most “extreme negative speculations” about climate change (despite the fact that many of those speculations appeared in his report). Though “Changing Climate” urged an accelerated transition to renewable fuels, noting that it would take thousands of years for the atmosphere to recover from the damage of the last century, Nierenberg recommended “caution, not panic.” Better to wait and see. Better to bet on American ingenuity to save the day. Major interventions in national energy policy, taken immediately, might end up being more expensive, and less effective, than actions taken decades in the future, after more was understood about the economic and social consequences of a warmer planet. Yes, the climate would change, mostly for the worst, but future generations would be better equipped to change with it.

As Pomerance listened at the briefing to the commission’s appeasements, he glanced, baffled, around the room. The reporters and staff members listened politely to the presentation and took dutiful notes, as at any technical briefing. Government officials who knew Nierenberg were not surprised by his conclusions: He was an optimist by training and experience, a devout believer in the doctrine of American exceptionalism, one of the elite class of scientists who had helped the nation win a global war, invent the most deadly weapon conceivable and create the booming aerospace and computer industries. America had solved every existential problem it had confronted over the previous generation; it would not be daunted by an excess of carbon dioxide. Nierenberg had also served on Reagan’s transition team. Nobody believed that he had been directly influenced by his political connections, but his views — optimistic about the saving graces of market forces, pessimistic about the value of government regulation — reflected all the ardor of his party.

Pomerance, who came of age during the Vietnam War and the birth of the environmental movement, shared none of Nierenberg’s Procrustean faith in American ingenuity. He worried about the dark undertow of industrial advancement, the way every new technological superpower carried within it unintended consequences that, if unchecked over time, eroded the foundations of society. New technologies had not solved the clean-air and clean-water crises of the 1970s. Activism and organization, leading to robust government regulation, had. Listening to the commission’s equivocations, Pomerance shook his head, rolled his eyes, groaned. He felt that he was the only sane person in a briefing room gone mad. It was wrong. A colleague told him to calm down.

The damage of “Changing Climate” was squared by the amount of attention it received. Nierenberg’s speech in the Great Hall, being one-500th the length of the actual assessment, received 500 times the press coverage. As The Wall Street Journal put it, in a line echoed by trade journals across the nation: “A panel of top scientists has some advice for people worried about the much-publicized warming of the Earth’s climate: You can cope.” The effusiveness of Nierenberg’s reassurances invited derision. On “CBS Evening News,” Dan Rather said the academy had given “a cold shoulder” to a grim, 200-page E.P.A. assessment published earlier that week (titled “Can We Delay a Greenhouse Warming?”; the E.P.A.’s answer, reduced to a word, was no). The Washington Post described the two reports, taken together, as “clarion calls to inaction.”

On its front page, The New York Times published its most prominent piece on global warming to date, under the headline “Haste on Global Warming Trend Is Opposed.” Although the paper included an excerpt from “Changing Climate” that detailed some of the report’s gloomier predictions, the article itself gave the greatest weight to a statement, heavily workshopped by the White House’s senior staff, from George Keyworth II, Reagan’s science adviser. Keyworth used Nierenberg’s optimism as reason to discount the E.P.A.’s “unwarranted and unnecessarily alarmist” report and warned against taking any “near-term corrective action” on global warming. Just in case it wasn’t clear, Keyworth added, “there are no actions recommended other than continued research.”

Exxon soon revised its position on climate-change research. In a presentation at an industry conference, Henry Shaw cited “Changing Climate” as evidence that “the general consensus is that society has sufficient time to technologically adapt to a CO_2 greenhouse effect.” If the academy had concluded that regulations were not a serious option, why should Exxon protest? Edward David Jr., two years removed from boasting of Exxon’s commitment to transforming global energy policy, told Science that the corporation had reconsidered. “Exxon has reverted to being mainly a supplier of conventional hydrocarbon fuels — petroleum products, natural gas and steam coal,” David said. The American Petroleum Institute canceled its own carbon-dioxide research program, too.

A few months after the publication of “Changing Climate,” Pomerance announced his resignation from Friends of the Earth. He had various reasons: He had struggled with the politics of managing a staff and a

board, and the environmental movement from which the organization had emerged in the early ’70s was in crisis. It lacked a unifying cause. Climate change, Pomerance believed, could be that cause. But its insubstantiality made it difficult to rally the older activists, whose strategic model relied on protests at sites of horrific degradation — Love Canal, Hetch Hetchy, Three Mile Island. How did you protest when the toxic waste dump was the entire planet or, worse, its invisible atmosphere?

Observing her husband, Lenore Pomerance was reminded of an old Philadelphia Bulletin ad campaign: “In Philadelphia — nearly everyone reads The Bulletin.” On a crowded beach, all the sunbathers have their faces buried in their newspapers, except for one man, who stares off into the distance. Here the scenario was reversed: Rafe, the loner, was staring down the world’s largest problem while everyone else was distracted by the minutiae of daily life. Pomerance acted cheerful at home, fooling his kids. But he couldn’t fool Lenore. She worried about his health. Near the end of his tenure at Friends of the Earth, a doctor found that he had an abnormally high heart rate.

Pomerance planned to take a couple of months to reflect on what he wanted to do with the rest of his life. Two months stretched to about a year. He brooded; he checked out. He spent weeks at a time at an old farmhouse that he and Lenore owned in West Virginia, near Seneca Rocks. When they bought it in the early ’70s, the house had a wood-burning stove and no running water. To make a phone call on a private line, you had drive to the operator’s house and hope she was in. Pomerance sat in the cold house and thought.

The winter took him back to his childhood in Greenwich. He had a vivid memory of being taught by his mother to ice skate on a frozen pond a short walk from their home. He remembered the muffled hush of twilight, the snow dusting the ice, the ghostly clearing encircled by a wood darker than the night. Their house was designed by his father, an architect whose glass-enveloped buildings mocked the vanity of humankind’s efforts to improve on nature; the windows invited the elements inside, the trees and the ice and, in the rattling of the broad panes, the wind. Winter, Pomerance believed, was part of his soul. When he thought about the future, he worried about the loss of ice, the loss of the spiky Connecticut January mornings. He worried about the loss of some irreplaceable part of himself.

He wanted to recommit himself to the fight but couldn’t figure out how. If science, industry and the press could not move the government to act, then who could? He didn’t see what was left for him, or anyone else, to do. He didn’t see that the answer was at that moment floating over his head, about 10 miles above his West Virginian farmhouse, just above the highest clouds in the sky.

2. ‘You Scientists Win’ ***1985***

It was as if, without warning, the sky opened and the sun burst through in all its irradiating, blinding fury. The mental image was of a pin stuck through a balloon, a chink in an eggshell, a crack in the ceiling — Armageddon descending from above. It was a sudden global emergency: There was a hole in the ozone layer.

The klaxon was rung by a team of British government scientists, until then little known in the field, who made regular visits to research stations in Antarctica — one on the Argentine Islands, the other on a sheet of ice floating into the sea at the rate of a quarter mile per year. At each site, the scientists had set up a machine invented in the 1920s called the Dobson spectrophotometer, which resembled a large slide projector turned with its eye staring straight up. After several years of results so alarming that they disbelieved their own evidence, the British scientists at last reported their discovery in an article published in May 1985 by Nature. “The spring values of total O_3 in Antarctica have now fallen considerably,” the abstract read. But by the time the news filtered into national headlines and television broadcasts several months later, it had transfigured into something far more terrifying: a substantial increase in skin cancer, a sharp decline in the global agricultural yield and the mass death of fish larva, near the base of the marine food chain. Later came fears of atrophied immune systems and blindness.

The urgency of the alarm seemed to have everything to do with the phrase “a hole in the ozone layer,” which, charitably put, was a mixed metaphor. For there was no hole, and there was no layer. Ozone, which shielded Earth from ultraviolet radiation, was distributed throughout the atmosphere, settling mostly in the middle stratosphere and never in a concentration higher than 15 parts per million. As for the “hole” — while the amount of ozone over Antarctica had declined drastically, the depletion was a temporary phenomenon, lasting about two months a year. In satellite images colorized to show ozone density, however, the darker region appeared to depict a void. When F.Sherwood Rowland, one of the chemists who identified the problem in 1974, spoke of the “ozone hole” in a university slide lecture in November 1985, the crisis found its catchphrase. The New York Times used it that same day in its article about the

British team's findings, and while scientific journals initially refused to use the term, within a year it was unavoidable. The ozone crisis had its signal, which was also a symbol: a hole.

It was already understood, thanks to the work of Rowland and his colleague Mario Molina, that the damage was largely caused by the man-made CFCs used in refrigerators, spray bottles and plastic foams, which escaped into the stratosphere and devoured ozone molecules. It was also understood that the ozone problem and the greenhouse-gas problem were linked. CFCs were unusually potent greenhouse gases. Though CFCs had been mass-produced only since the 1930s, they were already responsible, by Jim Hansen's calculation, for nearly half of Earth's warming during the 1970s. But nobody was worried about CFCs because of their warming potential. They were worried about getting skin cancer.

The United Nations, through two of its intergovernmental agencies — the United Nations Environment Program and the World Meteorological Organization — had in 1977 established a World Plan of Action on the Ozone Layer. In 1985, UNEP adopted a framework for a global treaty, the Vienna Convention for the Protection of the Ozone Layer. The negotiators failed to agree upon any specific CFC regulations in Vienna, but after the British scientists reported their findings from the Antarctic two months later, the Reagan administration proposed a reduction in CFC emissions of 95 percent. The speed of the reversal was all the more remarkable because CFC regulation faced virulent opposition. Dozens of American businesses with the word "refrigeration" in their names, together with hundreds involved in the production, manufacture and consumption of chemicals, plastics, paper goods and frozen food — around 500 companies in total, from DuPont and the American Petroleum Institute to Mrs. Smith's Frozen Food Company of Pottstown, Pa. — had united in 1980 as the Alliance for Responsible CFC Policy. The alliance hounded the E.P.A., members of Congress and Reagan himself, insisting that ozone science was uncertain. The few concessions the alliance won, like forcing the E.P.A. to withdraw a plan to regulate CFCs, were swiftly overturned by lawsuits, and once the public discovered the "ozone hole," every relevant government agency and every sitting United States senator urged the president to endorse the United Nations' plans for a treaty. When Reagan finally submitted the Vienna Convention to the Senate for ratification, he praised the "leading role" played by the United States, fooling nobody.

Senior members of the United Nations Environment Program and the World Meteorological Organization, including Bert Bolin, a veteran of the Charney group, began to wonder whether they could do for the carbon-dioxide problem what they had done for ozone policy. The organizations had been holding semiannual conferences on global warming since the early 1970s. But in 1985, just several months after the bad news from the Antarctic, at an otherwise sleepy meeting in Villach, Austria, the assembled 89 scientists from 29 countries began to discuss a subject that fell wildly outside their discipline: politics.

An Irish hydrology expert asked if his country should reconsider the location of its dams. A Dutch seacoast engineer questioned the wisdom of rebuilding dikes that had been destroyed by recent floods. And the conference's chairman, James Bruce, an unassuming, pragmatic hydrometeorologist from Ontario, posed a question that shocked his audience.

Bruce was a minister of the Canadian environmental agency, a position that conferred him the esteem that his American counterparts had forfeited when Reagan won the White House. Just before leaving for Villach, he met with provincial dam and hydropower managers. O.K., one of them said, you scientists win. You've convinced me that the climate is changing. Well, tell me how it's changing. In 20 years, will the rain be falling somewhere else?

Bruce took this challenge to Villach: You're the experts. What am I supposed to tell him? People are hearing the message, and they want to hear more. So how do we, in the scientific world, begin a dialogue with the world of action?

The world of action. For a room of scientists who prided themselves as belonging to a specialized guild of monkish austerity, this was a startling provocation. On a bus tour of the countryside, commissioned by their Austrian hosts, Bruce sat with Roger Revelle, ignoring the Alps, speaking animatedly about the need for scientists to demand political remedies in times of existential crisis.

The formal report ratified at Villach contained the most forceful warnings yet issued by a scientific body. Most major economic decisions undertaken by nations, it pointed out, were based on the assumption that past climate conditions were a reliable guide to the future. But the future would not look like the past. Though some warming was inevitable, the scientists wrote, the extent of the disaster could be "profoundly affected" by aggressive, coordinated government policies. Fortunately there was a new model in place to

achieve just that. The balloon could be patched, the eggshell bandaged, the ceiling replastered. There was still time.

3. The Size of the Human Imagination *Spring-Summer 1986*
It was the spring of 1986, and Curtis Moore, a Republican staff member on the Committee on Environment and Public Works, was telling Rafe Pomerance that the greenhouse effect wasn't a problem.

With his last ounce of patience, Pomerance begged to disagree.

Yes, Moore clarified — of course, it was an existential problem, the fate of the civilization depended on it, the oceans would boil, all of that. But it wasn't a politicalproblem. Know how you could tell? Political problems had solutions. And the climate issue had none. Without a solution — an obvious, attainable one any policy could only fail. No elected politician desired to come within shouting distance of failure. So when it came to the dangers of despoiling our planet beyond the range of habitability, most politicians didn't see a problem. Which meant that Pomerance had a very big problem indeed.

He had followed the rapid ascension of the ozone issue with the rueful admiration of a competitor. He was thrilled for its success — however inadvertently, the treaty would serve as the world's first action to delay climate change. But it offered an especially acute challenge for Pomerance, who after his yearlong hiatus had become, as far as he knew, the nation's first, and only, full-time global-warming lobbyist. At the suggestion of Gordon MacDonald, Pomerance joined the World Resources Institute, a nonprofit begun by Gus Speth, a senior environmental official in Jimmy Carter's White House and a founder of the Natural Resources Defense Council. Unlike Friends of the Earth, W.R.I. was not an activist organization; it occupied the nebulous intersection of politics, international relations and energy policy. Its mission was expansive enough to allow Pomerance to work without interference. Yet the only thing that anyone on Capitol Hill wanted to talk about was ozone.

That was Curtis Moore's proposal: Use ozone to revive climate. The ozone hole had a solution — an international treaty, already in negotiation. Why not hitch the milk wagon to the bullet train? Pomerance was skeptical. The problems were related, sure: Without a reduction in CFC emissions, you didn't have a chance of averting cataclysmic global warming. But it had been difficult enough to explain the carbon issue to politicians and journalists; why complicate the sales pitch? Then again, he didn't see what choice he had. The Republicans controlled the Senate, and Moore was his connection to the Senate's environmental committee.

Moore came through. At his suggestion, Pomerance met with Senator John Chafee, a Republican from Rhode Island, and helped persuade him to hold a double-barreled hearing on the twin problems of ozone and carbon dioxide on June 10 and 11, 1986. F.Sherwood Rowland, Robert Watson, a NASA scientist, and Richard Benedick, the administration's lead representative in international ozone negotiations, would discuss ozone; James Hansen, Al Gore, the ecologist George Woodwell and Carl Wunsch, a veteran of the Charney group, would testify about climate change. As soon as the first witness appeared, Pomerance realized that Moore's instincts had been right. The ozone gang was good.

Robert Watson dimmed the lights in the hearing room. On a flimsy screen, he projected footage with the staticky, low-budget quality of a slasher flick. It showed a bird's-eye view of the Antarctic, partly obscured by spiraling clouds. The footage was so convincing that Chafee had to ask whether it was an actual satellite image. Watson acknowledged that though created by satellite data, it was, in fact, a simulation. An animation, to be precise. The three-minute video showed every day of October — the month during which the ozone thinned most drastically — for seven consecutive years. (The other months, conveniently, were omitted.) A canny filmmaker had colored the "ozone hole" pink. As the years sped forward, the polar vortex madly gyroscoping, the hole expanded until it obscured most of Antarctica. The smudge turned mauve, representing an even thinner density of ozone, and then the dark purple of a hemorrhaging wound. The data represented in the video wasn't new, but nobody had thought to represent it in this medium. If F.Sherwood Rowland's earlier colorized images were crime-scene photographs, Watson's video was a surveillance camera catching the killer red-handed.

As Pomerance had hoped, fear about the ozone layer ensured a bounty of press coverage for the climate-change testimony. But as he had feared, it caused many people to conflate the two crises. One was Peter Jennings, who aired the video on ABC's "World News Tonight," warning that the ozone hole "could lead to flooding all over the world, also to drought and to famine."

The confusion helped: For the first time since the “Changing Climate” report, global-warming headlines appeared by the dozen. William Nierenberg’s “caution, not panic” line was inverted. It was all panic without a hint of caution: “A Dire Forecast for ‘Greenhouse’ Earth” (the front page of The Washington Post); “Scientists Predict Catastrophes in Growing Global Heat Wave” (Chicago Tribune); “Swifter Warming of Globe Foreseen” (The New York Times). On the second day of the Senate hearing, devoted to global warming, every seat in the gallery was occupied; four men squeezed together on a broad window sill.

Pomerance had suggested that Chafee, instead of opening with the typical statement about the need for more research, deliver a call for action. But Chafee went further: He called for the State Department to begin negotiations on an international solution with the Soviet Union. It was the kind of proposal that would have been unthinkable even a year earlier, but the ozone issue had established a precedent for global environmental problems: high-level meetings among the world’s most powerful nations, followed by a global summit meeting to negotiate a framework for a treaty to restrict emissions.

After three years of backsliding and silence, Pomerance was exhilarated to see interest in the issue spike overnight. Not only that: A solution materialized, and a moral argument was passionately articulated — by Rhode Island’s Republican senator no less. “Ozone depletion and the greenhouse effect can no longer be treated solely as important scientific questions,” Chafee said. “They must be seen as critical problems facing the nations of the world, and they are problems that demand solutions.”

The old canard about the need for more research was roundly mocked — by Woodwell, by a W.R.I. colleague named Andrew Maguire, by Senator George Mitchell, a Democrat from Maine. “Scientists are never 100 percent certain,” the Princeton historian Theodore Rabb testified. “That notion of total certainty is something too elusive ever to be sought.” As Pomerance had been saying since 1979, it was past time to act. Only now the argument was so broadly accepted that nobody dared object.

The ozone hole, Pomerance realized, had moved the public because, though it was no more visible than global warming, people could be made to see it. They could watch it grow on video. Its metaphors were emotionally wrought: Instead of summoning a glass building that sheltered plants from chilly weather (“Everything seems to flourish in there”), the hole evoked a violent rending of the firmament, inviting deathly radiation. Americans felt that their lives were in danger. An abstract, atmospheric problem had been reduced to the size of the human imagination. It had been made just small enough, and just large enough, to break through.

4. ‘Atmospheric Scientist, New York, N.Y.’ *Fall 1987-Spring 1988*

Four years after “Changing Climate,” two years after a hole had torn open the firmament and a month after the United States and more than three dozen other nations signed a treaty to limit use of CFCs, the climate -change corps was ready to celebrate. It had become conventional wisdom that climate change would follow ozone’s trajectory. Reagan’s E.P.A. administrator, Lee M. Thomas, said as much the day he signed the Montreal Protocol on Substances That Deplete the Ozone Layer (the successor to the Vienna Convention), telling reporters that global warming was likely to be the subject of a future international agreement. Congress had already begun to consider policy — in 1987 alone, there were eight days of climate hearings, in three committees, across both chambers of Congress; Senator Joe Biden, a Delaware Democrat, had introduced legislation to establish a national climate-change strategy. And so it was that Jim Hansen found himself on Oct. 27 in the not especially distinguished ballroom of the Quality Inn on New Jersey Avenue, a block from the Capitol, at “Preparing for Climate Change,” which was technically a conference but felt more like a wedding.

The convivial mood had something to do with its host. John Topping was an old-line Rockefeller Republican, a Commerce Department lawyer under Nixon and an E.P.A. official under Reagan. He first heard about the climate problem in the halls of the E.P.A. in 1982 and sought out Hansen, who gave him a personal tutorial. Topping was amazed to discover that out of the E.P.A.’s 13,000-person staff, only seven people, by his count, were assigned to work on climate, though he figured it was more important to the long-term security of the nation than every other environmental issue combined. After leaving the administration, he founded a nonprofit organization, the Climate Institute, to bring together scientists, politicians and businesspeople to discuss policy solutions. He didn’t have any difficulty raising $150,000 to hold “Preparing for Climate Change”; the major sponsors included BP America, General Electric and the American Gas Association. Topping’s industry friends were intrigued. If a guy like Topping thought this greenhouse business was important, they’d better see what it was all about.

Glancing around the room, Jim Hansen could chart, like an arborist counting rings on a stump, the growth

of the climate issue over the decade. Veterans like Gordon MacDonald, George Woodwell and the environmental biologist Stephen Schneider stood at the center of things. Former and current staff members from the congressional science committees (Tom Grumbly, Curtis Moore, Anthony Scoville) made introductions to the congressmen they advised. Hansen's owlish nemesis Fred Koomanoff was present, as were his counterparts from the Soviet Union and Western Europe. Rafe Pomerance's cranium could be seen above the crowd, but unusually he was surrounded by colleagues from other environmental organizations that until now had shown little interest in a diffuse problem with no proven fund-raising record. The party's most conspicuous newcomers, however, the outermost ring, were the oil-and-gas executives.

It was not entirely surprising to see envoys from Exxon, the Gas Research Institute and the electrical-grid trade groups, even if they had been silent since "Changing Climate." But they were joined by executives from General Electric, AT&T and the American Petroleum Institute, which that spring had invited a leading government scientist to make the case for a transition to renewable energy at the industry's annual world conference in Houston. Even Richard Barnett was there, the chairman of the Alliance for Responsible CFC Policy, the face of the campaign to defeat an ozone treaty. Barnett's retreat had been humiliating and swift: After DuPont, by far the world's single largest manufacturer of CFCs, realized that it stood to profit from the transition to replacement chemicals, the alliance abruptly reversed its position, demanding that the United States sign a treaty as soon as possible. Now Barnett, at the Quality Inn, was speaking about how "we bask in the glory of the Montreal Protocol" and quoting Robert Frost's "The Road Not Taken" to express his hope for a renewed alliance between industry and environmentalists. There were more than 250 people in all in the old ballroom, and if the concentric rings extended any further, you would have needed a larger hotel.

That evening, as a storm spat and coughed outside, Rafe Pomerance gave one of his exhortative speeches urging cooperation among the various factions, and John Chafee and Roger Revelle received awards; introductions were made and business cards earnestly exchanged. Not even a presentation by Hansen of his research could sour the mood. The next night, on Oct. 28, at a high-spirited dinner party in Topping's townhouse on Capitol Hill, the oil-and-gas men joked with the environmentalists, the trade-group representatives chatted up the regulators and the academics got merrily drunk. Mikhail Budyko, the don of the Soviet climatologists, settled into an extended conversation about global warming with Topping's 10-year-old son. It all seemed like the start of a grand bargain, a uniting of factions — a solution.

It was perhaps because of all this good cheer that it was Hansen's instinct to shrug off a peculiar series of events that took place just a week later. He was scheduled to appear before another Senate hearing, this time devoted entirely to climate change. It was called by the Committee on Energy and Natural Resources after Rafe Pomerance and Gordon MacDonald persuaded its chairman, Bennett Johnston, a Democrat from Louisiana, of the issue's significance for the future of the oil-and-gas industry (Louisiana ranked third among states in oil production). Hansen was accustomed to the bureaucratic nuisances that attended testifying before Congress; before a hearing, he had to send his formal statement to NASA headquarters, which forwarded it to the White House's Office of Management and Budget for approval. "Major greenhouse climate changes are a certainty," he had written. "By the 2010s [in every scenario], essentially the entire globe has very substantial warming."

The process appeared entirely perfunctory, but this time, on the Friday evening before his appearance that Monday, he was informed that the White House demanded changes to his testimony. No rationale was provided. Nor did Hansen understand by what authority it could censor scientific findings. He told the administrator in NASA's legislative-affairs office that he refused to make the changes. If that meant he couldn't testify, so be it.

The NASA administrator had another idea. The Office of Management and Budget had the authority to approve government witnesses, she explained. But it couldn't censor a private citizen.

At the hearing three days later, on Monday, Nov. 9, Hansen was listed as "Atmospheric Scientist, New York, N.Y. " — as if he were a crank with a telescope who had stumbled into the Senate off the street. He was careful to emphasize the absurdity of the situation in his opening remarks, at least to the degree that his Midwestern reserve would allow: "Before I begin, I would like to state that although I direct the NASA Goddard Institute for Space Studies, I am appearing here as a private citizen." In the most understated terms available to him, Hansen provided his credentials: "Ten years' experience in terrestrial climate studies and more than 10 years' experience in the exploration and study of other planetary atmospheres."

Assuming that one of the senators would immediately ask about this odd introduction, Hansen had prepared an elegant response. He planned to say that although his NASA colleagues endorsed his findings, the White House had insisted he utter false statements that would have distorted his conclusions. He figured this would lead to an uproar. But no senator thought to ask about his title. So the atmospheric scientist from New York City said nothing else about it.

After the hearing, he went to lunch with John Topping, who was stunned to hear of the White House's ham-handed attempt to silence him. "Uh, oh," Topping joked, "Jim is a dangerous man. We're going to have to rally the troops to protect him." The idea that quiet, sober Jim Hansen could be seen as a threat to anyone, let alone national security — well, it was enough to make him laugh.

But the brush with state censorship stayed with Hansen in the months ahead. It confirmed that even after the political triumph of the Montreal Protocol and the bipartisan support of climate policy, there were still people within the White House who hoped to prevent a debate. In its public statements, the administration showed no such reluctance: By all appearances, plans for major policy continued to advance rapidly. After the Johnston hearing, Timothy Wirth, a freshman Democratic senator from Colorado on the energy committee, began to plan a comprehensive package of climate-change legislation — a New Deal for global warming. Wirth asked a legislative assistant, David Harwood, to consult with experts on the issue, beginning with Rafe Pomerance, in the hope of converting the science of climate change into a new national energy policy.

In March 1988, Wirth joined 41 other senators, nearly half of them Republicans, to demand that Reagan call for an international treaty modeled after the ozone agreement. Because the United States and the Soviet Union were the world's two largest contributors of carbon emissions, responsible for about one-third of the world total, they should lead the negotiations. Reagan agreed. In May, he signed a joint statement with Mikhail Gorbachev that included a pledge to cooperate on global warming.

But a pledge didn't reduce emissions. Hansen was learning to think more strategically — less like a scientist, more like a politician. Despite the efforts of Wirth, there was as yet no serious plan nationally or internationally to address climate change. Even Al Gore himself had, for the moment, withdrawn his political claim to the issue. In 1987, at the age of 39, Gore announced that he was running for president, in part to bring attention to global warming, but he stopped emphasizing it after the subject failed to captivate New Hampshire primary voters.

Hansen told Pomerance that the biggest problem with the Johnston hearing, at least apart from the whole censorship business, had been the month in which it was held: November. "This business of having global-warming hearings in such cool weather is never going to get attention," he said. He wasn't joking. At first he assumed that it was enough to publish studies about global warming and that the government would spring into action. Then he figured that his statements to Congress would do it. It had seemed, at least momentarily, that industry, understanding what was at stake, might lead. But nothing had worked.

As spring turned to summer, Anniek Hansen noticed a change in her husband's disposition. He grew pale and unusually thin. When she asked him about his day, Hansen replied with some ambiguity and turned the conversation to sports: the Yankees, his daughter's basketball team, his son's baseball team. But even for him, he was unusually quiet, serious, distracted. Anniek would begin a conversation and find that he hadn't heard a word she said. She knew what he was thinking: He was running out of time. We were running out of time. Then came the summer of 1988, and Jim Hansen wasn't the only one who could tell that time was running out.

5. 'You Will See Things That You Shall Believe' *Summer 1988*

It was the hottest and driest summer in history. Everywhere you looked, something was bursting into flames. Two million acres in Alaska incinerated, and dozens of major fires scored the West. Yellowstone National Park lost four million acres. Smoke was visible from Chicago, 1,600 miles away.

In Nebraska, suffering its worst drought since the Dust Bowl, there were days when every weather station registered temperatures above 100 degrees. The director of the Kansas Department of Health and Environment warned that the drought might be the dawning of a climatic change that within a half century could turn the state into a desert. "The dang heat," said a farmer in Grinnell. "Farming has so many perils, but climate is 99 percent of it." In parts of Wisconsin, where Gov. Tommy Thompson banned fireworks and smoking cigarettes outdoors, the Fox and Wisconsin Rivers evaporated completely. "At that point," said an official from the Department of Natural Resources, "we must just sit back and watch the fish die."

Harvard University, for the first time, closed because of heat. New York City's streets melted, its mosquito population quadrupled and its murder rate reached a record high. "It's a chore just to walk," a former hostage negotiator told a reporter. "You want to be left alone." The 28th floor of Los Angeles's second-tallest building burst into flames; the cause, the Fire Department concluded, was spontaneous combustion. Ducks fled the continental United States in search of wetlands, many ending up in Alaska, swelling the pintail population there to 1.5 million from 100,000. "How do you spell relief?" asked a spokesman for the Fish and Wildlife Service. "If you are a duck from America's parched prairies, this year you may spell it A-L-A-S-K-A."

Nineteen Miss Indiana contestants, outfitted with raincoats and umbrellas, sang "Come Rain or Come Shine," but it did not rain. The Rev. Jesse Jackson, a Democratic presidential candidate, stood in an Illinois cornfield and prayed for rain, but it did not rain. Cliff Doebel, the owner of a gardening store in Clyde, Ohio, paid $2,000 to import Leonard Crow Dog, a Sioux Indian medicine man from Rosebud, S.D. Crow Dog claimed to have performed 127 rain dances, all successful. "You will see things that you shall believe," he told the townspeople of Clyde. "You will feel there is a chance for us all." After three days of dancing, it rained less than a quarter of an inch.

Texas farmers fed their cattle cactus. Stretches of the Mississippi River flowed at less than one-fifth of normal capacity. Roughly 1,700 barges beached at Greenville, Miss.; an additional 2,000 were marooned at St. Louis and Memphis. The on-field thermometer at Veterans Stadium in Philadelphia, where the Phillies were hosting the Chicago Cubs for a matinee, read 130 degrees. During a pitching change, every player, coach and umpire, save the catcher and the entering reliever, Todd Frohwirth, fled into the dugouts. (Frohwirth would earn the victory.) In the Cleveland suburb of Lakewood on June 21, yet another record-smasher, a roofer working with 600-degree tar exclaimed, "Will this madness ever end?"

On June 22 in Washington, where it hit 100 degrees, Rafe Pomerance received a call from Jim Hansen, who was scheduled to testify the following morning at a Senate hearing called by Timothy Wirth.

"I hope we have good media coverage tomorrow," Hansen said.

This amused Pomerance. He was the one who tended to worry about press; Hansen usually claimed indifference to such vulgar considerations. "Why's that?" Pomerance asked.

Hansen had just received the most recent global temperature data. Just over halfway into the year, 1988 was setting records. Already it had nearly clinched the hottest year in history. Ahead of schedule, the signal was emerging from the noise.

"I'm going to make a pretty strong statement," Hansen said.

6. 'The Signal has Emerged' ***June 1988***

The night before the hearing, Hansen flew to Washington to give himself enough time to prepare his oral testimony in his hotel room. But he couldn't focus — the ballgame was on the radio. The slumping Yankees, who had fallen behind the Tigers for first place, were trying to avoid a sweep in Detroit, and the game went to extra innings. Hansen fell asleep without finishing his statement. He awoke to bright sunlight, high humidity, choking heat. It was signal weather in Washington: the hottest June 23 in history.

Before going to the Capitol, he attended a meeting at NASA headquarters. One of his early champions at the agency, Ichtiaque Rasool, was announcing the creation of a new carbon-dioxide program. Hansen, sitting in a room with dozens of scientists, continued to scribble his testimony under the table, barely listening. But he heard Rasool say that the goal of the new program was to determine when a warming signal might emerge. As you all know, Rasool said, no respectable scientist would say that you already have a signal.

Hansen interrupted.

"I don't know if he's respectable or not," he said, "but I do know one scientist who is about to tell the U.S. Senate that the signal has emerged."

The other scientists looked up in surprise, but Rasool ignored Hansen and continued his presentation. Hansen returned to his testimony. He wrote: "The global warming is now large enough that we can ascribe with a high degree of confidence a cause-and-effect relationship to the greenhouse effect." He wrote:

“1988 so far is so much warmer than 1987, that barring a remarkable and improbable cooling, 1988 will be the warmest year on record.” He wrote: “The greenhouse effect has been detected, and it is changing our climate now.”

By 2:10 p.m., when the session began, it was 98 degrees, and not much cooler in Room 366 of the Dirksen Senate Office Building, thanks to the two rows of television-camera lights. Timothy Wirth’s office had told reporters that the plain-spoken NASA scientist was going to make a major statement. After the staff members saw the cameras, even those senators who hadn’t planned to attend appeared at the dais, hastily reviewing the remarks their aides had drafted for them. Half an hour before the hearing, Wirth pulled Hansen aside. He wanted to change the order of speakers, placing Hansen first. The senator wanted to make sure that Hansen’s statement got the proper amount of attention. Hansen agreed.

“We have only one planet,” Senator Bennett Johnston intoned. “If we screw it up, we have no place to go.” Senator Max Baucus, a Democrat from Montana, called for the United Nations Environment Program to begin preparing a global remedy to the carbon-dioxide problem. Senator Dale Bumpers, a Democrat of Arkansas, previewed Hansen’s testimony, saying that it “ought to be cause for headlines in every newspaper in America tomorrow morning.” The coverage, Bumpers emphasized, was a necessary precursor to policy. “Nobody wants to take on any of the industries that produce the things that we throw up into the atmosphere,” he said. “But what you have are all these competing interests pitted against our very survival.”

Wirth asked those standing in the gallery to claim the few remaining seats available. “There is no point in standing up through this on a hot day,” he said, happy for the occasion to emphasize the historical heat. Then he introduced the star witness.

Hansen, wiping his brow, spoke without affect, his eyes rarely rising from his notes. The warming trend could be detected “with 99 percent confidence,” he said. “It is changing our climate now.” But he saved his strongest comment for after the hearing, when he was encircled in the hallway by reporters. “It is time to stop waffling so much,” he said, “and say that the evidence is pretty strong that the greenhouse effect is here.”

The press followed Bumpers’s advice. Hansen’s testimony prompted headlines in dozens of newspapers across the country, including The New York Times, which announced, across the top of its front page: “Global Warming Has Begun, Expert Tells Senate.”

But Hansen had no time to dwell on any of this. As soon as he got home to New York, Anniek told him she had breast cancer. She had found out two weeks earlier, but she didn’t want to upset him before the hearing. In the following days, while the entire world tried to learn about James Hansen, he tried to learn about Anniek’s illness. After he absorbed the initial shock and made a truce with the fear — his grandmother died from the disease — he dedicated himself to his wife’s treatment with all the rigor of his profession. As they weighed treatment options and analyzed medical data, Anniek noticed him begin to change. The frustration of the last year began to fall away. It yielded, in those doctor’s offices, to a steady coolness, an obsession for detail, a dogged optimism. He began to look like himself again.

7. ‘Woodstock for Climate Change’ June 1988-April 1989

In the immediate flush of optimism after the Wirth hearing — henceforth known as the Hansen hearing — Rafe Pomerance called his allies on Capitol Hill, the young staff members who advised politicians, organized hearings, wrote legislation. We need to finalize a number, he told them, a specific target, in order to move the issue — to turn all this publicity into policy. The Montreal Protocol had called for a 50 percent reduction in CFC emissions by 1998. What was the right target for carbon emissions? It wasn’t enough to exhort nations to do better. That kind of talk might sound noble, but it didn’t change investments or laws. They needed a hard goal — something ambitious but reasonable. And they needed it soon: Just four days after Hansen’s star turn, politicians from 46 nations and more than 300 scientists would convene in Toronto at the World Conference on the Changing Atmosphere, an event described by Philip Shabecoff of The New York Times as “Woodstock for climate change.”

Pomerance hastily arranged a meeting with, among others, David Harwood, the architect of Wirth’s climate legislation; Roger Dower in the Congressional Budget Office, who was calculating the plausibility of a national carbon tax; and Irving Mintzer, a colleague at the World Resources Institute who had a deep knowledge of energy economics. Wirth was scheduled to give the keynote address at Toronto — Harwood would write it — and could propose a number then. But which one?

Pomerance had a proposal: a 20 percent reduction in carbon emissions by 2000.

Ambitious, Harwood said. In all his work planning climate policy, he had seen no assurance that such a steep drop in emissions was possible. Then again, 2000 was more than a decade off, so it allowed for some flexibility.

What really mattered wasn't the number itself, Dower said, but simply that they settle on one. He agreed that a hard target was the only way to push the issue forward. Though his job at the C.B.O. required him to come up with precise estimates of speculative, complex policy, there wasn't time for yet another academic study to arrive at the exact right number. Pomerance's unscientific suggestion sounded fine to him.

Mintzer pointed out that a 20 percent reduction was consistent with the academic literature on energy efficiency. Various studies over the years had shown that you could improve efficiency in most energy systems by roughly 20 percent if you adopted best practices. Of course, with any target, you had to take into account the fact that the developing world would inevitably consume much larger quantities of fossil fuels by 2000. But those gains could be offset by a wider propagation of the renewable technologies already at hand — solar, wind, geothermal. It was not a rigorous scientific analysis, Mintzer granted, but 20 percent sounded plausible. We wouldn't need to solve cold fusion or ask Congress to repeal the law of gravity. We could manage it with the knowledge and technology we already had.

Besides, Pomerance said, 20 by 2000 sounds good.

In Toronto a few days later, Pomerance talked up his idea with everyone he met — environmental ministers, scientists, journalists. Nobody thought it sounded crazy. He took that as an encouraging sign. Other delegates soon proposed the number to him independently, as if they had come up with it themselves. That was an even better sign.

Wirth, in his keynote on June 27, called for the world to reduce emissions by 20 percent by 2000, with an eventual reduction of 50 percent. Other speakers likened the ramifications of climate change to a global nuclear war, but it was the emissions target that was heard in Washington, London, Berlin, Moscow. The conference's final statement, signed by all 400 scientists and politicians in attendance, repeated the demand with a slight variation: a 20 percent reduction in carbon emissions by 2005. Just like that, Pomerance's best guess became global diplomatic policy.

Hansen, emerging from Anniek's successful cancer surgery, took it upon himself to start a one-man public information campaign. He gave news conferences and was quoted in seemingly every article about the issue; he even appeared on television with homemade props. Like an entrant at an elementary-school science fair, he made "loaded dice" out of sections of cardboard and colored paper to illustrate the increased likelihood of hotter weather in a warmer climate. Public awareness of the greenhouse effect reached a new high of 68 percent.

At the end of the sulfurous summer, several months after Gore ended his candidacy, global warming became a major subject of the presidential campaign. While Michael Dukakis proposed tax incentives to encourage domestic oil production and boasted that coal could satisfy the nation's energy needs for the next three centuries, George Bush took advantage. "I am an environmentalist," he declared on the shore of Lake Erie, the first stop on a five-state environmental tour that would take him to Boston Harbor, Dukakis's home turf. "Those who think we are powerless to do anything about the greenhouse effect," he said, "are forgetting about the White House effect." His running mate emphasized the ticket's commitment to the issue at the vice-presidential debate. "The greenhouse effect is an important environmental issue," Dan Quayle said. "We need to get on with it. And in a George Bush administration, you can bet that we will."

This kind of talk roused the oil-and-gas men. "A lot of people on the Hill see the greenhouse effect as the issue of the 1990s," a gas lobbyist told Oil & Gas Journal. Before a meeting of oil executives shortly after the "environmentalist" candidate won the election, Representative Dick Cheney, a Wyoming Republican, warned, "It's going to be very difficult to fend off some kind of gasoline tax." The coal industry, which had the most to lose from restrictions on carbon emissions, had moved beyond denial to resignation. A spokesman for the National Coal Association acknowledged that the greenhouse effect was no longer "an emerging issue. It is here already, and we'll be hearing more and more about it."

By the end of the year, 32 climate bills had been introduced in Congress, led by Wirth's omnibus National Energy Policy Act of 1988. Co-sponsored by 13 Democrats and five Republicans, it established as a national goal an "International Global Agreement on the Atmosphere by 1992," ordered the Energy Department to submit to Congress a plan to reduce energy use by at least 2 percent a year through 2005 and directed the Congressional Budget Office to calculate the feasibility of a carbon tax. A lawyer for the Senate energy committee told an industry journal that lawmakers were "frightened" by the issue and predicted that Congress would eventually pass significant legislation after Bush took office.

The other great powers refused to wait. The German Parliament created a special commission on climate change, which concluded that action had to be taken immediately, "irrespective of any need for further research," and that the Toronto goal was inadequate; it recommended a 30 percent reduction of carbon emissions. The prime ministers of Canada and Norway called for a binding international treaty on the atmosphere; Sweden's Parliament went further, announcing a national strategy to stabilize emissions at the 1988 level and eventually imposing a carbon tax; and Margaret Thatcher, who had studied chemistry at Oxford, warned in a speech to the Royal Society that global warming could "greatly exceed the capacity of our natural habitat to cope" and that "the health of the economy and the health of our environment are totally dependent upon each other."

It was at this time — at a moment when the environmental movement was, in the words of one energy lobbyist, "on a tear" — that the United Nations unanimously endorsed the establishment, by the World Meteorological Organization and the United Nations Environment Program, of an Intergovernmental Panel on Climate Change, composed of scientists and policymakers, to conduct scientific assessments and develop global climate policy. One of the I.P.C.C.'s first sessions to plan an international treaty was hosted by the State Department, 10 days after Bush's inauguration. James Baker chose the occasion to make his first speech as secretary of state. "We can probably not afford to wait until all of the uncertainties about global climate change have been resolved," he said. "Time will not make the problem go away." Much of Congress agreed: On April 14, 1989, a bipartisan group of 24 senators, led by the majority leader, George Mitchell, requested that Bush cut emissions in the United States even before the I.P.C.C.'s working group made its recommendation. "We cannot afford the long lead times associated with a comprehensive global agreement," the senators wrote. Bush had promised to combat the greenhouse effect with the White House effect. The self-proclaimed environmentalist was now seated in the Oval Office. It was time.

8. 'You Never Beat the White House' ***April 1989***

After Jim Baker gave his boisterous address to the I.P.C.C. working group at the State Department, he received a visit from John Sununu, Bush's chief of staff. Leave the science to the scientists, Sununu told Baker. Stay clear of this greenhouse-effect nonsense. You don't know what you're talking about.

Baker, who had served as Reagan's chief of staff, didn't speak about the subject again. He later told the White House that he was recusing himself from energy-policy issues, on account of his previous career as a Houston oil-and-gas lawyer.

Sununu, an enthusiastic contrarian, delighted in defying any lazy characterizations of himself. His father was a Lebanese exporter from Boston, and his mother was a Salvadoran of Greek ancestry; he was born in Havana. In his three terms as governor of New Hampshire, he had come, in the epithets of national political columnists, to embody Yankee conservatism: pragmatic, business-friendly, technocratic, "no-nonsense." He had fought angrily against local environmentalists to open a nuclear power plant, but he had also signed the nation's first acid-rain legislation and lobbied Reagan directly for a reduction of sulfur-dioxide pollution by 50 percent, the target sought by the Audubon Society. He was perceived as more conservative than the president, a budget hawk who had turned a $44 million state deficit into a surplus without raising taxes, and openly insulted Republican politicians and the president of the U.S. Chamber of Commerce when they drifted, however tentatively, from his anti-tax doctrinairism. Yet he increased spending on mental health care and public-land preservation in New Hampshire, and in the White House he would help negotiate a tax increase and secure the Supreme Court nomination of David Souter.

Bush had chosen Sununu for his political instincts — he was credited with having won Bush the New Hampshire primary, after Bush came in third in Iowa, all but securing him the nomination. But despite his reputation as a political wolf, he still thought of himself as a scientist — an "old engineer," as he was fond of putting it, having earned a Ph.D. in mechanical engineering from M.I.T. decades earlier. He lacked the reflexive deference that so many of his political generation reserved for the class of elite government scientists. Since World War II, he believed, conspiratorial forces had used the imprimatur of scientific knowledge to advance an "anti-growth" doctrine. He reserved particular disdain for Paul Ehrlich's "The

Population Bomb," which prophesied that hundreds of millions of people would starve to death if the world took no step to curb population growth; the Club of Rome, an organization of European scientists, heads of state and economists, which similarly warned that the world would run out of natural resources; and as recently as the mid-'70s, the hypothesis advanced by some of the nation's most celebrated scientists — including Carl Sagan, Stephen Schneider and Ichtiaque Rasool — that a new ice age was dawning, thanks to the proliferation of man-made aerosols. All were theories of questionable scientific merit, portending vast, authoritarian remedies to halt economic progress.

Sununu had suspected that the greenhouse effect belonged to this nefarious cabal since 1975, when the anthropologist Margaret Mead convened a symposium on the subject at the National Institute of Environmental Health Sciences. "Unless the peoples of the world can begin to understand the immense and long-term consequences of what appear to be small immediate choices," Mead wrote, "the whole planet may become endangered." Her conclusions were stark, immediate and absent the caveats that hobbled the scientific literature. Or as Sununu saw it, she showed her hand: "Never before have the governing bodies of the world been faced with decisions so far-reaching," Mead wrote. "It is inevitable that there will be a clash between those concerned with immediate problems and those who concern themselves with long-term consequences." When Mead talked about "far-reaching" decisions and "long-term consequences," Sununu heard the marching of jackboots.

In April, the director of the O.M.B., Richard Darman, a close ally of Sununu's, mentioned that the NASA scientist James Hansen, who had forced the issue of global warming onto the national agenda the previous summer, was going to testify again — this time at a hearing called by Al Gore. Darman had the testimony and described it. Sununu was appalled: Hansen's language seemed extreme, based on scientific arguments that he considered, as he later put it, like "technical garbage."

While Sununu and Darman reviewed Hansen's statements, the E.P.A. administrator, William K. Reilly, took a new proposal to the White House. The next meeting of the I.P.C.C.'s working group was scheduled for Geneva the following month, in May; it was the perfect occasion, Reilly argued, to take a stronger stand on climate change. Bush should demand a global treaty to reduce carbon emissions.

Sununu disagreed. It would be foolish, he said, to let the nation stumble into a binding agreement on questionable scientific merits, especially as it would compel some unknown quantity of economic pain. They went back and forth. Reilly didn't want to cede leadership on the issue to the European powers; after all, the first high-level diplomatic meeting on climate change, to which Reilly was invited, would take place just a few months later in the Netherlands. Statements of caution would make the "environmental president" look like a hypocrite and hurt the United States' leverage in a negotiation. But Sununu wouldn't budge. He ordered the American delegates not to make any commitment in Geneva. Very soon after that, someone leaked the exchange to the press.

Sununu, blaming Reilly, was furious. When accounts of his argument with Reilly appeared in The Los Angeles Times and The Washington Post ahead of the Geneva I.P.C.C. meeting, they made the White House look as if it didn't know what it was doing.

A deputy of Jim Baker pulled Reilly aside. He said he had a message from Baker, who had observed Reilly's infighting with Sununu. "In the long run," the deputy warned Reilly, "you never beat the White House."

9. 'A Form of Science Fraud' ***May 1989***

In the first week of May 1989, when Hansen received his proposed testimony back from the O.M.B., it was disfigured by deletions and, more incredible, additions. Gore had called the hearing to increase the pressure on Bush to sign major climate legislation; Hansen had wanted to use the occasion to clarify one major point that, in the hubbub following the 1988 hearing, had been misunderstood. Global warming would not only cause more heat waves and droughts like those of the previous summer but would also lead to more extreme rain events. This was crucial — he didn't want the public to conclude, the next time there was a mild summer, that global warming wasn't real.

But the edited text was a mess. For a couple of days, Hansen played along, accepting the more innocuous edits. But he couldn't accept some of the howlers proposed by the O.M.B. With the hearing only two days away, he gave up. He told NASA's congressional liaison to stop fighting. Let the White House have its way, he said.

But Hansen would have his way, too. As soon as he hung up, he drafted a letter to Gore. He explained that

the O.M.B. wanted him to demote his own scientific findings to “estimates” from models that were “evolving” and unreliable. His anonymous censor wanted him to say that the causes of global warming were “scientifically unknown” and might be attributable to “natural processes,” caveats that would not only render his testimony meaningless but make him sound like a moron. The most bizarre addition, however, was a statement of a different kind. He was asked to argue that Congress should only pass climate legislation that immediately benefited the economy, “independent of concerns about an increasing greenhouse effect” — a sentence that no scientist would ever utter, unless perhaps he were employed by the American Petroleum Institute. Hansen faxed his letter to Gore and left the office.

When he arrived home, Anniek told him Gore had called. Would it be all right, Gore asked when Hansen spoke with him, if I tell a couple of reporters about this?

The New York Times’s Philip Shabecoff called the next morning. “I should be allowed to say what is my scientific position,” Hansen told him. “I can understand changing policy, but not science.”

On Monday, May 8, the morning of the hearing, he left early for his flight to Washington and did not see the newspaper until he arrived at Dirksen, where Gore showed it to him. The front-page headline read: “Scientist Says Budget Office Altered His Testimony.” They agreed that Hansen would give his testimony as planned, after which Gore would ask about the passages that the O.M.B. had rewritten.

Gore stopped at the door. “We better go separately,” he said. “Otherwise they’ll be able to get both of us with one hand grenade.”

In the crowded hearing room, the cameras fixed on Hansen. He held his statement in one hand and a single Christmas tree bulb in the other — a prop to help explain, however shakily, that the warming already created by fossil-fuel combustion was equivalent to placing a Christmas light over every square meter of Earth’s surface. After Hansen read his sanitized testimony, Gore pounced. He was puzzled by inconsistencies in the distinguished scientist’s presentation, he said in a tone thick with mock confusion. “Why do you directly contradict yourself?”

Hansen explained that he had not written those contradictory statements. “The Bush administration is acting as if it is scared of the truth,” Gore said. “If they forced you to change a scientific conclusion, it is a form of science fraud.”

Another government scientist testifying at the hearing, Jerry Mahlman from NOAA, acknowledged that the White House had previously tried to change his conclusions too. Mahlman had managed to deflect the worst of it, however — “objectionable and also unscientific” recommendations, he said, that would have been “severely embarrassing to me in the face of my scientific colleagues.”

Gore called it “an outrage of the first order of magnitude.” The 1988 hearing had created a hero out of Jim Hansen. Now Gore had a real villain, one far more treacherous than Fred Koomanoff — a nameless censor in the White House, hiding behind O.M.B. letterhead.

The cameras followed Hansen and Gore into the marbled hallway. Hansen insisted that he wanted to focus on the science. Gore focused on the politics. “I think they’re scared of the truth,” he said. “They’re scared that Hansen and the other scientists are right and that some dramatic policy changes are going to be needed, and they don’t want to face up to it.”

10. The White House Effect *Fall 1989*

The censorship did more to publicize Hansen’s testimony and the dangers of global warming than anything he could have possibly said. At the White House briefing later that morning, Press Secretary Marlin Fitzwater admitted that Hansen’s statement had been changed. He blamed an official “five levels down from the top” and promised that there would be no retaliation. Hansen, he added, was “an outstanding and distinguished scientist” and was “doing a great job.”

The Los Angeles Times called the censorship “an outrageous assault.” The Chicago Tribune said it was the beginning of “a cold war on global warming,” and The New York Times warned that the White House’s “heavy-handed intervention sends the signal that Washington wants to go slow on addressing the greenhouse problem.”

The day after the hearing, Gore received an unannounced visit from the O.M.B. director, Richard Darman.

He came alone, without aides. He said he wanted to apologize to Gore in person. He was sorry, and he wanted Gore to know it; the O.M.B. would not try to censor anyone again. Gore, stunned, thanked Darman. Something about his apology — the effusiveness, the mortified tone or perhaps the fact that he had come by himself, as if in secret — left Gore with the impression that the idea to censor Hansen didn't come from someone five levels down from the top, or even below Darman. It had come from someone above Darman.

Darman went to see Sununu. He didn't like being accused of censoring scientists. They needed to issue some kind of response. Sununu called Reilly to ask if he had any ideas. We could start, Reilly said, by recommitting to a global climate treaty. The United States was the only Western nation on record as opposing negotiations.

Sununu sent a telegram to Geneva endorsing a plan "to develop full international consensus on necessary steps to prepare for a formal treaty-negotiating process. The scope and importance of this issue are so great that it is essential for the U.S. to exercise leadership." He proposed an international workshop to improve the accuracy of the science and calculate the economic costs of emissions reductions. Sununu signed the telegram himself. A day later, the president pledged to host a climate workshop at the White House. Rafe Pomerance was unconvinced, telling the press that this belated effort to save face was a "waffle" that fell short of real action: "We should be able to complete a treaty by the end of 1990," he said, "not be starting one." But the general response from the press was relief and praise.

Still, Sununu seethed at any mention of the subject. He had taken it upon himself to study more deeply the greenhouse effect; he would have a rudimentary, one-dimensional general circulation model installed on his personal desktop computer. He decided that the models promoted by Jim Hansen were a lot of bunk. They were horribly imprecise in scale and underestimated the ocean's ability to mitigate warming. Sununu complained about Hansen to D. Allan Bromley, a nuclear physicist from Yale who, at Sununu's recommendation, was named Bush's science adviser. Hansen's findings were "technical poppycock" that didn't begin to justify such wild-eyed pronouncements that "the greenhouse effect is here" or that the 1988 heat waves could be attributed to global warming, let alone serve as the basis for national economic policy.

When a junior staff member in the Energy Department, in a meeting at the White House with Sununu and Reilly, mentioned an initiative to reduce fossil-fuel use, Sununu interrupted her. "Why in the world would you need to reduce fossil-fuel use?" he asked. "Because of climate change," the young woman replied.

"I don't want anyone in this administration without a scientific background using 'climate change' or 'global warming' ever again," he said. "If you don't have a technical basis for policy, don't run around making decisions on the basis of newspaper headlines." After the meeting, Reilly caught up to the staff member in the hallway. She was shaken. Don't take it personally, Reilly told her. Sununu might have been looking at you, but that was directed at me.

Relations between Sununu and Reilly became openly adversarial. Reilly, Sununu thought, was a creature of the environmental lobby. He was trying to impress his friends at the E.P.A. without having a basic grasp of the science himself. Most unforgivable of all was what Sununu saw as Reilly's propensity to leak to the press. Whenever Reilly sent the White House names of candidates he wanted to hire for openings at the E.P.A., Sununu vetoed them. When it came time for the high-level diplomatic meeting in November, a gathering of environmental ministers in the Netherlands, Sununu didn't trust Reilly to negotiate on behalf of the White House. So he sent Allan Bromley to accompany him.

Reilly, for his part, didn't entirely blame Sununu for Bush's indecision on the prospect of a climate treaty. The president had never taken a vigorous interest in global warming and was mainly briefed about it by nonscientists. Bush had brought up the subject on the campaign trail, in his speech about the White House effect, after leafing through a briefing booklet for a new issue that might generate some positive press. When Reilly tried in person to persuade him to take action, Bush deferred to Sununu and Baker. Why don't the three of you work it out, he said. Let me know when you decide. But by the time Reilly got to the Noordwijk Ministerial Conference in the Netherlands, he suspected that it was already too late.

11. 'The Skunks at the Garden Party' ***November 1989***

Rafe Pomerance awoke at sunlight and stole out of his hotel, making for the flagpoles. It was nearly freezing — Nov. 6, 1989, on the coast of the North Sea in the Dutch resort town of Noordwijk — but the wind had yet to rise and the photographer was waiting. More than 60 flags lined the strand between the hotel and the beach, one for each nation in attendance at the first major diplomatic meeting on global warming.

The delegations would review the progress made by the I.P.C.C. and decide whether to endorse a framework for a global treaty. There was a general sense among the delegates that they would, at minimum, agree to the target proposed by the host, the Dutch environmental minister, more modest than the Toronto number: a freezing of greenhouse-gas emissions at 1990 levels by 2000. Some believed that if the meeting was a success, it would encourage the I.P.C.C. to accelerate its negotiations and reach a decision about a treaty sooner. But at the very least, the world's environmental ministers should sign a statement endorsing a hard, binding target of emissions reductions. The mood among the delegates was electric, nearly giddy — after more than a decade of fruitless international meetings, they could finally sign an agreement that meant something.

Pomerance had not been among the 400 delegates invited to Noordwijk. But together with three young activists — Daniel Becker of the Sierra Club, Alden Meyer of the Union of Concerned Scientists and Stewart Boyle from Friends of the Earth — he had formed his own impromptu delegation. Their constituency, they liked to say, was the climate itself. Their mission was to pressure the delegates to include in the final conference statement, which would be used as the basis for a global treaty, the target proposed in Toronto: a 20 percent reduction of greenhouse-gas combustion by 2005. It was the only measure that mattered, the amount of emissions reductions, and the Toronto number was the strongest global target yet proposed.

The activists booked their own travel and doubled up in rooms at a beat-up motel down the beach. They managed to secure all-access credentials from the Dutch environmental ministry's press secretary. He was inclined to be sympathetic toward the activists because it had been rumored that Allan Bromley, one of the United States' lead delegates, would try to persuade the delegates from Japan and the Soviet Union to join him in resisting the idea of a binding agreement, despite the fact that Bush had again claimed just earlier that week that the United States would "play a leadership role in global warming." The Dutch were especially concerned about this development, as even a minor rise in sea level would swamp much of their nation.

The activists planned to stage a stunt each day to embarrass Bromley and galvanize support for a hard treaty. The first took place at the flagpoles, where they met a photographer from Agence France-Presse at dawn. Performing for the photographer, Boyle and Becker lowered the Japanese, Soviet and American flags to half-staff. Becker gave a reporter an outraged statement, accusing the three nations of conspiring to block the one action necessary to save the planet. The article appeared on front pages across Europe.

On the second day, Pomerance and Becker met an official from Kiribati, an island nation of 33 atolls in the middle of the Pacific Ocean about halfway between Hawaii and Australia. They asked if he was Kiribati's environmental minister.

Kiribati is a very small place, the man said. I do everything. I'm the environmental minister. I'm the science minister. I'm everything. If the sea rises, he said, my entire nation will be underwater.

Pomerance and Becker exchanged a look. "If we set up a news conference," Pomerance asked, "will you tell them what you just told us?"

Within minutes, they had assembled a couple dozen journalists.

There is no place on Kiribati taller than my head, began the minister, who seemed barely more than five feet tall. So when we talk about one-foot sea-level rise, that means the water is up to my shin.

He pointed to his shin.

Two feet, he said, that's my thigh.

He pointed to his thigh.

Three feet, that's my waist.

He pointed to his waist.

Am I making myself clear?

Pomerance and Becker were ecstatic. The minister came over to them. Is that what you had in mind? he asked.

It was a good start, and necessary too — Pomerance had the sinking feeling that the momentum of the previous year was beginning to flag. The censoring of Hansen's testimony and the inexplicably strident opposition from John Sununu were ominous signs. So were the findings of a report Pomerance had commissioned, published in September by the World Resources Institute, tracking global greenhouse-gas emissions. The United States was the largest contributor by far, producing nearly a quarter of the world's carbon emissions, and its contribution was growing faster than that of every other country. Bush's indecision, or perhaps inattention, had already managed to delay the negotiation of a global climate treaty until 1990 at the earliest, perhaps even 1991. By then, Pomerance worried, it would be too late.

The one meeting to which Pomerance's atmospheric delegation could not gain admittance was the only one that mattered: the final negotiation. The scientists and I.P.C.C. staff members were asked to leave; just the environmental ministers remained. Pomerance and the other activists haunted the carpeted hallway outside the conference room, waiting and thinking. A decade earlier, Pomerance helped warn the White House of the dangers posed by fossil-fuel combustion; nine years earlier, at a fairy-tale castle on the Gulf of Mexico, he tried to persuade Congress to write climate legislation, reshape American energy policy and demand that the United States lead an international process to arrest climate change. Just one year ago, he devised the first emissions target to be proposed at a major international conference. Now, at the end of the decade, senior diplomats from all over the world were debating the merits of a binding climate treaty. Only he was powerless to participate. He could only trust, as he stared at the wall separating him from the diplomats and their muffled debate, that all his work had been enough.

The meeting began in the morning and continued into the night, much longer than expected; most of the delegates had come to the conference ready to sign the Dutch proposal. Each time the doors opened and a minister headed to the bathroom at the other end of the hall, the activists leapt up, asking for an update. The ministers maintained a studied silence, but as the negotiations went past midnight, their aggravation was recorded in their stricken faces and opened collars.

"What's happening?" Becker shouted, for the hundredth time, as the Swedish minister surfaced.

"Your government," the minister said, "is fucking this thing up!"

When the beaten delegates finally emerged from the conference room, Becker and Pomerance learned what happened. Bromley, at the urging of John Sununu and with the acquiescence of Britain, Japan and the Soviet Union, had forced the conference to abandon the commitment to freeze emissions. The final statement noted only that "many" nations supported stabilizing emissions — but did not indicate which nations or at what emissions level. And with that, a decade of excruciating, painful, exhilarating progress turned to air.

The environmentalists spent the morning giving interviews and writing news releases. "You must conclude the conference is a failure," Becker said, calling the dissenting nations "the skunks at the garden party." Greenpeace called it a "disaster." Timothy Wirth, in Washington, said the outcome was proof that the United States was "not a leader but a delinquent partner."

Pomerance tried to be more diplomatic. "The president made a commitment to the American people to deal with global warming," he told The Washington Post, "and he hasn't followed it up." He didn't want to sound defeated. "There are some good building blocks here," Pomerance said, and he meant it. The Montreal Protocol on CFCs wasn't perfect at first, either — it had huge loopholes and weak restrictions. Once in place, however, the restrictions could be tightened. Perhaps the same could happen with climate change. Perhaps. Pomerance was not one for pessimism. As William Reilly told reporters, dutifully defending the official position forced upon him, it was the first time that the United States had formally endorsed the concept of an emissions limit. Pomerance wanted to believe that this was progress.

Before leaving the Netherlands, he joined the other activists for a final round of drinks and commiseration. He would have to return to Washington the next day and start all over again. The I.P.C.C.'s next policy-group meeting would take place in Edinburgh in two months, and there was concern that the Noordwijk failure might influence the group members into lowering their

expectations for a treaty. But Pomerance refused to be dejected — there was no point to it. His companions, though more openly disappointed, shared his determination. One of them, Daniel Becker, had just found out that his wife was pregnant with their first child.

She had traveled with Becker to the Netherlands to visit friends before the conference started. One day, their hosts took them on a day trip to Zeeland, a southwestern province where three rivers emptied into the sea. All week in Noordwijk, Becker couldn't stop talking about what he had seen in Zeeland. After a flood in 1953, when the sea swallowed much of the region, killing more than 2,000 people, the Dutch began to build the Delta Works, a vast concrete-and-steel fortress of movable barriers, dams and sluice gates — a masterpiece of human engineering. The whole system could be locked into place within 90 minutes, defending the land against storm surge. It reduced the country's exposure to the sea by 700 kilometers, Becker explained. The United States coastline was about 153,000 kilometers long. How long, he asked, was the entire terrestrial coastline? Because the whole world was going to need this. In Zeeland, he said, he had seen the future.

Epilogue

Ken Caldeira, a climate scientist at the Carnegie Institution for Science in Stanford, Calif., has a habit of asking new graduate students to name the largest fundamental breakthrough in climate physics since 1979. It's a trick question. There has been no breakthrough. As with any mature scientific discipline, there is only refinement. The computer models grow more precise; the regional analyses sharpen; estimates solidify into observational data. Where there have been inaccuracies, they have tended to be in the direction of understatement. Caldeira and a colleague recently published a paper in Nature finding that the world is warming more quickly than most climate models predict. The toughest emissions reductions now being proposed, even by the most committed nations, will probably fail to achieve "any given global temperature stabilization target."

More carbon has been released into the atmosphere since the final day of the Noordwijk conference, Nov. 7, 1989, than in the entire history of civilization preceding it. In 1990, humankind burned more than 20 billion metric tons of carbon dioxide. By 2017, the figure had risen to 32.5 billion metric tons, a record. Despite every action taken since the Charney report — the billions of dollars invested in research, the nonbinding treaties, the investments in renewable energy — the only number that counts, the total quantity of global greenhouse gas emitted per year, has continued its inexorable rise.

Like the scientific story, the political story hasn't changed greatly, except in its particulars. Even some of the nations that pushed hardest for climate policy have failed to honor their own commitments. When it comes to our own nation, which has failed to make any binding commitments whatsoever, the dominant narrative for the last quarter century has concerned the efforts of the fossil-fuel industries to suppress science, confuse public knowledge and bribe politicians.

The mustache-twirling depravity of these campaigns has left the impression that the oil-and-gas industry always operated thus; while the Exxon scientists and American Petroleum Institute clerics of the '70s and '80s were hardly good Samaritans, they did not start multimillion-dollar disinformation campaigns, pay scientists to distort the truth or try to brainwash children in elementary schools, as their successors would. It was James Hansen's testimony before Congress in 1988 that, for the first time since the "Changing Climate" report, made oil-and-gas executives begin to consider the issue's potential to hurt their profits. Exxon, as ever, led the field. Six weeks after Hansen's testimony, Exxon's manager of science and strategy development, Duane LeVine, prepared an internal strategy paper urging the company to "emphasize the uncertainty in scientific conclusions." This shortly became the default position of the entire sector. LeVine, it so happened, served as chairman of the global petroleum industry's Working Group on Global Climate Change, created the same year, which adopted Exxon's position as its own.

The American Petroleum Institute, after holding a series of internal briefings on the subject in the fall and winter of 1988, including one for the chief executives of the dozen or so largest oil companies, took a similar, if slightly more diplomatic, line. It set aside money for carbon-dioxide policy — about $100,000, a fraction of the millions it was spending on the health effects of benzene, but enough to establish a lobbying organization called, in an admirable flourish of newspeak, the Global Climate Coalition. It was joined by the U.S. Chamber of Commerce and 14 other trade associations, including those representing the coal, electric-grid and automobile industries. The G.C.C. was conceived as a reactive body, to share news of any proposed regulations, but on a whim, it added a press campaign, to be coordinated mainly by the A.P.I. It gave briefings to politicians known to be friendly to the industry and approached scientists who professed skepticism about global warming. The A.P.I.'s payment for an original op-ed was $2,000.

The chance to enact meaningful measures to prevent climate change was vanishing, but the industry had just begun. In October 1989, scientists allied with the G.C.C. began to be quoted in national publications, giving an issue that lacked controversy a convenient fulcrum. “Many respected scientists say the available evidence doesn’t warrant the doomsday warnings,” was the caveat that began to appear in articles on climate change.

Cheap and useful, G.C.C.-like groups started to proliferate, but it was not until international negotiations in preparation for the 1992 Rio Earth Summit began that investments in persuasion peddling rose to the level of a line item. At Rio, George H.W. Bush refused to commit to specific emissions reductions. The following year, when President Bill Clinton proposed an energy tax in the hope of meeting the goals of the Rio treaty, the A.P.I. invested $1.8 million in a G.C.C. disinformation campaign. Senate Democrats from oil-and-coal states joined Republicans to defeat the tax proposal, which later contributed to the Republicans’ rout of Democrats in the midterm congressional elections in 1994 — the first time the Republican Party had won control of both houses in 40 years. The G.C.C. spent $13 million on a single ad campaign intended to weaken support for the 1997 Kyoto Protocol, which committed its parties to reducing greenhouse-gas emissions by 5 percent relative to 1990 levels. The Senate, which would have had to ratify the agreement, took a pre-emptive vote declaring its opposition; the resolution passed 95-0. There has never been another serious effort to negotiate a binding global climate treaty.

The G.C.C. disbanded in 2002 after the defection of various members who were embarrassed by its tactics. But Exxon (now Exxon Mobil) continued its disinformation campaign for another half decade. This has made the corporation an especially vulnerable target for the wave of compensatory litigation that began in earnest in the last three years and may last a generation. Tort lawsuits have become possible only in recent years, as scientists have begun more precisely to attribute regional effects to global emission levels. This is one subfield of climate science that has advanced significantly since 1979 — the assignment of blame.

A major lawsuit has targeted the federal government. A consortium of 21 American children and young adults — one of whom, Sophie Kivlehan of Allentown, Pa., is Jim Hansen’s granddaughter — claims that the government, by “creating a national energy system that causes climate change,” has violated its duty to protect the natural resources to which all Americans are entitled.

In 2015, after reports by the website InsideClimate News and The Los Angeles Times documented the climate studies performed by Exxon for decades, the attorneys general of Massachusetts and New York began fraud investigations. The Securities and Exchange Commission separately started to investigate whether Exxon Mobil’s valuation depended on the burning of all its known oil-and-gas reserves. (Exxon Mobil has denied any wrongdoing and stands by its valuation method.)

The rallying cry of this multipronged legal effort is “Exxon Knew.” It is incontrovertibly true that senior employees at the company that would later become Exxon, like those at most other major oil-and-gas corporations, knew about the dangers of climate change as early as the 1950s. But the automobile industry knew, too, and began conducting its own research by the early 1980s, as did the major trade groups representing the electrical grid. They all own responsibility for our current paralysis and have made it more painful than necessary. But they haven’t done it alone.

The United States government knew. Roger Revelle began serving as a Kennedy administration adviser in 1961, five years after establishing the Mauna Loa carbon-dioxide program, and every president since has debated the merits of acting on climate policy. Carter had the Charney report, Reagan had “Changing Climate” and Bush had the censored testimony of James Hansen and his own public vow to solve the problem. Congress has been holding hearings for 40 years; the intelligence community has been tracking the crisis even longer.

Everybody knew. In 1958, on prime-time television, “The Bell Science Hour” — one of the most popular educational film series in American history — aired “The Unchained Goddess,” a film about meteorological wonders, produced by Frank Capra, a dozen years removed from “It’s a Wonderful Life,” warning that “man may be unwittingly changing the world’s climate” through the release of carbon dioxide. “A few degrees’ rise in the Earth’s temperature would melt the polar ice caps,” says the film’s kindly host, the bespectacled Dr. Research. “An inland sea would fill a good portion of the Mississippi Valley. Tourists in glass-bottomed boats would be viewing the drowned towers of Miami through 150 feet of tropical water.” Capra’s film was shown in science classes for decades.

Everyone knew — and we all still know. We know that the transformations of our planet, which will come

gradually and suddenly, will reconfigure the political world order. We know that if we don't act to reduce emissions, we risk the collapse of civilization. We also know that, without a gargantuan intervention, whatever happens will be worse for our children, worse yet for their children and even worse still for their children's children, whose lives, our actions have demonstrated, mean nothing to us.

Could it have been any other way? In the late 1970s, a small group of philosophers, economists and political scientists began to debate, largely among themselves, whether a human solution to this human problem was even possible. They did not trouble themselves about the details of warming, taking the worst-case scenario as a given. They asked instead whether humankind, when presented with this particular existential crisis, was willing to prevent it. We worry about the future. But how much, exactly?

The answer, as any economist could tell you, is very little. Economics, the science of assigning value to human behavior, prices the future at a discount; the farther out you project, the cheaper the consequences. This makes the climate problem the perfect economic disaster. The Yale economist William D. Nordhaus, a member of Jimmy Carter's Council of Economic Advisers, argued in the 1970s that the most appropriate remedy was a global carbon tax. But that required an international agreement, which Nordhaus didn't think was likely. Michael Glantz, a political scientist who was at the National Center for Atmospheric Research at the time, argued in 1979 that democratic societies are constitutionally incapable of dealing with the climate problem. The competition for resources means that no single crisis can ever command the public interest for long, yet climate change requires sustained, disciplined efforts over decades. And the German physicist-philosopher Klaus Meyer-Abich argued that any global agreement would inevitably favor the most minimal action. Adaptation, Meyer-Abich concluded, "seems to be the most rational political option." It is the option that we have pursued, consciously or not, ever since.

These theories share a common principle: that human beings, whether in global organizations, democracies, industries, political parties or as individuals, are incapable of sacrificing present convenience to forestall a penalty imposed on future generations. When I asked John Sununu about his part in this history — whether he considered himself personally responsible for killing the best chance at an effective global-warming treaty — his response echoed Meyer-Abich. "It couldn't have happened," he told me, "because, frankly, the leaders in the world at that time were at a stage where they were all looking how to seem like they were supporting the policy without having to make hard commitments that would cost their nations serious resources." He added, "Frankly, that's about where we are today."

If human beings really were able to take the long view — to consider seriously the fate of civilization decades or centuries after our deaths — we would be forced to grapple with the transience of all we know and love in the great sweep of time. So we have trained ourselves, whether culturally or evolutionarily, to obsess over the present, worry about the medium term and cast the long term out of our minds, as we might spit out a poison.

Like most human questions, the carbon-dioxide question will come down to fear. At some point, the fears of young people will overwhelm the fears of the old. Some time after that, the young will amass enough power to act. It will be too late to avoid some catastrophes, but perhaps not others. Humankind is nothing if not optimistic, even to the point of blindness. We are also an adaptable species. That will help.

The distant perils of climate change are no longer very distant, however. Many have already begun to occur. We are capable of good works, altruism and wisdom, and a growing number of people have devoted their lives to helping civilization avoid the worst. We have a solution in hand: carbon taxes, increased investment in renewable and nuclear energy and decarbonization technology. As Jim Hansen told me, "From a technology and economics standpoint, it is still readily possible to stay under two degrees Celsius." We can trust the technology and the economics. It's harder to trust human nature. Keeping the planet to two degrees of warming, let alone 1.5 degrees, would require transformative action. It will take more than good works and voluntary commitments; it will take a revolution. But in order to become a revolutionary, you need first to suffer.

Hansen's most recent paper, published last year, announced that Earth is now as warm as it was before the last ice age, 115,000 years ago, when the seas were more than six meters higher than they are today. He and his team have concluded that the only way to avoid dangerous levels of warming is to bend the emissions arc below the x-axis. We must, in other words, find our way to "negative emissions," extracting more carbon dioxide from the air than we contribute to it. If emissions, by miracle, do rapidly decline, most of the necessary carbon absorption could be handled by replanting forests and improving agricultural practices. If not, "massive technological CO_2 extraction," using some combination of

technologies as yet unperfected or uninvented, will be required. Hansen estimates that this will incur costs of $89 trillion to $535 trillion this century, and may even be impossible at the necessary scale. He is not optimistic.

Like Hansen, Rafe Pomerance is close to his granddaughter. When he feels low, he wears a bracelet she made for him. He finds it difficult to explain the future to her. During the Clinton administration, Pomerance worked on environmental issues for the State Department; he is now a consultant for Rethink Energy Florida, which hopes to alert the state to the threat of rising seas, and the chairman of Arctic 21, a network of scientists and research organizations that hope "to communicate the ongoing unraveling of the Arctic." Every two months, he has lunch with fellow veterans of the climate wars — E.P.A. officials, congressional staff members and colleagues from the World Resources Institute. They bemoan the lost opportunities, the false starts, the strategic blunders. But they also remember their achievements. In a single decade, they turned a crisis that was studied by no more than several dozen scientists into the subject of Senate hearings, front-page headlines and the largest diplomatic negotiation in world history. They helped summon into being the world's climate watchdog, the Intergovernmental Panel on Climate Change, and initiated the negotiations for a treaty signed by nearly all of the world's nations.

It is true that much of the damage that might have been avoided is now inevitable. And Pomerance is not the romantic he once was. But he still believes that it might not be too late to preserve some semblance of the world as we know it. Human nature has brought us to this place; perhaps human nature will one day bring us through. Rational argument has failed in a rout. Let irrational optimism have a turn. It is also human nature, after all, to hope.

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