

CRS Issue Brief for Congress

Received through the CRS Web

Global Climate Change

Updated January 12, 2001

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Global Climate Change

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. Human activities, particularly the burning of fossil fuels, have increased atmospheric carbon dioxide (CO₂) and other trace greenhouse gases. If these gases continue to accumulate in the atmosphere at current rates, many 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. Regional agricultural practices could change, yield stabilities might decrease in some regions, and survival over winter of some insect pests might increase. Forest productivity might decline in some regions; and changes in climate, when added to other environmental stressors, could produce major regional disturbances. Some climate modification, e.g., in northernmost growing regions, is thought to be beneficial for agriculture however.

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 is: Given scientific uncertainties about the magnitude,

timing, rate, and regional consequences of potential climatic change, what are the appropriate responses for world decision makers?

Fossil-fuel combustion is the primary source of CO₂ emissions, and also emits other "greenhouse" gases. Removing these gases after combustion is a technical challenge and imposes economic penalties. Policy options to curb emissions, so far, have stressed energy efficiency and conservation, sequestering of atmospheric CO₂, market-oriented strategies such as carbon taxes, emissions trading, switching to less CO₂-intensive fuels, and substituting renewable and nuclear energy. A warmer climate might also result in less energy consumption during winter months.

Congress has reviewed scientific information about climate change to evaluate potential economic and strategic impacts of a warmer, and perhaps more variable, climate to formulate policy responses. Because of the global implications of this problem, concerns are - addressed internationally through direct communication between U.S. decision makers and world leaders, participation in international conferences, passage of legislation, and exchange of views and information with international organizations within and outside the United Nations system.

The 1992 U.N. Framework Convention on Climate Change called for a "non-binding" voluntary aim for industrialized countries to control atmospheric concentrations of greenhouse gases by stabilizing their emissions at 1990 levels by the year 2000. The 1997 U.N. Kyoto Protocol on Climate Change goes further and, if it were to enter into force, would commit world governments to legally binding emissions reductions.

MOST RECENT DEVELOPMENTS

At the November 2000 conference of parties to the U.N. Framework Convention on Climate Change (COP-6), held in the Hague, Netherlands, international climate change negotiations on implementing the Kyoto Protocol were viewed as reaching a stalemate over carbon sink issues involving mainly the U.S./Umbrella Group and the European Union. Nevertheless, the President of COP-6 concluded that major progress was made in completing many important elements of the 2-year Buenos Aires Plan of Action that would potentially govern implementation of the Kyoto Protocol. Attempts were made to bring the two major opposing blocs back to the table in Ottawa, Canada during the first week of December, although these talks did not lead to any further agreements. In any case, many FCCC parties have expressed confidence that negotiations could be resumed possibly as early as May/June 2001, at a session in Bonn, Germany, which will be called "COP-6 bis."

*The FY2001 Appropriations Act for the Department of Agriculture (P.L. 106-387), enacted October 28, 2000, contained a ban on implementing the Kyoto Protocol prior to advice and consent of the Senate to ratification and would apply to certain types of climate change funding. Similar language is also found in Interior, Energy and Water, VA-HUD, Foreign Operations, and Commerce, Justice, and State appropriations bills for FY2001, some of which have become public law (see **Legislation**).*

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 (CO₂) by one-third over the past 100 years, may possibly be leading to an increase in global average temperatures. However, this so-called "global warming" theory 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 (CO₂) that, along with increasing concentrations of other trace gases such as chlorofluorocarbons-CFCs, methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆), 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 (CO₂), methane (CH₄), nitrous oxide (N₂O), and chlorofluorocarbons (CFCs). Historically, CO₂ 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 CO₂. 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 (SF₆), 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 CO₂ is enormous — some 800 billion tons. Ice cores and other proxy climate data, which also indicate CO₂ 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 CO₂ 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 CO₂ 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 CO₂ are now about 32% higher than they were some 150 years ago. Some scientists suggest that a large amount of CO₂ 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 CO₂ 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.html>].

State-of-the-art computer models of the Earth’s climate (GCMs) have projected a globally averaged warming of 3 to 8 degrees F over the next 100 years, if greenhouse gases continue to accumulate in the atmosphere at the current rate. Prominent 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.

So-called “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, although recent episodic weather events may seem more extreme in nature, this is indicative of long-term climate change. The Clinton Administration received criticism about attributing seemingly more frequent weather anomalies to a warming of the climate. And so the scientific questions remains: Can scientists now confirm that humans are indeed, at least in part, the cause of recent climate changes? Also, as a result of this, is the Earth committed to some degree of future global warming? If so, then what might be the consequences, and what if any of those might be prevented?

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 continue. 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 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 measure indirectly average temperatures of the atmosphere in a deep column above the surface — for the past 20 years are hard pressed to demonstrate any positive trends. A recent report by the U.S. National Research Council, Board on Atmospheric Sciences and Climate, Panel on *Reconciling Observations of Global Temperature Change* (January 13, 2000) revisited observed surface warming data of the Earth during the past 20 years. The report 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 that long-term, systematic monitoring of the upper atmosphere could resolve the differences in temperature trends.

A May 2000 draft report by the IPCC working group on the science of global climate change concluded "There has been a discernible human influence on the climate." However, authors reported little else new in terms of future climate change projections or the ability to resolve remaining uncertainties about GCMs, including the behavior of clouds, or the climatic effects of human's burning of fossil fuels. Skeptics have not denied a human role in climate change, but lately have been emphasizing a modest role and an inferred minimal, if not beneficial, future impact of climate change. The third IPCC assessment was used to guide international negotiations on climate change on the Kyoto Protocol, at COP-6.

A June 2000 draft assessment report, *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*, released by 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 projected impacts of climate change were overstated and unsubstantiated. The National Assessment Synthesis Team (NAST), which authored the report, countered that much of the criticism it has received does 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, while seemingly contradictory results were produced by the two models selected for the study. NAST noted that one model scenario demonstrated a 3-4 times increase in atmospheric concentration levels of CO₂, which scientists have projected for the end of the next century, if a business as usual, or no policy change is assumed. Various regional and resource-focused assessments are now available at the USGCRP website [<http://www.nacc.usgcrp.gov>]. A final 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, although its conclusions did not differ significantly.

In August 2000, NASA scientist James Hansen suggested that climate change benefits could be achieved through near-term regulation of non-CO₂ 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-CO₂ greenhouse gases have relatively short atmospheric lifetimes compared with CO₂; 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 CO₂ 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 CO₂. Hansen also noted that modest gains from reducing CO₂ and non-CO₂ emissions in the near-term could be achieved primarily through cleaner energy production.

The Policy Context

The prospect of global warming from an increase in greenhouse gases has become a major science policy issue during 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?

Policymakers, here and abroad, are counseling cautious courses of action to address the prospect of climate change that many believe is still theoretical and cannot be foreseen 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 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 CO₂ sequestration from the atmosphere, and substitution of lesser or non-CO₂ 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.

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 under the terms of the U.N. FCCC (see **International Action**). The CCAP reflected the President's own goals to stabilize U.S. emissions at 1990 levels by the year 2000, and called for a comprehensive suite of 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 CO₂. By avoiding mandatory command and control measures, CCAP, in one sense, appeared to be moving aggressively to implement "no-regrets" policies endorsed by former President Bush.

However, periodically, the Clinton Administration hinted at stronger regulatory actions; and some economists have 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 CO₂ emissions, claiming their members would bear the greatest economic burden of regulating fossil fuel emissions. These organizations project the loss of many American jobs to countries which would not be required to impose as strong environmental regulations, and have expressed opposition to any effort by the President to commit to greenhouse gas reductions that are not supported by sound scientific and economic analysis. Such interest groups, and some Members of Congress, have continued to challenge greenhouse gas control proposals under the 1997 U.N. Kyoto Protocol that would *not* apply to developing countries in kind, and, consequently, many of the same are opposed to U.S. ratification of the Protocol.

Not all business/industry-related organizations, the Pew Center for example, 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 CO₂-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 to thousands of scientists by major interest groups with differing views on the treaty.

Clinton Administration climate change policy encouraged voluntary efforts by government, industry and citizens alike which emphasize *flexibility* in achieving U.S. greenhouse gas emissions goals, taking into account *where* global emissions occur and *when* such reductions would be the most economically feasible. This policy addressed the life cycle and potential market of new capital equipment, e.g., energy generating technologies, that might portend savings in energy costs while enabling concomitant emissions reductions. In concert with the *when* and *where* policy, is *joint implementation* that would allow industrialized countries to share credits for emissions reduction with developing host countries. The latest dimension of the "flexible" policy response was the *what* factor, which U.S. representatives characterize as, choosing what off-the-shelf mitigation technologies, or what adaptation strategies may make the most sense to develop and utilize it now where and when feasible. 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 because the Kyoto Protocol had not yet, and still has not been submitted to the U.S. Senate for advice and consent to ratification. 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 participation of all FCCC parties. The President announced he would continue to pursue “meaningful” commitments from key developing countries, perhaps unilaterally, over the next few years, before he would send the treaty to the Senate in deference to S.Res. 98.

The Clinton Administration did release 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 country 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.gcric.org/National Assessment/](http://www.gcric.org/National%20Assessment/)]). 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 CO₂. 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. 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.

Global Climate Change Funding

On February 14, 2000, the Clinton Administration detailed plans to spend some \$4.1 billion in FY2001 for climate change-related domestic programs, and investments and tax incentives. This funding included \$1.7 billion for the U.S. Global Change Research Program (USGCRP), which will focus on 1) Improved Climate Observations, 2) the Global Water Cycle, 3) Ecosystem Changes (climate change impacts), and 4) Understanding the Carbon Cycle. USGCRP funding is divided among nine federal agencies, details of which are to be included in "Our Changing Planet: FY2001," budget document. The President recently announced a 50% increase in funding for all climate change programs from FY1998 to FY2001.

As part of this, the President slated \$2.4 billion for a "Climate Change Solutions" (CCS) initiative, which includes technology investment spending and tax breaks (\$4 billion in total tax incentives would be realized between FY01-FY05) associated with the President's Climate Change Technology Initiative (CCTI). Also, included under CCS was Biofuels & Bioproducts Initiative, Energy Conservation programs, and International Clean Energy Initiative (ICEI) for international investments in "enviro-friendly" technologies, for which grants would be provided by the Agency for International Development (AID). For a funding update for FY2001, see CRS Report RL30452: *Climate Change Technology Initiative (CCTI): R&D and Related Programs*.

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 (FCCC). 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*, also in which early aspects of the scientific debate and a chronology of U.S. government involvement in climate change policy are featured.

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

The U.N. Framework Convention on Climate Change (FCCC) was opened for signature at the 1992 UNCED conference in Rio de Janeiro ("The Earth Summit"). On June 12, 1992, the United States, along with 153 other nations, signed the FCCC, that contained a legal framework 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 FCCC parties. On September 8, 1992, President Bush transmitted the FCCC for advice and consent of the U.S. Senate to ratification. The Foreign Relations Committee endorsed 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 FCCC, having received over 50 countries' instruments of ratification, it entered into force March 24, 1994.

COP-1, The Berlin Mandate

Seeking grounds for a uniform approach toward climate protection, the Conference of Parties (COP) to FCCC 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. Criticism was leveled by many industrialized countries, including the United States, at newly industrializing countries, such as Brazil, India, and China. These would continue to be classified as non-Annex I countries and enjoy exemption from any future, legally binding emissions reduction agreements even though, collectively, these would 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 and a Ministerial Declaration

The Second Conference of Parties to the FCCC (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 outright 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 FCCC would not object to a "future decision which would be binding on all parties," opening the door for a possible international regulatory protocol. Individual party's objections were recorded.

COP-3, The UN (Kyoto) Protocol on Climate Change

The U.N. Kyoto Protocol on Climate Change was adopted by the COP, in December 1997 in Kyoto, Japan, one day after the official session ended. 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 Treaty: Kyoto Protocol.*)

The Clinton Administration has attempted to implement emissions reductions agreed upon in the UNFCCC, and in his FY2001 budget requested funding for a Climate Change

Technology Initiative (CCTI) first introduced in his FY1999 budget. Somewhat reduced funding for his climate technology initiatives has been received in previous years, and the market-based incentives, including tax breaks for industry and individuals and R&D credits for industry, still have not been implemented by Congress. (See CRS Report RL30452. *Climate Change Technology Initiative (CCTI): R&D and Related Programs.*)

COP-4, Buenos Aires

COP-4 took place in Buenos Aires in November 1998. Here, FCCC parties adopted a 2-year “Plan of Action” to advance efforts and to devise mechanisms for implementing the Kyoto Protocol. FCCC 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.” Work continued at COP-4 to determine how to calculate emissions reductions from strengthening “carbon sinks,” 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 criteria 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 FCCC. This action, in and of itself, would 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

The Sixth Conference of Parties to the United Nations Framework Convention on Climate Change (COP-6) convened November 13-25, 2000. Despite a major impasse reached at this session for final implementation of the Kyoto Protocol, a number of FCCC parties expressed confidence that progress was made in resolving a number of technical issues associated with the Kyoto Protocol. Throughout the session, however, the United States and European Union (EU) parties remained split along policy lines as to the content of the final treaty and how it should be implemented. A proposal submitted by the United States

focusing on forestry and land-use practices and land-use change as a possible means to receive legitimate emissions reduction credits was also considered; however, who might take those credits and when they might be applied was contested among FCCC parties. Talks continued in Ottawa, Canada during the first week of December 2000, but no further agreements were reached.

Throughout COP-6 many parties seemed in favor of developing actual mechanisms by which Annex B countries under the Kyoto Protocol might trade emissions credits and pursue flexible response strategies such as international joint implementation among industrialized (Annex 1) countries; and also develop a clean development mechanisms (CDM) in cooperation with industrialized countries, for lesser developed countries that might allow them to forego greenhouse gas emissions-intense economic development paths.

However, negotiations appeared to falter when the EU charged that the United States stood to enjoy a “number of loopholes” under the agreement negotiated thus far and would lessen the former’s respective burden of domestic emissions reductions. Instead, the EU sought to impose certain limits on the United States in using these flexibility mechanisms. Otherwise, the EU claimed that little would be accomplished in terms of environmental improvement if the United States failed to rein-in its contributions of greenhouse gas emissions (24% of the total). U.S. negotiators countered that U.S. emissions growth had been stemmed significantly over the past 10 years, growth was occurring elsewhere, and that emissions reductions should be counted no matter where in the world they occur or how they are achieved. Also under debate was whether some U.S. proposals would achieve any real emissions reductions. For example, the EU consistently criticized the United States for its proposal to pay Russia and Central European countries for rights for it to pollute, if surplus credits were eventually granted to the latter, under Annex B of the Kyoto Protocol.

Already, a number of industrialized countries, including the U.S. and an Umbrella Group consisting of Japan, U.S., Canada, Australia, New Zealand, Russia, the Ukraine and Norway, and their major industries, are proposing domestic schemes for emissions trading, which might at some point, negotiators claim, serve as a model for an international trading regime under an international agreement sanctioned by UNFCCC parties. The EU even has its own proposal for such a scheme, known as the “EU Bubble.”

In the opinion of many business leaders and some Members of Congress, current domestic proposals for voluntary flexible mechanisms to reduce global greenhouse emissions have had strong U.S. business and agricultural community input and support; this support has been reflected in recent legislation proposed and supported in a bi-partisan spirit in Congress. (See **Legislation**). On the other hand, there was strong opposition to the Kyoto Protocol by the U.S. congressional delegation, which attended COP-6. Regardless of the ultimate legal vehicle – the Kyoto Protocol, or some other treaty – in order for the United States to move forward on any such agreements will require the advice and consent of the U.S. Senate before any such agreements are binding for U.S. citizens. Congress would also have the responsibility to implement provisions of the treaty, domestically, if in force.

Major environmental interests continue to oppose any agreement that would not take strong international legally-binding regulatory action to reduce greenhouse gas emissions. On the other hand, many reputable scientists feel that the scientific evidence about climate change has been compelling enough for world leaders to accept prospective climate change as a certainty. To reduce the apparent human contribution, they believe, can only be done by

reducing atmospheric emissions of greenhouse gases under an international regulatory regime regardless whether those remedial actions would be voluntary or mandatory. In September 2000, world leaders adopted the text of the “U.N. Millennium Declaration,” which affirmed nations should make efforts to ensure that the Kyoto Protocol enters into force by the next U.N. Conference on Economic Development (UNCED), scheduled for 2002. At the same time, skeptics of global warming continue to question whether any action is necessary based upon their interpretation of the scientific data.

Most importantly, the Kyoto Protocol has yet to be ratified by the United States and is still a long way from meeting the criteria established by the COP necessary for its entry into force, and there are a number of policy issues confronting approval of the Kyoto Protocol that still need to be resolved. Some of these include: 1) deciding what parties will be able to participate in flexibility mechanisms should they be adopted (and who *should* participate); 2) determining the adequacy of current commitments of parties under the FCCC; 3) establishing what might be the consequences, if any, for non-compliance under a prospective protocol; 4) determining whether the amount of emissions credits earned by any one country should be capped, if resulting in nothing more than a zero-sum gain for global emissions reductions; 5) where and when carbon sink credits might be taken; and 6) whether activities primarily taken in a host country should be credited in the absence of any domestic efforts (the so-called “additionality” argument) – and the crux of the EU’s resistance to U.S. flexibility mechanisms.

Many developing countries lacking the necessary monetary and human resources fear that they will face significant impacts from climate change. Many of these countries have expressed frustration over the results of COP-6 because of what they now believe are negotiations which are not in their interest, but being held hostage by the interests of the United States and EU.

Congressional Interest and Activities

For a review of legislative activities in the 100th - 102nd Congresses, see CRS Report 93-445 SPR: *Global Climate Change Legislation: A Review of the 102nd Congress*. Recent legislation and other related information on global climate change may also be found in the CRS Electronic Briefing Book, *Global Climate Change at* [<http://www.congress.gov/brbk/html/ebgcc1.html>].

No fewer than 17 bills were introduced on global climate change in the first session of the 106th Congress, but only a handful received consideration in the second session. Many of these dealt with congressional concern about possible “back door” implementation of the 1997 Kyoto Protocol to the 1992 U.N. Framework Convention on Climate Change, that is, implementation prior to advice and consent to ratification by the Senate. Related directives were found in other FY2001 appropriation bills. Other climate change legislation dealt with funding priorities for of U.S. research activities and still other proposed schemes for voluntary greenhouse gas emissions reductions and greenhouse gas emission trading credits. Also President Clinton requested increases for a number of presidential climate change initiatives for FY2001. (See **Global Climate Change Funding**.)

Most of the bills not related to appropriations introduced this session seek ways to act legislatively on climate change protection, in lieu of the Kyoto Protocol, and these mostly

stress voluntary measures. Much legislative activity in the 106th Congress was confined to relevant committees of jurisdiction, or had been in the nature of oversight hearings. Also, Congress continued to exercise its oversight authority to ensure that aspects of U.S. research on climate change are complying with the 1994 Government Performance and Results Act (GPRA), and that such research is being used effectively to inform the policy process. The Senate still awaits transmittal of the Kyoto Protocol for its advice and consent to ratification.

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, 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. These two reports, and many other issues stated above, will likely be subject of House and Senate hearings in the 107th Congress.

LEGISLATION

P.L. 106-387, the Agricultural Appropriations Act for FY2001 (H.R. 4461), and its conference report (H.Rept. 106-619 §734) contain language about funding for Kyoto Protocol activities. Some have argued its provisions challenge programs that were previously authorized by Congress in other laws. H.R. 4461 served as a model for language in other climate change appropriations bills and reports. The majority of these prohibit unauthorized funding of activities related to the Kyoto Protocol prior to the Senate's advice and consent to ratification of this Treaty. In many cases, technical and clarifying amendments were added to these bills as they have progressed through the FY2001 appropriations process to ensure climate change programs previously authorized by Congress continue to receive funding.

S. 882 (Murkowski)

Strengthens provisions in the Energy Policy Act of 1992 and the Federal Nonnuclear Energy Research and Development Act of 1974 with respect to potential Climate Change. Establishes the Office of Global Climate Change in Department of Energy for coordination of climate change activities at agency which reports to Secretary of Energy. Authorizes \$2 billion for a ten-year research, development and demonstration program to develop new technology through public-private partnerships to help stabilize greenhouse gas concentrations in the atmosphere. Promotes voluntary efforts to reduce greenhouse gas emissions and reporting under Sect. 1605 of the Energy Policy Act of 1992. Reiterates continued opposition to Kyoto Protocol because of its potential costs and little, if any

environmental gain. Introduced April 27, 1999; referred to Committee on Energy and Natural Resources. Hearings held March 30, 2000.

S. 935 (Lugar)

National Sustainable Fuels and Chemicals Act of 1999. Amends the National Agricultural Research, Extension, and Teaching Policy Act of 1997 to authorize research to promote conversion of biomass into bio-based industrial products, and for other purposes. Cites zero net greenhouse gas emissions from biomass fuels. Authorizes \$49 million per year for each of fiscal years 2000 through 2005 for a sustainable fuels and chemicals research initiative, including research on bio-based products that can compete in performance with fossil-based products, and on accurate measurement and analysis of carbon sequestration and carbon-cycling in relation to bio-based industrial products and feedstocks. Introduced April 30, 1999; referred to Committee on Agriculture, Nutrition, and Forestry. Hearings held May 27, 1999. Ordered to be reported with amendments in the nature of a substitute on July 29, 1999; Senate Agriculture Committee reported measure (S.Rept. 106-179) on October 8, 1999. S. 935 passed the Senate (amended) on February 29, 2000, with an amendment to the Title, and was referred to the House Agriculture and Science Committees on March 9, 2000. Referred to House Subcommittee on Energy and Environment on March 23, 2000.

S. 1066 (Roberts)

Introduced May 18, 1999, referred to Senate Committee on Agriculture, Nutrition and Forestry. Amends the National Agricultural Research, Extension, and Teaching Policy Act of 1977. Encourages the use of and research into agricultural best practices to improve the environment, and for other purposes. Findings of bill cite magnitude and importance of carbon storage in soils. Authorizes appropriations of \$10 million. Suggests enhancement of carbon storing strategies through agricultural best practices in lieu of implementing the Kyoto Protocol. Requires the Economic Research Service to report on the impact on the farm economy of the United States under the Kyoto Protocol and Framework Convention on Climate Change. Allows for research MOU between USDA and NOAA. On June 20, 2000, the House ordered the bill reported with an amendment in the nature of a substitute. On September 2, 2000 the Senate ordered the measure reported as an amendment in the nature of a substitute (S.Rept. 106-407). The House prepared this legislation for the Floor on October 18, 2000.

S. 1776/S. 1777 (Craig)

Climate Change Energy Policy Response Act. Amends the Energy policy Act of 1992 to revise the energy policies of the United States in order to reduce greenhouse gas emissions (voluntarily), advance global climate science, promote technology development, and increase citizen awareness, and for other purposes (e.g., creates mechanisms and institutions necessary for implementing provisions of Bill. Section 1604 extends authority to DOE to become the lead agency on climate change research and public information programs in support of these provisions. Section 1612 establishes a Natural Resource Center on Climate Change (NRCCC). Makes any certifications for emissions reductions prior to enactment subject to review by Secretary of Energy. Authorizes funding for energy technology RD&D. S.1777 (Craig) is tax legislation which would enable implementation of S. 1776. Both introduced October 25, 1999; S. 1776 was referred to Senate Committee on Energy and Natural Resources; hearings held March 30, 2000. S. 1777 was referred to Senate Finance Committee on October 25, 1999.

S. 2540/S.2982 (Brownback)

Amends the Food Security Act of 1985 to require the Secretary of Agriculture, acting through the Chief of the Natural Resources Conservation Service, to establish a carbon sequestration program to permit owners and operators of land to enroll land in the program to increase the sequestration of carbon, educational outreach through the Agricultural Extension Service and for other purposes. Authorization to be made from funds available for climate change initiatives or greenhouse gas emission reductions. Domestic Carbon Storage Incentive Act of 2000. Introduced May 10, 2000; referred to Committee on Agriculture, Nutrition, and Forestry. Similar in intent, S. 2982 would enhance *international* conservation to promote the role of carbon sequestration as a means of slowing the buildup of greenhouse gases in the atmosphere, and promote voluntary, proactive efforts on the issue of climate change. Introduced July 27, 2000; referred to the Senate Committee on Finance.

CHRONOLOGY

- 11/13/00-11/25/00** – COP- 6 convened in The Hague, Netherlands. USGCRP released *National Assessment of Potential Impacts of the United States of Climate Change*. President Clinton promised U.S. leadership for facing the challenge of climate change, and proposed new rules for pollution from U.S. electricity production and a domestic emissions trading scheme.
- 09/08/00 - 09/15/00** – Preparatory session for COP-6 in Lyons, France. U.N. Millennium Declaration proposes entry into force of Kyoto Protocol by UNCED 2002.
- 06/02-12/00** – UNFCCC Subsidiary Bodies met in Bonn, Germany in preparation for COP-6.
- 10/25/99 - 11/04/99** — COP-5 convened in Bonn, Germany.
- 11/12/98** — President Clinton instructed a U.S. representative to sign the Kyoto Protocol.
- 11/2-13/98** — COP-4 met in Buenos Aires; a 2-year “Plan of Action” was adopted.
- 03/16/98** — Kyoto Protocol opened for signature.
- 12/01-11/97** — U.N. Kyoto Protocol on Climate Change adopted at conclusion of COP-3.
- 06/12/97**— S.Res. 98 introduced (the Byrd/Hagel Resolution).
- 07/08-19/96** — Ministerial Declaration issued in Geneva, Switzerland at COP-2 (07/18/96).
- 03/28-04/06/95** — First Conference of Parties (COP-1) met, adopted “Berlin Mandate.”
- 03/24/94** — U.N. Framework Convention on Climate Change entered into force.

FOR ADDITIONAL READING

U.S. Department of State. Bureau of Oceans and International Environmental and Scientific Affairs. Office of Global Change. *Climate Action Report: 1997 Submission of the United States of America Under the U.N. Framework Convention on Climate Change*. (DOS Pub. 10496), Washington, DC: 1996.

U.S. Executive Office of the President. *Climate Change Action Plan*, by President William J. Clinton and Vice President Albert T. Gore, Jr. Washington, DC: October 1993.

U.S. Global Change Research Program. *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*, Overview by the National Assessment Synthesis Team. Washington, DC: November 2000.

U.S. Office of Science and Technology Policy. Committee on Environment and Natural Resources Research. *Our changing planet: the FY2000 U.S. Global Change Research Program; Implementation and Budget Overview*. Washington, DC: May 1999.

U.S. National Research Council. Commission on Geosciences, Environment, and Resources. Board on Atmospheric Sciences and Climate. Climate Research Committee. *Reconciling Observations of Global Temperature Change*, by the Panel. Washington DC: January 2000.

CRS Reports

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

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

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 RL30452. *Climate Change Technology Initiative (CCTI): R&D and Related Programs*, by Michael Simpson.

CRS Report RL30522. *Global Climate Change: A Survey of Scientific Research and Policy Reports*, by Wayne Morrissey.

Global climate change has already resulted in a wide range of impacts across every region of the country and many sectors of the economy that are expected to grow in the coming decades. Understand the impacts of climate change on regions and sectors across the United States in NCA4 Volume II: Impacts, Risks, and Adaptation in the United States. What's Happening & Why. Climate change is a long-term shift in global or regional climate patterns. Often climate change refers specifically to the rise in global temperatures from the mid-20th century to present. Grades. 5 - 8. Fracking tower. Fracking is a controversial form of drilling that uses high-pressure liquid to create cracks in underground shale to extract natural gas and petroleum. Carbon emissions from fossil fuels like these have been linked to global warming and climate change. Photograph by Mark Thiessen / National Geographic. This is known as climate change or global warming. What are greenhouse gases? The greenhouse gas with the greatest impact on warming is water vapour. The change in the global surface temperature between 1850 and the end of the 21st Century is likely to exceed 1.5C, most simulations suggest. The WMO says that if the current warming trend continues, temperatures could rise 3-5C by the end of this century. Temperature rises of 2C had long been regarded as the gateway to dangerous warming.