

November 2005

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*A Short History*

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# How Climate Change Policy Developed: A Short History

J. W. Anderson\*

In the summer of 1988, the possibility of worldwide climate change suddenly burst onto the agenda of international politics. It happened quite abruptly. The occasions were a U.S. Senate hearing in Washington and a world conference in Toronto. Among specialists, concern had been rising for some time as they gathered data on rising temperatures and the changing chemical composition of the Earth's atmosphere. Then came the moment in which the policymakers and the general public realized that something might, conceivably, be going dangerously wrong.

In the years since then, every country on Earth has been drawn into the struggle over what to do about it. The politics of global warming, as it has developed over the past 17 years, provides the setting for the hard decisions that may lie ahead.

Climate change is, by a wide margin, the most complex environmental challenge that governments have ever attempted to address. This change is being driven by the emission into the atmosphere of gases that cause it to retain heat—and the most important of those greenhouse gases is carbon dioxide, generated chiefly by burning the fossil fuels that provide five-sixths of the world's energy. Reducing those emissions would require profound changes in the way the world produces and uses energy. The central challenge for policy is to accomplish it without unacceptable disruption of the world economy and reductions in standards of living. One key question is how much society should pay now to reduce a risk of severe and damaging climate change in the future—a risk that may be great, but that no one can quantify with any certainty.

A related question is the degree of urgency. Is it essential to begin reducing greenhouse emissions immediately, as most European governments believe? Or is it enough to rely on new technologies to phase down fossil fuel use over the next half-century, without resorting to unpopular mandatory limits, as the U.S. government believes?

Climate change is an unusually difficult issue for the people who make the decisions in democratic governments. The science contains important uncertainties, but governments have to

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make firm decisions—if only the decision to do nothing—long before these uncertainties can be resolved. Any serious attempt to cut emissions will have clear and immediate costs, but the benefits may not appear for a long time. To the extent that the benefits may be disasters that don't happen, they may never be obvious. But the costs will be. As the debate develops, much of it is being cast in terms of the restraint that the present generation owes to future generations.

Another dimension is the obligations that rich countries have to the poor, and that all countries have to the world. To achieve effective worldwide cooperation, policy has to find a fair way to allocate the burdens of emissions control between the rich countries and the poor. The United States, in 2001, generated 20 tons of carbon dioxide per capita. China generated 2.4 tons per capita, and India 0.9 tons per capita. China and India have argued that, in view of this wide disparity, the United States has an obligation to make deep reductions before it can ask the developing countries to assume any burdens. But the United States has said that it won't join any international agreement that doesn't put restrictions on developing countries' emissions.

Scientists demonstrated in the nineteenth century that more carbon dioxide in the atmosphere causes an increase in heat retention. But despite the gathering momentum of industrial development they gave little thought to the climate because most assumed that the carbon dioxide was being absorbed in the oceans. That assumption was not tested until the late 1950s, when it rapidly became clear that the concentration of carbon dioxide in the atmosphere was rising steadily. In the centuries before the Industrial Revolution began, the concentration of carbon dioxide in the atmosphere had hovered around 280 parts per million. By 1958, when scientists began to pay attention to it, the concentration was 316 parts per million. At present, in 2005, it is approaching 380 parts per million.

The average global temperature has also been rising, although less regularly. A period of steady warming began around 1910 and ended in the early 1940s, followed by a pattern of stable or slightly declining temperatures through the mid-1970s. From then through the present, temperatures have been rising steadily and rapidly. The year 1998 is the warmest in a record that goes back to the mid-nineteenth century, and all 10 of the warmest years in that record have occurred since 1990. By the end of the twentieth century, the global average temperature was about 0.5 degrees Celsius higher than a century and a half earlier. In recent years the rise has clearly been accelerating.

These data have set off a series of furious debates among scientists, industrial interests, environmental advocacy organizations and politicians. The first question was whether the rise in temperatures is real, or whether it might be the product of the way that the figures are collected.

The publication of many studies over the years with increasingly broad data bases seems to have settled that issue: both the rise and the recent acceleration are real.

Another question was the break, from the 1940s to the 1970s, in the pattern of warming. If growing atmospheric concentrations of carbon dioxide mean a warmer climate, why didn't global temperatures rise in those decades? The answer seems to involve aerosols, the tiny particles of solids and liquids blown into the air along with carbon dioxide in the exhausts of furnaces and engines. Aerosols in the atmosphere tend to reflect heat from the sun, just as carbon dioxide tends to retain it. But with the legislation in Europe and the United States in the 1960s and 1970s to clean up the air, the load of aerosols dropped and no longer offset the effects of carbon dioxide.

A more difficult question is the basic relationship between carbon dioxide and warming. Skeptics point out that the Earth's climate has swung from hot to cold and back many times in the geological record. How do we know that the current warming is not caused mainly by purely natural changes that would be little affected by any reduction, however drastic, in greenhouse gases? One example of such a natural cause is the multidecadal oscillations in ocean currents, which clearly affect climate.

The case for identifying carbon dioxide as the main cause of global warming is in large part statistical. Research organizations have constructed mathematical models of the global climate system, and run them backwards to see how closely they mimic the actual historical record. No one has yet come up with a reasonably accurate model that does not give high importance to carbon dioxide, generated by human activity, as a cause of what's happening. The present consensus among most scientists holds that the increasing carbon dioxide in the atmosphere is certainly a cause of global warming, and highly probably the major cause—but it may not be the only cause.

So far, so good. The next question is where we go from here. That one is much harder to answer, and research has not yet produced a reliable consensus. The amounts of carbon dioxide generated over the coming century will depend on rates of population increase, the speed of economic growth, and the nature of technological development—all factors impossible to forecast over a period as long as a hundred years. The scientists running climate models have sidestepped these variables by adopting a baseline scenario in which the concentration of carbon dioxide rises to 550 parts per million—roughly twice the pre-industrial level—by the year 2100. They have then tried to calculate the temperatures that would result from that rise. (This exercise,

incidentally, was included by the journal *Science* in July 2005 in a list of the great questions now driving basic scientific research.)

A major international study published in 1995 found that a concentration of 550 parts per million of carbon dioxide in the atmosphere would increase the world's average temperature by 1 to 3.5 degrees Celsius. Since then results have shifted to a somewhat higher range, 1.5 to 4.5 degrees or even higher. This range is too wide to be helpful to politicians who have to make decisions. At 1 degree over a century, the change would affect some species but, to homo sapiens, it would hardly be noticeable. At 3.5 degrees, the change might well approach the catastrophic for much of humanity.

While scientists use temperature as the metric of change, the greatest impacts on human life might well come from the secondary effects. Higher temperatures would probably mean a shifting pattern of precipitation, with more storms and droughts, and perhaps less rain here and more there — with enormous implications for the world's food supply. Higher temperatures also mean a rising sea level, because water expands with heat and because the polar glaciers are already melting.

Because these projections are generated by computer models, they generally show temperatures rising along a smooth and predictable curve. But the actual record, over geological time, is very different, an erratic sawtooth pattern. Over the millennia the world has swung, sometimes with astounding speed, between ice ages and warm periods, suggesting the existence of powerful feedback mechanisms not yet known to climate science. A committee of the National Research Council recently published a study of abrupt climate change in which it concluded that “the only thing we can be sure of is that there will be climatic surprises.” In the very distant past, the global average temperature has sometimes changed by much more than 4.5 degrees within a matter of decades, not centuries. In the past century, the world's climate has already moved beyond the range of recent historical experience, this study warned, and no one really knows how it will react to further warming. Feedback mechanisms might hold temperatures in the present range despite rising carbon dioxide concentrations. Or they could send temperatures shooting up well beyond anything in human experience.

Confronted with these risks and uncertainties, political leaders and governments have had great difficulty deciding what to do about them.

In June 1988, Senator Timothy Wirth (D-CO), deeply exasperated by his inability to draw public attention to the subject, waited for a day that was forecast to be spectacularly hot. He then called a hearing at which several experts testified. With the temperature at 98 degrees

Fahrenheit and anxiety rising about a drought gripping the Midwest and South, one of the witnesses, James E. Hansen, told the senators that the world was warmer than at any time in the century and he was 99 percent certain that the cause was human-made gases and not natural variations. Hansen's testimony had unusual force because he was the director of the National Aeronautics and Space Administration's Goddard Institute for Space Studies and the first scientist of his stature to declare flatly that rising temperatures were related to burning fuel.

"It is time to stop waffling so much and say the evidence is pretty strong that the greenhouse effect is here," he told a reporter for the *New York Times*, which put the story at the top of its front page.

Four days after that Senate hearing a conference opened in Toronto, attended by several hundred government officials and politicians as well as scientists. It started the push for action by calling for a 20 percent reduction in CO<sub>2</sub> emissions by the year 2005—a goal, incidentally, that was not set on the basis of any economic or scientific analysis, but rather because it was a number that seemed to the conferees to indicate a serious purpose. In December 1988, the U.N. General Assembly approved the establishment of an Intergovernmental Panel on Climate Change (IPCC) to provide expert reports on the science. The following year, at their annual summit meeting, the heads of state of the seven big industrial democracies called for a treaty—a "framework convention," as it became known—to limit the world's production of CO<sub>2</sub>. Negotiations shortly got under way.

But strains between the United States and most of the western European countries soon became visible. President George H. W. Bush and his administration said that they were uneasy about the scientific basis for policy and wanted more time for research, while most Europeans thought the evidence was more than clear. Part of the difference arose from the relatively rapid rates of population and economic growth in North America, which meant that limitations on fuel use would bind more tightly there. It is also true that the energy and automobile industries in the United States were more influential than in Europe and the American unions more hostile to limits on their products. But basically it was a disparity in cultural attitudes. Second thoughts about the desirability of high economic growth are much more prevalent in Europe. In the United States, where people are accustomed to high consumption and inexpensive transportation, the idea of constraints on fuel use struck many people as an attack on their way of life and was widely unpopular.

In 1990, the first of the IPCC reports appeared, reflecting contributions of hundreds of scientists from dozens of countries. It showed a broad consensus among them that the possibility

of global warming at least had to be taken seriously. If warming had not yet started, the IPCC said, continuing the increases would certainly lead to it sooner or later.

At the huge and colorful 1992 United Nations Conference on Environment and Development, held in Rio de Janeiro, nearly every government in the world joined in agreement on a treaty that they titled the Framework Convention on Climate Change (FCCC). In it they set the goal of stabilizing the concentrations of greenhouse gases at a level that would prevent “dangerous” interference with the world’s climate system. Most governments, including the United States, promptly ratified the treaty and put it in force.

But no one could say exactly at what point greenhouse concentrations in the atmosphere become dangerous. And the FCCC left any remedy entirely to voluntary action. No country was actually committed to make cuts in its greenhouse emissions. The FCCC was written with the intention simply of stating a goal in the expectation that, if necessary, further treaties would supplement it.

The 1992 elections brought to Washington a president more sympathetic to action on environmental issues than his predecessor. In April 1993, to celebrate Earth Day, Bill Clinton announced that he would reverse the government’s previous position and work to stabilize greenhouse gas emissions at the 1990 level by 2000, as the FCCC urged. He called for a broad tax on all energy consumption to force conservation. But Clinton’s own Democratic Party was split on this issue. A vigorous but relatively small part of his constituency was strongly in favor of action to protect the environment. A larger part was wary, and acutely concerned about the possible costs in terms of jobs lost.

Although the Democrats controlled both houses of Congress, the idea of the broad energy tax met a wall of hostility. Nothing emerged but a rise of 4.3 cents a gallon in the gasoline tax, a concession that had much less to do with reducing greenhouse emissions than with a need for more money for highway construction. When the president’s Climate Change Action Plan appeared, it recommended nothing beyond voluntary cooperation. Many environmental advocacy organizations denounced it as futile, and they turned out to be correct. Emissions of carbon dioxide kept rising unimpeded.

But the earlier Bush administration turned out to have been correct when it suspected the Europeans of making promises that they could not keep. By the mid-1990s it was clear that of the world’s major industrialized countries, only three would have lower emissions in 2000 than in 1990—and in none of those three cases would the cause be deliberate environmental policy. Russia’s emissions were lower because the Soviet economy had collapsed. Germany’s were

lower because it had been closing down the grossly inefficient plants it had inherited from the former East German regime. And the United Kingdom would succeed because, again for reasons of economic efficiency, it was shifting from coal to natural gas from the North Sea.

At this point, in 1996, the IPCC published its second survey of the science of global warming. Markedly more decisive than in the first report five years earlier, it concluded, in a line that became widely quoted, that the statistical evidence “now points towards a discernible human influence on global climate.” But it followed that judgment with an admonition about the limitations on knowledge and the need for further research. Like all of the IPCC assessments, it did not represent unanimity among researchers. The skeptics and dissenters included highly reputable scientists. But the report was, in effect, a textbook reflecting mainstream opinion among the specialists in climate science and the many other sciences on which it draws. It was not as sharply conclusive as many politicians would have liked. Its emphasis on the many questions still unanswered made it an uncertain foundation on which to build public policy. But the publication of this report marked the stage at which most of the scientists involved had decided that, to one degree or another, human activity was playing a part in global warming.

Because voluntary cooperation to diminish emissions was having no visible effect, the governments that had ratified the FCCC—formally, the parties to the treaty—began meeting to consider what might be done next. At the second conference of the parties, COP-2, in Geneva in the summer of 1996, the Clinton administration moved toward a firmer position. Timothy Wirth, the former senator, now Undersecretary of State for Global Affairs, announced that the United States would support legally binding limits on greenhouse gas emissions if other countries also did so. With that, negotiators went to work on a treaty—technically, a protocol to the FCCC—that could be signed at COP-3, scheduled for Kyoto, Japan, in December 1997.

President Clinton knew that the political base in the United States was inadequate for broad action, and he began a campaign to strengthen public understanding of the subject. He went to New York in June 1997 to address a special session of the United Nations. “The science is clear and compelling,” he said, “We humans are changing the global climate.” He spoke of new technologies and economic strategies such as emissions trading that would, he argued, reduce greenhouse emissions without damaging economic growth. In late July, he returned to the issue, holding a White House conference in which he and Vice President Al Gore, the administration’s ranking environmentalist, pursued their campaign for greater public awareness. “We see the train coming,” the president said, “but most Americans in their daily lives can’t hear the whistle blowing.”

The following day, as if in response, the Senate passed, 95 to 0, a resolution warning the president not to agree at Kyoto to any treaty that would hurt the American economy or fail to commit the large developing countries to similar action. The chief sponsors were Robert Byrd, Democrat of West Virginia, a coal-mining state, and Chuck Hegel, Republican of Nebraska. While lobbyists from the energy industries had vigorously pressed this resolution, it also reflected wider concerns in the Senate about rising commercial competition from Asia and, specifically, from China.

President Clinton refined his plan in a speech in October at the National Geographic Society in Washington—the proper setting, he thought, for the topic. He said that the United States would support at Kyoto “the binding and realistic target of returning to emissions of 1990 levels between 2008 and 2012.” The United States wanted the target to be a five-year average, not a single year’s emissions, to avoid distortions arising from the ups and downs of the economic cycle. On one key point he agreed with the Senate. “The United States will not assume binding obligations,” he said, “unless key developing nations meaningfully participate in this effort.”

But Clinton avoided any reference to an issue that hung heavily over the whole discussion—the cost of emissions control. That meant the cost not only in dollars but, more important, the cost in jobs lost and in economic growth foregone. Oddly, there was very little serious economic analysis on emissions reduction before the middle 1990s, too late to have any influence on the drafting of the Kyoto text. The goals set by the negotiators continued to reflect political judgments as to what was desirable.

Although there was some discussion in the drafting process of policies and measures to achieve the cuts, it is fair to say that very few governments had any clear idea how they were actually to achieve the goals to which they were committing themselves. Most of the means involved profound changes in technology or in society’s habits in the use of energy. To make those changes, the authors of Kyoto gave themselves only 11 years to the beginning of the commitment period in which the limits became binding. Beneath all the other debates over the treaty ran a current of doubt whether the goals were even possible in so short a time.

The Kyoto Conference identified six key greenhouse gases and plunged into the task of writing language to measure and reduce emissions of them. The conference was a huge affair, with some 10,000 officials from nearly every government on Earth as well as a large following of lobbyists and observers from a great variety of nongovernmental organizations representing both environmental and industrial interests. The work was immensely complex and, as generally

happens at the eleventh hour, one relatively simple issue became the crucial symbol. The United States was willing to return its emissions only to the 1990 level, as President Clinton had proposed, while the Europeans demanded a much deeper cut.

President Clinton sent Vice President Gore on an emergency mission to Japan to save the day. Gore worked out a compromise under which the United States would reduce its emissions 7 percent below the 1990 level in the first commitment period, 2008 through 2012. With the increases that would result from expected economic growth, that meant a reduction of more than 30 percent below business-as-usual emissions in 2008–2012. Europe was to go to 8 percent below 1990. But the text put no obligations on the developing countries to cut emissions—a violation of the condition that Clinton himself had laid down in his October speech. The Kyoto text applied limits to the emissions of only the 38 industrialized countries. The developing countries had argued vehemently that the threat of climate change had been created by those countries as they had grown rich over two centuries of industrial growth, and that it was altogether unfair to impose the burdens of a solution on countries that were only beginning the same ascent.

Nevertheless, the Kyoto Conference declared the negotiations a success and opened the treaty to signature by the world's governments. A number of issues that had proved insoluble at Kyoto, not all of them minor, were quietly set aside for further discussions.

The United States had played a large role in shaping the Kyoto document. In particular, it had pushed for flexibility as the world ventured into this altogether new realm of governance. Flexibility meant, among other things, introducing methods for trading emissions permits, modeled on the trading provisions in the U.S.'s Clean Air Act. This kind of trading was much less familiar in the rest of the world, and the rules were unfinished when the conference ended.

In the United States, a spirited debate soon developed over the costs of meeting the Kyoto requirements. The administration produced figures showing that they would be low. The energy industries countered with studies showing that the costs would be devastatingly high. Both camps were using the same models and the same widely accepted methods of calculation. The differences lay in the assumptions that the analysts made about the future trading systems. Those differences could not be resolved because, of course, the rules for the trading systems had not yet been negotiated.

Because of the vast uncertainty over costs and the exclusion of the developing countries from any emissions limits, the chances that the U.S. Senate would ratify the Kyoto Protocol appeared close to nil. The Clinton administration signed it, a gesture of support with little legal

significance. But in the administration's remaining three years in power, it never submitted the treaty to the Senate for ratification.

Around the world, supporters of Kyoto diligently put themselves to the task of working out the detailed regulations that would make it possible for the treaty to operate effectively. After nearly three years of planning and preparation, they set the sixth conference of the parties to the Framework Convention—COP-6—to be held in The Hague in late 2000, as the time and the place for the final decisions and agreements. But COP-6 was an ill-timed and dispirited affair. It convened a week after the election in which George W. Bush had defeated Kyoto's champion, Vice President Gore, for the American presidency. The American delegation, which had hoped to play a major role, was suddenly adrift and the hope of any serious agreements receded. The managers of the conference called a second session to be held in the spring.

American policy was changing. As a candidate, Mr. Bush had once said that he favored controlling CO<sub>2</sub> emissions. But as president, he moved in the opposite direction. He opposed the Kyoto Protocol because, he said, echoing the Byrd–Hagel resolution four years earlier, it would damage the American economy and would exempt the big developing countries. But, he emphasized, his administration “takes the issue of global climate change seriously.” He closed his statement by declaring, “I am very optimistic that, with the proper focus and working with our friends and allies, we will be able to develop technologies, market incentives, and other creative ways to address global climate change.”

President Bush's repudiation of Kyoto had a harsh impact on other governments, particularly in Europe. They knew that the United States would never ratify the current treaty. But they expected the United States to take an active part in further negotiations over the period after 2012 (when the first commitment period under Kyoto expires) and wrestle the regime around into something that it could support. Instead, the flat rejection meant that the world's most powerful economy, and biggest source of emissions, planned to do nothing in future talks but drag its feet.

Among some of Kyoto's supporters, especially in Europe, one effect was to increase their determination to put Kyoto in force and demonstrate that the United States could not, alone, control international action. They drew strength from the Third Assessment Report in 2001 of the IPCC, the international consortium of climate scientists. Once again the new report used sharper and less conditional language than the previous version six years earlier: “There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to

human activities.” While many sources of uncertainty remained, the report said, accumulating evidence supported the new conclusion.

COP-7 met in the fall of 2001 in Marrakesh, Morocco, under the leadership of people who badly wanted to finish, at last, the intricate job of writing the rules that would transform Kyoto from a statement of principles into a regime that could operate in the real world. It soon appeared that there was tension between the Europeans, who wanted tight enforcement of the emissions limits, and several other countries—most notably Japan, Canada and Australia—that felt that they needed greater latitude in making the substantial adjustments that Kyoto required.

Much of the dickering took place over the highly technical provisions regarding sinks, the natural reservoirs such as the soil or living plants like trees, into which carbon is absorbed from the atmosphere. A great deal depended on the precise wording of the provisions that gave governments credit for policies in agriculture and forestry that affected the amounts of carbon absorbed.

Another point of contention was the Kyoto text’s omission of any means of enforcement. The negotiators finally agreed that any country emitting more than its limit in 2008–2012 would have to make up the excess, with a 30 percent penalty added, in a subsequent commitment period. But since the treaty made no mention of a subsequent commitment period or the limits that might apply then, the attitude toward sinners seemed comfortably forgiving.

In the end, Japan and Canada got most of what they felt they needed (although Australia decided to join the United States in dropping out the Kyoto treaty altogether). But the effect of all the fixes and flexes, together with the absence of the United States, was that the projected reduction in worldwide emissions would be very small.

The original targets were significantly loosened because the ratification process gave great leverage to countries that were having trouble making up their minds. The Kyoto text provided that it would go into force when it was ratified by 55 countries, including countries that represented 55 percent of the industrial countries’ CO<sub>2</sub> emissions in 1990. Since the United States alone had contributed 36.1 percent of those emissions, ratification by nearly every other large industrial country was required to carry the treaty into effect. In particular Russia, with 17.4 percent of the emissions, was crucial. After Marrakesh, three years of hard bargaining ensued in which the Russians withheld their ratification to see what advantages they could extract in exchange for it.

In the United States, the criticism of the Kyoto Protocol was by no means limited to the Bush administration. Many American economists pointed out the inefficiency of a regime that

began by requiring very deep emissions cuts in the short term, but said nothing about the longer future. Scholars argued that it was unwise to impose dramatic goals with no idea how they might be achieved. Regarding the trading system, they contended, international law was not strong enough to protect the property rights represented by the emissions permits. These objections were widely influential in the United States, if not in Europe, but they left the critics with a question: If you don't like Kyoto, what do you like?

President Bush, unlike some of his supporters, was not prepared to say that the warnings of climate change were spurious and that nothing needed to be done. In February 2002, nearly a year after he had pulled the United States out of the Kyoto process, the president returned to the subject with a speech and a series of global climate change initiatives. Here the administration's reliance on long-term technical solutions, rather than immediate regulatory and coercive ones, became more explicit. But the president also showed an awareness that the issue of global warming was getting more important, and was not one on which he would want to have an empty record.

The key concept in Bush's new initiative was emissions intensity, the ratio of emissions to the total output of the American economy. His plan, the president said, would reduce intensity by 18 percent over the next decade. Since that number was very close to the amount by which the normal processes of modernization and improvement had reduced intensity over the previous decade, neither Bush's friends nor his adversaries took the plan very seriously. The instruments were to be tax incentives, federal funds for industrial research and development, and voluntary cooperation. Analysts pointed out that even should the plan succeed, normal economic growth would push the total volume of emissions to a level substantially higher at the end of the decade than in 2002. But the Bush administration was sticking with its calculation that the world had time to wait for the development of technologies—such as alternative fuels, and methods of capturing and sequestering carbon dioxide—that would make mandatory emissions cuts unnecessary.

The diplomacy of Kyoto often seemed to suggest a simple struggle between Europe and the United States, with the developing countries sitting off to one side. In truth, none of those blocs was as monolithic as it sometimes seemed.

Among the developing countries, views and interests were very mixed. The two big countries, China and India, were adamant that nothing interfere with their economic growth. Yet both were increasingly anxious about the effects of air pollution on public health, and were well aware that carbon dioxide usually is associated with the emissions of other gases and particles

that carry a significant death rate. Most of the oil exporting countries vigorously fought Kyoto and any other scheme that might threaten their market. On the other side, the small island nations formed a bloc of their own, plaintively observing that global warming and the consequent rise in sea level threatened their very existence. Some of the tropical countries, notably Brazil, were uneasy about Kyoto because of its possible implications for international control of land use. Clearing forest and jungle land sends huge amounts of carbon into the atmosphere.

In the United States, in the absence of federal leadership, state and municipal governments began to take action to cut greenhouse gases. At the state level, the first reactions to Kyoto were negative. A number of states passed resolutions or legislation attacking it. But very soon, around the turn of the century, states started to move in the opposite direction. That was unexpected, since the contribution of any one state alone has to be regarded, arithmetically, as negligible. But some state governments wanted to be seen to be at work protecting economic interests, such as agricultural yields or a tourist industry's interest in scenic values. Some wanted to start a movement to build national policy from the bottom up. Some, although certainly not all, intended their programs to be a reproach to the Bush administration in Washington. As is usual in environmental politics, the alignments had more to do with geography than with political party allegiance.

In 2001–2002 the six New England states and five eastern Canadian provinces agreed on targets for reduction of greenhouse emissions. In 2002, California enacted legislation to control greenhouse emissions of cars (the implementing regulations are currently being challenged in litigation over the right of states to make climate policy). In 2003, George Pataki, the Republican governor of New York, took the initiative in forming the Regional Greenhouse Gas Initiative, a consortium of nine New England and Mid-Atlantic states that is currently developing a cap-and-trade program—that is, a program that will impose caps on major sources' emissions of greenhouse gases and permit them to meet these requirements by trading emissions permits among themselves. In 2004, eight states sued five power companies to try to force them to reduce their carbon emissions.

By 2005, some 20 states had enacted legislation requiring various industries, usually the electric utilities, to obtain certain percentages of their power from renewable sources. And in June 2005, the Republican governor of California, Arnold Schwarzenegger, signed an executive order calling for sharp reductions in the state's greenhouse emissions over the next half century.

“As of today,” Schwarzenegger declared, “California is going to be the leader in the fight against global warming. I say the debate is over. We know the science, we see the threat, and the time for action is now.”

This activity had not gone unnoticed by Congress. In 2003, two leading senators, John McCain (R-NM) and Joseph I Lieberman (D-CT), introduced a bill with a national cap-and-trade program to impose controls on carbon dioxide. The bill got 43 votes—not enough to pass the Senate, but enough to signal a substantial prospect for passage in the future. In 2005, the Senate passed a resolution declaring that the time had come for Congress to enact national limits on greenhouse gas emissions to slow, then stop and reverse their rise. The vote was 53 to 44. Compared with the 95 to 0 vote on the Byrd–Hagel resolution six years earlier condemning the principles on which the Kyoto Protocol was built, these more recent votes showed that climate change was no longer an unfamiliar subject for American politicians and that concerns about warming were growing stronger. The comparison also suggested that, in the judgment of these senators, the first step in a response to the threat of climate change was a national program using tools already familiar in federal anti-pollution legislation, rather than a highly complex international treaty and all the unknown and untried instruments that it required.

The European Union had become increasingly irritated by the delays and defections in the process of moving the Kyoto treaty forward, and had agreed on a cap-and-trade program of its own that would be legally separate from it and not dependent on it. The European Trading System (ETS) went into effect on Jan. 1, 2005, placing emissions limits on carbon dioxide. The principle was simple, largely modeled on the American program to control sulfur dioxide emissions under the Clean Air Act. But the actual operation promised to be far more complicated. The ETS covered perhaps four times as many sources of emissions as the American model, in a much wider range of industries. Many of the key policy decisions had been handed down to the 25 national governments with the prospect that rules would be far from uniform. But despite all the possible pitfalls ahead, the ETS was a serious and determined effort to reduce greenhouse emissions, conducted by the governments that felt most deeply about the need to do it.

In February 2005, the Kyoto Protocol finally went into force—more than seven years after it had been drafted and opened for signature. Over the previous year, the Russians abandoned their hope of making large sums of money by selling emissions permits. In the end, they struck a bargain with the Europeans in which, in return for the crucial Russian ratification of Kyoto, the Europeans would support the Russian application for membership in the World Trade Organization.

In its immediate impact on emissions, Kyoto was likely to prove a disappointment to its authors. With the United States out of the regime, and with the concessions to other countries to bring them in, Kyoto's effect on the rising curve of worldwide emissions promised to be mild at best. But it was equally true that, under mandatory restrictions, the world would begin to get real experience in managing an international control system. That would include reliable data on what emissions reductions actually cost. All of that might well prove monumentally important if, in the future, the world decided that it needed a more comprehensive system to get faster cuts.

While the Bush administration continued to cite scientific uncertainty as the reason for opposing carbon emissions controls, the scientific consensus was moving in the opposite direction. In June 2005, the heads of 11 countries' academies of science, including Bruce Alberts, the president of the U.S. National Academy of Sciences, published a statement addressed to a forthcoming meeting of the leaders of the major industrial countries in which they said: "The scientific understanding of climate change is now sufficiently clear to justify nations taking prompt action. It is vital that all nations identify cost-effective steps that they can take now, to contribute to substantial and long-term reduction in net global greenhouse gas emissions." Other signers included the heads of the Chinese, Indian and Brazilian academies, as well as those in the highly industrialized countries.

At this time of writing, in mid-2005, nearly half a century has passed since researchers found that concentrations of carbon dioxide in the Earth's atmosphere were rising. It has been 13 years since nearly every government on Earth agreed, in the FCCC, on the goal of "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." In that period, public policy has yet to show any substantial impact on the steadily rising curve of carbon dioxide in the atmosphere or on the more irregular but similarly accelerating rise in the planet's average surface temperature.

But a great deal of preparatory work has in fact been accomplished, through the hard work of many people around the world and the expenditure of a good deal of money. The results are visible in three areas.

First, in the science of the Earth's climate, much more is known than in 1992, at the time when the FCCC was signed. There are still skeptics, but many more scientists are prepared to say that accumulating evidence strongly indicates that recent warming has been caused mainly by human activities—that is, by burning fossil fuels. Much of the present uncertainty concerns the future consequences of a continued rise in carbon dioxide concentrations.

Second, two grand experiments are now under way to control carbon dioxide emissions by regulation, and a third is being organized. The Kyoto Treaty binds 36 industrialized countries to clearly quantified limits in the period 2008 through 2012. The European ETS commits the 25 states of the European Union to similar emissions limits and is already in force. In the United States, nine northeastern states are working toward an agreement on carbon emissions. Some other states and even municipalities have set their own emissions goals. None of these efforts is likely to change the volumes of emissions sharply in the near term, but they will all produce valuable demonstrations of what works and what doesn't—and at what cost. In retrospect, the year 2005 may well turn out to be the point at which the debate over the economics of emissions control ceased to be based on hypotheses and projections and began to have a foundation in actual experience in many different societies.

Third, around the world, but especially in the United States, research is well under way on radically new technologies to keep carbon out of the atmosphere. Two well advertised examples are the development of hydrogen as a highway fuel and an industrial-scale electric power plant in which all pollutants, including carbon dioxide, are captured and sequestered. Neither will have a rapid pay-off. By most estimates it will be a matter of some decades before any significant number of Americans are driving on hydrogen, and the emissions-free generating plant will take at least a decade to put in operation. But these initiatives, if they prove successful, would have the capacity to alter fundamentally the carbon economy.

For public policy, the question is how much of an effort to make as a form of insurance against the risk of global warming. Disrupting the growth of economies that run mainly on fossil fuels would have a high cost. But allowing carbon dioxide concentrations to rise unimpeded might, at some unknown level, lead to disaster.

As the world works its way toward answers, it will be strongly influenced by actual events, changes in climate, and the scientific understanding of them, that make the risk seem greater or smaller. Perhaps the most important development in the past couple of decades, in political terms, is that millions of people now understand that climate can change, and science offers no guarantee that change will be either gradual or benign.

Suggested Reading:

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