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Global Climate Change

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SUMMARY

There is concern that human activities are affecting the heat/energy-exchange balance between Earth, the atmosphere, and space, and inducing global climate change, often termed "global warming." Human activities, particularly the burning of fossil fuels, have increased atmospheric carbon dioxide (CO_2) and other trace greenhouse gases. If these gases continue to accumulate in the atmosphere at current rates, most scientists believe global warming would occur through intensification of Earth's natural heat-trapping "greenhouse effect." Possible impacts might be seen as both positive and negative.

A warmer climate would probably have far reaching effects on agriculture and forestry, managed and un-managed ecosystems, including natural habitats, human health, water resources, and sea level depending on climate responses. Although causal relationships between projected long-range global climate trends and record-setting warmth and severe weather events of the past two decades have not been firmly established, attention has been focused on possible extremes of climate change and the need for better understanding of climate processes to improve climate model forecasts.

The basic policy question remains: Given scientific uncertainties about the magnitude, timing, rate, and regional consequences of potential climatic change, what are the appropriate responses for U.S. and world decisionmakers?

Fossil-fuel combustion is the primary source of CO_2 emissions, and also emits other "greenhouse" gases. Because the U.S. economy is so dependent upon energy, and so much of U.S. energy is derived from fossil fuels, reducing these emissions poses major challenges and controversy.

The 1992 United Nations Framework Convention on Climate Change (UNFCCC), which the United States has ratified, called for a "non-binding" voluntary aim for industrialized countries to control atmospheric concentrations of green-house gases by stabilizing their emissions at 1990 levels by the year 2000. The 1997 Kyoto Protocol to the UNFCCC goes further and, if it were to enter into force, would commit the 38 major industrialized nations to specified, legally binding emissions reductions.

International negotiations continued during 2001 at meetings in July at Bonn, Germany, and at Marrakech, Morocco, during late October into November, to resolve major differences and refine details of the Kyoto Protocol.

In March 2001, the Bush Administration rejected the Kyoto Protocol and chose to act only as observers, declining to participate in discussions at international negotiations on the Protocol. In July, major political agreements were reached, led by the European Union (EU), and parties agreed to seek ratification and entry into force without the United States; most remaining issues were resolved in the Marrakech meeting of the parties.

The United States has indicated it would continue its cabinet-level review of climate change, and would seek new approaches based on voluntary measures and market mechanisms, but no timeframe for a new U.S. proposal has emerged. Other parties continue to express hope that the United States will rejoin international efforts to reduce greenhouse gas emissions.

MOST RECENT DEVELOPMENTS

Over the past year, intensive negotiations have taken place among the parties to the 1992 United Nations Framework Convention on Climate Change (UNFCCC) to finalize and resolve major issues related to the legally binding reductions in greenhouse gases mandated by the 1997 Kyoto Protocol to the UNFCCC, while the United States position was reformulated under the Bush Administration to repudiate and disengage from the Protocol. Following an impasse over several specific issues (such as credit for carbon sequestration and emissions trading) at the November 2000 sixth conference of the parties (COP-6) held in The Hague, Netherlands, negotiations were set to resume in July in Bonn, Germany. In late March 2001, the Bush Administration declared the Kyoto Protocol a failed effort and indicated that the United States would not continue to participate in negotiations related to the Protocol. This caused widespread concern and dismay in certain diplomatic circles, expressed primarily by European Union (EU) nations, Japan, and others. COP-6 negotiations were resumed in Bonn, Germany, in July 2001. The United States attended, but for the most part did not participate in discussions related to the Protocol. At the Bonn meeting, the UNFCCC parties reached agreement on the political elements of the Protocol, including the key issues such as carbon sequestration and determinations to proceed with emissions trading and compliance, and announced their decision to seek ratification of the Protocol by enough parties to bring it into force, without the United States. When parties resumed negotiations to finalize key issues at COP-7 in Marrakech, Morocco, the United States continued to act as an observer, declining to participate in negotiations. At the conclusion of the Marrakech negotiations, most major issues were resolved, and a goal emerged of bringing the Kyoto Protocol into force, without the United States if necessary, by the August-September 2002 meeting of the World Summit on Sustainable Development (WSSD) to be held in Johannesburg, South Africa. To date, only one Annex B country with binding obligations–Romania–has ratified the Protocol. Most parties to the UNFCCC continue to express hope that the United States will re-engage in international efforts to reduce greenhouse gas emissions.

On June 6, 2001, the U.S. National Research Council (NRC) released a report requested by the White House stating that global warming could well have serious societal and ecological impacts by the end of this century. President Bush made a policy statement on June 11, 2001, following release of the NRC report and completion of a cabinet-level review of climate change options. In that statement, the President acknowledged that the world has warmed and that greenhouse gases have increased, largely due to human activity, but emphasized that the magnitude and rate of future warming are unknown. The President then outlined the U.S. approach as rejecting the Kyoto Protocol and favoring voluntary actions, increased scientific research, better technology, and market mechanisms.

BACKGROUND AND ANALYSIS

Global Climate Change: Science and Policy

A large number of scientists believe that human activities, which have increased atmospheric concentrations of carbon dioxide (CO_2) by one-third over the past 100 years, may be leading to an increase in global average temperatures. However, the science of "global warming" is not without challengers, who argue that scientific proof is incomplete or contradictory, and that there remain many uncertainties about the nature and direction of Earth's climate. Nevertheless, concern is growing that human activities, such as the burning of fossil fuels, industrial production, deforestation, and certain land-use practices are increasing atmospheric concentrations of carbon dioxide (CO_2) that, along with increasing concentrations of other trace gases such as chlorofluorocarbons-CFCs, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6), may be leading to changes in the chemical composition and physical dynamics of Earth's atmosphere, including how heat/energy is distributed between the land, ocean, atmosphere and space.

Greenhouse Gases: Sources and Trends

Scientists have found that the four most important variable greenhouse gases, whose atmospheric concentrations can be influenced by human activities, are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and chlorofluorocarbons (CFCs). Historically, CO_2 has been the most important, but over the past several decades other gases have assumed increasing significance and, collectively, are projected to contribute about as much to potential global warming over the next 60 years as CO_2. The 1997 U.N. Kyoto Protocol on Climate Change, if it were to become a treaty in force, would also regulate three other trace gases: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), whose limited concentrations in the atmosphere are anticipated to grow over the long-term. Sulfate aerosols, a byproduct of air pollution, and other natural phenomena, are also viewed as important for their transient and regional "climate cooling" effects in Earth's atmosphere.

The amount of carbon cycling from naturally occurring processes each year through the biosphere as CO_2 is enormous — some 800 billion tons. Ice cores and other proxy climate data, which also indicate CO_2 concentrations in the atmosphere, have shown, in general, a relatively stable global climate, at least over the past 10,000 years. As such, many scientists suggest that the amount of CO_2 generated by natural processes is about equal to the amounts absorbed and sequestered by natural processes. However, human activity since the Industrial Revolution (c.a. 1850), and primarily in the form of burning fossil fuels, is now generating some additional 24 billion tons of CO_2 per year. Available evidence shows that about half this amount is absorbed by natural processes on land and in the ocean, and that atmospheric concentrations of CO_2 are now about 32% higher than they were some 150 years ago. Some scientists believe that a large amount of CO_2 may be stored in northern latitude soils and in temperate and tropical forests, suggesting a greater importance of the role of natural resources management and land-use practices in these regions, including burning of biomass and deforestation. Scientists estimate that anthropogenic emissions of CO_2 alone may account for as much as a 60% increase in global mean temperatures of 0.9°F, since 1850. For

more information on the science of global climate change, visit the CRS Electronic Briefing Book: *Global Climate Change* web site. [http://www.congress.gov/brbk/html/ebgcc1.shtml].

The most recent projections of state-of-the-art computer models of the Earth's climate (global climate models--GCMs) have projected a globally averaged warming ranging from almost 3 to 10.7degrees F over the next 100 years, if greenhouse gases continue to accumulate in the atmosphere at the current rate. Climate scientists believe that such a warming could shift temperature zones, rainfall patterns, and agricultural belts and, under certain scenarios, and cause sea level to rise. They further predict that global warming could have far-reaching effects — some positive, some negative depending how it may be experienced in a given region — on natural resources; ecosystems; food and fiber production; energy supply, use, and distribution; transportation; land use; water supply and control; and human health.

Some skeptics of the global warming theory have called into question the reliability of the computer climate models and their output used to make projections of future warming that supported Kyoto Protocol negotiations. They also challenge some scientists' assertions that recent episodic weather events may seem more extreme in nature, and that this may be indicative of long-term climate change.

Evidence of natural variability of climate is large enough that even the record-setting warmth at the end of the 20th century does not allow a vast majority of knowledgeable scientists to state beyond a reasonable doubt that weather extremes experienced over the past two decades are attributable to "global warming," at least at the present time. However, the warming trend at the surface appears to be continuing. In some cases, causal relationships between seasonal and inter annual climate changes and present-day severe weather events are beginning to be recognized and even predicted, because of an improved ability to observe the *El Nino* and *La Nina* phenomena. This notwithstanding, singular extreme weather events have focused public attention on possible outcomes of potential long-term climate change and a need for a better understanding of regional climates on decadal to century time scales.

National Oceanic and Atmospheric Administration's (NOAA) researchers reported that the 12 warmest years (globally averaged) since historical records have been kept occurred in the past two decades, with 1990 and 1998 among the warmest. At least some of this warming, they concluded, is human-induced. On the other hand, satellite instruments — which, through indirect methods, measure the average temperature of the atmosphere in a deep column above the surface — for the past 20 years are hard pressed to demonstrate any positive trends. A report issued in January 2000 by the U.S. National Research Council's Board on Atmospheric Sciences and Climate, *Reconciling Observations of Global Temperature Change*, attempted to resolve apparent disparities between temperature data measured at the surface and those from satellites. Skeptics claim that disparate trends invalidate the output of general circulation models (GCMs), many of which demonstrate homogenous warming throughout all the levels of the Earth's atmosphere. Panel scientists concluded that there may be a systematic disconnect between the upper and near surface atmosphere and cited physical processes which may have an unique impact on the upper atmosphere that are not currently accounted for in GCMs. In addition, they acknowledged that only long-term, systematic monitoring of the upper atmosphere could resolve the differences in temperature trends.

The Intergovernmental Panel on Climate Change (IPCC), jointly established in 1988 by the United Nations World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP), reported in its Second Assessment (1996) that ". . . [such] a change is unlikely to be entirely natural in origin . . . [and that] the balance of evidence, from changes in global mean surface air temperature and from changes in geographical, seasonal, and vertical patterns of atmospheric temperature, suggests a discernible human influence on global climate." And now, the latest report (January 2001), the Intergovernmental Panel's Third Assessment, concluded that a firmer association between human activities and climate seems to have emerged. That was news, because reservations about the source of the past century's warming and whether it bore a human fingerprint are often cited in policy debates, usually in support of deferring actions aimed at mitigating possible global warming. In addition, the IPCC reported a higher range of potential warming – roughly between 2.7 and just under 11 degrees Fahrenheit over the next 100 years.

As background, a November 2000 national assessment report, *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*, released under the auspices of the U.S. Global Research Program received criticism from many of those who were involved in its early review. Critics claimed that many of the model-projected impacts of possible future climate changes were overstated and unsubstantiated. The National Assessment Synthesis Team (NAST), with overall authority for the report, countered that much of the criticism it had received did not take into account the time scales upon which the report was based; the report targeted the effects of climate toward the middle of this century to the end of the next. Also, seemingly contradictory outcomes were produced by the two climate models selected for making the climate projections, casting some lingering doubt on the overall value and utility of the results for decision makers at the local, regional, and national levels. Various regional and resource-focused assessments are now available at the USGCRP website [http://www.nacc.usgcrp.gov]. A final synthesis report by the NAST, of the same title and consisting of an overview of all of the regional and sectoral studies, was released in December 2000.

In August 2000, NASA scientist James Hansen suggested that climate change benefits could be achieved through near-term regulation of non-CO_2 greenhouse gases. He proposed that reducing emissions of halocarbons (refrigerants), methane, nitrogen oxides, and carbon-black aerosols (soot) could have the effect of reducing ozone (smog), in the troposphere, which itself is a greenhouse gas. Non-CO_2 greenhouse gases have relatively short atmospheric lifetimes compared with CO_2; however, most have a much larger global warming potential (gwp). This would suggest that controlling emissions of these greenhouse gases could reduce the rate and overall amount of climate warming from greenhouse gases, leaving only that expected from long-term CO_2 emissions whose full effects would not be realized for another 75-100 years hence. Nevertheless, Hansen emphasized that any actions to reduce emissions of these gases would need to be taken concomitantly with long-term strategies to reduce CO_2. Hansen also noted that modest gains from reducing CO_2 and non-CO_2 emissions in the near-term could be achieved primarily through cleaner energy production.

On June 6, 2001, a Committee on the Science of Climate Change of the U.S. National Research Council (NRC) released a report, *Climate Change Science: An Analysis of Some Key Questions*, stating that global warming could well have serious societal and ecological impacts by the end of this century. Commissioned by the Bush White House and prepared by 11 of the nation's leading climate scientists, the report summarized the current state of

knowledge on climate change and confirmed that the climatic changes observed during the past several decades were most likely due to human activities. The committee members warned, however, that they could not rule out the possibility that the climate's natural variability could be responsible for a significant portion of that trend. The authors agreed that human-induced warming and sea level rise were expected to continue through the 21st century and beyond, but they emphasized that current predictions of the magnitude and rate of future warming "should be regarded as tentative and subject to future adjustments (either upward or downward)." The NRC report generally concurred with the latest conclusions of the Intergovernmental Panel on Climate Change, which found that the Earth warmed by about 1 degree Fahrenheit during the 20th century, and that most of the warming of the past 50 years was probably due to increases in greenhouse gas concentrations in the atmosphere. The full report, *Climate Change Science: An Analysis of Some Key Questions*, is available online at [http://books.nap.edu/html/climatechange/] or may be downloaded as a PDF file at [http://books.nap.edu/html/climatechange/climatechange.pdf]

President Bush made a speech on global climate change from the Rose Garden on June 11, 2001, following release of the NRC report and completion of a cabinet-level review of climate change options. In that speech, timed just before his trip to Europe to meet with leaders there, the President acknowledged that the world has warmed and that greenhouse gases have increased, largely due to human activity, but emphasized that the magnitude and rate of future warming are unknown. In a policy statement, he then outlined the U.S. approach to potential climate change as rejecting the Kyoto Protocol and favoring voluntary actions, increased scientific research, better technology, and market mechanisms as solutions.

The Policy Context

The prospect of global warming from an increase in greenhouse gases has been a major science policy issue over the past 15 years. Seeking answers to a number of questions — How much warming?...How soon?...Should we worry? — a growing number of policymakers continue to debate the advantages and disadvantages of an active governmental role in forging policies to address prospective climate change. How real is the human-induced global warming threat? Another 10-15 years of continued warming might validate the scientific projections, but many scientists caution that waiting for this added assurance might put society at risk for a larger dose of climate change than if actions to curb or slow the buildup of greenhouse gases were implemented now. But actions on what scale?

Some policymakers, here and abroad, have counseled a cautious course of action to address the prospect of climate change that many believe is still theoretical and cannot be predicted with confidence. Given uncertainties about the timing, pace, and magnitude of global warming projections and the imprecise nature of the regional distribution of possible climate changes, and recognizing the complex feedback mechanisms within the climate system that could mask, mimic, moderate, amplify, or even reverse a greenhouse-gas-induced warming, the question is posed: What policy responses, if any, are indicated, now, or in the future?

Many proponents for early actions to address potential climate change have suggested adopting a "precautionary principle" comprised of a number of anticipatory, yet flexible policy responses that might be likened to the purchase of an insurance policy to hedge against some risks of potential climate change in the future. Broader national responses might range from

engineering countermeasures, to passive adaptation, to prevention, and pursuit of an international law of the atmosphere. One policy widely advocated by the first President Bush in the early 1990s, and to some degree implemented to date, is the so-called "no regrets" approach, which in theory would not only reduce emissions of greenhouse gases but provide other benefits to society as well. Such policy options stress energy efficiency and conservation, increased renewable energy use, planting trees to enhance CO_2 sequestration from the atmosphere, and substitution of lesser or non-CO_2 producing fuels. Many scientists suggest that early actions might buy time to gain a better understanding of global climate change and perhaps reduce possible negative impacts attributable to human-induced climate change, should they occur.

Clinton Administration Policies. Taking office the year after the UNFCCC was completed, the Clinton Administration presided over early U.S. efforts to deal internationally with climate change, and to participate in formulation of the Kyoto Protocol to the UNFCCC. On October 19, 1993, President Clinton released his *Climate Change Action Plan* (CCAP), which proposed voluntary domestic measures to attain greenhouse gas emissions stabilization as outlined by the UNFCCC**,** to stabilize U.S. emissions at 1990 levels by the year 2000. The CCAP called for comprehensive voluntary measures by industry, utilities and other large-scale energy users. CCAP stressed energy-efficiency upgrades through new building codes in residential and commercial sectors, and other improvements in energy generating or using technologies. Large-scale tree planting and forest reserves were encouraged to enhance sequestration of carbon dioxide and to conserve energy. Other aspects of the plan addressed mitigation of greenhouse gases other than CO_2. The CCAP avoided mandatory command and control measures.

However, periodically, the Clinton Administration hinted at stronger regulatory actions; and some economists suggested implementation of some form of carbon (or other energy use) tax to deter fossil fuel consumption. However, national energy taxes have historically proven to be controversial with U.S. energy producers and consumers alike. In deliberations over U.S. policy in international negotiations on global climate change, some trade groups and labor unions representing America's heavy industry, utility, and agricultural sectors have been some of the strongest vocal opponents of regulation of CO_2 emissions, claiming their members would bear heavy economic burdens in any regulation of fossil fuel emissions.

Not all business/industry-related organizations, are of the same opinion, however. Some industries see an opportunity to develop and market environmental "friendly" technologies to be marketed internationally, or to switch to less CO_2-intensive fossil fuels, expand renewable and alternative energy resources for power generation, and expand use of nuclear power. Also, In efforts to garner support for or against Kyoto Protocol ratification, petitions have been circulated and signed by thousands of scientists, sponsored by major interest groups with differing views on the treaty. While some economists have suggested that stronger climate protection measures could actually benefit the U.S. economy, by providing economic growth and employment, others such as WEFA (formerly, Wharton Economic Forecast Associates) have projected dire economic consequences, including major loss of GDP, and often conflicting results supporting both sides of the issue have depended upon what *assumptions* underlay their respective economic models.

On November 12, 1998, President Clinton instructed a representative to sign the Kyoto Protocol to "lock-in" U.S. interests achieved during negotiations. This act drew protest by

some in Congress. Some Members claimed Clinton action was in violation of the June 1997 Byrd/Hagel Resolution (S.Res. 98) that required an economic analysis of legally binding emission reductions on the United States, as well as binding obligations for all UNFCCC parties, including developing countries. The President announced he would continue to pursue"meaningful" commitments from key developing countries before he would send the treaty to the Senate for advice and consent.

The Clinton Administration released an economic analysis (July 1998), prepared by the Council of Economic Advisors, that concluded that with emissions trading among the Annex B-countries, and participation of key developing countries in the "Clean Development Mechanism" — which grants the latter business-as-usual emissions rates through 2012 — the costs of implementing the Kyoto Protocol could be reduced as much as 60% from many estimates. Other economic analyses, however, prepared by the Congressional Budget Office and the DOE Energy Information Administration (EIA), and others, demonstrated a potentially large loss of GDP from implementing the Protocol. Some have questioned the "hot air issue" surrounding proposed emission trading credits from joint implementation (JI) and whether these would actually be available for trade, especially in light of Eastern and Central Europe's and some countries of former Soviet Union's desire to resume rapid economic development. Furthermore, at the Ministerial session at COP-5, the EU demanded that industrialized nations' greenhouse gas emissions be reduced domestically first, in effect imposing a cap on emissions credits granted for developing county projects under JI. This continues to be a contentious topic of debate during Kyoto Protocol negotiations.

On June 3, 1999, President Clinton issued Executive Order (E.O.) No. 13123, that called for a "Greening the Government Through Efficient Energy Use." The Department of Energy has since announced that efforts under this E.O., along with other voluntary climate change initiatives undertaken to date, have helped the United States reduce its overall greenhouse emissions by as much as 19% below 1990 levels, well ahead of the timetable proposed by the Kyoto Protocol.

On November 11, 2000, President Clinton issued a statement on "Meeting the Challenge of Global Warming" in response to the results of the report: *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change* (see [http://www.gcrio.org/National Assessment/]). In his statement, President Clinton said he would promulgate new regulations for U.S. electric power plants, imposing emissions caps on sulphur, nitrogen oxides, mercury, and CO_2. He also called for establishment of a domestic emissions trading program and promised a continued U.S. leadership role in climate change to set an example for other industrialized countries. President Clinton announced he would take such steps as necessary to keep the United States on target for meeting Kyoto Protocol goals, if certain concessions were made regarding international adoption of flexible mechanisms such as emissions trading, the clean development mechanism (CDM), credit for carbon sinks, and accountable, legally-binding, compliance mechanisms.

Bush Administration Policies. Soon after taking office, the Bush Administration had asked for a delay in resumption of the collapsed COP-6 negotiations (see COP-6 discussion below), in order to allow time for consideration of its approach and policies. Talks were accordingly scheduled for the second half of July. However, in late March, the Bush Administration indicated its opposition to the Kyoto Protocol, and created widespread concern among the EU nations by essentially rejecting it, citing lack of developing country

participation and possible harm to the U.S. economy, especially in light of acute energy problems that were evident in the first half of 2001. This followed extensive press attention to, first, statements by the EPA Administrator that–pursuant to campaign statements by then-candidate George W. Bush–carbon dioxide would be included in a multi-pollutant regulatory effort; and then a repudiation of that position and clarification by President Bush and Administration spokespersons that carbon dioxide would not be regulated.

President Bush made a policy statement in mid-June, resulting from a continuing cabinet-level review of climate change options, in which he outlined the U.S. approach as rejecting the Kyoto Protocol and favoring voluntary actions, increased scientific research, and market mechanisms. President Bush also outlined a U.S. Climate Change Research Initiative, and the National Climate Change technology Initiative. (See CRS report RL30452, *Climate Change: Federal Research, Technology, and Related Programs)* This preceded his trip to Europe for meetings with European heads of state, which ended with statements that Europe and the United States "agree to disagree" on climate change approaches.

The Europeans then announced their intentions to proceed with ratification of the Kyoto Protocol, while President Bush indicated the United States will continue to participate in negotiations of the UNFCCC parties in order to pursue its objectives. When talks resumed among UNFCCC parties at "COP-6 resumed" in mid-July in Bonn, Germany, and continued in the fall in Marrakech, Morocco at COP-7, the United States delegation did not make new proposals and declined to participate in negotiations on issues of the Kyoto Protocol. The other parties surprised many observers at COP-6 resumed by reaching agreement on nearly all of the most contentious issues, including significant use of carbon sinks, establishing a compliance mechanism, and disallowing credit for nuclear facilities. Agreement among the other parties was also found on the remaining Protocol issues at COP-7, and they announced that they would seek ratification of the Kyoto Protocol, and its entry into force–even without the participation of the United States–by August/September 2002, the date of the World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa.

The Bush Administration continues its review of climate policy, which along with many other issues was eclipsed by terrorism concerns following the September 11, 2001, attacks on the World Trade Center and the Pentagon. It appears that domestic policy options predominate in climate discussions, and there is no current indication when a U.S. policy or alternative to the Kyoto Protocol might emerge from this process.

International Action

The United States was involved in negotiations and international scientific research on climate change prior to ratifying the 1992 U.N. Framework Convention on Climate Change (UNFCCC). This included passage of a National Climate Program Act of 1978 (P.L. 95-367). These activities are discussed in CRS Report RL30522, *Global Climate Change: A Survey of Scientific Research and Policy Reports*, in which early aspects of the scientific debate and a chronology of U.S. government involvement in climate change policy prior to 1992 are featured.

U.N. Framework Convention on Climate Change (UNFCCC)

The United Nations Framework Convention on Climate Change (UNFCCC) was opened for signature at the 1992 United Nations Conference on Environment and Development (UNCED) conference in Rio de Janeiro (known by its popular title, the Earth Summit). On June 12, 1992, the United States, along with 153 other nations, signed the UNFCCC, that upon ratification committed signatories' governments to a voluntary "non-binding aim" to reduce atmospheric concentrations of greenhouse gases with the goal of "preventing dangerous anthropogenic interference with Earth's climate system." These actions were aimed primarily at industrialized countries, with the intention of stabilizing their emissions of greenhouse gases at 1990 levels by the year 2000; and other responsibilities would be incumbent upon all UNFCCC parties. The parties agreed in general that they would recognize "common but differentiated responsibilities," with greater responsibility for reducing greenhouse gas emissions in the near term on the part of developed/industrialized countries, which were listed and identified in Annex I of the UNFCCC and thereafter referred to as "Annex I" countries.

On September 8, 1992, President Bush transmitted the UNFCCC for advice and consent of the U.S. Senate to ratification. The Foreign Relations Committee approved the treaty and reported it (Senate Exec. Rept. 102-55) October 1, 1992. The Senate consented to ratification on October 7, 1992, with a two-thirds majority vote. President Bush signed the instrument of ratification October 13, 1992, and deposited it with the U.N. Secretary General. According to terms of the UNFCCC, having received over 50 countries' instruments of ratification, it entered into force March 24, 1994. Since the UNFCCC entered into force, the parties have been meeting annually in conferences of the parties (COP) to assess progress in dealing with climate change, and beginning in the mid-1990's, to negotiate the Kyoto Protocol to establish legally binding obligations for developed countries to reduce their greenhouse gas emissions.

COP-1, The Berlin Mandate

The UNFCCC Conference of Parties met for the first time 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" for countries to pick from and choose future options to address climate change which for them, individually, made the best economic and environmental sense. The Berlin Mandate exempted non-Annex I countries from additional binding obligations, in keeping with the principle of "common but differentiated responsibilities" established in the UNFCCC-- even though, collectively, the larger, newly industrializing countries were expected to be the world's largest emitters of greenhouse gas emissions 15 years hence. (See, CRS Report 96-699, *Global Climate Change: Adequacy of Commitments Under the U.N. Framework Convention and the Berlin Mandate*.)

COP-2, Geneva, Switzerland

The Second Conference of Parties to the UNFCCC (COP-2) met in July 1996 in Geneva, Switzerland. Its Ministerial Declaration was adopted July 18, 1996, and reflected a U.S. position statement presented by Timothy Wirth, former Under Secretary for Global Affairs for the U.S. State Department at that meeting, which 1) accepted the scientific findings on climate change proffered by the Intergovernmental Panel on Climate Change (IPCC) in 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 a consensus that parties to the UNFCCC would not object to a "future decision which would be binding on all parties," opening the door for a possible legally mandatory international protocol. Individual parties' objections were recorded.

COP-3, The Kyoto Protocol on Climate Change

The Kyoto Protocol to the United Nations Framework Convention on Climate Change was adopted by COP-3, in December 1997 in Kyoto, Japan, after intensive–and tense–negotations. Most industrialized nations and some central European economies in transition (all defined as Annex B countries) agreed to legally binding reductions in greenhouse gas emissions of an average of 6%-8% below 1990 levels between the years 2008-2012, defined as the first emissions budget period. The United States would be required to reduce its total emissions an average of 7% below 1990 levels. (For more details, see CRS Report RL30692: *Global Climate Change: The Kyoto Protocol*.) The Protocol provides that it will enter into force when it has been ratified by 55 countries, accounting for 55% of developed country emissions in 1990. In 1997, prior to the completion of the Kyoto Protocol, the U.S. Senate passed S.Res.98, which urged the President not to agree to a treaty that did not include binding commitments for developing countries, or that would cause harm to the U.S. economy. As noted above, although President Clinton did sign the Protocol in 1998, it was never submitted by the Clinton Administration to the Senate because it would not have met the conditions of S.Res.98.

The Clinton Administration initiated funding efforts to address climate change; in the FY2001 budget request funding was included for a Climate Change Technology Initiative (CCTI) first introduced in his FY1999 budget. Somewhat reduced funding for the climate technology initiatives was received in previous years. (See CRS Report RL30452. *Climate Change: Federal Research, Technology, and Related Programs*.)

COP-4, Buenos Aires

COP-4 took place in Buenos Aires in November 1998. It had been expected that the remaining issues unresolved in Kyoto would be finalized at this meeting. However, the complexity and difficulty of finding agreement on these issues proved insurmountable, and instead the parties adopted a 2-year "Plan of Action" to advance efforts and to devise mechanisms for implementing the Kyoto Protocol. UNFCCC parties also addressed compliance and financial response mechanisms to encourage more developing countries to sign on to the protocol. Talks on compliance stressed a front end "qualifying" approach rather than "sanctions and punitive measures," as the European Union (EU), and the U.S. had originally, supported. (That is, parties must be in compliance with existing commitments to

take part in emissions trading and joint implementation. This meant being accepted for Annex-B status and committed to terms of the Kyoto Protocol. On the other hand, few restrictions would apply for developing countries wishing to participate in the "clean development mechanism" which would fund emissions-reducing projects in developing countries, with credit for these reductions going to developed country contributors to the fund). Work continued at COP-4 to determine how to calculate emissions reductions from strengthening "carbon sinks," which sequester and store carbon absorbed from the atmosphere, and devising technical definitions for sink capacity of current forest, vegetation, and land-use practices.

COP-5, Bonn, Germany

The 5th Conference of Parties to the U.N. Framework Convention on Climate Change met in Bonn, Germany, between October 25 and November 4, 1998. COP-5 included sessions of the Subsidiary Bodies on Implementation and Science and Technology and a two-day ministerial session. Major themes of negotiations included devising the technical and political mechanisms, such as the Clean Development Mechanism (CDM), Joint Implementation (JI), and developing criterial for project eligibility, all processes that would allow both developed and developing countries to meet their respective responsibilities under the FCCC, and 1997 Kyoto Protocol, with optimum flexibility. Also under consideration were legally-binding consequences for non-compliance of parties under the voluntary UNFCCC. This action, in and of itself, would likely require an amendment to the Kyoto Protocol, as well as establishment of a COP-certified national inventorying systems to track international greenhouse gas emissions and their reduction. Parties adopted a decision for a second round of national communications and emissions reporting (for Annex I countries); so that updated data and information could be used to inform upcoming negotiations at COP-6.

COP-6, The Hague, Netherlands

When COP-6 convened November 13-25, 2000 in The Hague, Netherlands, discussions evolved rapidly into a high-level negotiation over the major political issues. These included major controversy over the United States' proposal to allow credit for carbon "sinks" in forests and agricultural lands, satisfying a major proportion of the U.S. emissions reductions in this way; disagreements over consequences for non-compliance by countries that did not meet their emission reduction targets; and difficulties in resolving how developing countries could obtain financial assistance to deal with adverse effects of climate change and meet their obligations to plan for measuring and possibly reducing greenhouse gas emissions. In the final hours of COP-6, despite some compromises agreed between the United States and some EU countries, notably the United Kingdom, the EU countries as a whole, led by Denmark and Germany, rejected the compromise positions, and the talks in The Hague collapsed. Jan Pronk, the President of COP-6, suspended COP-6 without agreement, with the expectation that negotiations would later resume. It was later announced that the COP-6 meetings (termed "COP-6 bis") would be resumed in Bonn, Germany, in the second half of July. The next regularly scheduled meeting of the parties to the UNFCCC - COP-7 - had been set for

Marrakech, Morocco, in October-November, 2001. (For more detailed discussion of COP-6 issues, see CRS Report RL30692, *Global Climate Change: The Kyoto Protocol.*)

COP-6 "bis," Bonn, Germany

When the COP-6 negotiations resumed July 16-27, 2001, in Bonn, Germany, little progress had been made on resolving the differences that had produced an impasse in The Hague. However, this meeting took place after President George Bush had become the U.S. President, and had rejected the Kyoto Protocol in March; as a result the United States delegation to this meeting declined to participate in the negotiations related to the Protocol, and chose to act as observers at that meeting. As the other parties negotiated the key issues, agreement was reached on most of the major political issues, to the surprise of most observers given the low level of expectations that preceded the meeting. The agreements included:

(1) Mechanisms – the "flexibility" mechanisms which the United States had strongly favored as the Protocol was initially put together, including emissions trading; joint implementation; and the Clean Development Mechanism (CDM), which provides funding from developed countries for emissions reduction activities in developing countries, with credit for the donor countries. One of the key elements of this agreement was that there would be no quantitative limit on the credit a country could claim from use of these mechanisms, but that domestic action must constitute a significant element of the efforts of each Annex B country to meet their targets.

(2) Carbon sinks – credit was agreed to for broad activities that absorb carbon from the atmosphere or store it, including forest and cropland management, and revegetation, with no over-all cap on the amount of credit that a country could claim for sinks activities. In the case of forest management, an Appendix Z establishes country-specific caps for each Annex I country, for example, a cap of 13 million tons could be credited to Japan (which represents about 4% of its base-year emissions). For cropland management, countries could receive credit only for carbon sequestration increases above 1990 levels.

(3) Compliance – final action on compliance procedures and mechanisms that would address non-compliance with Protocol provisions was deferred to COP-7, but included broad outlines of consequences for failing to meet emissions targets that would include a requirement to "make up" shortfalls at 1.3 tons to 1, suspension of the right to sell credits for surplus emissions reductions; and a required compliance action plan for those not meeting their targets.

(4) Financing – three new funds were agreed upon to provide assistance for needs associated with climate change; a least-developed-country fund to support National Adaptation Programs of Action; and a Kyoto Protocol adaptation fund supported by a CDM levy and voluntary contributions.

A number of operational details attendant upon these decisions remained to be negotiated and agreed upon, and these were the major issues of the COP-7 meeting that followed.

COP-7, Marrakech, Morocco

At the COP-7 meeting in Marrakech, Morocco October 29-November 10, 2001, negotiators in effect completed the work of the Buenos Aires Plan of Action, finalizing most of the operational details and setting the stage for nations to ratify the Protocol. The United States delegation continued to act as observers, declining to participate in active negotiations. Other parties continued to express their hope that the United States would re-engage in the process at some point, but indicated their intention to seek ratification of the requisite number of countries to bring the Protocol into force (55 countries representing 55% of developed country emissions of carbon dioxide in 1990). A target date for bringing the Protocol into force was put forward–the August-September 2002 World Summit on Sustainable Development (WSSD) to be held in Johannesburg, South Africa. The main decisions at COP-7 included: operational rules for international emissions trading among parties to the Protocol and for the CDM and joint implementation; a compliance regime that outlines consequences for failure to meet emissions targets but defers to the parties to the Protocol after it is in force to decide whether these consequences are legally binding; accounting procedures for the flexibility mechanisms; and a decision to consider at COP-8 how to achieve to a review of the adequacy of commitments that might move toward discussions of future developing country commitments.

Congressional Interest and Activities

New scientific findings concerning the human contribution to climate change emerged during expert review of the third IPCC assessment on climate change; recently the overall projections of temperature and sea-level rise made in the 1995 IPCC Assessment were estimated to be higher than previously reported, and mostly on the high end of predictions. The IPCC has also suggested that it may be prudent to consider other potential greenhouse gases not slated to be regulated by the Kyoto Protocol, and also to account for potential indirect climatic change effects that may be attributable to other atmospheric emissions (e.g., replacements for ozone depleting substances).

On January 13, 2000, the National Research Council released a report which attempted to reconcile different surface and atmospheric temperature trends and the implication for global climate change models (GCMs), and confirmed a positive temperature trend at the surface since 1970. On November 10, 2000, the USGCRP released its assessment of the potential consequences of climate change impacts on the United States; the results, the National Assessment Synthesis team called for action to address potential significant regional climate changes in the United States resulting from global climate change. Also, the Intergovernmental Panel on Climate Change has this year released its *Third Assessment Report on Climate Change*. These three reports, and many other issues stated above, have succeeded in drawing the interest of House and Senate Members and the attention of committees of relevant jurisdiction in the 107th Congress. This legislation is discussed below.

LEGISLATION

Note: As in the previous two Congresses, language was included in several appropriations bills, to prohibit activities that would have the effect of implementing the Kyoto Protocol. Legislative language was also added to both House and Senate State Department authorization bills to encourage the United States to take leadership internationally and domestically in reducing greenhouse gas emissions, and to continue participating in negotiations to deal with climate change (see below). A number of bills on energy issues are relevant to climate change, especially those with provisions encouraging or authorizing energy efficiency and alternative energy sources, but are not included in this list unless they directly deal with climate change, *per se*, and go beyond simply referencing climate/emissions side benefits. For additional information on climate-relevant energy legislation, not included in the list below, see the Legislation section of CRS Issue Brief IB10041, *Renewable Energy: Tax Credit, Budget and Electricity Production Issues*; CRS Issue Brief IB10020, *Energy Efficiency: Budget, Oil Conservation, and Electricity Conservation Issues;* and CRS Report RL31044, *Renewable Energy Legislation in the 107th Congress.*

H.R. 1335 (Allen)

Reduces emissions of mercury, carbon dioxide, nitrogen oxides, and sulfur dioxide from fossil fuel-fired electric utility generating units operating in the United States, and for other purposes. Introduced April 3, 2001.

H.R. 1646 (Hyde)

Authorizes appropriations for the Department of State for fiscal years 2002 and 2003, and for other purposes. Section 745 of this bill expresses a "Sense of Congress Relating to Global Warming," which includes among its findings that global climate change poses a significant threat to national security, the American economy, public health and welfare, and the global environment, and reviews the scientific findings of the Inter-governmental Panel on Climate Change (IPCC) and threats to various ecological and agricultural systems, and the U.S. participation in the United Nations Framework Convention on Climate Change (UNFCCC). It states the sense of Congress that the United States should demonstrate international leadership in mitigating global warming threats by taking responsible action to achieve meaningful reductions in greenhouse gas emissions from all sectors, and by "continuing to participate in international negotiations with the objective of completing the rules and guidelines for the Kyoto Protocol in a manner that is consistent with the interests of the United States and that ensures the environmental integrity of the protocol." Introduced May 27, 2001; passed the House as amended May 16, 2001, and referred to the Senate Committee on Foreign Relations on May 17, 2001. On August 2, the Senate Foreign Relations Committee approved a similar "Sense of the Congress" resolution as an amendment to its State Department authorization bill, S. 1401.

H.Con.Res. 83

The Senate Budget Resolution, passed in the nature of a substitute for language in H.Con.Res.83, included **S.Amdt. 249**, sponsored by Senator John Kerry, to restore funding for programs related to global climate change to the funding level of $4.5 billion over 10 years, primarily for existing programs. Among the purposes identified by the amendment were "addressing global climate change concerns...promoting domestic energy security....to

provide increased funding to ensure adequate U.S. participation in negotiations...pursuant to the Senate-ratified U.N. Framework Convention on Climate Change..." and other purposes. Passed by the Senate April 6, 2001. See *Congressional Record* p. S3641.

H.Res. 117 (Lee, Barbara)

Expresses the sense of Congress that the United States should develop, promote, and implement policies to reduce emissions of fossil fuel generated carbon dioxide with the goal of achieving stabilization of greenhouse gas emissions in the United States at the 1990 level by the year 2010. Introduced April 4, 2001.

S. 388 and S. 389 (Murkowski)

Protects the energy and security of the United States and decreases America's dependency on foreign oil sources to 50% by the year 2011 by enhancing the use of renewable energy resources conserving energy resources, improving energy efficiencies, and increasing domestic energy supplies; improves environmental quality by reducing emissions of air pollutants and greenhouse gases; and for other purposes. Introduced February 26, 2001; referred to the Senate committee on Energy and Natural Resources.

S. 597 (Bingaman)

The Comprehensive and Balanced Energy Policy Act of 2001. Includes Title I: Integration of energy policy and climate change policy, and establishes a National commission on Energy and Climate Change; and in other titles, addresses a comprehensive program for "reliable and diverse power generation and transmission," including clean energy, power transmission and generation, renewable energy, hydroelectric relicensing, coal, oil and gas production, and other energy-related issues. Introduced March 22, 2001; markup session held by Senate Committee on Energy and Natural Resources August 2, 2001.

S. 769 (Brownback)

Establishes a carbon sequestration program and an implementing panel within the Department of Commerce to enhance international conservation, promotes the role of carbon sequestration as a means of slowing the buildup of greenhouse gases in the atmosphere, and rewards and encourage voluntary, pro-active environmental efforts on the issue of global climate change. Introduced April 24, 2001.

S. 785 (Brownback)

Amends the Food Security Act of 1985 to require the Secretary of Agriculture to establish a carbon sequestration program to permit owners and operators of land to enroll the land in the program to increase the sequestration of carbon, and for other purposes. Introduced April 26, 2001.

S. 820 (Wyden)

The "Forest Resources for the Environment and the Economy Act" amends the Energy Policy Act of 1992 to assess opportunities to increase carbon storage on national forests derived from the public domain and to facilitate voluntary and accurate reporting of forest projects that reduce atmospheric carbon dioxide concentrations, and for other purposes. Introduced May 3, 2001. Hearings held on July 4, 2001.

S. 1008 (Byrd)

Amends the Energy Policy Act of 1992 to develop the U.S. Climate Change Response Strategy, with the goals of stabilizing greenhouse gas concentrations in the atmosphere, minimizing adverse short-term and long-term economic and social impacts, aligning the Strategy with U.S. energy policy, promoting sound national environmental policy, establishing a research and development program that focuses on bold technological breakthroughs that contribute significantly toward greenhouse gas stabilization, establishing a National Office of Climate change Response within the Executive Office of the President, and for other purposes. Introduced June 8, 2001. Approved by the Senate Governmental Affairs Committee on August 2, 2001, and reported with amendments on November 15, 2001 (Senate Report 107-99).

S. 1255 (Wyden)

The "Carbon Sequestration and Reporting Act" would amend the Energy Policy Act to provide for the establishment of the Carbon Advisory Council to advise on reporting guidelines for greenhouse gas sequestration from soil carbon and forest management actions, and their potential effects and effectiveness. The act would also amend the Global Climate Change Prevention Act of 1990 to authorize the Secretary of Agriculture to enter into cooperative agreements for forest carbon activities on private, State, or Indian lands. It would direct the Secretary to provide states with assistance to establish revolving loan programs for forest carbon activities on nonindustrial private forest land. In addition, it would authorize Washington, Oregon, Idaho, and Montana to apply for funding from the Bonneville Power Administration for loans for related purposes or for specified fish and wildlife purposes. The Food Security Act of 1985 would be amended to direct the Secretary to establish a carbon sequestration program, which could include conservation reserve and wetlands reserve lands, and it would direct the Secretary to carry out four or more carbon monitoring pilot programs. Introduced July 26, 2001.

S. 1293 (Craig)

Amends the Internal Revenue Code to provide incentives for the voluntary reduction, avoidance, and sequestration of greenhouse gas emissions and to advance global climate science and technology development and deployment. Introduced August 1, 2001.

S. 1294 (Murkowski)

Establishes a new national policy designed to manage the risk of potential climate change, ensures long-term energy security, and strengthens provisions in the Energy Policy Act of 1992 and the Federal Non-nuclear Energy Research and Development Act of 1974 with respect to potential climate change. Introduced August 1, 2001.

S. 1716 (Kerry)

Entitled the Global Climate Change Act of 2001, this bill provides for establishment of a number of new Government entities, including: (1) a National Office of Climate Change Action and an integrated program office for the global change research program within the Office of Science and Technology Policy; (2) an interagency climate change action task force to develop a national strategy for, among other things, substantially reducing U.S. Greenhouse gas emissions and promoting energy efficiency research and development; and (3) a Science and Technology Assessment Service in the legislative branch. Introduced November 15, 2001.

S. 1766 (Daschle)

Officially entitled A bill to provide for the energy security of the Nation, and for other purposes, this bill includes seven titles focused on various aspects of energy provision, many of which would have climate implications. One title is the Climate Change Strategy and Technology Innovation Act of 2002, which incorporates key aspects of S. 1008 and S. 1716. Introduced December 5, 2001.