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Losing Earth: The Decade We Almost Stopped Climate Change

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This narrative by Nathaniel Rich is a work of history, addressing the 10-year period from 1979 to 1989: the decisive decade when humankind first came to a broad understanding of the causes and dangers of climate change. Complementing the text is a series of aerial photographs and videos, all shot over the past year by George Steinmetz. With support from the Pulitzer Center, this two-part article is based on 18 months of reporting and well over a hundred interviews. It tracks the efforts of a small group of American scientists, activists and politicians to raise the alarm and stave off catastrophe. It will come as a revelation to many readers — an agonizing revelation — to understand how thoroughly they grasped the problem and how close they came to solving it. *Jake Silverstein*

The world has warmed more than one degree Celsius since the Industrial Revolution. The Paris climate agreement — the nonbinding, unenforceable and already unheeded treaty signed on Earth Day in 2016 — hoped to restrict warming to two degrees. The odds of succeeding, according to a recent

study based on current emissions trends, are one in 20. If by some miracle we are able to limit warming to two degrees, we will only have to negotiate the extinction of the world's tropical reefs, sea-level rise of several meters and the abandonment of the Persian Gulf. The climate scientist James Hansen has called two-degree warming "a prescription for long-term disaster." Long-term disaster is now the best-case scenario. Three-degree warming is a prescription for short-term disaster: forests in the Arctic and the loss of most coastal cities. Robert Watson, a former director of the United Nations Intergovernmental Panel on Climate Change, has argued that three-degree warming is the realistic minimum. Four degrees: Europe in permanent drought; vast areas of China, India and Bangladesh claimed by desert; Polynesia swallowed by the sea; the Colorado River thinned to a trickle; the American Southwest largely uninhabitable. The prospect of a five-degree warming has prompted some of the world's leading climate scientists to warn of the end of human civilization.

Is it a comfort or a curse, the knowledge that we could have avoided all this?

Because in the decade that ran from 1979 to 1989, we had an excellent opportunity to solve the climate crisis. The world's major powers came within several signatures of endorsing a binding, global framework to reduce carbon emissions — far closer than we've come since. During those years, the conditions for success could not have been more favorable. The obstacles we blame for our current inaction had yet to emerge. Almost nothing stood in our way — nothing except ourselves.

Nearly everything we understand about global warming was understood in 1979. By that year, data collected since 1957 confirmed what had been known since before the turn of the 20th century: Human beings have altered Earth's atmosphere through the indiscriminate burning of fossil fuels. The main scientific questions were settled beyond debate, and as the 1980s began, attention turned from diagnosis of the problem to refinement of the predicted consequences. Compared with string theory and genetic engineering, the "greenhouse effect" — a metaphor dating to the early 1900s — was ancient history, described in any Introduction to Biology textbook. Nor was the basic science especially complicated. It could be reduced to a simple axiom: The more carbon dioxide in the atmosphere, the warmer the planet. And every year, by burning coal, oil and gas, humankind belched increasingly obscene quantities of carbon dioxide into the atmosphere.

Why didn't we act? A common boogeyman today is the fossil-fuel industry, which in recent decades has committed to playing the role of villain with comic-book bravado. An entire subfield of climate literature has chronicled the machinations of industry lobbyists, the corruption of scientists and the propaganda campaigns that even now continue to debase the political debate, long after the largest oil-and-gas companies have abandoned the dumb show of denialism. But the coordinated efforts to bewilder the public did not begin in earnest until the end of 1989. During the preceding decade, some of the largest oil companies, including Exxon and Shell, made good-faith efforts to understand the scope of the crisis and grapple with possible solutions.

Nor can the Republican Party be blamed. Today, only 42 percent of Republicans know that “most scientists believe global warming is occurring,” and that percentage is falling. But during the 1980s, many prominent Republicans joined Democrats in judging the climate problem to be a rare political winner: nonpartisan and of the highest possible stakes. Among those who called for urgent, immediate and far-reaching climate policy were Senators John Chafee, Robert Stafford and David Durenberger; the E.P.A. administrator, William K. Reilly; and, during his campaign for president, George H.W. Bush. As Malcolm Forbes Baldwin, the acting chairman of the president’s Council for Environmental Quality, told industry executives in 1981, “There can be no more important or conservative concern than the protection of the globe itself.” The issue was unimpeachable, like support for veterans or small business. Except the climate had an even broader constituency, composed of every human being on Earth.

It was understood that action would have to come immediately. At the start of the 1980s, scientists within the federal government predicted that conclusive evidence of warming would appear on the global temperature record by the end of the decade, at which point it would be too late to avoid disaster. More than 30 percent of the human population lacked access to electricity. Billions of people would not need to attain the “American way of life” in order to drastically increase global carbon emissions; a light bulb in every village would do it. A report prepared at the request of the White House by the National Academy of Sciences advised that “the carbon-

dioxide issue should appear on the international agenda in a context that will maximize cooperation and consensus-building and minimize political manipulation, controversy and division." If the world had adopted the proposal widely endorsed at the end of the '80s — a freezing of carbon emissions, with a reduction of 20 percent by 2005 — warming could have been held to less than 1.5 degrees.

A broad international consensus had settled on a solution: a global treaty to curb carbon emissions. The idea began to coalesce as early as February 1979, at the first World Climate Conference in Geneva, when scientists from 50 nations agreed unanimously that it was "urgently necessary" to act. Four months later, at the Group of 7 meeting in Tokyo, the leaders of the world's seven wealthiest nations signed a statement resolving to reduce carbon emissions. Ten years later, the first major diplomatic meeting to approve the framework for a binding treaty was called in the Netherlands. Delegates from more than 60 nations attended, with the goal of establishing a global summit meeting to be held about a year later. Among scientists and world leaders, the sentiment was unanimous: Action had to be taken, and the United States would need to lead. It didn't.

The inaugural chapter of the climate-change saga is over. In that chapter — call it Apprehension — we identified the threat and its consequences. We spoke, with increasing urgency and self-delusion, of the prospect of triumphing against long odds. But we did not seriously consider the prospect of failure. We understood what failure would mean for global temperatures, coastlines, agricultural yield, immigration patterns, the world

economy. But we have not allowed ourselves to comprehend what failure might mean for us. How will it change the way we see ourselves, how we remember the past, how we imagine the future? Why did we do this to ourselves? These questions will be the subject of climate change's second chapter — call it The Reckoning. There can be no understanding of our current and future predicament without understanding why we failed to solve this problem when we had the chance.

That we came so close, as a civilization, to breaking our suicide pact with fossil fuels can be credited to the efforts of a handful of people, among them a hyperkinetic lobbyist and a guileless atmospheric physicist who, at great personal cost, tried to warn humanity of what was coming. They risked their careers in a painful, escalating campaign to solve the problem, first in scientific reports, later through conventional avenues of political persuasion and finally with a strategy of public shaming. Their efforts were shrewd, passionate, robust. And they failed. What follows is their story, and ours.

The first suggestion to Rafe Pomerance that humankind was destroying the conditions necessary for its own survival came on Page 66 of the government publication EPA-600/7-78-019. It was a technical report about coal, bound in a coal-black cover with beige lettering — one of many such reports that lay in uneven piles around Pomerance's windowless office on the first floor of the Capitol Hill townhouse that, in the late 1970s, served as the Washington headquarters of Friends of the Earth. In the final paragraph of a chapter on environmental regulation, the coal report's authors noted that the continued use of fossil fuels might, within two or three decades, bring

about “significant and damaging” changes to the global atmosphere.

Pomerance paused, startled, over the orphaned paragraph. It seemed to have come out of nowhere. He reread it. It made no sense to him. Pomerance was not a scientist; he graduated from Cornell 11 years earlier with a degree in history. He had the tweedy appearance of an undernourished doctoral student emerging at dawn from the stacks. He wore horn-rimmed glasses and a thickish mustache that wilted disapprovingly over the corners of his mouth, though his defining characteristic was his gratuitous height, 6 feet 4 inches, which seemed to embarrass him; he stooped over to accommodate his interlocutors. He had an active face prone to breaking out in wide, even maniacal grins, but in composure, as when he read the coal pamphlet, it projected concern. He struggled with technical reports. He proceeded as a historian might: cautiously, scrutinizing the source material, reading between the lines. When that failed, he made phone calls, often to the authors of the reports, who tended to be surprised to hear from him. Scientists, he had found, were not in the habit of fielding questions from political lobbyists. They were not in the habit of thinking about politics.

Pomerance had one big question about the coal report. If the burning of coal, oil and natural gas could invite global catastrophe, why had nobody told him about it? If anyone in Washington — if anyone in the United States — should have been aware of such a danger, it was Pomerance. As the deputy legislative director of Friends of the Earth, the wily, pugnacious nonprofit that David Brower helped found after

resigning from the Sierra Club a decade earlier, Pomerance was one of the nation's most connected environmental activists. That he was as easily accepted in the halls of the Dirksen Senate Office Building as at Earth Day rallies might have had something to do with the fact that he was a Morgenthau — the great-grandson of Henry Sr., Woodrow Wilson's ambassador to the Ottoman Empire; great-nephew of Henry Jr., Franklin D. Roosevelt's Treasury secretary; second cousin to Robert, district attorney for Manhattan. Or perhaps it was just his charisma — voluble, energetic and obsessive, he seemed to be everywhere, speaking with everyone, in a very loud voice, at once. His chief obsession was air. After working as an organizer for welfare rights, he spent the second half of his 20s laboring to protect and expand the Clean Air Act, the comprehensive law regulating air pollution. That led him to the problem of acid rain, and the coal report.

He showed the unsettling paragraph to his office mate, Betsy Agle. Had she ever heard of the "greenhouse effect"? Was it really possible that human beings were overheating the planet?

Agle shrugged. She hadn't heard about it, either.

That might have been the end of it, had Agle not greeted Pomerance in the office a few mornings later holding a copy of a newspaper forwarded by Friends of the Earth's Denver office. Isn't this what you were talking about the other day? she asked.

Agle pointed to an article about a prominent geophysicist named Gordon MacDonald, who was conducting a study on

climate change with the Jasons, the mysterious coterie of elite scientists to which he belonged. Pomerance hadn't heard of MacDonald, but he knew all about the Jasons. They were like one of those teams of superheroes with complementary powers that join forces in times of galactic crisis. They had been brought together by federal agencies, including the C.I.A, to devise scientific solutions to national-security problems: how to detect an incoming missile; how to predict fallout from a nuclear bomb; how to develop unconventional weapons, like plague-infested rats. The Jasons' activities had been a secret until the publication of the Pentagon Papers, which exposed their plan to festoon the Ho Chi Minh Trail with motion sensors that signaled to bombers. After the furor that followed — protesters set MacDonald's garage on fire — the Jasons began to use their powers for peace instead of war.

There was an urgent problem that demanded their attention, MacDonald believed, because human civilization faced an existential crisis. In "How to Wreck the Environment," a 1968 essay published while he was a science adviser to Lyndon Johnson, MacDonald predicted a near future in which "nuclear weapons were effectively banned and the weapons of mass destruction were those of environmental catastrophe." One of the most potentially devastating such weapons, he believed, was the gas that we exhaled with every breath: carbon dioxide. By vastly increasing carbon emissions, the world's most advanced militaries could alter weather patterns and wreak famine, drought and economic collapse.

In the decade since then, MacDonald had been alarmed to see humankind begin in earnest to weaponize weather — not

out of malice, but unwittingly. During the spring of 1977 and the summer of 1978, the Jasons met to determine what would happen once the concentration of carbon dioxide in the atmosphere doubled from pre-Industrial Revolution levels. It was an arbitrary milestone, the doubling, but a useful one, as its inevitability was not in question; the threshold would most likely be breached by 2035. The Jasons' report to the Department of Energy, "The Long-Term Impact of Atmospheric Carbon Dioxide on Climate," was written in an understated tone that only enhanced its nightmarish findings: Global temperatures would increase by an average of two to three degrees Celsius; Dust Bowl conditions would "threaten large areas of North America, Asia and Africa"; access to drinking water and agricultural production would fall, triggering mass migration on an unprecedented scale. "Perhaps the most ominous feature," however, was the effect of a changing climate on the poles. Even a minimal warming "could lead to rapid melting" of the West Antarctic ice sheet. The ice sheet contained enough water to raise the level of the oceans 16 feet.

The Jasons sent the report to dozens of scientists in the United States and abroad; to industry groups like the National Coal Association and the Electric Power Research Institute; and within the government, to the National Academy of Sciences, the Commerce Department, the E.P.A., NASA, the Pentagon, the N.S.A., every branch of the military, the National Security Council and the White House.

Pomerance read about the atmospheric crisis in a state of shock that swelled briskly into outrage. "This," he told Betsy

Agle, “is the whole banana.”

Gordon MacDonald worked at the federally funded Mitre Corporation, a think tank that works with agencies throughout the government. His title was senior research analyst, which was another way of saying senior science adviser to the national-intelligence community. After a single phone call, Pomerance, a former Vietnam War protester and conscientious objector, drove several miles on the Beltway to a group of anonymous white office buildings that more closely resembled the headquarters of a regional banking firm than the solar plexus of the American military-industrial complex. He was shown into the office of a brawny, soft-spoken man in blocky, horn-rimmed frames, who extended a hand like a bear’s paw.

“I’m glad you’re interested in this,” MacDonald said, sizing up the young activist.

“How could I not be?” Pomerance said. “How could anyone not be?”

MacDonald explained that he first studied the carbon-dioxide issue when he was about Pomerance’s age — in 1961, when he served as an adviser to John F. Kennedy. Pomerance pieced together that MacDonald, in his youth, had been something of a prodigy: In his 20s, he advised Dwight D. Eisenhower on space exploration; at 32, he became a member of the National Academy of Sciences; at 40, he was appointed to the inaugural Council on Environmental Quality, where he advised Richard Nixon on the environmental dangers of burning coal. He monitored the carbon-dioxide

problem the whole time, with increasing alarm.

MacDonald spoke for two hours. Pomerance was appalled. “If I set up briefings with some people on the Hill,” he asked MacDonald, “will you tell them what you just told me?”

Thus began the Gordon and Rafe carbon-dioxide roadshow. Beginning in the spring of 1979, Pomerance arranged informal briefings with the E.P.A., the National Security Council, The New York Times, the Council on Environmental Quality and the Energy Department, which, Pomerance learned, had established an Office of Carbon Dioxide Effects two years earlier at MacDonald’s urging. The men settled into a routine, with MacDonald explaining the science and Pomerance adding the exclamation points. They were surprised to learn how few senior officials were familiar with the Jasons’ findings, let alone understood the ramifications of global warming. At last, having worked their way up the federal hierarchy, the two went to see the president’s top scientist, Frank Press.

Press’s office was in the Old Executive Office Building, the granite fortress that stands on the White House grounds just paces away from the West Wing. Out of respect for MacDonald, Press had summoned to their meeting what seemed to be the entire senior staff of the president’s Office of Science and Technology Policy — the officials consulted on every critical matter of energy and national security. What Pomerance had expected to be yet another casual briefing assumed the character of a high-level national-security meeting. He decided to let MacDonald do all the talking. There was no need to emphasize to Press and his lieutenants that this was an issue of profound national significance. The

hushed mood in the office told him that this was already understood.

To explain what the carbon-dioxide problem meant for the future, MacDonald would begin his presentation by going back more than a century to John Tyndall — an Irish physicist who was an early champion of Charles Darwin's work and died after being accidentally poisoned by his wife. In 1859, Tyndall found that carbon dioxide absorbed heat and that variations in the composition of the atmosphere could create changes in climate. These findings inspired Svante Arrhenius, a Swedish chemist and future Nobel laureate, to deduce in 1896 that the combustion of coal and petroleum could raise global temperatures. This warming would become noticeable in a few centuries, Arrhenius calculated, or sooner if consumption of fossil fuels continued to increase.

Consumption increased beyond anything the Swedish chemist could have imagined. Four decades later, a British steam engineer named Guy Stewart Callendar discovered that, at the weather stations he observed, the previous five years were the hottest in recorded history. Humankind, he wrote in a paper, had become "able to speed up the processes of Nature." That was in 1939.

MacDonald's voice was calm but authoritative, his powerful, heavy hands conveying the force of his argument. He was a geophysicist trapped in the body of an offensive lineman — he had turned down a football scholarship to Rice in order to attend Harvard — and seemed miscast as a preacher of atmospheric physics and existential doom. His audience listened in bowed silence. Pomerance couldn't read them.

Political bureaucrats were skilled at hiding their opinions. Pomerance wasn't. He shifted restlessly in his chair, glancing between MacDonald and the government suits, trying to see whether they grasped the shape of the behemoth that MacDonald was describing.

MacDonald's history concluded with Roger Revelle, perhaps the most distinguished of the priestly caste of government scientists who, since the Manhattan Project, advised every president on major policy; he had been a close colleague of MacDonald and Press since they served together under Kennedy. In a 1957 paper written with Hans Suess, Revelle concluded that "human beings are now carrying out a large-scale geophysical experiment of a kind that could not have happened in the past nor be reproduced in the future." Revelle helped the Weather Bureau establish a continuous measurement of atmospheric carbon dioxide at a site perched near the summit of Mauna Loa on the Big Island of Hawaii, 11,500 feet above the sea — a rare pristine natural laboratory on a planet blanketed by fossil-fuel emissions. A young geochemist named Charles David Keeling charted the data. Keeling's graph came to be known as the Keeling curve, though it more closely resembled a jagged lightning bolt hurled toward the firmament. MacDonald had a habit of tracing the Keeling curve in the air, his thick forefinger jabbing toward the ceiling.

After nearly a decade of observation, Revelle had shared his concerns with Lyndon Johnson, who included them in a special message to Congress two weeks after his inauguration. Johnson explained that his generation had

“altered the composition of the atmosphere on a global scale” through the burning of fossil fuels, and his administration commissioned a study of the subject by his Science Advisory Committee. Revelle was its chairman, and its 1965 executive report on carbon dioxide warned of the rapid melting of Antarctica, rising seas, increased acidity of fresh waters — changes that would require no less than a coordinated global effort to forestall.

In 1974, the C.I.A. issued a classified report on the carbon-dioxide problem. It concluded that climate change had begun around 1960 and had “already caused major economic problems throughout the world.” The future economic and political impacts would be “almost beyond comprehension.” Yet emissions continued to rise, and at this rate, MacDonald warned, they could see a snowless New England, the swamping of major coastal cities, as much as a 40 percent decline in national wheat production, the forced migration of about one-quarter of the world’s population. Not within centuries — within their own lifetimes.

“What would you have us do?” Press asked.

The president’s plan, in the wake of the Saudi oil crisis, to promote solar energy — he had gone so far as to install 32 solar panels on the roof of the White House to heat his family’s water — was a good start, MacDonald thought. But Jimmy Carter’s plan to stimulate production of synthetic fuels — gas and liquid fuel extracted from shale and tar sands — was a dangerous idea. Nuclear power, despite the recent tragedy at Three Mile Island, should be expanded. But even natural gas and ethanol were preferable to coal. There was no way around

it: Coal production would ultimately have to end.

The president's advisers asked respectful questions, but Pomerance couldn't tell whether they were persuaded. The men all stood and shook hands, and Press led MacDonald and Pomerance out of his office. After they emerged from the Old Executive Office Building onto Pennsylvania Avenue, Pomerance asked MacDonald what he thought would happen.

Knowing Frank as I do, MacDonald said, I really couldn't tell you.

In the days that followed, Pomerance grew uneasy. Until this point, he had fixated on the science of the carbon-dioxide issue and its possible political ramifications. But now that his meetings on Capitol Hill had concluded, he began to question what all this might mean for his own future. His wife, Lenore, was eight months pregnant; was it ethical, he wondered, to bring a child onto a planet that before much longer could become inhospitable to life? And he wondered why it had fallen to him, a 32-year-old lobbyist without scientific training, to bring greater attention to this crisis.

Finally, weeks later, MacDonald called to tell him that Press had taken up the issue. On May 22, Press wrote a letter to the president of the National Academy of Sciences requesting a full assessment of the carbon-dioxide issue. Jule Charney, the father of modern meteorology, would gather the nation's top oceanographers, atmospheric scientists and climate modelers to judge whether MacDonald's alarm was justified — whether the world was, in fact, headed to cataclysm.

Pomerance was amazed by how much momentum had built in

such a short time. Scientists at the highest levels of government had known about the dangers of fossil-fuel combustion for decades. Yet they had produced little besides journal articles, academic symposiums, technical reports. Nor had any politician, journalist or activist championed the issue. That, Pomerance figured, was about to change. If Charney's group confirmed that the world was careering toward an existential crisis, the president would be forced to act.

When Hurricane Harvey struck Texas last summer, record rainfall caused catastrophic flooding. In six days, as much as 60 inches of rain fell, leaving at least 68 people dead and $125 billion in damage. One study found that climate change has made cataclysmic rain events like Harvey three times as common as they were. Harvey was a particularly slow-moving hurricane, making it significantly more destructive: The storm stood still and drenched already flood-prone areas. "There's a good chance another event like Harvey will happen again," said Adam Sobel, the director of Columbia University's Initiative on Extreme Weather and Climate. "This is the kind of thing we expect to see more and more, even if we stop emitting carbon today." — Text by Jaime Lowe. Photographs by George Steinmetz for The New York Times. Video by George Steinmetz

There was a brown velvet love seat in the living room of James and Anniek Hansen, under a bright window looking out on Morningside Park in Manhattan, that nobody ever sat in. Erik, their 2-year-old son, was forbidden to go near it. The ceiling above the couch sagged ominously, as if pregnant with some alien life form, and the bulge grew with each passing

week. Jim promised Anniek that he would fix it, which was only fair, because it had been on his insistence that they gave up the prospect of a prewar apartment in Spuyten Duyvil overlooking the Hudson and moved from Riverdale to this two-story walk-up with crumbling walls, police-siren lullabies and gravid ceiling. Jim had resented the 45-minute commute to NASA's Goddard Institute for Space Studies in Manhattan and complained that such a gross waste of his time would soon be unsustainable, once the Pioneer spacecraft reached Venus and began to beam back data. But even after the Hansens moved within a few blocks of the institute, Jim couldn't make time for the ceiling, and after four months it finally burst, releasing a confetti of browned pipes and splintered wood.

Jim repeated his vow to fix the ceiling as soon as he had a moment free from work. Anniek held him to his word, though it required her to live with a hole in her ceiling until Thanksgiving — seven months of plaster dust powdering the love seat.

Another promise Jim made to Anniek: He would make it home for dinner every night by 7 p.m. By 8:30, however, he was back at his calculations. Anniek did not begrudge him his deep commitment to his work; it was one of the things she loved about him. Still, it baffled her that the subject of his obsession should be the atmospheric conditions of a planet more than 24 million miles away. It baffled Jim, too. His voyage to Venus from Denison, Iowa, the fifth child of a diner waitress and an itinerant farmer turned bartender, had been a series of bizarre twists of fate over which he claimed no agency. It was just something that happened to him.

Hansen figured he was the only scientist at the National

Aeronautics and Space Administration who, as a child, did not dream of outer space. He dreamed only of baseball. On clear nights, his transistor radio picked up the broadcast of the Kansas City Blues, the New York Yankees' AAA affiliate. Every morning, he cut out the box scores, pasted them into a notebook and tallied statistics. Hansen found comfort in numbers and equations. He majored in math and physics at the University of Iowa, but he never would have taken an interest in celestial matters were it not for the unlikely coincidence of two events during the year he graduated: the eruption of a volcano in Bali and a total eclipse of the moon.

On the night of Dec. 30, 1963 — whipping wind, 12 degrees below zero — Hansen accompanied his astronomy professor to a cornfield far from town. They set a telescope in an old corncrib and, between 2 and 8 in the morning, made continuous photoelectric recordings of the eclipse, pausing only when the extension cord froze and when they dashed to the car for a few minutes to avoid frostbite.

During an eclipse, the moon resembles a tangerine or, if the eclipse is total, a drop of blood. But this night, the moon vanished altogether. Hansen made the mystery the subject of his master's thesis, concluding that the moon had been obscured by the dust erupted into the atmosphere by Mount Agung, on the other side of the planet from his corncrib, six months earlier. The discovery led to his fascination with the influence of invisible particles on the visible world. You could not make sense of the visible world until you understood the whimsies of the invisible one.

One of the leading authorities on the invisible world happened

to be teaching then at Iowa: James Van Allen made the first major discovery of the space age, identifying the two doughnut-shaped regions of convulsing particles that circle Earth, now known as the Van Allen belts. At Van Allen's prodding, Hansen turned from the moon to Venus. Why, he tried to determine, was its surface so hot? In 1967, a Soviet satellite beamed back the answer: The planet's atmosphere was mainly carbon dioxide. Though once it may have had habitable temperatures, it was believed to have succumbed to a runaway greenhouse effect: As the sun grew brighter, Venus's ocean began to evaporate, thickening the atmosphere, which forced yet greater evaporation — a self-perpetuating cycle that finally boiled off the ocean entirely and heated the planet's surface to more than 800 degrees Fahrenheit. At the other extreme, Mars's thin atmosphere had insufficient carbon dioxide to trap much heat at all, leaving it about 900 degrees colder. Earth lay in the middle, its Goldilocks greenhouse effect just strong enough to support life.

Anniek expected Jim's professional life to resume some semblance of normality once the data from Venus had been collected and analyzed. But shortly after Pioneer entered Venus's atmosphere, Hansen came home from the office in an uncharacteristic fervor — with an apology. The prospect of two or three more years of intense work had sprung up before him. NASA was expanding its study of Earth's atmospheric conditions. Hansen had already done some work on Earth's atmosphere for Jule Charney at the Goddard Institute, helping to develop computerized weather models. Now Hansen would

have an opportunity to apply to Earth the lessons he had learned from Venus.

We want to learn more about Earth's climate, Jim told Anniek — and how humanity can influence it. He would use giant new supercomputers to map the planet's atmosphere. They would create Mirror Worlds: parallel realities that mimicked our own. These digital simulacra, technically called "general circulation models," combined the mathematical formulas that governed the behavior of the sea, land and sky into a single computer model. Unlike the real world, they could be sped forward to reveal the future.

Anniek's disappointment — another several years of distraction, stress, time spent apart from family — was tempered, if only slightly, by the high strain of Jim's enthusiasm. She thought she understood it. Does this mean, she asked, that you'll able to predict weather more accurately?

Yes, Jim said. Something like that.

The scientists summoned by Jule Charney to judge the fate of civilization arrived on July 23, 1979, with their wives, children and weekend bags at a three-story mansion in Woods Hole, on the southwestern spur of Cape Cod. They would review all the available science and decide whether the White House should take seriously Gordon MacDonald's prediction of a climate apocalypse. The Jasons had predicted a warming of two or three degrees Celsius by the middle of the 21st century, but like Roger Revelle before them, they emphasized their reasons for uncertainty. Charney's scientists were asked to quantify that uncertainty. They had to get it right: Their

conclusion would be delivered to the president. But first they would hold a clambake.

They gathered with their families on a bluff overlooking Quissett Harbor and took turns tossing mesh produce bags stuffed with lobster, clams and corn into a bubbling caldron. While the children scrambled across the rolling lawn, the scientists mingled with a claque of visiting dignitaries, whose status lay somewhere between chaperone and client — men from the Departments of State, Energy, Defense and Agriculture; the E.P.A.; the National Oceanic and Atmospheric Administration. They exchanged pleasantries and took in the sunset. It was a hot day, high 80s, but the harbor breeze was salty and cool. It didn't look like the dawning of an apocalypse. The government officials, many of them scientists themselves, tried to suppress their awe of the legends in their presence: Henry Stommel, the world's leading oceanographer; his protégé, Carl Wunsch, a Jason; the Manhattan Project alumnus Cecil Leith; the Harvard planetary physicist Richard Goody. These were the men who, in the last three decades, had discovered foundational principles underlying the relationships among sun, atmosphere, land and ocean — which is to say, the climate.

The hierarchy was made visible during the workshop sessions, held in the carriage house next door: The scientists sat at tables arranged in a rectangle, while their federal observers sat along the room's perimeter, taking in the action as at a theater in the round. The first two days of meetings didn't make very good theater, however, as the scientists reviewed the basic principles of the carbon cycle, ocean circulation,

radiative transfer. On the third day, Charney introduced a new prop: a black speaker, attached to a telephone. He dialed, and Jim Hansen answered.

Charney called Hansen because he had grasped that in order to determine the exact range of future warming, his group would have to venture into the realm of the Mirror Worlds. Jule Charney himself had used a general circulation model to revolutionize weather prediction. But Hansen was one of just a few modelers who had studied the effects of carbon emissions. When, at Charney's request, Hansen programmed his model to consider a future of doubled carbon dioxide, it predicted a temperature increase of four degrees Celsius. That was twice as much warming as the prediction made by the most prominent climate modeler, Syukuro Manabe, whose government lab at Princeton was the first to model the greenhouse effect. The difference between the two predictions — between warming of two degrees Celsius and four degrees Celsius — was the difference between damaged coral reefs and no reefs whatsoever, between thinning forests and forests enveloped by desert, between catastrophe and chaos.

In the carriage house, the disembodied voice of Jim Hansen explained, in a quiet, matter-of-fact tone, how his model weighed the influences of clouds, oceans and snow on warming. The older scientists interrupted, shouting questions; when they did not transmit through the telephone, Charney repeated them in a bellow. The questions kept coming, often before their younger respondent could finish his answers, and Hansen wondered if it wouldn't have been easier for him to drive the five hours and meet with them in person.

Among Charney's group was Akio Arakawa, a pioneer of computer modeling. On the final night at Woods Hole, Arakawa stayed up in his motel room with printouts from the models by Hansen and Manabe blanketing his double bed. The discrepancy between the models, Arakawa concluded, came down to ice and snow. The whiteness of the world's snowfields reflected light; if snow melted in a warmer climate, less radiation would escape the atmosphere, leading to even greater warming. Shortly before dawn, Arakawa concluded that Manabe had given too little weight to the influence of melting sea ice, while Hansen had overemphasized it. The best estimate lay in between. Which meant that the Jasons' calculation was too optimistic. When carbon dioxide doubled in 2035 or thereabouts, global temperatures would increase between 1.5 and 4.5 degrees Celsius, with the most likely outcome a warming of three degrees.

The publication of Jule Charney's report, "Carbon Dioxide and Climate: A Scientific Assessment," several months later was not accompanied by a banquet, a parade or even a news conference. Yet within the highest levels of the federal government, the scientific community and the oil-and-gas industry — within the commonwealth of people who had begun to concern themselves with the future habitability of the planet — the Charney report would come to have the authority of settled fact. It was the summation of all the predictions that had come before, and it would withstand the scrutiny of the decades that followed it. Charney's group had considered everything known about ocean, sun, sea, air and fossil fuels and had distilled it to a single number: three. When the

doubling threshold was broached, as appeared inevitable, the world would warm three degrees Celsius. The last time the world was three degrees warmer was during the Pliocene, three million years ago, when beech trees grew in Antarctica, the seas were 80 feet higher and horses galloped across the Canadian coast of the Arctic Ocean.

The Charney report left Jim Hansen with more urgent questions. Three degrees would be nightmarish, and unless carbon emissions ceased suddenly, three degrees would be only the beginning. The real question was whether the warming trend could be reversed. Was there time to act? And how would a global commitment to cease burning fossil fuels come about, exactly? Who had the power to make such a thing happen? Hansen didn't know how to begin to answer these questions. But he would learn.

After the publication of the Charney report, Exxon decided to create its own dedicated carbon-dioxide research program, with an annual budget of $600,000. Only Exxon was asking a slightly different question than Jule Charney. Exxon didn't concern itself primarily with how much the world would warm. It wanted to know how much of the warming Exxon could be blamed for.

A senior researcher named Henry Shaw had argued that the company needed a deeper understanding of the issue in order to influence future legislation that might restrict carbon-dioxide emissions. "It behooves us to start a very aggressive defensive program," Shaw wrote in a memo to a manager, "because there is a good probability that legislation affecting our business will be passed."

Shaw turned to Wallace Broecker, a Columbia University oceanographer who was the second author of Roger Revelle's 1965 carbon-dioxide report for Lyndon Johnson. In 1977, in a presentation at the American Geophysical Union, Broecker predicted that fossil fuels would have to be restricted, whether by taxation or fiat. More recently, he had testified before Congress, calling carbon dioxide "the No.1 long-term environmental problem." If presidents and senators trusted Broecker to tell them the bad news, he was good enough for Exxon.

The company had been studying the carbon-dioxide problem for decades, since before it changed its name to Exxon. In 1957, scientists from Humble Oil published a study tracking "the enormous quantity of carbon dioxide" contributed to the atmosphere since the Industrial Revolution "from the combustion of fossil fuels." Even then, the observation that burning fossil fuels had increased the concentration of carbon in the atmosphere was well understood and accepted by Humble's scientists. What was new, in 1957, was the effort to quantify what percentage of emissions had been contributed by the oil-and-gas industry.

The American Petroleum Institute, the industry's largest trade association, asked the same question in 1958 through its air-pollution study group and replicated the findings made by Humble Oil. So did another A.P.I. study conducted by the Stanford Research Institute a decade later, in 1968, which concluded that the burning of fossil fuels would bring "significant temperature changes" by the year 2000 and ultimately "serious worldwide environmental changes,"

including the melting of the Antarctic ice cap and rising seas. It was “ironic,” the study’s authors noted, that politicians, regulators and environmentalists fixated on local incidents of air pollution that were immediately observable, while the climate crisis, whose damage would be of far greater severity and scale, went entirely unheeded.

The ritual repeated itself every few years. Industry scientists, at the behest of their corporate bosses, reviewed the problem and found good reasons for alarm and better excuses to do nothing. Why should they act when almost nobody within the United States government — nor, for that matter, within the environmental movement — seemed worried? Besides, as the National Petroleum Council put it in 1972, changes in the climate would probably not be apparent “until at least the turn of the century.” The industry had enough urgent crises: antitrust legislation introduced by Senator Ted Kennedy; concerns about the health effects of gasoline; battles over the Clean Air Act; and the financial shock of benzene regulation, which increased the cost of every gallon of gas sold in America. Why take on an intractable problem that would not be detected until this generation of employees was safely retired? Worse, the solutions seemed more punitive than the problem itself. Historically, energy use had correlated to economic growth — the more fossil fuels we burned, the better our lives became. Why mess with that?

But the Charney report had changed industry’s cost-benefit calculus. Now there was a formal consensus about the nature of the crisis. As Henry Shaw emphasized in his conversations with Exxon’s executives, the cost of inattention would rise in

step with the Keeling curve.

Wallace Broecker did not think much of one of Exxon's proposals for its new carbon-dioxide program: testing the corked air in vintage bottles of French wine to demonstrate how much carbon levels had increased over time. But he did help his colleague Taro Takahashi with a more ambitious experiment conducted onboard one of Exxon's largest supertankers, the Esso Atlantic, to determine how much carbon the oceans could absorb before coughing it back into the atmosphere. Unfortunately, the graduate student installed on the tanker botched the job, and the data came back a mess.

Shaw was running out of time. In 1978, an Exxon colleague circulated an internal memo warning that humankind had only five to 10 years before policy action would be necessary. But Congress seemed ready to act a lot sooner than that. On April 3, 1980, Senator Paul Tsongas, a Massachusetts Democrat, held the first congressional hearing on carbon-dioxide buildup in the atmosphere. Gordon MacDonald testified that the United States should "take the initiative" and develop, through the United Nations, a way to coordinate every nation's energy policies to address the problem. That June, Jimmy Carter signed the Energy Security Act of 1980, which directed the National Academy of Sciences to start a multiyear, comprehensive study, to be called "Changing Climate," that would analyze social and economic effects of climate change. More urgent, the National Commission on Air Quality, at the request of Congress, invited two dozen experts, including Henry Shaw himself, to a meeting in Florida to propose

climate policy.

It seemed that some kind of legislation to restrict carbon combustion was inevitable. The Charney report had confirmed the diagnosis of the problem — a problem that Exxon helped create. Now Exxon would help shape the solution.

Two days before Halloween, Rafe Pomerance traveled to a cotton-candy castle on the Gulf of Mexico, near St. Petersburg, Fla, that locals called the Pink Palace. The Don CeSar hotel was a child's daydream with cantilevered planes of bubble-gum stucco and vanilla-white cupolas that appeared to melt in the sunshine like scoops of ice cream. The hotel stood amid blooms of poisonwood and gumbo limbo on a narrow spit of porous limestone that rose no higher than five feet above the sea. In its carnival of historical amnesia and childlike faith in the power of fantasy, the Pink Palace was a fine setting for the first rehearsal of a conversation that would be earnestly restaged, with little variation and increasing desperation, for the next 40 years.

In the year and a half since he had read the coal report, Pomerance had attended countless conferences and briefings about the science of global warming. But until now, nobody had shown much interest in the only subject that he cared about, the only subject that mattered — how to prevent warming. In a sense, he had himself to thank: During the expansion of the Clean Air Act, he pushed for the creation of the National Commission on Air Quality, charged with ensuring that the goals of the act were being met. One such goal was a stable global climate. The Charney report had made clear that goal was not being met, and now the commission wanted to

hear proposals for legislation. It was a profound responsibility, and the two dozen experts invited to the Pink Palace — policy gurus, deep thinkers, an industry scientist and an environmental activist — had only three days to achieve it, but the utopian setting made everything seem possible. The conference room looked better suited to hosting a wedding party than a bureaucratic meeting, its tall windows framing postcard views of the beach. The sands were blindingly white, the surf was idle, the air unseasonably hot and the dress code relaxed: sunglasses and guayaberas, jackets frowned upon.

“I have a very vested interest in this,” said State Representative Tom McPherson, a Florida Democrat, introducing himself to the delegation, “because I own substantial holdings 15 miles inland of the coast, and any beachfront property appreciates in value.” There was no formal agenda, just a young moderator from the E.P.A. named Thomas Jorling and a few handouts left on every seat, including a copy of the Charney report. Jorling acknowledged the vagueness of their mission.

“We are flying blind, with little or no idea where the mountains are,” he said. But the stakes couldn’t be higher: A failure to recommend policy, he said, would be the same as endorsing the present policy — which was no policy. He asked who wanted “to break the ice,” not quite appreciating the pun.

“We might start out with an emotional question,” proposed Thomas Waltz, an economist at the National Climate Program. “The question is fundamental to being a human being: Do we care?”

This provoked huffy consternation. “In caring or not caring,” said John Laurmann, a Stanford engineer, “I would think the main thing is the timing.” It was not an emotional question, in other words, but an economic one: How much did we value the future?

We have less time than we realize, said an M.I.T. nuclear engineer named David Rose, who studied how civilizations responded to large technological crises. “People leave their problems until the 11th hour, the 59th minute,” he said. “And then: ‘*Eloi, Eloi, Lama Sabachthani?*’” — “My God, my God, why hast thou forsaken me?” It was a promising beginning, Pomerance thought. Urgent, detailed, cleareyed. The attendees seemed to share a sincere interest in finding solutions. They agreed that some kind of international treaty would ultimately be needed to keep atmospheric carbon dioxide at a safe level. But nobody could agree on what that level was.

William Elliott, a NOAA scientist, introduced some hard facts: If the United States stopped burning carbon that year, it would delay the arrival of the doubling threshold by only five years. If Western nations somehow managed to stabilize emissions, it would forestall the inevitable by only eight years. The only way to avoid the worst was to stop burning coal. Yet China, the Soviet Union and the United States, by far the world’s three largest coal producers, were frantically accelerating extraction.

“Do we have a problem?” asked Anthony Scoville, a congressional science consultant. “We do, but it is not the atmospheric problem. It is the political problem.” He doubted that any scientific report, no matter how ominous its

predictions, would persuade politicians to act.

Pomerance glanced out at the beach, where the occasional tourist dawdled in the surf. Beyond the conference room, few Americans realized that the planet would soon cease to resemble itself.

What if the problem was that they were thinking of it as a problem? “What I am saying,” Scoville continued, “is that in a sense we are making a transition not only in energy but the economy as a whole.” Even if the coal and oil industries collapsed, renewable technologies like solar energy would take their place. Jimmy Carter was planning to invest $80 billion in synthetic fuel. “My God,” Scoville said, “with $80 billion, you could have a photovoltaics industry going that would obviate the need for synfuels forever!”

The talk of ending oil production stirred for the first time the gentleman from Exxon. “I think there is a transition period,” Henry Shaw said. “We are not going to stop burning fossil fuels and start looking toward solar or nuclear fusion and so on. We are going to have a very orderly transition from fossil fuels to renewable energy sources.”

“We are talking about some major fights in this country,” said Waltz, the economist. “We had better be thinking this thing through.”

But first — lunch. It was a bright day, low 80s, and the group voted to break for three hours to enjoy the Florida sun. Pomerance couldn’t — he was restless. He had refrained from speaking, happy to let others lead the discussion, provided it moved in the right direction. But the high-minded talk had soon

stalled into fecklessness and pusillanimity. He reflected that he was just about the only participant without an advanced degree. But few of these policy geniuses were showing much sense. They understood what was at stake, but they hadn't taken it to heart. They remained cool, detached — pragmatists overmatched by a problem that had no pragmatic resolution. "Prudence," Jorling said, "is essential."

After lunch, Jorling tried to focus the conversation. What did they need to know in order to take action?

David Slade, who as the director of the Energy Department's $200 million Office of Carbon Dioxide Effects had probably considered the question more deeply than anyone else in the room, said he figured that at some point, probably within their lifetimes, they would see the warming themselves.

"And at that time," Pomerance bellowed, "it will be too late to do anything about it."

Yet nobody could agree what to do. John Perry, a meteorologist who had worked as a staff member on the Charney report, suggested that American energy policy merely "take into account" the risks of global warming, though he acknowledged that a nonbinding measure might seem "intolerably stodgy."

"It is so weak," Pomerance said, the air seeping out of him, "as to not get us anywhere."

Reading the indecision in the room, Jorling reversed himself and wondered if it might be best to avoid proposing any specific policy. "Let's not load ourselves down with that burden," he said. "We'll let others worry."

Pomerance begged Jorling to reconsider. The commission had asked for hard proposals. But why stop there? Why not propose a new national energy plan? “There is no single action that is going to solve the problem,” Pomerance said. “You can’t keep saying, That isn’t going to do it, and This isn’t going to do it, because then we end up doing nothing.”

Scoville pointed out that the United States was responsible for the largest share of global carbon emissions. But not for long. “If we’re going to exercise leadership,” he said, “the opportunity is now.” One way to lead, he proposed, would be to classify carbon dioxide as a pollutant under the Clean Air Act and regulate it as such. This was received by the room like a belch. By Scoville’s logic, every sigh was an act of pollution. Did the science really support such an extreme measure?

The Charney report did exactly that, Pomerance said. He was beginning to lose his patience, his civility, his stamina. “Now, if everybody wants to sit around and wait until the world warms up more than it has warmed up since there have been humans around — fine. But I would like to have a shot at avoiding it.”

Most everybody else seemed content to sit around. Some of the attendees confused uncertainty around the margins of the issue (whether warming would be three or four degrees Celsius in 50 or 75 years) for uncertainty about the severity of the problem. As Gordon MacDonald liked to say, carbon dioxide in the atmosphere would rise; the only question was when. The lag between the emission of a gas and the warming it produced could be several decades. It was like adding an extra blanket on a mild night: It took a few minutes before you started to sweat.

Yet Slade, the director of the Energy Department's carbon-dioxide program, considered the lag a saving grace. If changes did not occur for a decade or more, he said, those in the room couldn't be blamed for failing to prevent them. So what was the problem?

"*You're* the problem," Pomerance said. Because of the lag between cause and effect, it was unlikely that humankind would detect hard evidence of warming until it was too late to reverse it. The lag would doom them. "The U.S. has to do something to gain some credibility," he said.

"So it *is* a moral stand," Slade replied, sensing an advantage.

"Call it whatever." Besides, Pomerance added, they didn't have to ban coal tomorrow. A pair of modest steps could be taken immediately to show the world that the United States was serious: the implementation of a carbon tax and increased investment in renewable energy. Then the United States could organize an international summit meeting to address climate change. This was his closing plea to the group. The next day, they would have to draft policy proposals.

But when the group reconvened after breakfast, they immediately became stuck on a sentence in their prefatory paragraph declaring that climatic changes were "likely to occur."

"Will occur," proposed Laurmann, the Stanford engineer.

"What about the words: highly likely to occur?" Scoville asked.

"Almost sure," said David Rose, the nuclear engineer from M.I.T.

“Almost surely,” another said.

“Changes of an undetermined — ”

“Changes as yet of a little-understood nature?”

“Highly or extremely likely to occur,” Pomerance said.

“Almost surely to occur?”

“No,” Pomerance said.

“I would like to make one statement,” said Annemarie Crocetti, a public-health scholar who sat on the National Commission on Air Quality and had barely spoken all week. “I have noticed that very often when we as scientists are cautious in our statements, everybody else misses the point, because they don’t understand our qualifications.”

“As a nonscientist,” said Tom McPherson, the Florida legislator, “I really concur.”

Yet these two dozen experts, who agreed on the major points and had made a commitment to Congress, could not draft a single paragraph. Hours passed in a hell of fruitless negotiation, self-defeating proposals and impulsive speechifying. Pomerance and Scoville pushed to include a statement calling for the United States to “sharply accelerate international dialogue,” but they were sunk by objections and caveats.

“It is very emotional,” Crocetti said, succumbing to her frustration. “What we have asked is to get people from different disciplines to come together and tell us what you agree on and what your problems are. And you have only made vague statements — ”

She was interrupted by Waltz, the economist, who wanted simply to note that climate change would have profound effects. Crocetti waited until he exhausted himself, before resuming in a calm voice. “All I am asking you to say is: ‘We got ourselves a bunch of experts, and by God, they all endorse this point of view and think it is very important. They have disagreements about the details of this and that, but they feel that it behooves us to intervene at this point and try to prevent it.’”

They never got to policy proposals. They never got to the second paragraph. The final statement was signed by only the moderator, who phrased it more weakly than the declaration calling for the workshop in the first place. “The guide I would suggest,” Jorling wrote, “is whether we know enough not to recommend changes in existing policy.”

Pomerance had seen enough. A consensus-based strategy would not work — could not work — without American leadership. And the United States wouldn’t act unless a strong leader persuaded it to do so — someone who would speak with authority about the science, demand action from those in power and risk everything in pursuit of justice. Pomerance knew he wasn’t that person: He was an organizer, a strategist, a fixer — which meant he was an optimist and even, perhaps, a romantic. His job was to assemble a movement. And every movement, even one backed by widespread consensus, needed a hero. He just had to find one.

The Antarctic Peninsula, where about three million pairs of penguins breed, is one of the most quickly warming areas on the planet; its average temperature has increased by five

degrees Fahrenheit over the past 75 years. Many scientists believe that this warming will endanger some penguin colonies in two ways: dwindling food and loss of nesting habitats. On the rocky shores of Deception Island, where the penguins breed, they need cold, dry land for their eggs to survive, but rising temperatures have introduced rain and pools of water to nesting sites. And because of the rapid loss of sea ice, krill — the tiny crustaceans that serve as penguins' main source of food — can't sustain the large colonies they need to thrive. The penguin population of Baily Head, in the northern part of Antarctica, seems to have dropped from 85,000 breeding pairs in 2003 to 52,000 seven years later, a decline of almost 40 percent. Scientists fear that as warm water shifts farther south along other coastal regions, larger populations of penguins could face a similar decline. Photographs by George Steinmetz for The New York Times. Video by George Steinmetz

The meeting ended Friday morning. On Tuesday, four days later, Ronald Reagan was elected president. And Rafe Pomerance soon found himself wondering whether what had seemed to have been a beginning had actually been the end.

After the election, Reagan considered plans to close the Energy Department, increase coal production on federal land and deregulate surface coal mining. Once in office, he appointed James Watt, the president of a legal firm that fought to open public lands to mining and drilling, to run the Interior Department. "We're deliriously happy," the president of the National Coal Association was reported to have said. Reagan preserved the E.P.A. but named as its administrator Anne

Gorsuch, an anti-regulation zealot who proceeded to cut the agency's staff and budget by about a quarter. In the midst of this carnage, the Council on Environmental Quality submitted a report to the White House warning that fossil fuels could "permanently and disastrously" alter Earth's atmosphere, leading to "a warming of the Earth, possibly with very serious effects." Reagan did not act on the council's advice. Instead, his administration considered eliminating the council.

At the Pink Palace, Anthony Scoville had said that the problem was not atmospheric but political. That was only half right, Pomerance thought. For behind every political problem, there lay a publicity problem. And the climate crisis had a publicity nightmare. The Florida meeting had failed to prepare a coherent statement, let alone legislation, and now everything was going backward. Even Pomerance couldn't devote much time to climate change; Friends of the Earth was busier than ever. The campaigns to defeat the nominations of James Watt and Anne Gorsuch were just the beginning; there were also efforts to block mining in wilderness areas, maintain the Clean Air Act's standards for air pollutants and preserve funding for renewable energy (Reagan "has declared open war on solar energy," the director of the nation's lead solar-energy research agency said, after he was asked to resign). Reagan appeared determined to reverse the environmental achievements of Jimmy Carter, before undoing those of Richard Nixon, Lyndon Johnson, John F. Kennedy and, if he could get away with it, Theodore Roosevelt.

Reagan's violence to environmental regulations alarmed even members of his own party. Senator Robert Stafford, a Vermont

Republican and chairman of the committee that held confirmation hearings on Gorsuch, took the unusual step of lecturing her from the dais about her moral obligation to protect the nation's air and water. Watt's plan to open the waters off California for oil drilling was denounced by the state's Republican senator, and Reagan's proposal to eliminate the position of science adviser was roundly derided by the scientists and engineers who advised him during his presidential campaign. When Reagan considered closing the Council on Environmental Quality, its acting chairman, Malcolm Forbes Baldwin, wrote to the vice president and the White House chief of staff begging them to reconsider; in a major speech the same week, "A Conservative's Program for the Environment," Baldwin argued that it was "time for today's conservatives explicitly to embrace environmentalism." Environmental protection was not only good sense. It was good business. What could be more conservative than an efficient use of resources that led to fewer federal subsidies?

Meanwhile the Charney report continued to vibrate at the periphery of public consciousness. Its conclusions were confirmed by major studies from the Aspen Institute, the International Institute for Applied Systems Analysis near Vienna and the American Association for the Advancement of Science. Every month or so, nationally syndicated articles appeared summoning apocalypse: "Another Warning on 'Greenhouse Effect,'" "Global Warming Trend 'Beyond Human Experience,'" "Warming Trend Could 'Pit Nation Against Nation.'" People magazine had profiled Gordon MacDonald, photographing him standing on the steps of the Capitol and

pointing above his head to the level the water would reach when the polar ice caps melted. “If Gordon MacDonald is wrong, they’ll laugh,” the article read. “Otherwise, they’ll gurgle.”

But Pomerance understood that in order to sustain major coverage, you needed major events. Studies were fine; speeches were good; news conferences were better. Hearings, however, were best. The ritual’s theatrical trappings — the members of Congress holding forth on the dais, their aides decorously passing notes, the witnesses sipping nervously from their water glasses, the audience transfixed in the gallery — offered antagonists, dramatic tension, narrative. But you couldn’t have a hearing without a scandal, or at least a scientific breakthrough. And two years after the Charney group met at Woods Hole, it seemed there was no more science to break through.

It was with a shiver of optimism, then, that Pomerance read on the front page of The New York Times on Aug. 22, 1981, about a forthcoming paper in Science by a team of seven NASA scientists. They had found that the world had already warmed in the past century. Temperatures hadn’t increased beyond the range of historical averages, but the scientists predicted that the warming signal would emerge from the noise of routine weather fluctuations much sooner than previously expected. Most unusual of all, the paper ended with a policy recommendation: In the coming decades, the authors wrote, humankind should develop alternative sources of energy and use fossil fuels only “as necessary.” The lead author was James Hansen.

Pomerance called Hansen to ask for a meeting. He explained to Hansen that he wanted to make sure he understood the paper's conclusions. But more than that, he wanted to understand James Hansen.

At the Goddard Institute, Pomerance entered Hansen's office, maneuvering through some 30 piles of documents arrayed across the floor like the skyscrapers of a model city, some as high as his waist. On top of many of the stacks lay a scrap of cardboard on which had been scrawled words like Trace Gases, Ocean, Jupiter, Venus. At the desk, Pomerance found, hidden behind another paper metropolis, a quiet, composed man with a heavy brow and implacable green eyes. Hansen's speech was soft, equable, deliberate to the point of halting. He would have no trouble passing for a small-town accountant, insurance-claims manager or actuary. In a sense he held all of those jobs, only his client was the global atmosphere. Pomerance's political sensitivities sparked. He liked what he saw.

As Hansen spoke, Pomerance listened and watched. He understood Hansen's basic findings well enough: Earth had been warming since 1880, and the warming would reach "almost unprecedented magnitude" in the next century, leading to the familiar suite of terrors, including the flooding of a 10th of New Jersey and a quarter of Louisiana and Florida. But Pomerance was excited to find that Hansen could translate the complexities of atmospheric science into plain English. Though he was something of a wunderkind — at 40, he was about to be named director of the Goddard Institute — he spoke with the plain-spoken Midwestern forthrightness that

played on Capitol Hill. He presented like a heartland voter, the kind of man interviewed on the evening news about the state of the American dream or photographed in the dying sun against a blurry agricultural landscape in a campaign ad. And unlike most scientists in the field, he was not afraid to follow his research to its policy implications. He was perfect.

“What you have to say needs to be heard,” Pomerance said. “Are you willing to be a witness?”

Mauritania is one of the regions in Africa most vulnerable to recurrent drought. Winds sweep desert sands and dust over formerly arable land, creating dunes that blanket roads and demolish homes. Nouakchott, the capital of Mauritania, was designed to accommodate 15,000 people. Today, more than one million people live there, because decades of severe drought and extreme weather have driven farmers to the area. “The capital city is on the seaside, and the sand covered the city in a very short period of time,” said Cheikh Kane, a climate-resilience policy adviser at the Red Cross Red Crescent Climate Center. The country, he said, is suffering “chronic food insecurity and environmental degradation.” Video by George Steinmetz for The New York Times. Video by George Steinmetz

Though few people other than Rafe Pomerance seemed to have noticed amid Reagan’s environmental blitzkrieg, another hearing on the greenhouse effect was held several weeks earlier, on July 31, 1981. It was led by Representative James Scheuer, a New York Democrat — who lived at sea level on the Rockaway Peninsula, in a neighborhood no more than four blocks wide, sandwiched between two beaches — and a

canny, 33-year-old congressman named Albert Gore Jr.

Gore had learned about climate change a dozen years earlier as an undergraduate at Harvard, when he took a class taught by Roger Revelle. Humankind was on the brink of radically transforming the global atmosphere, Revelle explained, drawing Keeling's rising zigzag on the blackboard, and risked bringing about the collapse of civilization. Gore was stunned: Why wasn't anyone talking about this? He had no memory of hearing it from his father, a three-term senator from Tennessee who later served as chairman of an Ohio coal company. Once in office, Gore figured that if Revelle gave Congress the same lecture, his colleagues would be moved to act. Or at least that the hearing would get picked up by one of the three major national news broadcasts.

Gore's hearing was part of a larger campaign he had designed with his staff director, Tom Grumbly. After winning his third term in 1980, Gore was granted his first leadership position, albeit a modest one: chairman of an oversight subcommittee within the Committee on Science and Technology — a subcommittee that he had lobbied to create. Most in Congress considered the science committee a legislative backwater, if they considered it at all; this made Gore's subcommittee, which had no legislative authority, an afterthought to an afterthought. That, Gore vowed, would change. Environmental and health stories had all the elements of narrative drama: villains, victims and heroes. In a hearing, you could summon all three, with the chairman serving as narrator, chorus and moral authority. He told his staff director that he wanted to hold a hearing every week.

It was like storyboarding episodes of a weekly procedural drama. Grumbly assembled a list of subjects that possessed the necessary dramatic elements: a Massachusetts cancer researcher who faked his results, the dangers of excessive salt in the American diet, the disappearance of an airplane on Long Island. All fit Gore's template; all had sizzle. But Gore wondered why Grumbly hadn't included the greenhouse effect.

There are no villains, Grumbly said. Besides, who's your victim?

If we don't do something, Gore replied, we're all going to be the victims.

He didn't say: *If we don't do something, we'll be the villains too*.

The Revelle hearing went as Grumbly had predicted. The urgency of the issue was lost on Gore's older colleagues, who drifted in and out while the witnesses testified. There were few people left by the time the Brookings Institution economist Lester Lave warned that humankind's profligate exploitation of fossil fuels posed an existential test to human nature. "Carbon dioxide stands as a symbol now of our willingness to confront the future," he said. "It will be a sad day when we decide that we just don't have the time or thoughtfulness to address those issues." That night, the news programs featured the resolution of the baseball strike, the ongoing budgetary debate and the national surplus of butter.

But Gore soon found another opening. Congressional staff members on the science committee heard that the White House planned to eliminate the Energy Department's carbon-

dioxide program. If they could put a hearing together quickly enough, they could shame the White House before it could go through with its plan. The Times article about Hansen's paper had proved that there was a national audience for the carbon-dioxide problem — it just had to be framed correctly. Hansen could occupy the role of hero: a mild-mannered scientist who had seen the future and now sought to rouse the world to action. A villain was emerging, too: Fred Koomanoff, Reagan's new director of the Energy Department's carbon-dioxide program, a Bronx native with the manner of a sergeant major and an unconstrained passion for budget-cutting. Each man would testify.

Hansen did not disclose to Gore's staff that, in late November, he received a letter from Koomanoff declining to fund his climate-modeling research despite a promise from Koomanoff's predecessor. Koomanoff left open the possibility of funding other carbon-dioxide research, but Hansen was not optimistic, and when his funding lapsed, he had to release five employees, half his staff. Koomanoff, it seemed, would not be moved. But the hearing would give Hansen the chance to appeal directly to the congressmen who oversaw Koomanoff's budget.

Hansen flew to Washington to testify on March 25, 1982, performing before a gallery even more thinly populated than at Gore's first hearing on the greenhouse effect. Gore began by attacking the Reagan administration for cutting funding for carbon-dioxide research despite the "broad consensus in the scientific community that the greenhouse effect is a reality." William Carney, a Republican from New York, bemoaned the

burning of fossil fuels and argued passionately that science should serve as the basis for legislative policy. Bob Shamansky, a Democrat from Ohio, objected to the use of the term “greenhouse effect” for such a horrifying phenomenon, because he had always enjoyed visiting greenhouses. “Everything,” he said, “seems to flourish in there.” He suggested that they call it the “microwave oven” effect, “because we are not flourishing too well under this; apparently, we are getting cooked.”

There emerged, despite the general comity, a partisan divide. Unlike the Democrats, the Republicans demanded action. “Today I have a sense of déjà vu,” said Robert Walker, a Republican from Pennsylvania. In each of the last five years, he said, “we have been told and told and told that there is a problem with the increasing carbon dioxide in the atmosphere. We all accept that fact, and we realize that the potential consequences are certainly major in their impact on mankind.” Yet they had failed to propose a single law. “Now is the time,” he said. “The research is clear. It is up to us now to summon the political will.”

Gore disagreed: A higher degree of certainty was required, he believed, in order to persuade a majority of Congress to restrict the use of fossil fuels. The reforms required were of such magnitude and sweep that they “would challenge the political will of our civilization.”

Yet the experts invited by Gore agreed with the Republicans: The science was certain enough. Melvin Calvin, a Berkeley chemist who won the Nobel Prize for his work on the carbon cycle, said that it was useless to wait for stronger evidence of

warming. “You cannot do a thing about it when the signals are so big that they come out of the noise,” he said. “You have to look for early warning signs.”

Hansen’s job was to share the warning signs, to translate the data into plain English. He explained a few discoveries that his team had made — not with computer models but in libraries. By analyzing records from hundreds of weather stations, he found that the surface temperature of the planet had already increased four-tenths of a degree Celsius in the previous century. Data from several hundred tide-gauge stations showed that the oceans had risen four inches since the 1880s. Most disturbing of all, century-old glass astronomy plates had revealed a new problem: Some of the more obscure greenhouse gases — especially chlorofluorocarbons, or CFCs, a class of man-made substances used in refrigerators and spray cans — had proliferated wildly in recent years. “We may already have in the pipeline a larger amount of climate change than people generally realize,” Hansen told the nearly empty room.

Gore asked when the planet would reach a point of no return — a “trigger point,” after which temperatures would spike. “I want to know,” Gore said, “whether I am going to face it or my kids are going to face it.”

“Your kids are likely to face it,” Calvin replied. “I don’t know whether you will or not. You look pretty young.”

It occurred to Hansen that this was the only political question that mattered: How long until the worst began? It was not a question on which geophysicists expended much effort; the

difference between five years and 50 years in the future was meaningless in geologic time. Politicians were capable of thinking only in terms of electoral time: six years, four years, two years. But when it came to the carbon problem, the two time schemes were converging.

“Within 10 or 20 years,” Hansen said, “we will see climate changes which are clearly larger than the natural variability.”

James Scheuer wanted to make sure he understood this correctly. No one else had predicted that the signal would emerge that quickly. “If it were one or two degrees per century,” he said, “that would be within the range of human adaptability. But we are pushing beyond the range of human adaptability.”

“Yes,” Hansen said.

How soon, Scheuer asked, would they have to change the national model of energy production?

Hansen hesitated — it wasn’t a scientific question. But he couldn’t help himself. He had been irritated, during the hearing, by all the ludicrous talk about the possibility of growing more trees to offset emissions. False hopes were worse than no hope at all: They undermined the prospect of developing real solutions.

“That time is very soon,” Hansen said finally.

“My opinion is that it is past,” Calvin said, but he was not heard because he spoke from his seat. He was told to speak into the microphone.

“It is already later,” Calvin said, “than you think.”

Last year, the California fire season was the most destructive in the state's history, culminating in a series of wine-country blazes that killed 40 people and leveled more than 8,000 homes and other buildings. That winter had been one of California's rainiest, which caused grass to grow in areas it normally doesn't; in the summer those grasses dried out, adding kindling to an already fire-prone state. "The day before the Santa Rosa fires," said Daniel Swain, a climate scientist at the University of California, Los Angeles, "the vegetation was at record-high values for dryness, and just weeks before, the vegetation was at a record high for the century. This was following the hottest summer on record." He added: "There's this component of vegetation dryness that matters. It affects how intense the burn is and how receptive the fuels are to embers." Video by George Steinmetz for The New York Times.
Video by George Steinmetz

From Gore's perspective, the hearing was an unequivocal success. That night Dan Rather devoted three minutes of "CBS Evening News" to the greenhouse effect. A correspondent explained that temperatures had increased over the previous century, great sheets of pack ice in Antarctica were rapidly melting, the seas were rising; Calvin said that "the trend is all in the direction of an impending catastrophe"; and Gore mocked Reagan for his shortsightedness. Later, Gore could take credit for protecting the Energy Department's carbon-dioxide program, which in the end was largely preserved.

But Hansen did not get new funding for his carbon-dioxide research. He wondered whether he had been doomed by his

testimony or by his conclusion, in the Science paper, that full exploitation of coal resources — a stated goal of Reagan's energy policy — was "undesirable." Whatever the cause, he found himself alone. He knew he had done nothing wrong — he had only done diligent research and reported his findings, first to his peers, then to the American people. But now it seemed as if he was being punished for it.

Anniek could read his disappointment, but she was not entirely displeased. Jim cut down on his work hours, leaving the Goddard Institute at 5 o'clock each day, which allowed him to coach his children's basketball and baseball teams. (He was a patient, committed coach, detail-oriented, if a touch too competitive for his wife's liking.) At home, Jim spoke only about the teams and their fortunes, keeping to himself his musings — whether he would be able to secure federal funding for his climate experiments, whether the institute would be forced to move its office to Maryland to cut costs.

But perhaps there were other ways forward. Not long after Hansen laid off five of his assistants, a major symposium he was helping to organize received overtures from a funding partner far wealthier and less ideologically blinkered than the Reagan administration: Exxon. Following Henry Shaw's recommendation to establish credibility ahead of any future legislative battles, Exxon had begun to spend conspicuously on global-warming research. It donated tens of thousands of dollars to some of the most prominent research efforts, including one at Woods Hole led by the ecologist George Woodwell, who had been calling for major climate policy as early as the mid-1970s, and an international effort coordinated

by the United Nations. Now Shaw offered to fund the October 1982 symposium on climate change at Columbia's Lamont-Doherty campus.

As an indication of the seriousness with which Exxon took the issue, Shaw sent Edward David Jr., the president of the research division and the former science adviser to Nixon. Hansen was glad for the support. He figured that Exxon's contributions might go well beyond picking up the bill for travel expenses, lodging and a dinner for dozens of scientists at the colonial-style Clinton Inn in Tenafly, N.J. As a gesture of appreciation, David was invited to give the keynote address.

There were moments in David's speech in which he seemed to channel Rafe Pomerance. David boasted that Exxon would usher in a new global energy system to save the planet from the ravages of climate change. He went so far as to argue that capitalism's blind faith in the wisdom of the free market was "less than satisfying" when it came to the greenhouse effect. Ethical considerations were necessary, too. He pledged that Exxon would revise its corporate strategy to account for climate change, even if it were not "fashionable" to do so. As Exxon had already made heavy investments in nuclear and solar technology, he was "generally upbeat" that Exxon would "invent" a future of renewable energy.

Hansen had reason to feel upbeat himself. If the world's largest oil-and-gas company supported a new national energy model, the White House would not stand in its way. The Reagan administration was hostile to change from within its ranks. But it couldn't be hostile to Exxon.

It seemed that something was beginning to turn. With the carbon-dioxide problem as with other environmental crises, the Reagan administration had alienated many of its own supporters. The early demonstrations of autocratic force had retreated into compromise and deference. By the end of 1982, multiple congressional committees were investigating Anne Gorsuch for her indifference to enforcing the cleanup of Superfund sites, and the House voted to hold her in contempt of Congress; Republicans in Congress turned on James Watt after he eliminated thousands of acres of land from consideration for wilderness designation. Each cabinet member would resign within a year.

The carbon-dioxide issue was beginning to receive major national attention — Hansen's own findings had become front-page news, after all. What started as a scientific story was turning into a political story. This prospect would have alarmed Hansen several years earlier; it still made him uneasy. But he was beginning to understand that politics offered freedoms that the rigors of the scientific ethic denied. The political realm was itself a kind of Mirror World, a parallel reality that crudely mimicked our own. It shared many of our most fundamental laws, like the laws of gravity and inertia and publicity. And if you applied enough pressure, the Mirror World of politics could be sped forward to reveal a new future. Hansen was beginning to understand that too.

From a stray comment in an obscure coal report to portentous front-page headlines in the national press and hearings on Capitol Hill — in just three years, Rafe Pomerance had watched as an issue considered esoteric even within the

scientific community rose nearly to the level of action, the level at which congressmen made statements like, “It is up to us now to summon the political will.” Then, overnight, it died. Pomerance knew, from tired experience, that politics didn’t move in a straight line, but jaggedly, like the Keeling curve — a slow progression interrupted by sharp seasonal declines. But in the fall of 1983, the climate issue entered an especially long, dark winter. And all because of a single report that had done nothing to change the state of climate science but transformed the state of climate politics.

After the publication of the Charney report in 1979, Jimmy Carter had directed the National Academy of Sciences to prepare a comprehensive, $1 million analysis of the carbon-dioxide problem: a Warren Commission for the greenhouse effect. A team of scientist-dignitaries — among them Revelle, the Princeton modeler Syukuro Manabe and the Harvard political economist Thomas Schelling, one of the intellectual architects of Cold War game theory — would review the literature, evaluate the consequences of global warming for the world order and propose remedies. Then Reagan won the White House.

For the next three years, as the commission continued its work — drawing upon the help of about 70 experts from the fields of atmospheric chemistry, economics and political science, including veterans of the Charney group and the Manhattan Project — the incipient report served as the Reagan administration’s answer to every question on the subject. There could be no climate policy, Fred Koomanoff and his associates said, until the academy ruled. In the Mirror World of

the Reagan administration, the warming problem hadn't been abandoned at all. A careful, comprehensive solution was being devised. Everyone just had to wait for the academy's elders to explain what it was.

On Oct. 19, 1983, the commission finally announced its findings at a formal gala, preceded by cocktails and dinner in the academy's cruciform Great Hall, a secular Sistine Chapel, with vaulted ceilings soaring to a dome painted as the sun. An inscription encircling the sun honored science as the "pilot of industry," and the academy had invited the nation's foremost pilots of industry: Andrew Callegari, the head of Exxon's carbon-dioxide research program, and vice presidents from Peabody Coal, General Motors and the Synthetic Fuels Corporation. They were eager to learn how the United States planned to act, so they could prepare for the inevitable policy debates. Rafe Pomerance was eager, too. But he wasn't invited.

He did manage, however, to get into a crowded press briefing earlier that day, where he grabbed a copy of the 500-page report, "Changing Climate," and scanned its contents. Its scope was impressive: It was the first study to encompass the causes, effects and geopolitical consequences of climate change. But as he flipped through, Pomerance surmised that it offered no significant new findings — nothing that wasn't in the Charney report or the blue-ribbon studies that had been published since. "We are deeply concerned about environmental changes of this magnitude," read the executive summary. "We may get into trouble in ways that we have barely imagined."

The authors did try to imagine some of them: an ice-free Arctic, for instance, and Boston sinking into its harbor, Beacon Hill an island two miles off the coast. There was speculation about political revolution, trade wars and a long quotation from “A Distant Mirror,” a medieval history written by Pomerance’s aunt, Barbara Tuchman, describing how climate changes in the 14th century led to “people eating their own children” and “feeding on hanged bodies taken down from the gibbet.” The committee’s chairman, William Nierenberg — a Jason, presidential adviser and director of Scripps, the nation’s pre-eminent oceanographic institution — argued that action had to be taken immediately, before all the details could be known with certainty, or else it would be too late.

That’s what Nierenberg wrote in “Changing Climate.” But it’s not what he said in the press interviews that followed. He argued the opposite: There was no urgent need for action. The public should not entertain the 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.

By the end of the 21st century, scientists predict that Switzerland could face a temperature increase of five degrees Fahrenheit because of climate change; by then, a majority of central Switzerland's glaciers will have disappeared. Twenty years ago, there was no lake in this location — the flat tongue of Trift Glacier filled the basin completely, and mountaineers were able to walk across it to get to the other side of the valley. "Global warming will most likely eliminate most of the glacier ice in the Alps within a few decades," said Wilfried Haeberli, a glaciologist at the University of Zurich. "We are now looking at the tipping of the first domino piece — glaciers — in a complex system of domino pieces, natural systems on earth. And we are losing options for action. It is too late to save the glaciers." Video by George Steinmetz for The New York Times. Video by George Steinmetz

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.

Thirty years ago, the waters of Lake Tai, China’s third-largest lake, were clear of algae. But the lake is surrounded by several high-density cities, including Shanghai, Suzhou and Changzhou, metropolitan areas that have grown rapidly in the past few decades. Rampant sewer dumping and livestock drainage, combined with shifting agricultural practices, allowed the algae blooms to flourish, and now human mismanagement and global warming have entrenched them. “They love warm, stagnant, nutrient-rich conditions,” said Hans Paerl, a professor of marine and environmental sciences at the University of North Carolina, Chapel Hill. Over the past decade, the blooms have significantly expanded, and their season has grown longer. In 2007, the “pea soup” conditions of the lake were so bad, Paerl said, that the cities surrounding the basin “had green slime coming out of their faucets, and the

central government had to bring in drinking water." At least two million people were without fresh water. Photographs by George Steinmetz for The New York Times. Video by George Steinmetz

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 *political* problem. 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.

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.

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 nearly one 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.

In March, Geophysical Research Letters reported that the western part of Greenland’s ice sheet is melting at its fastest rate in at least 450 years. Some scientists believe that the Arctic hasn’t seen ice melt like this in 5,000 years. If the ice sheet melts entirely, sea levels would rise 20 feet, leaving Lower Manhattan underwater. Jason Gulley, a geologist, and Celia Trunz, a Ph.D. student in geology, have been conducting meltwater research by releasing a fluorescent red dye to determine how and why more rivers form on the surface of the ice sheet and what will happen as a result of these new and turbulent flows. So far, they have found that the rivers lubricate the ice slab, making the sheets move faster toward the coasts, which could cause even more icebergs to calve into the ocean. Video by George Steinmetz for The New York Times.
Video by George Steinmetz

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.

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.

Shark Bay, an 8,500-square-mile Unesco World Heritage Site, is home to the largest sea-grass meadows in the world. These subtropical forests are home to thousands of large sharks, fish, sea turtles, bottlenose dolphins and dugongs, a mammal related to the manatee. In 2011, during an extreme, prolonged heat wave, shallow waters in the bay reached 93 degrees Fahrenheit, the hottest temperature ever recorded there; an estimated 22 percent of the sea grass disappeared, leaving bare sands in vast areas. "The water was four degrees Celsius warmer than usual for that time of year — everything cooked," said Elizabeth Sinclair, a senior research fellow at the University of Western Australia. "The sea grass is like a rain forest. They provide the habitat and food for a lot of species. If you take away the home and food, there's nothing left but a complete collapse of an ecosystem." The 8,000-year-old sea-grass meadows also stored carbon dioxide; when they died, they released up to the equivalent of what two coal-fired power plants or 1.6 million cars emit into the atmosphere each year.

Video by George Steinmetz for The New York Times. Video by George Steinmetz

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."

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.”

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.

Last year's monsoons, which typically run from June through September, were the worst in 40 years, and more than eight million Bangladeshis were affected by the devastation. At least 145 people died, an estimated 307,000 people were forced into emergency shelters, 700,000 homes were damaged or destroyed and about a third of Bangladesh was submerged. Areas along the Bay of Bengal, long prone to chronic flooding, have become increasingly uninhabitable. Scientists believe that a sharp rise in the bay's surface temperature is why Bangladesh has suffered some of the fastest sea-level rises in the world. Some project a five-foot rise by 2100, which could displace 50 million people. Video by George Steinmetz for The New York Times. Video by George Steinmetz

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.

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.