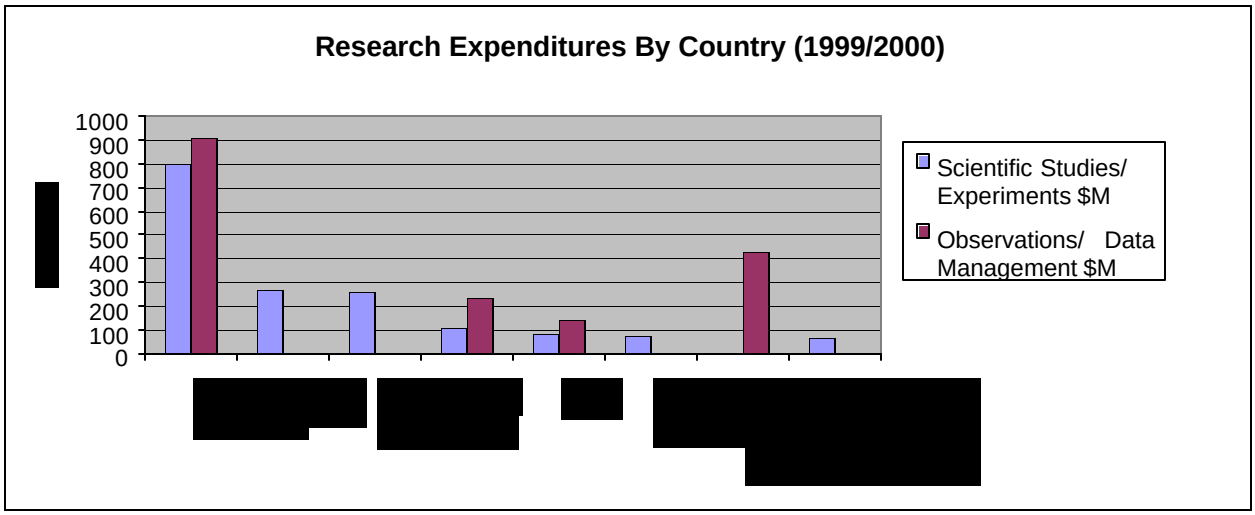
- **Challenges the major greenhouse gas emitting countries to increase significantly their investments** in high priority areas of climate change research;
- **Provides up to $25 million**, and calls on other developed countries to provide matching funds, to help build climate observation systems in developing countries; and

- **Proposes a joint venture** with the EU, Japan and others to develop state-of-the-art climate modeling to help us better predict the causes and consequences of climate change.

U.S. Climate Research to Date

U.S. Global Change Research Program

The United States leads the world in climate change research, spending approximately $1.6 billion annually. The United States is responsible for half of the world's annual climate change research expenditures, three times more than the next largest contributor and larger than the contributions of Japan and all 15 nations of the European Union combined.



Source: IGFA National Updates" (IGFA, 2000), NASA, European Space Agency, National Space Development Agency of Japan, Centre National d'Etudes Spatiales

The U.S. Global Change Research Program (USGCRP) is a national research program that coordinates most of the federal government's research on climate change. Definition of the program began under the Reagan Administration; the program became a presidential initiative under President George Bush, and was codified by Congress in the Global Change Research Act of 1990.

Since its establishment in 1990, USGCRP has spent approximately $18 billion. The President's fiscal year 2002 budget requests $1.6 billion for USGCRP. One half of this investment is devoted to climate change science and the other half to associated satellite systems. During its first decade, USGCRP research activities have identified a series of global scale changes, including ozone depletion, climate change, and land cover change. USGCRP has also explored and categorized likely human links to these changes, improved forecasts of the El Nino-Southern

Oscillation, and increased understanding of other climate changes. The USGCRP has also developed and deployed a series of remote sensing satellites that could form the basis of a global environmental observing system, and has developed models to analyze the climate process and produce scenarios of potential future climate change and possible consequences.

The USGCRP currently conducts research and observations in the following areas: Understanding the Earth's Climate System; Composition and Chemistry of the Atmosphere; Global Water Cycle; Carbon Cycle Science; Biology and Biochemistry of Ecosystems; Human Dimensions of Global Change; and Paleoenvironment/Paleoclimate (analysis of prehistoric changes in climate). Ten federal agencies participate in the USGCRP and their respective roles are described in Annex I.

Key Gaps in Science of Climate Change

Despite the United States' intensive investment in climate change science over the past decade, numerous gaps remain in our understanding of climate change. The National Academy of Sciences identified in its report, *Climate Change Science: An Analysis of Some Key Questions (June 2001)*, critical uncertainties about the science of climate change. At the most fundamental level, the report indicated the need to better understand the causes of warming. The National Academy of Sciences stated, "Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise. Temperatures are, in fact, rising. The changes observed over the last several decades are likely mostly due to human activities, but we cannot rule out that some significant part of these changes are also a reflection of natural variability."

The National Academy of Sciences report goes on to identify a range of specific areas of scientific uncertainty that require additional study and research. These gaps include:

- **How much carbon is sequestered by oceans and terrestrial sinks and how much remains in the atmosphere is uncertain:**
  - ✓ **"How land contributes, by location and processes, to exchanges of carbon with the atmosphere is still highly uncertain. . . ." (p. 11)**
  - ✓ **"These estimates [of future carbon dioxide climate forcings] . . . are only approximate because of uncertainty about how efficiently the ocean and terrestrial biosphere will sequester atmospheric CO_2." (p. 13)**
  - ✓ "How much of the carbon from future use of fossil fuels will be seen as increases in carbon dioxide in the atmosphere will depend on what fractions are taken up by land and by the oceans. The exchanges with land occur on various time scales, out to centuries for soil decomposition in high latitudes, and they are sensitive to climate change. Their projection into the future is highly problematic." (p. 18)

- **The feedbacks in the climate system that determine the magnitude and rate of temperature increases are uncertain:**

- ✓ "Because there is considerable uncertainty in current understanding of how the climate system varies naturally and reacts to emissions of greenhouse gases and aerosols, current estimates of the magnitude of future warming should be regarded as tentative and subject to future adjustments (either upward or downward)." (p. 1)

- ✓ "Much of the difference in predictions of global warming by various climate models is attributable to the fact that each model represents these [feedback] processes in its own particular way. These uncertainties will remain until a more fundamental understanding of the processes that control atmospheric relative humidity and clouds is achieved." (p. 4)

- ➢ **The direct and indirect effects of aerosols are uncertain:**

  - ✓ "The greatest uncertainty about the aerosol climate forcing—indeed, the largest of all the uncertainties about global climate forcings—is probably the indirect effect of aerosols on clouds." (p. 14)
  - ✓ "The great uncertainty about this indirect aerosol climate forcing presents a severe handicap both for the interpretation of past climate change and for future assessments of climate changes." (p. 14)
  - ✓ "Climate forcing by anthropogenic aerosols is a large source of uncertainty about future climate change." (p. 13)
  - ✓ "Because of the scientific uncertainties associated with the sources and composition of carbonaceous aerosols, projections of future impacts on climate are difficult." (p. 12)

- ➢ **The details and impacts of regional climate change resulting from global climate change are uncertain:**

  - ✓ "On the regional scale and in the longer term, there is much more uncertainty" with respect to effects on agriculture and forestry. (p. 19)
  - ✓ "The Northern Hemisphere as a whole experienced a slight cooling from 1946-75, and the cooling during that period was quite marked over the eastern United States. The cause of this hiatus in the warming is still under debate." (p. 16)
  - ✓ "Health outcomes in response to climate change are the subject of intense debate. . . .The understanding of the relationships between weather/climate and human health is in its infancy and therefore the health consequences of climate change are poorly understood. The costs, benefits, and availability of resources for adaptation are also uncertain." (p. 20)
  - ✓ "Changes in storm frequency and intensity are one of the more uncertain elements of future climate change prediction." (p. 20)

- ➢ **The nature and causes of the natural variability of climate and its interactions with forced changes are uncertain:**

  - ✓ "Because of the large and still uncertain level of natural variability inherent in the climate record and the uncertainties in the time histories of the various forcing agents (and particularly aerosols), a causal linkage between the buildup of greenhouse gases in

the atmosphere and the observed climate changes during the 20th century cannot be unequivocally established." (p. 17)

- ✓ The value of indirect effect of ozone changes induced by solar ultraviolet irradiance variations "remains highly uncertain." (p. 14)

- **The future usage of fossil fuels and the future emissions of methane are uncertain:**

  - ✓ "With a better understanding of the sources and sinks of methane, it may be possible to encourage practices . . . that lead to a decrease in atmospheric methane and significantly reduce future climate change." (p. 13)
  - ✓ "There is no definitive scientific basis for choosing among several possible explanations for these variations in the rates of change of global methane contributions, making it very difficult to predict its future atmospheric concentrations." (p. 11)

In response to these gaps in our knowledge, **the National Academy of Sciences study also recommends, "research that couples physical, chemical biological and human systems; an improved capability of integrating scientific knowledge, including its uncertainty, into effective decision support systems**, and an ability to conduct research at the regional or sectoral level that promotes analysis of the response of human and natural systems to multiple stresses."

The NAS report also indicates that to advance the understanding of climate change, it will be necessary to have "a global observing system in support of long term climate monitoring and prediction [and] concentration on large-scale modeling through increased, dedicated supercomputing and human resources." In addition to the recent National Academy of Sciences report, the USGCRP has updated its ten-year plan and submitted it to the National Research Council (NRC) for review. High priority areas for further research are identified in numerous recent reports and documents, such as: "*Global Environmental Change: Research Pathways for the Next Decade" (NRC 1998), "Capacity of US Climate Modeling to Support Climate Change Assessment Activities" (NRC, 1998), "Adequacy of Climate Observing Systems" (NRC, 1999),* and others.

Advancing the Science

The National Academy of Sciences report states that an "effective strategy for advancing the understanding of climate change will also require…efforts to ensure that climate research is supported and managed to assure innovation, effectiveness and efficiency." Over the decade of the USGCRP, interagency management of the program has weakened. The National Research Council in its report, "*Global Environmental Change: Research Pathways for the Next Decade" (NRC 1998),* identified the problem, and the USGCRP draft ten-year plan has proposed changes to the management structure. Such issues merit careful and high-level review, in consultation with the Congress.

Therefore, to advance the science of climate change and focus efforts on the many key areas of uncertainty, President Bush will:

- **Direct the Secretary of Commerce, working with other agencies, to set priorities for additional investments in climate change research**, to review such investments, and to maximize coordination among federal agencies.
- **Fully fund all priority research areas** that the review finds are underfunded or need to be accelerated relative to other research. Such areas could include the carbon cycle, climate modeling, and global water cycle.

The United States is making significant investments in the science of climate change and is pledging to accelerate its own research. Climate change is a global problem, however, and other nations must continue to advance the state of scientific knowledge.

The National Research Council, the US Global Change Research Program, and the World Meteorological Organization have all identified the building of a global observing system to monitor climate as being crucial to improving our understanding of the science of climate change. This system must include developing countries that have limited resources to make the necessary measurements.

The United States, Europe, and Japan each have significant climate modeling capabilities. The United States leads the world in the basic science of climate modeling, and Europe and Japan have built dedicated centers for climate modeling with a clearly defined mission.

Therefore, to enhance research, build a global climate observation system, and improve climate modeling, President Bush will:

- **Challenge the major greenhouse gas emitting countries** to increase significantly their investments in high priority areas of climate change research.
- **Provide up to $25 million to help build climate observation systems in developing countries** throughout the world, and call upon other developed countries to provide matching funds for such an investment.
- **Propose a joint venture** with the European Union, Japan and others to develop state-of-the-art climate modeling to help us better predict the causes and consequences of climate change.

Annex I

Agency Roles in the USGCRP

US Department of Agriculture: USDA-sponsored research focuses on understanding terrestrial systems and the effects of global change (including water balance, atmospheric deposition, vegetative quality, and UV-B radiation) on food, fiber, and forestry production in agricultural, forest, and range ecosystems. USDA estimates changes in carbon stocks on forests and agricultural lands and greenhouse gas emissions from agricultural sources, and performs research on how agricultural and forestry activities such as afforestation, changes in tillage practices, and bioenergy can contribute to a reduction in greenhouse gases.

Department of Commerce/National Oceanic and Atmospheric Administration (NOAA): NOAA's ground, ocean, and satellite observations, with an emphasis on oceanic and atmospheric dynamics, circulation, and chemistry, are an important part of the U.S. research program. They have resulted in improvements in climate modeling, prediction, and information management capabilities. NOAA also sponsors a wide range of studies on ocean-land-atmosphere interactions, the global hydrological cycle, and the role of global transfers of carbon dioxide among the atmosphere, ocean and terrestrial biosphere in climate change; the projection and assessment of variability across multiple timescales and the study of the relationship between the natural climate system and society and the development of methodologies for applying climate information to problems of social and economic consequences.

Department of Defense: The Department of Defense continues a history of participation in the USGCRP through sponsored research that concurrently satisfies national security requirements and stated goals of the USGCRP.

Department of Energy: Research supported by DOE's Office of Biological and Environmental Research (BER) addresses the effects of energy production and use on the global Earth system, primarily through studies of climate response. It includes research in climate modeling, atmospheric chemistry and transport, atmospheric properties and processes affecting the Earth's radiation balance and sources and sinks of energy-related greenhouse gases (primarily CO_2). It also includes research on the consequences of atmospheric and climatic changes on ecological systems and resources, critical data needs for the detection and attribution of climate change, tools and methods needed to conduct scientific assessments of climate change, and education and training of scientists and researchers in global change.

National Institutes of Health: Four NIH institutes support research on the health effects of UV and near-UV radiation. Their main objectives include increased understanding of the effects of UV and near-UV radiation exposure on target organs (e.g., eyes, skin, immune system) and of the molecular changes that lead to these effects, and the development of strategies to prevent the initiation or promotion of disease before it is clinically defined. National Institutes of Environmental Health Sciences (NIEHS) supports research on the health effects of chlorofluorocarbon replacement chemicals, including studies on the metabolism and toxicity of hydrochlorofluorocarbons and halogenated hydrocarbons.

Department of the Interior/U.S. Geological Survey (USGS): Research at USGS examines terrestrial and marine processes and the natural history of global change, including the interactions between climate and the hydrologic system. Studies seek to understand the character of past and present environments and the geological, biological, hydrological, and geochemical processes involved in environmental change.

Environmental Protection Agency: EPA's Global Change Research Program is an assessment-oriented program with primary emphasis on understanding the potential consequences of climate variability and change on human health, ecosystems, and socio-economic systems in the United States. This entails: (1) improving the scientific basis for evaluating effects of global change in the context of other stresses and human dimensions (as humans are catalysts of and respond to global change); (2) conducting assessments of the risks and opportunities presented by global change; and (3) assessing adaptation options to improve society's ability to effectively respond to the risks and opportunities presented by global change as they emerge.

National Aeronautics and Space Administration: NASA research efforts in global change involve space-based studies of the Earth as an integrated system, including research and satellite programs studying atmospheric chemistry and ozone; ocean surface winds, tropical precipitation and the global hydrological cycle and climate variability cycle; and the global carbon cycle, ocean biological productivity and land surface vegetation and ecosystems. The space-based activity complements ongoing ground-based research programs in the observation, understanding, and modeling of radiation, climate dynamics, and hydrology and water resources; ecosystem dynamics and biogeochemical cycles; atmospheric chemistry; and the processing, archiving, retrieval, dissemination, and use of global change data. The focus is Earth system science, which involves interdisciplinary research and coupled modeling. Development of algorithms for retrieval of the information content of space-based observations is carried out as part of the flight mission.

National Science Foundation: NSF global change research programs support research and related activities to advance the fundamental understanding of dynamic physical, biological, and socio-economic systems and the interactions among them. The programs encourage interdisciplinary activities with particular focus on Earth system processes and the consequences of change. NSF programs facilitate data acquisition and information management activities necessary for fundamental research on global change, promote the enhancement of models designed to improve our understanding of Earth system processes and interactions, and develop advanced analytic methods to facilitate basic research. NSF also supports fundamental research on the general processes used by organizations to identify and evaluate policies for mitigation, adaptation, and other responses to the challenge of varying environmental conditions.

Smithsonian Institution: The Smithsonian Institution program strives to improve knowledge of the natural processes involved in global climate change, to provide a long-term repository of climate-relevant research materials for present and future studies, and to bring this knowledge to various audiences, ranging from scholarly to lay public. The unique contribution of the Smithsonian Institution is a long-term perspective – e.g., undertaking investigations that may require extended study before producing useful results and conducting observations on

sufficiently long (e.g. decadal) time-scales to resolve human-caused modification of natural variability.
Source: FY2001 edition of "Our Changing Planet" (the USGCRP annual report)

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PROMOTING COOPERATION IN THE WESTERN HEMISPHERE AND BEYOND

"CLIMATE CHANGE – WITH ITS POTENTIAL TO IMPACT EVERY CORNER OF THE WORLD – IS AN ISSUE THAT MUST BE ADDRESSED BY THE WORLD. EVEN WITH THE BEST SCIENCE, EVEN WITH THE BEST TECHNOLOGY, WE ALL KNOW THE UNITED STATES CANNOT SOLVE THIS GLOBAL PROBLEM ALONE. WE ARE BUILDING PARTNERSHIPS WITHIN THE WESTERN HEMISPHERE AND WITH OTHER LIKE-MINDED COUNTRIES."

-- PRESIDENT GEORGE W. BUSH

Executive Summary

Climate change is a global issue that requires a truly global solution. Even with the best science and the most innovative technology, neither the United States nor any other country can solve this problem alone.

That is why **President Bush is directing the Secretary of State**, **working closely with other agencies, to consult with nations in the hemisphere and throughout the world and identify areas for enhanced cooperation. Specifically**, **the Secretary of State will**:

- **Build on the recently signed CONCAUSA declaration with Central America**, which calls for "intensified cooperative efforts" on climate change.
- **Strengthen and expand scientific research within the Western Hemisphere**, exploring opportunities presented by the Inter-American Institute for Global Change Research and other potential institutional linkages.
- **Revitalize U.S. efforts to assist developing countries to acquire the tools and expertise needed to measure and monitor emissions**, and to identify and act on priority emissions of both CO_2 and non-$C0_2$ gases.
- **Promote the export of climate-friendly, clean energy technology**, building on recommendations of the President's National Energy Policy.
- **Promote sustainable forest conservation** and land use in the developing world.

A Global Problem

Climate change is a global issue that requires a global solution, embracing developed and developing countries alike. The major greenhouse gas emitting nations include not only industrialized countries such as the United States and Germany, but also developing countries such as China, India, and Indonesia.

Major Emitting Countries

	NATION	Total Emissions (Millions of tonnes C per Year)	% of Global Total	Cumulative % of Global Total
	1995 Global Total	**6,173**	100%	100%
1	United States of America	1,407	23%★	23%
2	China	871	14%	37%
3	Russian Federation	496	8%	45%
4	Japan	308	5%	50%
5	India	248	4%	54%
6	Germany	228	4%	58%
7	United Kingdom	148	2%	60%
8	Ukraine	120	2%	62%
9	Canada	119	2%	64%
10	Italy	112	2%	66%
11	Republic of Korea	102	2%	67%
12	Mexico	98	2%	69%
13	France	93	2%	70%
14	Poland	92	1%	72%
15	South Africa	83	1%	73%
16	Indonesia	81	1%	75%

★ Note: When all greenhouse gas emissions are included, the U.S. total is less than 20%.
Source: Oak Ridge National Laboratories, U.S. Department of Energy

Partnerships for Climate Solutions

The United States has partnered on climate change issues through myriad activities with countries throughout the world. For example, through the U.S. Country Studies Program, we have helped 56 countries put together greenhouse gas inventories and action plans in the last eight years. We have worked with countries in Latin America, Asia and Africa to promote land use and forest conservation practices that promote carbon sequestration and other sustainable development goals. Through the Technology Cooperation and Agreement Pilot Project and other clean energy initiatives, the United States has worked with countries throughout the world to identify priority areas for adapting clean technologies in power supply and other sectors. And we have worked throughout the world on projects to reduce air pollution and emissions from non-CO_2 greenhouse gases.

President Bush intends to build on and strengthen our cooperation with countries in these and other areas. Thus, he has directed the Secretary of State, working closely with other agencies, to consult with our international partners and identify areas for cooperation in the Western Hemisphere and beyond.

Partnering in the Western Hemisphere

The Western Hemisphere offers exceptional opportunities for climate change in both the short and long term. The strong commitment to open democratic processes, market economies and sensible environmental solutions, as well as the growing economic ties in the region, provide a strong basis for increased cooperation on climate change.

Expanded CONCAUSA Declaration

As a first step, on June 7, 2001, the Secretary of State signed a Joint Declaration with seven Central American countries that reaffirms and broadens our joint efforts on sustainable development. The Declaration emphasizes "the need for intensified cooperative efforts to address climate change," citing as priority areas for action:

- Scientific research;
- Estimating and monitoring greenhouse gases;
- Investing in forestry conservation;
- Enhancing energy efficiency;
- Promoting environmental technologies;
- Enhancing capacity to adapt to climate change; and
- Collaborating to better understand regional impacts of climate change.

An action plan will be developed based on the declaration, with details to be completed by the time of the U.N. General Assembly meeting in September of this year.

Strengthening Scientific Research in the Western Hemisphere

Countries in the Western Hemisphere have a strong history of cooperation on scientific issues, but the climate challenge demands more. Therefore, the Secretary of State in cooperation with other agencies will seek ways to:

- **Strengthen cooperation on the development and application of regional climate models** to better understand climate "hot-spots" such as the Caribbean monsoon region, the Amazon basin, the influence of the mountains from Alaska to Chile on regional climate, and the El Nino and La Nina phenomena.
- **Support enhanced observations, research, modeling, and application** through institutions such as the Inter-American Institute for Global Change Research and other countries.

Increasing Cooperation Globally

Monitoring, Measurement and Mitigation Assistance

In order for countries to reduce their greenhouse gas emissions, they need basic information about their emissions, which can help prioritize mitigation efforts. Countries' ability to perform these vital tasks has been uneven to date. For example, it has been nearly ten years since the U.N. Framework Convention on Climate Change was established in 1992, yet only one-third of developing countries have submitted information on their emissions. Through the U.S. Country Studies Program, the United States has in the past been a leader in helping developing countries with the tools they need to measure and monitor their emissions, and to identify and act on priority emissions. Therefore, the Department of State, the Environmental Protection Agency and other agencies will:

- **Consider how to build on and substantially strengthen current efforts to cooperate with countries on the crucial tasks of emissions monitoring, measurement and mitigation.** These efforts will have an increased emphasis on effective mitigation of priority sources of CO2 and non-CO2 emissions.

Climate-friendly Technology

Energy use in developing countries is expected to account for three-quarters of the increase in global energy use between now and 2050, and our ability to effectively disseminate and adapt appropriate technologies is key to the climate change effort. Therefore, the United States will:

- **Explore ways of helping countries in the Western Hemisphere and throughout the world build the technical and policy foundations for a cleaner energy future.** This effort will build on the recommendations of the President's National Energy Policy, and will be guided by the strategic plan of the Clean Energy Technology Exports Working Group, a Federal interagency task force chaired by USAID and the Departments of Commerce and Energy.

Land Use and Forest Conservation

Substantial opportunities exist for early and significant reductions in greenhouse gas emissions through effective sequestration efforts in Latin America and elsewhere, with substantial benefits to biodiversity and conservation. Therefore, the United States will:

- Work with others to promote sustainable forest conservation and land use, **including through the Tropical Forest Conservation Act (which facilitates debt swaps with other countries to protect globally and regionally important tropical forests) and the establishment of a process of standardizing methodologies for measuring greenhouse gas reductions from sequestration projects.**