

CRS Report for Congress

Global Climate Change: A Survey of Scientific Research and Policy Reports

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ABSTRACT

This report is intended to guide the reader through U.S. global climate change policy from the passage of the National Climate Program Act of 1978 (P.L. 95-367) through the 1992 Earth Summit in Rio de Janeiro, where the U.N. Framework Convention on Climate Change (FCCC) was opened for signatures. It offers a summary of scientific research on global climate change and related U.S. policy and identifies what many consider to be important milestones in the international policy debate on global climate change. Major reports are listed that have underpinned such debates and have advised international decision makers. Also, major international meetings at which the United States had diplomatic representation are included as well as a chronology that serves as historical background for CRS Issue Brief 89005: *Global Climate Change*, which discusses U.S. policy and activities since ratification of the FCCC, including negotiations and debate leading to the 1997 U.N. Kyoto Protocol on Climate Change. This report will not be updated.

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Global Climate Change:

A Survey of Scientific Research and Policy Reports

Summary

The scientific proposition of an "enhanced greenhouse effect," or warming of the Earth's atmosphere because of carbon dioxide (CO₂) from industrial pollution, is now more than 100 years old. Since the late 1950s, U.S. Government scientists have participated in scientific workshops and international conferences on the nature of Earth's climate system and CO₂ and other greenhouse gases' potential to increase global average temperatures. The scientific debate centers on whether measurable changes in the global climate are human-induced and, if so, what might be the extent, nature and impacts of climate change.

Extensive involvement of the federal government in formulating a U.S. policy on climate change and assuming a diplomatic role in international scientific debates on this issue began in earnest in 1978 with efforts to coordinate federal scientific research activities in this area. Because of the global implications of climate change, concerns had also been addressed in international scientific conferences, developed as part of national policies, to exchange views and information in international scientific organizations within and outside the United Nations system.

In 1988, U.N. members requested the World Meteorological Organization (WMO) and the U.N. Environment Program (UNEP) to conduct an assessment of the state of knowledge about global climate change. The U.N. Intergovernmental Panel on Climate Change (IPCC) was established that year, and it reported its findings in the Fall of 1991. Subsequently, the IPCC has advised international negotiations on the 1992 U.N. Framework Convention on Climate Change (FCCC), and the 1997 Kyoto Protocol to the FCCC, which if it were to enter into force, would commit industrialized nations to legally binding greenhouse gas emissions reductions.

The Kyoto Protocol has received mixed reaction in the U.S. Government. The Clinton Administration supports it, generally, and is attempting to make it acceptable to Congress. However, many in Congress are concerned that endorsing the Protocol might lead to disruption of domestic economic growth, and produce few, if any, tangible environmental benefits. Still others in Congress question the scientific validity of the "global warming" theory. The U.S. Senate has a statutory role to provide advice and consent to ratification of U.S. treaties. Hearings in both the House and the Senate have been held by several committee on the science and possible effects of global climate change, and potential economic impacts as they relate to the Kyoto Protocol.

Given the remaining uncertainties about the possible magnitude, timing, rate, and potential regional consequences of climate change, policy makers continue to assess what policy actions might be appropriate. This report reviews the scientific research and policy which has framed current, and possible future, U.S. policy debate on climate change.

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Global Climate Change: A Survey of Scientific Research and Policy Reports

Introduction

It is difficult to ascribe a singular event that might have encouraged the U.S. Government to begin a major program to investigate global climate change; rather, it might be described as a long succession of events. The idea that carbon dioxide from industrial production could trap heat in Earth's atmosphere was proffered a century ago, in 1898, by Swedish physicist Svante Arrhenius. Following the 1957-1958 International Geophysical Year,¹ scientists within U.S. federal agencies participated extensively in scientific workshops, international conferences, and international scientific research that explored the nature of Earth's climate system and the role of carbon dioxide (CO₂) and other greenhouse gases believed to modify it. In 1965 the President's Science Advisory Committee issued a report, *Restoring the Quality of Our Environment*, that identified climate change and CO₂ buildup as deserving expanded monitoring and study.

Notable early research programs included the Global Atmospheric Research Program (GARP) and the World Climate Research Program (WCRP). Around 1977, the prospect of global climate change had emerged from lecture halls and academic conferences and had begun to be presented in United Nations (U.N.) sponsored international fora attended by U.S. scientists. Not long after, international experts involved in research on potential global warming from greenhouse gas emissions would be asked by policymakers to contribute their scientific findings to an incipient international policy debate on the validity of concerns that global average temperatures might increase because of human activities.

The National Climate Program Act (NCPA) of 1978 (P.L. 95-367, 15 USC §2901 *et seq.*) marked a major milestone in establishing a federal interest in global climate change policy. It signaled the beginning of a national policy, a diplomatic role in international actions on potential global climate change, and enhanced scientific research on these issues. It mandated coordination of domestic programs in climate research, applications, and services through an independent National Climate Program Office authorized under § 2908, of the Act. The NCPA also coordinated U.S. government participation in climate research conducted under international auspices.

¹ The International Geophysical Year's focus was organized to improve scientific knowledge about the Earth and its physical systems. Also, it celebrated the 100th anniversary of the first international Geophysical Survey undertaken to validate spatial measurements of the Earth.

The first major international studies on global climate change requested by world decision makers were performed by three United Nations organizations: the U.N. Environment Programme (UNEP), the World Meteorological Organization (WMO), and the International Council of Scientific Unions (ICSU). Their first study, which addressed potential global policy considerations, was released for public review and adopted by the U.N. Secretary General at the First World Climate Conference (FWCC) in Geneva in 1979. For about 10 years after FWCC, discussions continued the science of global climate change was further studied by WMO and UNEP, laying foundation for negotiations on a possible convention/treaty.

In November 1988, at the request of U.N. members involved in climate change research, the U.N. Secretary General, acting on recommendations of WMO and UNEP for an assessment of the state of knowledge about climate change, created the Intergovernmental Panel on Climate Change (IPCC). The IPCC's charge was to establish an orderly process to ensure that research and impact assessment studies proceeded concurrently and that adequate scientific research would precede legal or regulatory activities. To aid in its participation in the IPCC assessment process, and to coordinate U.S. research activities, the United States established the U.S. Global Change Research Program in 1989, pursuant to the Global Change Research Act (P.L. 100-606, 15 USC §2921 *et seq.*). In 1990, the IPCC completed the first of a series of periodic international scientific and policy assessments of global climate change. These assessments aimed to "review scientific knowledge about natural and human-induced climate change and ... provide governments with a sound consensus of scientific evidence on climate change and resulting impact on natural and human systems from which policy options can be developed."²

In 1990, after analysis of the first IPCC assessment, the U.N. General Assembly established an International Negotiating Committee (INC) to begin a process leading to a treaty on climate change. In 1992, the U.N. Framework Convention on Climate Change (FCCC) was adopted. The United States, along with 152 other nations, agreed to an ultimate objective of "stabilizing atmospheric greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system." The U.N. FCCC established a non-binding goal and policy framework for the industrialized countries to pursue various voluntary measures to limit their emissions of greenhouse gases to 1990 levels by the year 2000. In October 1993, President Clinton outlined a voluntary Climate Change Action Plan (CCAP) intended to work toward stabilizing U.S. emissions of greenhouse gases.

Prominent scientists were soon projecting that global greenhouse gas emissions would continue to rise long after the fundamental, voluntary commitments under the U.N. FCCC might be satisfied. Since the FCCC's "entry into force" in March 1994, debate has continued about the adequacy of scientific knowledge to be able predict future climate change and how to deal with its possible impacts if it were occurring. Also, there has been debate about whether all U.N. FCCC parties — and not only industrialized countries — should participate in activities aimed at protecting Earth's

² National Climate Program Office, January 15, 1988.

climate.³ Congress has held numerous hearings to inquire about the robustness of scientific findings relating to climate change and on other reports by social scientists projecting potential impacts for the U.S. economy, human health, and in other areas. Many studies have recommended possible policy responses, such as mitigation and adaptation strategies, to prevent or adapt to possible climate change. Members of Congress have also elevated concern about the issue internationally through direct communication with world leaders. Some have participated in international negotiations. Congress has passed resolutions and legislation that would help to coordinate scientific research on climate change, and has collected information from U.N. scientific bodies, and other international governmental and non-governmental organizations concerned with climate change.

While the U.N. FCCC focused on voluntary actions to be taken by the year 2000 for long-term control of the total concentration of atmospheric greenhouse gases, subsequent attention focused on regulating and reducing greenhouse gas emissions after the year 2000. As early as 1995, when U.N. FCCC parties were advised that it was unlikely that the voluntary goals of that treaty would be met, a Conference of Parties (COP) authorized under FCCC began to consider legally binding measures to reduce greenhouse gas emissions and proposed to craft a protocol or some other legal instrument that would be binding on the industrialized and developing countries.

The Berlin Mandate, which was adopted at the first meeting of COP (COP-1), in 1995, proposed dealing with future climate change by strengthening existing commitments under FCCC. However, it also continued to exempt developing countries, who are parties, from any new binding commitments related to controls on greenhouse gas emissions. Shortly thereafter, the IPCC released its second assessment on climate change (IPCC-2) in December 1995. Despite debate on its scientific findings, the United Nations endorsed IPCC-2 as the basis and scientific guidelines for negotiations on further action to limit possible human alteration of the climate system. One of the main findings of IPCC-2 — and one that has attracted considerable debate — was that “the balance of scientific evidence suggested a discernible human impact on the climate system.” At the conclusion of COP-1, a two year “Analysis and Assessment” phase was begun to consider the possible elements of a regulatory instrument to limit greenhouse gas emissions.

Successive negotiations by the Conference of Parties helped to forge a December 1997 accord, the U.N. Kyoto Protocol on Climate Change, an international treaty which, if it enters into force, would implement the first legally binding reduction of greenhouse gas emissions with the aim of stabilizing (if not reducing) atmospheric concentrations of these pollutants at some point in the future. Different countries would be bound by different levels of responsibility and compliance under the Protocol, but combined efforts required of industrialized countries, *alone*, would

³ For a more indepth discussion of this period of negotiations, see CRS Report 96-699 SPR, *Global Climate Change: Adequacy of Commitments under the U.N. Framework Convention and the Berlin Mandate*.

be expected to reduce global emissions of greenhouse gases by some 5% from 1990 levels by the year 2012.⁴

On November 12, 1998, the United States became the 60th country to sign the Kyoto Protocol despite protest from some in Congress. It has not yet been submitted to the Senate for advice and consent to ratification. Members of Congress have since introduced legislation, and Congress has included provisions in FY1999 and FY2000 appropriations bills to prohibit activities that would implement the Kyoto Protocol without prior Senate advice and consent to ratification.⁵

Scientific Debate on Global Climate Change and U.S. Policy

Many uncertainties continue to surround the theory of "global warming." At the very core of the scientific debate has been over the extent to which human activities influence climate change. Another uncertainty is whether the potential impacts of climate change might be harmful or beneficial for humans, managed agriculture, and natural ecosystems. Some question the validity and reliability of the scientific data to date which have underpinned negotiations toward possible international cooperation on regulation of greenhouse gases suspected to be causing globally-averaged warming. Others are convinced that actions must be taken as soon as possible to reduce potential effects of human-added gases released into the atmosphere since the beginning of the industrial era (c.a. 1850).

A number of seminal scientific studies were performed by international scientific institutions prior to and since the U.S. began to formulate a national policy on global climate change. Subsequently, the state of the knowledge about climate change has evolved and so have future projections of the potential impacts of climate change as demonstrated by a variety of computer models of Earth's climate.

Atmospheric concentrations of carbon dioxide (CO₂), the major greenhouse gas, have increased by about one-third over the past 100 years or so; over this period global temperature has averaged an increase of an estimated 0.5 °C (0.9 °F). A majority of state-of-the-art computerized general circulation models (GCMs), which approximate the Earth's climate, have projected a globally averaged warming in a range of 3 to 8 degrees Fahrenheit over the next 100 years, if greenhouse gases were to continue to accumulate in the atmosphere at the current rate. Prominent climate scientists have concluded that such a warming could shift temperature zones, rainfall patterns, and agricultural belts and, under certain scenarios cause sea level to rise and inundate low-lying coastal areas. Global warming, they believe, could have far-reaching effects — some positive, some negative, depending on regional impacts

⁴ For more details, see CRS Report 98-2, *Global Climate Change Treaty: The Kyoto Protocol*. Also see, CRS briefing book on *Global Climate Change*, [<http://www.congress.gov/brbk/html/ebgcctop.html>]

⁵ See CRS Report 98-664 STM, *Global Climate Change: Congressional Concern About "Back Door" Implementation of the 1997 U.N. Kyoto Protocol*.

— on natural resources; ecosystems; food and fiber production; energy supply, use, and distribution; transportation; land use; water supply and control; and human health. However, other scientists who are skeptical of the “global warming” theory debate the credibility of available data, claim it is insufficient for public decision makers, and criticize the results of mathematics- and physics-based climate models which use these data.”⁶

Most scientists are confident that the increase in atmospheric concentrations of carbon dioxide (CO₂) since the industrial revolution are primarily from human activities, and many of these scientists also conclude that this increase could be leading to higher global average temperatures. Other scientists, however, argue that scientific proof of the link between greenhouse gases and warming is inconclusive, or even contradictory, and that many uncertainties remain about the nature and future direction of Earth’s climate. In any event, concern is growing that increased CO₂ from human activities, such as the burning of fossil fuels, industrial production, deforestation, and certain land-use practices, along with increasing concentrations of other trace gases, including chlorofluorocarbons, (CFCs), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆), may be changing the chemical composition and the physical dynamics of Earth’s atmosphere, including how heat/energy is distributed among the land, ocean, atmosphere, and space.⁷

✱ In its 1995 assessment of global climate change, the U.N. Intergovernmental Panel on Climate Change (IPCC) reported a “discernible human impact on the climate system.” Some critics argue, however, that the signal has not emerged clearly from the background noise of natural climate variability that has transpired over long time periods. Lead authors of the IPCC scientific working group countered that uncertainties were adequately addressed in Chapter 8 (“Detection of Climate Changes and Attribution of Causes”) in the Science Working Group Report, and in the contents of other IPCC working group reports.

Skeptics have testified in congressional hearings that, upon reviewing the latest scientific literature about global climate change, they believe that 1) carbon dioxide may be 15% less potent in its ability as a greenhouse gas to warm the climate than previously thought, 2) methane has stabilized in the atmosphere and may be on the decline, calling into question the magnitude of its radiative contribution to climate change, and 3) global average temperatures have not risen at the rate or magnitude projected by GCMs. All of which, they claim, call into question the reliability of the computer climate models used to make projections of future warming and those that served as the basis for Kyoto Protocol negotiations.⁸

⁶ For a more in depth discussion, see “Policy Forum: Uncertainties in Projections of Human-Caused Climate Warming,” by J.D. Mahlman. *Science*, vol. 278, Nov. 21, 1997: 1416-1417.

⁷ See CRS Issue brief IB89005, *Global Climate Change*.

⁸ Testimony of Patrick Michaels, Professor of Environmental Sciences, University of Virginia and Senior Fellow in Environmental Studies at the Cato Institute to House Commerce Committee, Subcommittee on Small Business, July 27, 1998.

Skeptics have also challenged some scientists' interpretations that recent episodic weather events, which seem more extreme in nature, are indicative of long-term climate change. The Clinton Administration has been criticized for suggesting the possibility that recent floods, forest fires, rather severe weather and certain other weather anomalies could relate to a warming of the climate.

Natural variability of climate (or climate fluctuation) is large enough that statistically even the record-setting warmth and severe weather events in the 1980s and 1990s cannot be attributed entirely to human activities. In some cases, connections between inter annual and inter decadal climate fluctuations such as *El Nino* and *La Nina* and seasonal patterns of severe weather events are just beginning to be recognized, largely because of an improved ability to observe the nature, frequency, and severity of atmospheric and oceanic phenomena. This notwithstanding, singular extreme weather events have focused public attention on possible outcomes of potential long-term climate change and the need for a better understanding of regional climates. Consequently, it appears that many scientific questions about the nature of climate change and its relationship to regional weather patterns remain to be answered.

National Oceanic and Atmospheric Administration's (NOAA) researchers have reported that the 12 warmest years, in terms of global averages, since historical records have been kept (since about 1780) occurred during the past two decades, with 1990, 1998, and 1999 among the warmest. At least some of this warming, they concluded, is human-induced, because of the rate of change observed since post-industrial times. On the other hand, satellite instruments — which measure radiative properties of certain gases from which average temperatures of the atmosphere in a deep column above the surface may be deduced — have not demonstrated any significant temperature rise at upper levels of the atmosphere over the past 20 years. A recent report sheds some light on this debate. (See **National Research Council**, below.) Arguments such as this have cast some doubt as to whether historic temperature data — among other indicators of climate change, such as ice core sampling and tree ring data, for example — are a reliable way to estimate future atmospheric temperature. Scientists have also debated whether recent emergence of tropical diseases in the mid-latitudes and apparent biological changes manifested in certain species of flora and fauna are signaling that Earth's climate is warming on average. In efforts to address many of these unresolved issues, a third IPCC assessment of global climate change is expected late in the year 2000, and will likely influence future negotiations on global climate change.

Major Reports by International Scientific Institutions

The following selection of reports identifies major studies from an international perspective that have contributed to U.S. policy debates on global climate change. They are generally listed in chronological order and are attributed to the scientific institution responsible for the work. These include some of the earliest studies on climate change as it became a science policy issue for the United States and in international affairs. These represent a progression of views during the ten-year period between the first World Climate Conference in 1979 and the eventual

establishment of the U.S. Global Change Research Program in 1989, which defined a U.S. scientific research framework for global climate change. Those listed are selected based upon endorsement, involvement, or membership of U.S. government scientists in the WMO, UNEP, and ICSU. For additional studies by individuals, public interest groups, and others, see the CRS global climate change electronic briefing book web site. [<http://www.congress.gov/brbk/html/ebgcc1.html>].

U.N. World Meteorological Organization (WMO)

Three important reports were issued as a result of activities stemming from the 1979 World Meteorological Organization (WMO) First World Climate Conference (FWCC), cosponsored by UNEP and ICSU, which resulted in the creation of a U.N. World Climate Research Program. These organizations began to consider what might be possible issues of concern for world decision makers, and reviewed administrative responsibilities of the WMO as far as its role in international research on climate change. Many other reports by WMO have followed, focusing on more specific aspects of global climate change research and its potential role in informing public decision makers. In addition, other important reports by WMO's plenary body and WCRP have been issued. The three reports are:

- *Proceedings of the World Climate Conference: A Conference of Experts on Climate and Mankind*: Geneva, Switzerland, February 12-23, 1979. Secretariat of WMO, Geneva: 1979. WMO-No.537.
- *Report of the International Conference on the Assessment of the Role of Carbon Dioxide and of Other Greenhouse Gases in Climate Variations and Associated Impacts*: Villach, Austria, October 9-15, 1985. World Climate Research Program, WMO/UNEP/ICSU, Geneva: 1986. WMO-No. 661.
- *World Climate Program Impact Studies: Developing Policies for Responding to Climatic Change; a Summary of the Recommendations of the Workshops Held in Villach (28 September-2 October 1987) and Bellagio (9-11 November, 1987)* Beijer Institute. Stockholm: April 1988.

Two other WMO publications are published on its internet website [<http://www.unep.org/ipcc/qa/cover.html>]. These discuss contemporary aspects of the scientific debate on global climate change, and include:

“Common Questions About Climate Change”. This report is undated. It poses 10 of the most commonly asked questions about climate change, including whether the Earth has warmed, which human activities might be contributing to climate change, what further climate changes are expected to occur, and what effects these changes may have on humans and the environment, and suggests possible answers for those questions.

“Scientific Assessment of Stratospheric Ozone Depletion”. WMO Global Ozone Research and Monitoring Project-Report Series. *An Assessment of our Understanding of the Processes Controlling its Present Distribution and Change.*

This report is prepared every 3 years in cooperation with the UNEP, the U.S. National Aeronautics and Space Administration, Federal Aviation Administration (FAA), National Oceanic and Atmospheric Administration (NOAA), the Commission of the European Communities and, beginning in 1989, the intergovernmental Alternative Fluorocarbon Environmental Acceptability Study (AFEAS) team. This report series offers insight into the potential role of some chlorofluorocarbons (CFCs) in stratospheric ozone depletion and global warming, as well as the potential climate effects of their approved replacements. This report acknowledged that, although regulated under the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer for their ozone depleting effects, some of these compounds have, in addition, a Total Environmental Warming Potential (TEWP) while others may produce secondary effects on the climate by cooling the stratosphere.

International Council of Scientific Unions (ICSU)

International Geosphere-Biosphere Program (IGBP): A Study of Global Change. Global change report series, report no. 4: A Plan for Action. International Council of Scientific Unions (ICSU), Special Committee for the IGBP. Stockholm, Sweden: August 1988. This report, prepared for discussion at the First Meeting of the Scientific Advisory Council for the IGBP, Stockholm, Sweden, October 24-28, 1988, laid out a framework for “(1) Documenting and predicting global change; (2) Observing and improving our understanding of dominant forcing functions; (3) Improving our understanding of interactive phenomena in the total Earth system; and (4) Assessing the effects of global change that will cause large-scale important modifications in the availability of renewable and non-renewable resources.” Working groups also evaluated current and projected research capacity in four areas: (1) global geosphere-biosphere modeling; (2) data and information systems; (3) techniques for extracting environmental data of the past; and (4) geosphere-biosphere observatories.

The U.N. Commission on Environment and Development (UNCED)

Our Common Future. U.N. Commission on Environment and Development (UNCED). Geneva, Switzerland: 1987. The General Assembly of the United Nations called upon UNCED to propose long-term environmental strategies for achieving sustainable development by the year 2000 and beyond in ways that would promote greater co-operation among developing countries and between countries at different stages of economic and social development. As part of this report, the Commission stated that “The burning of fossil fuels puts into the atmosphere carbon dioxide, which is causing gradual global warming. This greenhouse effect may by early next century have increased average global temperatures enough to shift agricultural production areas, raise sea levels to flood coastal cities, and disrupt national economies.”

The U.N. Intergovernmental Panel on Climate Change (IPCC)

Established by the U.N. in November 1988, and made up of prominent scientists from WMO and UNEP governing bodies and representatives of national climate

change research programs, the IPCC was charged with performing the first internationally sponsored assessment of global climate change. Its members were requested by world governments to consider issues associated with the science, impacts, and possible response strategies to prepare for the possible onset of a greenhouse warming.

IPCC First Assessment Report: Overview. World Meteorological Organization and United Nations Environment Programme, Geneva: August 31, 1990. This report focused on the science of, impacts of, and responses to potential global climate change, and contained a policymakers' summary of the IPCC Special Committee on the Participation of Developing Countries. The overview brought together material from the four IPCC policymakers summaries. It presented conclusions, proposed lines of possible action (including suggestions of factors which might form the basis for negotiations) and outlined further work required for a more complete understanding of the problem of climate change resulting from human activities. This document summarized the three full reports of the working groups on Science (WG-1), Impacts (WG-2), and Responses (WG-3). Also, the Overview Report was an opportunity for additional technical assessment by experts of those governments that could not participate in the three Working Groups of IPCC, but was not one which reflected individual government's positions.

IPCC Supplement: Radiative Forcing of Greenhouse Gases. IPCC, Geneva: February 1992. This report presented an overview and findings of a meeting held in Guangzhou, China, to assess latest scientific data on global climate change, including new estimates of the indirect global warming potential of some greenhouse gases, and to update or confirm findings originally put forth in the three IPCC Working Group Reports completed in the summer of 1990.

IPCC Second Assessment Synthesis of Scientific-Technical Information Relevant to Interpreting Article 2 of the U.N. Framework Convention on Climate Change and Summaries for Policymakers of Working Groups I, II, and III Reports of the IPCC. IPCC Secretariat: Geneva: December 1995. This report presents a review of the role of developing countries in greenhouse gas emissions reduction and reporting requirements, and a summary of major findings of the three working group reports: 1) science, 2) impacts, adaptation, and mitigation, and 3) economic and social dimensions of climate change. The chairman of the science working group released a controversial claim in a policymakers summary stating that "The balance of scientific evidence suggests a discernible human influence on climate."

IPCC Technical Papers (1-4). IPCC. Geneva: 1997. Four technical papers were produced by IPCC working groups at the request of the Ad Hoc Group on the Berlin Mandate. Papers delved more in depth into a number of technical issues surrounding potential climate change agreements, including elements of a possible international regulatory framework (i.e., in support of a possible future protocol), and issues not resolved by the IPCC's 1995 assessment. The 4 papers include:

- *Technologies, Policies and Measures for Mitigating Climate Change*, November 1996;

- *An Introduction to Simple Climate Models Used in the IPCC Second Assessment Report*, February 1997;
- *Stabilization of Atmospheric Greenhouse Gases: Physical, Biological, and Socioeconomic Implications*, February 1997; and
- *Implications of Proposed CO₂ Emissions Limitations*, October 1997.

IPCC Special Report, The Regional Impacts of Climate Change: An Assessment of Vulnerability. IPCC, Geneva: November 1997. To expand upon the work of the IPCC's Second Working Group, the report consisted of vulnerability assessments for 10 regions that comprise the Earth's entire land surface and adjoining coastal seas. It also included annexes that provide information about climate observations, climate projections, vegetation distribution projections and socioeconomic trends.

Major Reports by U.S. Science Institutions and Federal Agencies

Official U.S. scientific organizations such as the National Research Council and federal government agencies have been involved in scientific research on global climate change for many years now. Some of the latter have also been mandated by Congress under U.S. law to produce reports that present a snapshot of U.S. policy on climate change. The U.S. Global Change Research Program (USGCRP) began in 1989. Today, representatives from nine federal agencies contribute focused scientific research to USGCRP and, along with a few additional agencies, contribute, indirectly to global climate change research efforts through various intramural scientific research programs. The following science institutions and agencies are listed in chronological order of their involvement with the U.S. global climate change research and policy debate.

U.S. National Research Council (NRC)

The National Research Council (NRC) of the National Academy of Sciences, a federally chartered institution of scientists, has played an important role in organizing U.S. efforts in international studies on the state of the knowledge about global climate change. The NRC Global Change Committee, for example, serves as the U.S. representative for the International Geosphere-Biosphere Program – a global change study – sponsored by ICSU. NRC has also advised federal agencies on the broad range of multidisciplinary earth systems studies being undertaken to garner knowledge about global climate change, and has served as a major forum for communications between scientists and policymakers on these issues.

Early NRC reports (pre-1983) focused on scientific research related to the issue, and summarized findings on the state-of-knowledge about global climate change and the role of CO₂. These were of a technical nature and reviewed scientific findings, not policy questions. The significance of these reports was that they represented the opinion of an internationally respected scientific institution, and reported the consensus of many of the world's leading scientific experts on climate change that

carbon dioxide in the atmosphere had the potential to pose a significant threat to the environment by causing a warming of the Earth's average global temperature. A few examples of these are:

- *Studies in Geophysics: Energy and Climate*. National Academy Press, Washington, DC: 1977. Geophysics Study Committee, Geophysics Research Board.
- *Carbon Dioxide and Climate: a Scientific Assessment*. National Academy Press, Washington, DC: 1979. Report of an Ad Hoc Study Group on Carbon Dioxide and Climate, Woods Hole, MA, July 23--27, 1979.
- *Carbon Dioxide and Climate: A Second Assessment: Report of the CO₂ Climate Review Panel*. National Academy Press, Washington, DC: 1982. Climate Research Committee, Board on Atmospheric Sciences and the Carbon Dioxide Assessment Committee of the Climate Change Board.

Subsequent NRC reports began to include scientific findings of interest to public policymakers, and also addressed science policy concerns such as prioritizing a research framework, coordinating federal agency activities, allocating research funding for global change research programs, and reviewing strengths and shortcomings in the federal science infrastructure that operates such programs.

Changing Climate: Report of the Carbon Dioxide Assessment Committee. National Academy Press, Washington, DC: 1983. The Commission on Physical Sciences, Mathematics and Resources, Board on Atmospheric Sciences and Climate prepared this report in response to the Energy Security Act of 1980 (P.L. 96-294, 41 USC § 8911) to assess the potential impacts of the buildup of CO₂ in the atmosphere from the full-scale production of synthetic fuels. Authors of the report state, "Our stance is conservative: we believe there is reason for caution, not panic. Since understanding and proof of what is happening to climate as a result of practices that load the atmosphere with CO₂ may come too late to allow for corrective action, we may not be able to wait to make certain there is a best course." This is, perhaps, one of the first "policy" documents on the issue of global climate change contributed to by scientists, and one that was required by Congress, under P.L. 96-294, Title VII, subtitle B--Carbon Dioxide Study.

Policy Implications of Greenhouse Warming: Mitigation, Adaptation, Science, and Synthesis Documents. National Academy Press, Washington, DC: 1991. The Synthesis Panel. The House Committee on Appropriations called for an NAS study on the potential societal impacts of global climate change (H. Rept. 100-701: 26). This was funded by an EPA grant approved under the HUD-Independent Agencies Appropriations Act of 1989 (P.L. 100-404, 42 USC §13381). The Committee on Science Engineering and Public Policy of National Academy of Sciences undertook this study, popularly known as known as the "COSEPUP study," Three reports were prepared and released in the following order: *Adaptation* (August 1991); *Mitigation* (June 1991); and *Science* (September 1991). However, the *Synthesis Panel Report*, which summarized the findings of all three COSEPUP

reports was published first in April 1991, and proposed least cost strategies for reducing U.S. greenhouse gas emissions 10% - 40% of 1990 levels by the year 2000. The panel concluded that some greenhouse gas emission reductions could be realized at a net savings if appropriate policies were implemented.

A Decade of International Climate Research: The First Ten Years of the World Climate Research Program. National Academy Press, Washington, DC: 1992. Climate Research Committee, Board on Atmospheric Sciences and Climate. One component of the WMO, the World Climate Research Program (WCRP), is reviewed by NAS at the request of the U.S. National Climate Program Office on behalf of federal agencies which support climate change research, observation systems, and services. The report findings state, "The WCRP, a framework for cooperation that has been active for a decade, has made measurable progress in leading all nations to a better understanding of climate." The Committee assessed the principle achievements and shortcomings of WCRP, and included conclusions about and recommendations for future direction.

Overview: Global Environmental Change: Research Pathways for the Next Decade. National Academy Press, Washington, DC: 1998. Committee on Global Change Research, Board on Sustainable Development, Policy Division. Participants noted that deliberations over the Kyoto Protocol set "environmental goals, which would affect the science priorities as well as economic paths in the coming century, and that scientists needed to create an intellectual framework to hone the questions that need immediate attention, to separate the vital from the interesting, and to preserve basic research for discovery of the unexpected." The Committee provided guidance on such a framework and clarified pathways for planning future U.S. research on global climate change. The report summarized background, findings, and recommendations of the Committee and reviewed research over the past decade, especially that of the U.S. Global Change Research Program (USGCRP). This initial charge to assess performance of the USGCRP would serve as a basis for a future report that would: 1) articulate the central scientific issues posed by global environmental change; 2) state the key scientific questions which must be addressed by USGCRP; and 3) identify the scientific programs, observational efforts, modeling strategies, and synthesis activities needed to attack these scientific questions. The Committee called for a revitalization of USGCRP and stressed the importance of U.S. leadership in supporting global change research.

Decade-to-Century-Scale Climate Variability and Change: A Science Strategy. National Academy Press, Washington, DC: 1998. Commission on Geosciences, Environment, and Resources. Board on Atmospheric Sciences and Climate and Climate Change Committees. "Dec-Cen" Panel on Climate Variability on Decade-to Century Time Scales. Panel members reported, "In 1990, the Intergovernmental Panel on Climate Change (IPCC) released its monumental first scientific assessment on climate change.... One significant gap involved our meager understanding and documentation of natural variability in Earth's climate system which provides a context for evaluating the significance of human-induced changes." This report formulated a research strategy and presented those scientific issues and infrastructure considerations required to most effectively advance understanding of climate variability and change on decade-to-century time scales. It also emphasized steps necessary to more confidently predict future climate conditions and detect

climate change as part of a holistic research perspective, which the panel believed is required to address this issue.

The Atmospheric Sciences: Entering the 21st Century. National Academy Press, Washington, DC: 1998. Commission on Geosciences, Environment, and Resources. Board on Atmospheric Sciences and Climate. This report set forth recommendations intended to strengthen atmospheric sciences and provide climate prediction services intended to benefit for the nation. Board members concluded, “It [the report] is thus intended for those who share the responsibility for maintaining the pace of improvement in the atmospheric sciences, including leaders and policy makers in the public sector, such as legislators and executives of the relevant federal agencies; decision makers in the private sector of the atmospheric sciences; executives of other economic endeavors whose activities are dependent on atmospheric information, and of course university departments that include atmospheric science.”

Adequacy of Climate Observing Systems. National Academy Press, Washington, DC: 1999. Commission on Geosciences, Environment, and Resources. Board on Atmospheric Sciences and Climate. Climate Change Research Committee. Panel on Climate Observing Systems Status. This report discussed how instrumentation, observing practices, processing algorithms, and data archive methods used by scientists may profoundly affect the understanding of climate change. The Board assessed whether scientists are making the measurements, collecting the data, and making it available in a way that would enable contemporary and future scientists to effectively increase understanding of natural and human-induced climate change. The report concluded that this was not the case, and illuminated the importance of multi-decadal climate monitoring and recommended strategies to achieve those goals.

Reconciling Observations of Global Temperature Change. National Academy Press, Washington, DC: January 2000. National Research Council, Board on Atmospheric Sciences and Climate Panel. This report discusses whether the observed surface warming of the Earth (over the past 20 years) is real or a product of unreliable and inconsistent data. Also, the report attempts to resolve disparities between temperature trends measured at the surface and upper air temperature trends from satellite data which skeptics have claimed may invalidate the results of general circulation models (GCMs) that have forecasted future climate change. Critics of GCMs point out that results of model runs demonstrate a homogenous warming throughout all the layers of the Earth’s atmosphere. Panel scientists believe that there may be a systematic disconnect between the upper and near surface atmosphere and have cited physical processes, which may have a unique impact on the upper atmosphere that are not currently accounted for in GCMs. The Panel reported that because of scientific uncertainties the difference in temperature trends cannot be explained. This, they concluded, was because of the paucity of surface and radiosonde data for some geographic locations, and the lack of consistent, long-term monitoring of the upper atmosphere.

U.S. Department of Energy (DOE)

Carbon Dioxide Research: State-of-the-Art Report Series. Office of Energy Research and Office of Basic Energy Sciences, Carbon Dioxide Research Division, Washington, DC. DOE reported that the enormity and diversity of the problem of coordination of multi-disciplinary research on carbon dioxide made it difficult to: define the problem; develop strategies for solving the problem; and establish communication and cooperation among the researchers working on different facets of the problem. DOE also recognized that the compilation, integration, interpretation, and dissemination of information were especially important. To improve communication between scientists and public decision makers, DOE prepared four State of the Art reports:

- Atmospheric Carbon Dioxide and the Global Carbon Cycle, February 1986;
- Direct Effects of Increasing Carbon Dioxide on Vegetation, March 1986;
- Detecting the Climatic Effects of Increasing Carbon Dioxide, February 1986;
- Projecting the Climatic Effects of Increasing Carbon Dioxide, April 1986.

Two additional reports, completed earlier, were later added to the series:

- Characterization of Information Requirements for Studies of CO₂ Effects: Water Resources, Agriculture, Fisheries, Forests, and Human Health, October 1985; and
- Glaciers, Ice Sheets, and Sea Level: Effects of a CO₂-Induced Climatic Change, 1984.

A Compendium of Options for Government Policy to Encourage Private Sector Responses to Potential Climate Change. U.S. Dept. of Energy, Washington, DC, October 1989. This is a compendium of generic policy instruments and specific policy options available to the U.S. government if it chooses to require significant private sector efforts to prevent, mitigate, or adapt to climate change. Authors of the report pointed out, "The selection of any particular package ... is a largely political choice of preferred means to achieve the overall policy goal."

Interim Report of the National Energy Strategy: A Compilation of Public Comments. U.S. Dept. of Energy, Washington, DC: April, 1990. The executive summary of the document stated that "Consistent with the President's directive to build national consensus, we have begun the task of developing a National Energy Strategy by opening a dialogue with the American people. We [DOE] have held fifteen public hearings in many areas of the country, several co-chaired by Cabinet Secretaries from other Federal agencies. More than 375 witnesses representing 43 States have contributed to several thousand pages of testimony. Further, our efforts to seek input from State and local governments, consumer organizations, business, industry, and recognized representatives of diverse points of view have resulted in more than 1,000 written submissions. The purpose of the Interim document is to convey the results of this public dialogue [on a National energy strategy] ... The

comments received are organized on the basis of presented public concerns, publicly identified goals, publicly identified obstacles to achieving those goals, and publicly suggested options for action to remove or overcome the obstacles.”

Scenarios of U.S. Carbon Reductions: Potential Impacts of Energy Technologies by 2010 and Beyond, “The Five-Lab Study”. U.S. Dept. of Energy. Washington, DC, September 1997. The report analyzed some options for using cost-effective, high efficiency energy technologies and other low carbon technologies to curb greenhouse gas emissions. It also estimated the potential cost per ton for carbon reduction required to stabilize U.S. emissions at 1990 levels by 2010, through implementation of such technologies. The 5-lab study also concluded that all emission-reduction scenarios that were modeled could be achieved at low or no net costs.

Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity. U.S. Dept. of Energy, Energy Information Administration (EIA), Washington, DC, October, 1998. The analysis in this report was undertaken at the request of the U.S. House of Representatives Committee on Science on March 3, 1998,⁹ to analyze potential economic impacts of the Kyoto Protocol, by focusing on different scenarios for U.S. energy use and prices and the economy in the years 2008 to 2012. This report was prepared as a critique of the DOE “5-Lab Study,” described above, and basically disagreed with the former’s economic conclusions. Authors noted, “the report was prepared with sensitivities evaluating key uncertainties [such as]: U.S. economic growth, the cost and performance of energy-using technologies, and the possible construction of new nuclear power plants.”¹⁰

Emissions of Greenhouse Gases in the United States. DOE, Energy Information Administration, Office of Integrated Analysis and Forecasting. DOE/EIA-0573(98), Washington, DC: October, 1999. Annual report series begun in 1996, reflecting 1995 U.S. emissions. These documents report U.S. aggregate greenhouse gas emissions based upon reporting consequent to §1605 of the Energy Policy Act of 1992 (PL. 102-486, 42 USC §13385). They also project future emissions based upon projected energy demand. Latest estimates of emissions for carbon dioxide, methane, nitrous oxide, and other greenhouse gases are included.

National Aeronautics and Space Administration (NASA)

Earth Systems Science: A Program for Global Change. National Aeronautics and Space Administration, Earth System Sciences Committee, NASA Advisory Council, Washington, DC: January 1988. This extensive study proposed near-term (1987-1995) and long-term (1995 and beyond) recommendations for: 1) sustained, long-term measurements of global variables; 2) a fundamental description of the Earth and its history; 3) research foci and process studies; 4) development of Earth system models; 5) an automated information system/clearinghouse for Earth

⁹ See Appendix D of the cited report: “Letters from the House Committee on Science.”

¹⁰ The legislation establishing EIA in 1977 vested the organization with an element of statutory independence. EIA does not take positions on policy questions, and does not purport to represent the official position of the Department of Energy or the Administration.

system science; 6) coordination of federal agencies activities; and 7) enhanced international cooperation.

National Oceanic and Atmospheric Administration (NOAA)

Reports to the Nation on Our Changing Planet: Our Changing Climate Dept. of Commerce, National Oceanic and Atmospheric Administration, Boulder, CO: Fall 1997. This report, prepared under a grant to University Corporation for Atmospheric Research, succinctly reviewed the state of the knowledge of climate change as of its publication and explored the role of natural and possibly human-induced changes. Authors stated that, "We have entered an era when actions by humanity may have as much influence on Earth's climate as the natural processes that have driven climate change in the past. Our future climate will be partly of our own making."

National Science Foundation (NSF)

Global Change. (NSF) *Mosaic* 19, 3/4, Fall/Winter 1998: entire issue. This special double issue outlined a potential framework for international climate change research and introduced the major players in science policy in the global change community. It discussed a potential role for the U.S. in the International Geosphere Biosphere Program (IGBP). The editor of this issue states, "The planners of the worldwide effort to untangle the processes that lead to global change have seized the moment by producing an outline: now it's up to the scientific communities of many nations and many disciplines to fill in the blanks."

White House Office of Science and Technology (OSTP)

Our Changing Planet: the U.S. Global Change Research Program. U.S. Office of Science and Technology Policy, Committee on Environment and Natural Resources, Washington, DC: 1989. Originally issued as *A U.S. Strategy for Global Change Research*, a report by the Committee on Earth Sciences, to accompany the President's FY1990 Budget, with expectations that this document would be released annually thereafter (pursuant to P.L. 101-606, 15 USC §2921 et seq.). This report was followed by a formal FY1990 "research plan" which looked forward 10 years. Only one more formal research plan was released for FY1991. Five-year assessments were called for thereafter. The FY1990 report stated that, "The purpose of this document is to provide an initial research strategy to guide planning and conduct of the U.S. Global Climate Change Research Program (USGCRP)."

These comprehensive research plans presented details of the USGCRP, evaluated how well the current activities addressed the key scientific questions and program goals, identified the gaps in knowledge, prioritized among research needs, and defined individual federal agency roles. They were developed in close collaboration with other national and international planning groups and activities, including the National Academy of Sciences and the International Geosphere-Biosphere Program, and took into account programs outlined in the 5-year plan of the National Climate Program. After FY1991, the research plan was integrated into the "*Our Changing Planet* (OCP)" budget document, which has been published annually

through FY2001. For FY2000, the OCP contained a section entitled "Perspectives for the USGCRP for the decade ahead, preparing the agenda for the 21st century."

U.S. Environmental Protection Agency (EPA)

The Potential Effects of Climate Change on the United States. U.S. Environmental Protection Agency, Office of Policy, Planning, and Evaluation, Washington, DC: December, 1989. The Continuing Resolution Authority for FY1987 (P.L.99-591, 15 USC §2901, note) mandated that EPA conduct a study on the greenhouse effect and to prepare two reports which focus on the health and environmental effects of climate change. This first report focused on the potential health and environmental effects of climate change including, but not limited to, the potential impacts on agriculture, forests, wetlands, human health, rivers, lakes, estuaries as well as societal impacts, and it was structured to address regional impacts of climate change on the Southeast, the Great Plains, California, and the Great Lakes.

Policy Options for Stabilizing Global Climate Change. U.S. Environmental Protection Agency, Office of Policy, Planning, and Evaluation, Washington, DC: December, 1990. Second of two reports on the greenhouse effect mandated by Congress in PL. 99-591. The report presented, "A comprehensive and global approach," covering all sectors and all greenhouse gases, in the analysis of policy options for reducing greenhouse gases. The report reflected a wide range of policy options, from energy efficiency to new methods of rice cultivation, and presented possible future scenarios of greenhouse gas emissions up to the year 2100, with different levels of policy response, and other independent factors, such as domestic economic performance.

U.S. Efforts to Address Global Climate Change: Report to Congress and Appendices. U.S. Environmental Protection Agency, Office of Policy, Planning and Evaluation and U.S. Department of State, Washington, DC: February, 1991. Mandated by Congress in the Global Climate Protection Act of the *Foreign Relations Authorization Act, Fiscal Years 1988 and 1989* (P.L. 100-204, §1103, Title XI; Global Climate Protection - Global Climate Protection Act of 1987). Section 1103 expressed certain congressional findings regarding global climate protection, including the following: (1) there is evidence that manmade pollution may be producing a long-term and substantial increase in the average temperature on the surface of the Earth, a phenomenon known as the "greenhouse" effect; and (2) vigorous research is required in order to prevent such pollution from altering the global climate, and affecting agriculture and habitability over large portions of the Earth's surface within the next century. Also, in Title XI of this Act, the President, through EPA, was directed to develop and propose a coordinated national policy on global climate change; and to direct the Secretary of State (hereafter Secretary) to coordinate such U.S. policy in the international arena. The Secretary and the Administrator of the EPA (hereafter Administrator) were directed within 24 months after enactment of this Act to jointly report to the appropriate congressional committees an analysis, description, and strategy of the United States with respect to the greenhouse effect and its potential role in global climate change. Congress had also urged the Secretary of State to promote an International Year of Global Climate Protection (IYGCP), and encouraged the President to accord the problem of climate protection a high priority on the agenda of U.S.-Soviet relations. The President did

not endorse U.S. involvement in an IYGCP. The resulting report identified U.S. efforts to address potential climate change, and recommended that U.S. policy should seek to: (1) increase worldwide understanding of the greenhouse effect and its consequences; (2) foster cooperation among nations to coordinate research efforts with respect to such effect; and (3) identify technologies and activities that limit mankind's adverse effect on the global climate.

Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1996. U.S. Environmental Protection Agency, Office of Policy, Planning, and Evaluation, Washington, DC: March, 1998. EPA 236-R-98-006. This annually published report summarizes the latest information on U.S. greenhouse gas emissions trends from 1990, for emissions sources related to energy consumption, land-use change and forestry (CO₂), hydrofluorocarbons, (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆) and selected methane (CH₄) sources.

U.S. Department of State (DOS)

Climate Action Report: 1997 Submission of the United States of America Under the U.N. Framework Convention on Climate Change. U.S. Dept. of State, Washington, DC: 1996. DOS Pub. 10496. The report stated, "This document has been developed using the methodologies and format agreed to at the First Conference of Parties to the FCCC, and modified by the second meeting of the Conference of Parties and by sessions of the Convention's Subsidiary Body on Scientific and Technological Advice and the Subsidiary Body on Implementation." Also, in the report the United States stated that it assumes that this communication, like those of other countries — and like the preceding U.S. communication (December 1992) — would be subject to a thorough review and discussed in the evaluation process for the Parties of Convention. The authors noted that, "Even though the measures listed in this report are not expected to reduce U.S. emissions below 1990 levels by the year 2000, the United States believes that many of the climate change actions included in this report upon being implemented have been successful at reducing emissions, send valuable signals to the private sector, and may be appropriate models for other countries."

U.S. Executive Office of the President (EOP)

America's Climate Change Strategy: An Action Agenda. By President George Bush, Washington, DC: February, 1991. This report highlighted comprehensive actions to be taken to mitigate or adapt to potential climate change, and featured possible actions that "make sense," as well as reviewed actions already being undertaken by the Bush Administration to address global climate change, such as energy efficiency improvements, reforestation pursuant to the "America the Beautiful Program," under the 1990 Farm Bill (P.L. 101-624, Title XXIII, 16 USC §2101), and through proposed reductions of CFCs, under Title VI of the Clean Air Act Amendments of 1990 (P.L. 101-549, 42 USC §7671a et seq.).

Climate Change Action Plan. By President William J. Clinton and Vice President Albert T. Gore, Jr., Washington, DC: October, 1993. On October 19, 1993, President Clinton released his Administration's *Climate Change Action Plan*

(CCAP), which featured domestic measures that might be taken to attain the goal of greenhouse gas emissions stabilization as outlined under the terms of the U.N. Framework Convention on Climate Change, which were comparable to the President's own emissions goals. The CCAP has relied on a comprehensive suite of voluntary actions by industry, utilities, and other large-scale energy users. It also promoted energy-efficiency upgrades through devising new building codes in residential and commercial sectors, as well as other energy efficiency improvements in generic energy-generating capacity and energy consumption. Large-scale tree planting and forest reserves were also encouraged to enhance sinks for atmospheric carbon dioxide and conserve energy. Other provisions of the plan called for increased utilization of hydroelectric power sources, including upgrading existing facilities; encouraged use of public transportation; regulated methane release in land fills and capture of waste methane to be utilized as a fuel source. In addition the president called for controls on nitrous oxide, and on hydrochlorofluorocarbon (HCFC) byproducts believed to be contributing to global warming.

The Kyoto Protocol and the President's Policies to Address Climate Change: Administration Economic Analysis. White House Council of Economic Advisors (CEA) and others. Washington, DC: July, 1998. The purpose of the report was to examine costs and benefits of taking action to mitigate the threat of global warming, and in particular, the costs of complying with the emissions reduction target for the United States set forth in the Kyoto Protocol on Climate Change, negotiated in December 1997. The report concluded that, "With the flexibility mechanisms included in the treaty, and by pursuing strong domestic policies, the United States can reach its Kyoto target at relatively modest cost. Moreover, the benefits of mitigating climate change are likely to be substantial."

U.S. Department of Justice (DOJ)

A Comprehensive Approach to Addressing Potential Climate Change. U.S. Dept. of Justice, Environment and Natural Resources Division, Task Force on the Comprehensive Approach to Climate Change, Washington, DC: February, 1991. The work of this group was the model for President Bush's *Action Agenda*, described above. The Task Force was created as a federal interagency effort with representatives from the President's Council of Economic Advisors, Council on Science and Technology, Council on Environmental Quality, White House Office of Policy Development and Office of Science and Technology Policy, U.S. Trade Representative and White House Legal Counsel. Federal agencies participating included: the U.S. Departments of Agriculture, Commerce (National Oceanic and Atmospheric Administration), Energy, Interior, Justice, State, Transportation, and Treasury. Other independent agencies included were the U.S. Environmental Protection Agency, National Aeronautics and Space Administration, and National Science Foundation. The report stated that "The best design for a climate change convention, and for any policy responses that might ensue, would be a 'comprehensive' approach that addresses all relevant trace gases, their sources and sinks ... in order to deal with the many scientific, environmental and economic aspects of the climate system, which involves multiple trace gases resulting from activities in every sector of human society."

U.S. Congress, Office of Technology Assessment (OTA)

Changing by Degrees: Steps to Reduce Greenhouse Gases. U.S. Congress, Office of Technology Assessment, Washington, DC: February, 1991. Report No. OTA-O-482. This assessment focuses principally on ways to cut carbon dioxide emissions in the United States and in other countries, although it does consider controls on other greenhouse gases. It states, "Major reductions of carbon dioxide and other greenhouse gases will require significant new initiatives by the federal government, the private sector, and individual citizens." The report considered programmatic requirements to reduce U.S. emissions by 15% by the year 2010. Authors concluded that, "Many of these initiatives will pay for themselves; for others, the economic cost may be considerable, ... [and that] many of these efforts need to be sustained over decades."

Preparing for an Uncertain Climate. U.S. Congress, Office of Technology Assessment, Washington, DC: October, 1993. Report no. OTA-O-567. OTA's second report on climate change. This report was requested by three congressional committees: the Senate Committees on Environment and Public Works and on Commerce, Science and Transportation; and the House Committee on Science, Space, and Technology. The report, published in two volumes, identified more than 100 options that could help ease the transition to an uncertain climate, known as near-term "targets of opportunity." This assessment addressed how natural and human systems may be affected by climate change; evaluated the tools at hand to ease adaptation to a warmer climate, considering coastal areas, water resources, agriculture, wetlands, preserved lands, and forests.

Global Climate Change Science Outlook

The U.S. Senate has constitutional responsibility to provide advice and consent to ratification of international treaties which the United States has signed. Also, Congress has appropriations and oversight responsibilities for funding global change research activities and environmental research and development. Additionally, some individual lawmakers have called for enhanced research and development funding to devise fossil fuel emissions control technologies, lesser polluting technologies, energy conservation, and expanded use of nuclear power in the United States as possible voluntary solutions to reducing greenhouse gases. These are highly technical and complex issues that require expert scientific advice.

A number of hearings in the 106th Congress have addressed federal funding for climate change research, scientific debate about theoretical versus observed climate change, and the assumptions and findings of a variety of economic analyses that estimate the potential costs of U.S. implementation of the Kyoto Protocol, and the potential physical impacts of climate change. International efforts at negotiating climate change protection measures, in which the United States is a party, are continuing under the U.N. Framework Convention on Climate Change (FCCC), and negotiations related to the 1997 Kyoto Protocol.

In the spring of 1999, the U.S. Global Change Research Program (USGCRP) submitted performance measures for the first time under the 1993 Government Performance and Results Act (GPRA), for funds that were authorized in FY1998. Congress reviewed this information, to justify and prioritize research funding for global climate change research in the FY2000 budget. Congress also directed the White House to report on expenditures for domestic and international climate change programs for FY1998 and FY1999. These were transmitted to several congressional committees, pursuant to language in Title V of PL 105-277, The Foreign Operations, Export Finance, and Related Programs Appropriation Bill, FY1999.¹¹

Late in the year 2000, the IPCC is expected to release a third scientific assessment on global climate change. New scientific findings and conclusions of the IPCC are likely to be revealed during expert review that might have bearing on U.S. policy and future negotiations on the Kyoto Protocol, to the extent that these occur. In addition, the USGCRP has prepared a National Assessment of the potential regional consequences of climate change for the United States, for which an overview, or synthesis report, is expected to be released in April 2000. Scientific knowledge about, and new research findings on, climate change will continue to play a role in the policy debate on key issues related to climate change concerns.

CRS Products on Global Climate Change

Current information on global climate change legislation and related activities can be found in the CRS electronic briefing book, *Global Climate Change*, which can be found at [<http://www.Congress.gov/brbk/html/ebgcc1.html>].

CRS Issue Briefs

CRS Issue Brief 97057. *Global Climate Change: Market-Based Strategies to Reduce Greenhouse Gases*, by Larry B. Parker.

CRS Issue Brief IB10020. *Energy Efficiency: Budget, Climate Change, and Electricity Restructuring Issues*, by Fred Sissine.

CRS Issue Brief IB10041. *Renewable Energy: Tax Credit, Budget, and Electricity Restructuring Issues*, by Fred Sissine.

CRS Reports

CRS Report 96-699. *Global Climate Change: Adequacy of Commitments under the U.N. Framework Convention and the Berlin Mandate*, by Wayne Morrissey.

¹¹ See CRS Report 98-664, *Global Climate Change: Congressional Concern About "Back Door" Implementation of the 1997 U.N. Kyoto Protocol*.

CRS Report 98-2. *Global Climate Change Treaty: Summary of the Kyoto Protocol*, by Susan R. Fletcher.

CRS Report 97-1015. *Global Climate Change: The Role of U.S. Foreign Assistance*, by Curt Tarnoff.

CRS Report 97-1017. *Industrial Energy Intensiveness and Energy Costs in the Context of Climate Change Policy*, by Bernard Gelb.

CRS Report 98-193. *Global Climate Change: The Energy Tax Incentives in the President's FY2000 Budget*, by Salvatore Lazzari.

CRS Report 98-235. *Global Climate Change: Reducing Greenhouse Gases —How Much from What Baseline?*, by Larry Parker and John Blodgett.

CRS Report 98-349. *Global Climate Change: Selected Legal Questions About the Kyoto Protocol*, by David Ackerman.

CRS Report 98-664. *Global Climate Change: Congressional Concern About "Back Door" Implementation of the 1997 U.N. Kyoto Protocol*, by Wayne Morrissey.

CRS Report 98-738. *Climate change: Three policy perspectives*, by Larry Parker and John Blodgett.

CRS Report RL30036. *Global Climate Change: Carbon Emissions and End-use Energy Demand*, by Richard Rowberg.

CRS Report RL30155. *Global Climate Change Policy: Domestic Early Action Credits*, by Larry Parker and John Blodgett.

CRS Report RL30209. *Global Climate Change Policy: From "No Regrets" to S. Res. 98*, by Larry Parker and John Blodgett.

CRS Report RL30285. *Global Climate Change: Lowering Cost Estimates through Emissions Trading – Some Dynamics and Pitfalls*, by Larry Parker.

CRS Report RL30414. *Global Climate Change and the Role of Energy Efficiency*, by Fred Sissine.

CRS Report RL30452. *Climate Change Technology Initiative (CCTI): Research, Technology, and Related Programs*, by Michael Simpson.

Appendix 1: A Chronology of U.S. Government Involvement in Global Climate Change Policy through 1998

For decades, scientists in federal agencies, such as the National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA), and others, have participated in scientific workshops and international conferences on the nature of Earth's climate system, and the role of CO₂ and other greenhouse gases that are believed by many to modify the global climate. Extensive involvement of the United States government in formulating U.S. policy and assuming a diplomatic role in international efforts which relate to that issue, however, probably began around 1978, with efforts to coordinate federal government activities. The following chronology lists what are considered by many to be major events which shaped U.S. policy over the past 22 years.

1978 — The National Climate Program Act, PL. 95-367, 15 USC §2901 *et seq.*, established the National Climate Program Office (NCPO) in the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce for the purposes of planning and coordinating U.S. involvement in international research efforts on climate change throughout the federal government.

February 1979 — The World Meteorological Organization (WMO), U.N. Environment Programme (UNEP), and International Council of Scientific Unions (ICSU) sponsored the First World Climate Conference (FWCC) in Geneva, Switzerland. Billed as “a conference of experts on climate and mankind,” and focusing on the scientific basis of climatic change, the FWCC addressed issues of northern hemisphere cooling; severe winters that were occurring in the mid-latitudes of the United States and Central Europe; widespread drought and desertification in Sub-Sahara Africa, and public concern about famine and death resulting from the observed effects of climate change on some world agricultural systems. The U.S. government sent representatives to the FWCC; however, those were mostly expert scientists employed at U.S. scientific mission agencies. Government scientists attending such conferences participated in their capacity as scientists, not as representatives of their respective governments.

Late 1979 — Out of the FWCC evolved the WMO World Climate Program (WCP) jointly sponsored by WMO/UNEP/ICSU, and the four components of WCP: (1) the World Climate Data Program; (2) the World Climate Applications Program; (3) the World Climate Impact Studies Program; and (4) the World Climate Research Program. Each was dedicated to examining particular aspects of the state of scientific knowledge about climate change while deducing the technological capability of various nations to address global climate change. In a series of conferences and workshops sponsored by the WMO, UNEP, and ICSU, the seeds of interest were sown among governments for officially participating in such activities.

1980 — The first WCP joint WMO/UNEP/ICSU meeting of experts on the Assessment of the Role of CO₂ on Climate Variations and Their Impact was held

in Villach, Austria in November. This meeting investigated how increasing greenhouse gas concentrations in the atmosphere could affect various regions of the Earth in the 21st Century. Participants also discussed the technical, financial, and institutional options for limiting or adapting to climatic changes.

1982 — The three representative organizations of the WCP (WMO, UNEP, and ICSU) met in October, in Geneva, Switzerland and recommended that continuing assessments of CO₂, believed to be responsible for global warming, be held every 5 years, starting from the first meeting in 1980. Following that meeting, an Interim Assessment was prepared.

1985 — A second WCP scientific conference was held in Villach, Austria, in October to follow up and update an assessment, originally prepared in 1980, of the role of increased CO₂ and other radiatively active greenhouse gases in climate variation and their associated impacts. Participants at this meeting concluded in a conference statement that, “As a result of the increasing concentrations of greenhouse gases, it is now believed that in the first half of the next century a rise of global mean temperature could occur which is greater than any in man’s history.” It was at this session that full-scale national government interaction with scientists took root because the WCP recommended policy actions to stem potential impacts of climate change from increasing concentrations of CO₂ and other greenhouse gases.

September 1987 — The United States completed international negotiations under the auspices of the WMO/UNEP toward an international treaty and regulatory annexes to protect the stratosphere from ozone depletion suspected to result from man-made chlorofluorocarbons (CFCs). These negotiations, and the guidelines for their conduct were set forth as early as 1985, in accordance with the Vienna Convention on the Prevention on Stratospheric Ozone Loss which the United States had previously ratified. By 1987, the Parties to the Vienna Convention had concluded negotiations on an international regulatory instrument and had opened for signature the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer. Some public policy experts have credited the generally positive experiences of scientists and policymakers working together on ozone protection negotiations as facilitating the organization and the conduct of both the activities of the IPCC working groups, and the subsequent U.N. negotiations undertaken for the Framework Convention on Climate Change.

October 1987 — Two WCP workshops took place in Villach, Austria, and Bellagio, Italy, which led to the discussion of developing international policies for responding to climatic change. The justification was built upon the results of both the 1980 and 1985 WCP scientific assessments on CO₂. The WCP Advisory Group on Greenhouse Gases (AGGG) saw this meeting as an important step in policy development in response to possible climate change at the international level and, as such, a realization of a goal that was called for originally by the Villach conference in 1985. About 6 months after the Bellagio meeting, the governing bodies of WMO and UNEP requested the U.N. to establish an Intergovernmental Panel on Climate Change (IPCC) to address the issue of climate change, its environmental, economic and social impacts, and possible national and international responses to such changes, and invited nations to have full ministerial representation in future proceedings.

December 1987 — The White House Committee on Earth Sciences (CES) was established under the White House Office of Science and Technology Policy (OSTP) Federal Coordinating Committee on Science, Technology and Engineering (FCCSET). The committee came to be called the Committee on Earth and Environmental Sciences (CEES), and was charged with the development of a 10-year U.S. Global Change Research Program, established by the National Global Change Research Act of 1990 (PL. 101-606, 15 USC §2921 *et seq.*).

June 1988 — The [U.N.] Toronto Conference on the Changing Atmosphere was held in June. Governments were invited by Canada to participate in formal discussions leading toward a possible “law of the atmosphere,” controlling atmospheric pollutants which, among other things, would seek to control emissions of CO₂ into the atmosphere.

November 1988 — The first meeting of a newly created U.N. Intergovernmental Panel on Climate Change (IPCC) convened in Geneva, November 9-11, 1988. The plenary meeting of the IPCC included representatives of 35 nations, including the United States, the U.S.S.R., several other foreign governments, and international governmental and non-governmental organizations. The latter served as observers and functioned as advisory bodies in the proceedings. As a result of this meeting, the IPCC was charged by the U.N. General Assembly to prepare an integrated state-of-the-art report on the science, impacts, and responses to global climate change by September 1990.

February 1989 — Following from the 1988 Toronto Conference, at a “Meeting of Legal and Policy Experts” held in Ottawa, on February 20-22, 1989, participants discussed the feasibility of a climate change convention and issued a statement that, among other things, addressed considerations and elements for a specific convention on climate change which would govern emissions of carbon dioxide implicated in global warming, and target a 20% reduction thereof.

Spring 1990 — Three consensus documents on science, impacts, and responses of the IPCC working groups were produced by the beginning of summer of 1990 and were viewed throughout most of the international scientific and global diplomatic community as definitive statements of the state-of-knowledge about global climate change. A majority of participants and independently polled scientists who peer reviewed those reports considered the results of each working group a relative success and a major accomplishment for multi-disciplinary scientific and social research bodies participating within a potential policy making milieu. The “responses” working group report was criticized for not offering concrete recommendations as to what governments should do to either mitigate or adapt to potential climate change. Furthermore, a group of dissenting scientists claimed that contrary opinions were neither considered nor presented in the final IPCC documents and, consequently, criticized the IPCC review process because no comments or reactions to comments were ever exchanged between independent peer reviewers and the IPCC.

June through August 1990 — The three IPCC working groups submitted their findings to the full IPCC in June 1990, and, following a plenary session in August 1990, the IPCC presented its *First Interim Assessment Report* to the 45th session of

the U.N. General Assembly, at a session of U.N. Second World Climate Conference (SWCC) in Geneva, Switzerland between October 29 - November 7, 1990. SWCC was convened by WMO, UNEP, and ICSU. The IPCC's integrated "synthesis report" was adopted by the U.N. General Assembly and would form the basis for international negotiations toward a framework convention on climate change. The synthesis report consisted of the Interim Assessment, a fourth working paper prepared by the ad hoc IPCC Working Group on Financial and Technical Assistance, and an IPCC Assessment Overview prepared by the Secretariat of the IPCC. It was subject to a short period of review during SWCC Scientific and Technical sessions.

November 1990 — After presentation of the IPCC integrated Interim Assessment of Global Climate Change at the SWCC, and its adoption by the U.N. General Assembly, some countries had expected that negotiating sessions for a regulatory mechanism to address potential global climate change would begin during Ministerial sessions that immediately followed the Scientific and Technical sessions. The United States and the former Soviet Union, however, opposed making any commitments at that time, especially any legally binding reductions of CO₂ or other greenhouse gases. The United States argued that such matters would be more appropriately considered under the authority of the U.N. General Assembly and not the WMO, and further suggested that interested nations reconvene in negotiations that would address specific regulatory actions relating to global climate change.

December 1990 — The U.N. General Assembly on December 21, 1990, in furthering its resolutions 43/53 of December 6, 1988 and 44/207 of December 22, 1989, which acknowledged that climate change is a common concern of mankind, established an Intergovernmental Negotiating Committee (INC). The INC, supported by WMO and UNEP, was charged with preparing the future FCCC, which would contain appropriate commitments and any related legal instruments as might be agreed upon. This resolution, A/RES/45/212, called for the framework convention negotiations to be completed prior to the U.N. Conference on Environment and Development (UNCED) scheduled for the June 1992 "Earth Summit" in Rio de Janeiro, and to be opened for signature during that conference.

February 1991 — The United States offered to host the first INC session in Chantilly, VA, in February 1991. The meeting was titled, "Protection of global climate for present and future generations of mankind." Some criticized it as unproductive because no protocols, memoranda of understanding, or terms of reference relating to a framework convention on climate change came out of this first session. Others (such as the United States delegation) insisted that INC's focus at its first session was primarily to attend to organizational business and the INC's administrative requirements. By the close of deliberations, two subsidiary bodies on science and technology and implementation (and their leadership) had been established.

June 1991 through May 1992 — The second session of the INC met in Geneva, June 19-29, 1991; the third session convened in Nairobi, September 9-20; the fourth session convened in Geneva, December 9-20; and the fifth session convened in New York City, February 18-28, 1992. One more negotiating session, described as an extension of the 5th INC session, took place in New York between April 29 and May 8, 1992. This session was the last remaining opportunity for the parties to meet as

a whole and agree upon a final text for a so-called framework convention on climate change that would be opened for signature in June at UNCED, in Rio de Janeiro. At the conclusion of this last session, it was evident that a flexible, voluntary response by nations to reduce net atmospheric concentrations of greenhouse gases would be the backbone of the climate convention. This agreement contained a “non-binding aim” of voluntary commitments for industrialized countries to begin to return their net emissions of greenhouse gases to 1990 levels and to devise plans for stabilizing concentrations of greenhouse gases in the atmosphere by 2000, both by controlling sources of emissions and enhancing sinks for greenhouse gases.

January 1992 — Resulting from a meeting in January in Guangzhou, China, the IPCC’s Working Group-1 on Science released a “Supplement” to update the first interim scientific assessment of climate change. An IPCC plenary document was also released that integrated findings from activities of the other IPCC working groups. New scientific insights into the role of CFCs and climate change, as potentially offsetting some global warming at Earth’s surface, challenged the Bush Administration’s “basket of options” approach to reducing greenhouse gas emissions, and shifted emphasis in international negotiations back to focusing on CO₂ reductions. The IPCC also declared a need to reassess the indirect global warming potential of other greenhouse gases and their concentration and effect over different time horizons; and the IPCC also called for further study on the possible climatic cooling effects of sulfate aerosols in Earth’s atmosphere.

February 1992 — In its *Statement on Commitments*, submitted at the 5th INC session, the United States outlined a new course of measures that it would undertake to mitigate climate change. The United States emphasized that these actions would begin immediately, would be taken unilaterally, and would not be contingent on its final acceptance or rejection of any legally binding timetables or provisions as might be set forth in a future international climate change agreement. Actions would be pursued in several areas, including: (1) improved energy efficiency; (2) transportation sector improvements; (3) supply-side changes to lower-emission technologies; (4) agriculture and natural resources—methane capture and tree planting; (5) federal research and development measures—technological and scientific; (6) joint U.S. government-industry programs to reduce emissions; and (7) state and local government actions. Some analysts estimated that such actions could reduce CO₂ by about 14% below 1990 levels by 2000. Environmentalists criticized these “new” measures as simply a delineation of what the United States had been prepared to do all along and, in some cases, what may have been required under existing law dealing with energy conservation.

April 1992 — A study by the Bush Administration, *U.S. Views on Climate Change*, suggested that the United States might not be far from the goal of reducing its net emissions of CO₂ to 1990 levels by 2000 — a goal called for by many INC parties — simply by undertaking energy efficiency and savings programs and other mitigation and adaptation strategies for climate change that were already underway in existing federal and state programs.

May 1992 — INC negotiations, which had begun in February 1991, concluded at the U.N. in New York City. A ministerial draft text was adopted culminating in an

international treaty formally known as the U.N. Framework Convention on Climate Change.

June 1992 — On June 12, at UNCED (the Earth Summit) in Rio de Janeiro, the United States and 142 other nations signed the U.N. Framework Convention on Climate Change (FCCC). The FCCC contained an action framework that would commit the world's industrialized countries to voluntary reduction of greenhouse gases and enhancing greenhouse gas sinks. Such actions would be aimed at stabilizing atmospheric concentrations of greenhouse gases at 1990 levels. The FCCC also contained other commitments for all signatory parties, including developing countries, related to its establishment, support, and administration. Furthermore, the Convention suggested the possibility of continuing negotiations through a Conference of Parties, subject to a judgment of the ratifying parties, after the FCCC's entry into force, that would meet periodically to pursue subsequent actions to counter global warming — similar to the 1985 Vienna Convention, that preceded the Montreal Protocol on Protection of the Ozone Layer.

The consensus view among INC representatives was that the convention opened for signature at UNCED represented a scientifically sound first step towards stabilizing industrial greenhouse gas emissions. Critics however, found it deficient because in their view it did not realistically address greenhouse gas emissions from the transportation sector and emissions reductions were voluntary, rather than legally binding. Furthermore, there was disagreement on how far the convention should have gone, and whether it should have also set future emission reduction targets and timetables beyond the year 2000 target.

September through October 1992 — On September 8, 1992, the Convention was transmitted by the White House to the Senate Committee on Foreign Relations for the advice and consent of the Senate to ratification. That Committee endorsed the treaty and reported it (S. Exec. Rept. 102-55) on October 1. The Senate consented to ratification of the U.N. Framework Convention on Climate Change on October 7, 1992, with a two-thirds majority vote; President Bush signed the instrument of ratification of the FCCC on October 13, 1992.

Late November 1992 — The *U.S. National Action Plan for Global Climate Change* was released at the end of November by the Bush Administration to supplement many of the energy conservation measures in force that may have had a secondary effect of limiting future U.S. net greenhouse gas emissions. The former was known as a “no-regrets” strategy, because it made sense economically, regardless of any potential global warming effects. The National Action Plan also considered other efforts that might be undertaken to adapt to potential climate change, reiterating many of the strategies outlined in President Bush's earlier 1991 *Action Agenda on Climate Change*. However, the 1992 U.S. National Plan went further than the *Action Agenda* to include: (1) additional federal government measures, both legislative and administrative; (2) actions taken by state governments; (3) private sector measures; and (4) measures undertaken in cooperation with other countries.

December 1992 — The INC convened its sixth meeting December 7-10, in Geneva, Switzerland, to discuss its future, and to reevaluate the urgency (timetable of meetings) of moving forward on measures to address potential global climate change.

The INC was requested to act as the interim coordinating body on business matters relating to global climate change for the U.N. Secretary General, until the Conference of the Parties to the FCCC would be established and meet for the first time. The INC met in March and August, 1993, and, among other things, debated the feasibility of the World Bank's Global Environmental Fund (GEF) as a mechanism for managing international funding of developing countries, which would assist the latter in fulfilling their commitments and obligations under the FCCC.

October 1993 — President Clinton and Vice President Gore released a U.S. Climate Change Action Plan that suggested some 52 voluntary measures to reduce U.S. greenhouse gas emissions to 1990 levels by 2000. This domestic goal would be aligned, in principle, with U.S. commitments under the FCCC.

March 1994 — According to terms of the FCCC, the U.N. Secretary General having received at least 50 countries' instruments of ratification, the Convention entered into force March 24, 1994.

April 1995 — Seeking grounds for a uniform approach toward climate protection, the first Conference of Parties (COP-1) to FCCC met in Berlin, Germany, in the spring of 1995, and voiced concerns about the adequacy of countries' abilities to meet commitments under the Convention. These were expressed in a U.N. ministerial declaration known as the "Berlin Mandate," which established a 2-year Analytical and Assessment Phase (AAP) to negotiate a "comprehensive menu of actions" from which countries would choose options to address climate change that for them, individually, made the best economic and environmental sense. FCCC parties also deliberated over elements of possible amendments to FCCC and/or a subsequent protocol that might advance climate protection. They also discussed whether numerical aims, such as targets and timetables, binding or non-binding agreements, or technology-related goals, alone, might be "adequate" for climate protection.

Another major issue dealt with was what some called "an arbitrary division between Annex I and Developing countries" that concerned the effectiveness of commitments of each class of countries in achieving the goals of FCCC. Criticism was leveled by many industrialized countries, including the United States, against many newly industrializing countries (NICs), such as Brazil, India, and China, because NICs would continue to be classified as non-Annex I countries and enjoy certain exemptions under the Berlin Mandate — including exemption from possible future, legally binding emissions reduction agreements — even though these countries collectively could become the world's largest emitters of greenhouse gas emissions within 15 years.¹²

July 1996 — The Second Conference of Parties to the FCCC (COP-2) met in July 1996 in Geneva, Switzerland, and its Ministerial Declaration was adopted July 18, 1996. This document reflected a U.S. position statement presented by Timothy Wirth (former Under Secretary for Global Affairs for the U.S. State Department) that: 1) accepted outright the scientific findings on climate change proffered by the IPCC in

¹² For more information, see CRS Report 96-699, *Global Climate Change: Adequacy of Commitments Under the U.N. Framework Convention and the Berlin Mandate*.

its second assessment (1995); 2) rejected uniform “harmonized policies” in favor of flexibility; and 3) called for “legally binding mid-term targets.” Legally, the Declaration represented the consensus of ministerial participants at COP-2 that, as a body, they did not object to a “future decision which would be binding on all parties under the FCCC,” with individual reservations included and noted.

June 1997 — On June 26, 1997, President Clinton submitted “Additional U.S. Proposals” aimed at efforts to educate the American public on the need for a climate protection protocol and stronger climate protection measures. This plan included installing a million solar panels on roofs across the United States by the year 2010, convening a White House Conference (October 6, 1997), \$1 billion in foreign aid for “best environmental practices,” and an environmental technology R&D and trade incentive for U.S. industry (known as the Climate Change Technology Initiative). The vehicle to achieve these reductions was a 3-track proposal which included \$5 billion in tax breaks (over 5 years) to U.S. industries to develop technologies and practices that reduce greenhouse gas emissions, a restructuring of the electric utilities industry, and the development of some form of emissions trading among FCCC parties for credits.

In addition, the State Department submitted “Additional U.S. Proposals” to the COP, that would: 1) condone penalties for parties who exceed an allowed emissions budget for a given 5-year period; 2) clarify eligibility of parties to participate in emissions trading schemes and their obligations pertaining to measurements and reporting of emissions, including devising national mechanisms for certification and verification of trades; and 3) preclude from trading any party which exceeds its emissions budget or is in question of compliance. These proposals concerning treaty compliance were not adopted in the final working text of the Protocol (“the Kyoto Accord”), but are currently part of ongoing negotiations leading up to COP-6.

December 1997 — Prior to ministerial negotiations and COP-3, in Kyoto in December 1997, President Clinton had proposed the goal to return U.S. greenhouse gas emissions to 1990 levels by 2012 (a 30% reduction from estimated 2012 levels). Japan, on the other hand, had proposed a 5% reduction in CO₂ below 1990 levels by the year 2012, and the EU had proposed reducing emissions of three greenhouse gases by 7.5% by 2005, and then by 15% by 2010. The developing countries (G-77) and the Association of Small Island States (AOSIS) sought a reduction of CO₂ emissions 35% below 1990 levels, to apply to the industrialized countries, exempting themselves from emissions reductions.

The work on the U.N. Kyoto Protocol on Climate Change was completed December 11, in Kyoto, Japan, in a half-day extension of the official session. Most industrialized nations and some central European countries (defined in “Annex B” to the Protocol) agreed to legally binding reductions in greenhouse gas emissions of an average of 5% below 1990 levels between the years 2008-2012, identified as the first emissions budget period. The United States would be required to reduce its total emissions an average of 7% below 1990 levels by the year 2012. However, some Annex-B countries (Australia, e.g.) would be allowed to increase their greenhouse gas emissions. Globally, emissions of three major greenhouse gases (CO₂, CH₄, N₂O) would be targeted to decline about 5% below 1990 levels over the next 10 years.

On November 12, 1998, President Clinton instructed a representative to sign the Kyoto Protocol to “lock-in” commitments he judged to be in the U.S. national interest that were achieved during negotiations. Subsequently, the United States became the 60th country to sign the treaty. This act drew protest by some in Congress because the Kyoto Protocol had not yet been debated by the U.S. Senate and many claimed that it was in violation of S.Res. 98, the Byrd/Hagel Resolution, introduced in July 1997, which required an economic analysis and legally binding emission reductions for all FCCC parties. Many in Congress believe the Protocol would pose an unfair burden on industrialized countries, while exempting developing countries from any regulatory requirements. After signing the Kyoto Protocol, the President announced he would continue to pursue efforts to gain “meaningful” commitments from key developing countries over the next couple of years, before he would consider sending the treaty to the U.S. Senate in deference to S.Res. 98.

In the meantime, Congress has held hearings on the potential economic impacts of ratifying the Kyoto Protocol. Some Administration officials and supporters claim there are economic benefits to be realized from U.S. ratification of the treaty, while many opponents, including a number in Congress, have projected a significant negative impact on the U.S. Economy.

For further details on global climate change activities and issues since the 1997 Kyoto Protocol, see CRS Report 98-2, *Global Climate Change Treaty: Summary of the Kyoto Protocol*; CRS Issue brief IB89005, *Global Climate Change*; and the CRS briefing book on *Global Climate Change*, online website: [<http://www.congress.gov/brbk/html/ebgcc1.html>]

**Table 1. Major Conferences on Global Climate Change
at Which the U.S. Government has had Diplomatic Representation¹³**

PERIOD	WHEN	WHAT	WHERE
Pre-UNCED	June 1988	The Changing Atmosphere (UNEP)	Toronto, Canada
	May 1989	Forum on Global Change	Washington, DC
	July 1989	Summit of the Arch (G-7)	Paris, France
	Nov. 1989	Ministerial Conference	Noordwijk, Neth.
	May 1990	Interparliamentary Conference	Washington, DC
	July 1990	Economic Summit (G-7)	Houston, TX
	Nov. 1990	Second World Climate Conference	Geneva, Switzerland
	1989-1992	INC negotiations: U.N. FCCC adopted	New York, NY
UNCED (FCCC opened for signature)	June 1992	UNCED (Earth Summit)	Rio de Janeiro, Brazil
	March 1994	FCCC enters into force	
Post-UNCED	April 1995	COP-1, Berlin Mandate	Berlin, Germany
	July 1996	COP-2, Ministerial Declaration	Geneva, Switzerland
Pre-Kyoto	Oct. 1997	"Challenge of Global Warming" Conf.	Washington, DC
Kyoto	Dec. 1997	COP-3, U.N. Kyoto Protocol text adopted	Kyoto, Japan

¹³ While this table is not exhaustive, it represents those meetings which many believe were significant milestones for United States participation in negotiations on international global climate protection agreements.