ENERGY AND POLICY INSTITUTE

Utilities Knew

Documenting Electric Utilities' Early Knowledge and Ongoing Deception on Climate Change From 1968-2017

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The Energy and Policy Institute is a watchdog organization working to expose attacks on renewable energy and counter misinformation by fossil fuel and utility interests. It does not receive funding from for-profit corporations or trade associations.

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Introduction

In this report, the Energy and Policy Institute presents the findings of its investigation into what electric utilities knew about climate change in the years before the issue emerged firmly onto the public stage in 1988, along with information about the industry's role since then in ongoing efforts to spread disinformation about climate science and block legal limits on heat-trapping carbon dioxide emissions.

It is a story with striking parallels to the ongoing investigations into what ExxonMobil and the oil industry knew decades ago, long before they joined with electric utilities, automakers, and manufacturers to sow doubt about the causes and risks of climate change. It is also a story that is analogous to the investigations into the tobacco industry's early knowledge about the health risks of smoking, and its deliberate decision to mislead the American people about those risks.

Long forgotten and overlooked documents reviewed for this report reveal that by 1968, scientists had begun to directly warn the electric utility industry about the possibly catastrophic effects that carbon dioxide emissions from burning fossil fuels could one day have on the Earth and its climate. Scientific understanding of climate change then was limited compared to what we know today, but by 1971 electric utilities knew enough to include a modest budget for research into the climatological "effects of CO2" and other power plant emissions in the industry's long-term national research and development goals for through the year 2000.

The documents also show that electric utilities, through the largely customer-funded Edison Electric Institute (EEI) and Electric Power Research Institute (EPRI), sponsored cutting-edge climate research during the 1970s and early 1980s. For example, starting in 1982, EPRI sponsored research by influential scientist Charles Keeling and the Scripps Institution of Oceanography that documented "virtually all that we knew at the time from measurements of atmospheric CO2."

The work of EEI, the trade association of investor-owned utilities, and EPRI, the utilities' research and development organization, during the 1970s and early 1980s carried early

warnings about the possible future rise in atmospheric CO2 levels and global temperatures. It echoed early scientific predictions about future climate change impacts, including the eventual melting of sea ice and coastal flooding. In 1977, a senior EPRI official warned Congress about the possible need to one day curtail the use of fossil fuels in order limit CO2 emissions. Utility-sponsored research confirmed that a global effort could be required to address the problem. Some experts cautioned the industry that waiting too long to act risked locking in harmful levels of climate change.

During the same time period, electric utilities pushed coal - the largest emitter of CO2 among fossil fuels - as a solution to the energy crisis, and made significant long-term investments in new coal-fired power generation. One EPRI official expressed uncertainty about the environmental and health impacts associated with increased use of coal. American Electric Power paid for a 1976 ad in *The New York Times* that claimed, "We must expand our use of coal."

"The problems generally associated with the mining and burning of coal have been solved," the 1976 AEP ad said. "Except - the destructive, regressive actions of a small minority… the fanatical environmentalists."

In 1988, EPRI acknowledged that "There is growing consensus in the scientific community that the greenhouse effect is real." After 1988, when the issue of climate change emerged firmly onto the public stage, internal documents show that the electric utility industry coordinated with fossil fuel interests on early disinformation campaigns that targeted climate science. For example, the Edison Electric Institute and Southern Company spearheaded the 1991 Information Council on the Environment ad campaign, which aimed to "reposition global warming as theory (not fact)."

Largely as a result of the electric utility industry's years of over-reliance on fossil fuels and opposition to legal limits on CO2 emissions from power plants, annual CO2 emissions from the electricity sector in the U.S. did not peak until around 2007. As of 2016, the electricity sector's annual CO2 emissions remained higher than they were in 1989. Documents show that in 1989, electric utilities joined forces with other industrial interests to launch the Global Climate Coalition, which would wage war on climate science until 2002.

Nearly 50 years has passed since a science advisor to President Lyndon B. Johnson warned of the possible climate risks of burning fossil fuels at EEI's 1968 Annual Convention. Some electric utilities, such as Southern Company, still continue to fight against legal limits on CO2 emissions from power plants. Many continue to fund special interest groups that attack climate science, such as the U.S. Chamber of Commerce, where one senior official recently claimed that climate concerns are based on "religion" and not "scientific facts." In 2017, major electric utilities - including AES Corp., Dominion Energy, DTE Energy, Duke Energy, PPL, and Southern Company - also resisted growing calls from investors to develop plans to align their business models with the global Paris agreement goal of limiting global warming to 2°C or less.

Research has shown that electric utilities could face serious financial repercussions if ever held liable for the climate change damages incurred by their power plant emissions. The New York State Office of the Attorney General has reached settlements with three major electric utilities and coal producer Peabody Energy after investigations into whether these companies adequately disclosed financial risks related to climate change to investors. It is also investigating ExxonMobil on similar grounds. A former Department of Justice attorney who prosecuted tobacco companies believes that fossil fuel interests should also be investigated based on evidence that they similarly misled the public about climate change.

The evidence compiled by the Energy and Policy Institute shows that the electric utility industry knew about the possible climate change risks of burning fossil fuels as far back as 1968, and likely earlier. But today EEI's website only traces the industry's involvement in the issue back 30 years to 1987, and details about its current work on climate change are locked away in a password protected "Climate Workroom." In 2014, EPRI claimed that it "has been involved in global climate change-related research for more than 20 years" in comments delivered to the Environmental Protection Agency.

This report documents the nearly 50-year long history of electric utilities and climate change. It's a history that the electric utility industry apparently believed and perhaps wished to be long forgotten, but is now resurrected.

The methodology behind this report

The information found in this report is largely unknown to most Americans who have no choice but to pay their electric utility every month, and who strongly support legal limits on CO2 from power plants. It is based on sources including academic databases, government archives, old industry journals, and university libraries. It also builds off the work that's been previously done by environmentalists and reporters to document the role of the fossil fuel and utility industries in perpetuating climate change denial.

This report focused on documents from a time period beginning in the 1960s, and not every document identified in this report could be obtained by the time of publication due to their age and scarcity. It also largely focused on two industry groups - the Edison Electric Institute and Electric Power Research Institute - that draw broad support from the electric utility industry, rather than attempt a deep dive into the histories of every one of the nation's numerous electric companies (though the report does cover details about a number of these companies). As such, it leaves many threads for other researchers to pull.

What this report is unable to reveal in much depth are the private internal conversations that electric utility officials had about climate change behind closed doors prior to 1988. Some secrets can only be revealed by leaks and whistleblowers, or the kind of document disclosure that a serious legal investigation can provide. As such, the information found in this report should be considered just the tip of the iceberg regarding electric utilities' early knowledge of climate change risks, and how they responded to the threat. All documents and sources are cited from links within the report text.

Southern Company's 2017 flashback to the 1960s

Sam Booher stood before the microphone at Southern Company's 2017 annual meeting in Atlanta, and offered his advice to Thomas Fanning, the CEO of this major electric utility company.

"I would like to see Southern Company organize the collective voices of all our electric power producers to support the existing Paris agreement to fight climate change," said Booher, a Southern Company shareholder and member of the Georgia chapter of the Sierra Club.

At the meeting, Southern Company faced a shareholder proposal that called on the utility to develop a report on its strategy for aligning its business model with the global Paris Agreement goal of limiting global warming to 2°C. Southern Company recommended that shareholders vote against the proposal, which received a strong 46 percent show of support despite management's opposition.

"We choose, we have chosen over the years, to stay away from the rhetoric or the discussion on the science of climate change and a variety of other things, and rather say, 'I want to figure out a way to deal with the emission of CO2.'," Fanning said in his response to Booher.

In reality, Fanning himself weighed in on climate science as recently as a March 2017 interview interview with the Squawk Box on CNBC:

"Do you think it's been proven that CO2 is the primary climate control knob?" Fanning was asked.

Thomas Fanning. March 2017. Credit: CNBC

"No, certainly not," Fanning said. "Is climate change happening? Certainly, it's been happening for millenia. That's not the issue, okay?"

CNBC set the record straight and pointed to the Environmental Protection Agency's website, which at the time said, "carbon dioxide is the primary greenhouse gas that is contributing to recent climate change."

At the time of Fanning's interview with CNBC, he also served as chairman of the Edison Electric Institute (EEI), the industry trade association that represents the nation's investor owned electric utilities. EEI and its utility members responded to Fanning's climate science denial with virtual silence. Fanning was the public face of the electric utility industry, yet no effort was made to set the record straight regarding the misleading statements about climate change he made on national television.

Fanning had doubled down on Southern Company's well documented record of deception on climate change. For example, documents obtained by Greenpeace and the Climate Investigations Center have revealed that Southern Company secretly funded the work of "climate misinformer" Dr. Wei-hock "Willie" Soon from 2008 to 2015. In 1991, leaked documents exposed the role of EEI and Southern Company in the Information Council on the Environment (ICE), an early industry-backed disinformation campaign to "reposition global warming as theory (not fact)."

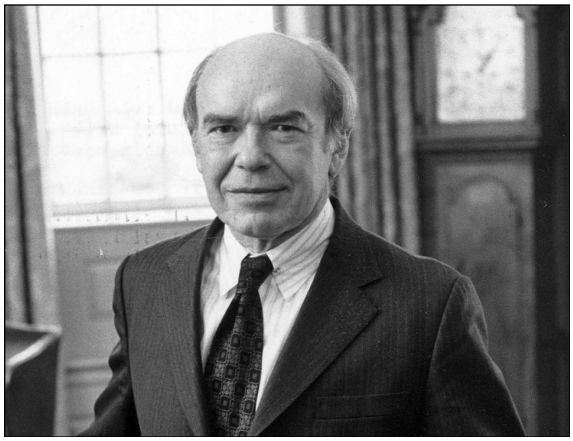
A line in Southern Company's 2017 proxy statement to shareholders also claimed the company's history of research and development efforts included a "Major focus on greenhouse gas emissions reduction and a record of technology advancement dating back to the 1960s."

"As an industry leader in the research, development and deployment of technologies that reduce carbon dioxide (CO2) emissions, the Company has committed substantial financial and human resources to these efforts since the 1960s," it also said.

It's not alone. The Energy and Policy Institute's investigation found that by 1968, scientists had begun to warn the electric utility industry about the possible threat that CO2 emissions from burning fossil fuels could one day pose to the Earth and its climate. Three years later, in

1971, the electric utility industry included research into the climatological "effects of CO2" emissions from power plants in its long-term research and development goals. Despite this early knowledge and effort, some bad actors within the electric utility industry went on to spearhead disinformation campaigns against climate science and solutions.

The 1960s: Early warnings



Dr. Donald F. Hornig. Credit: Brown University

On June 4, 1968, Dr. Donald F. Hornig, a science advisor to President Lyndon B. Johnson, addressed the Annual Convention of the Edison Electric Institute. Hornig warned that the federal government was looking into the possible effects that carbon dioxide emissions from burning fossil fuels could have the earth's climate:

Many of the problems we now face in managing our environment are a simple consequence of the ever-increasing scale of man's activities. We threaten to overwhelm nature – not just our streams and the air over our cities, but possibly even on a global scale. The President's Science Advisory Committee, in its report "Restoring the Quality of Our Environment," estimated that at the anticipated levels of fuel consumption by the year 2000, the carbon dioxide level in the entire earth's atmosphere will be increased 25 percent, and carbon dioxide is an absolutely unavoidable product of the combustion of fossil fuels.

Carbon dioxide is not toxic, but it is the chief heat-absorbing component of the atmosphere. Such a change in the carbon dioxide level might, therefore, produce major consequences on the climate – possibly even triggering catastrophic effects such as have occurred from time to time in the past. We are looking further into this question, but the scientific base for sound prediction is still very weak.

Hornig's warning came during the same year that scientists at the Stanford Research Institute prepared a final report to the American Petroleum Institute that sounded the early alarm on climate change for the fossil fuel industry, a document later unearthed by the Center for International Environmental Law in 2016.

Hornig mentioned his role in two earlier federal government reports that raised concerns about CO2 emissions and climate change, reports that involved representatives from electric utilities. One of these reports, "Restoring the Quality of Our Environment," included a section on "Atmospheric Carbon Dioxide," authored by Drs. Roger Revelle, Charles D.

Keeling, and other pioneers of modern climate science. The members of the Environmental Pollution Panel listed elsewhere in this 1965 White House report also included Louis H. Roddis, then president of the Pennsylvania Electric Company, or Penelec, which today is a subsidiary of FirstEnergy.

This report was released by the White House in November of 1965, along with a warning:

Carbon dioxide is being added to the earth's atmosphere by the burning of coal, oil, and natural gas at the rate of 6 billion tons a year. By the year 2000 there will be about 25 percent more carbon dioxide in our atmosphere than at present.

Hornig also mentioned his role in the Interdepartmental Energy Study's 1964 report, "Energy R&D and National Progress," that was ordered by President John F. Kennedy prior to his assassination in 1963. This report, which ran into the hundreds of pages, identified priorities for the nation's energy research and development efforts. The Energy and Policy Institute obtained a copy and posted excerpts from sections of the report relevant to our investigation online.

Representatives from the electric utility industry contributed to the broader suite of issues covered by report, and were likely aware of its general contents. Among them were officials from:

- American Electric Power
- Arkansas Power & Light
- Detroit Edison Company
- Edison Electric Institute
- Pacific Gas and Electric Company
- Pennsylvania Electric Company
- Southern California Edison
- Southern Services, Inc. (Southern Company)
- Tennessee Valley Authority
- Union Electric Company

Officials from the fossil fuel and auto industries also made contributions, including representatives from:

- American Petroleum Institute
- American Gas Association
- Continental Oil Company (now Conoco)
- Ford Motor Company

- Gulf Research and Development
- Independent Petroleum Association of America
- Chrysler Motors
- Esso Research & Engineering Company (now ExxonMobil)
- Ford Motor Company
- General Electric
- Humble Oil and Refining Company (now ExxonMobil)
- Northern Natural Gas Company
- Peabody Coal Company
- Phillips Petroleum (now ConocoPhillips)
- Shell Oil Company
- Socony Mobil Oil Company (now ExxonMobil)
- Standard Oil Company
- Texaco, Inc.
- Union Oil Company of California (now Chevron)
- Westinghouse Electric Corporation

Among the R&D issues identified by the Interdepartmental Energy Study report was the need to develop technological solutions to carbon dioxide "pollution" from fossil fuels:

Additional R&D is needed to devise economic methods for adequate control of particulate and gaseous air pollution from sulfur and carbon dioxides, oxides of nitrogen, and incompletely burned hydrocarbons. The only sure way to prevent increased air pollution by fossil fuels is to decrease emissions.

A chapter in the same report on the "Environmental Aspects of Energy Development" also covered carbon dioxide as a pollution problem in some detail. "The possible effects upon the weather of increased carbon dioxide in the atmosphere by the year 2000 have aroused some concerns," the section on carbon dioxide began. This section also cited a landmark 1956 paper, "Carbon Dioxide and the Climate," by Gilbert N. Plass, whose work would later be recognized as "pivotal in the establishment of the central role of carbon dioxide in climate change, and in the danger that anthropogenic carbon emissions posed to the Earth's climate system."

Various perspectives on the CO2 issue were also presented in the Interdepartmental Energy Study report. "On one side, it must be realized that the current rate of population growth, with its current disturbance of the carbon cycle through the combustion of fossil fuels, represents the greatest ecological upheaval in human history," the report said. But another view offered by the report suggested that, qualitatively, the role of plants and oceans as

possible natural sinks for absorbing CO2 emissions provided some hope that the problem would not be one of "alarming magnitude," though the general timeframe analyzed for the report extended only through the year 2000. Similarly optimistic views about the possible effects of CO2 emissions from fossil fuels were expressed publicly by Robert E. Wilson of the Standard Oil Company of Indiana in 1937 and Dr. M.A. Matthews of Shell International Chemical Company in 1959. But by 1959, physicist Dr. Edward Teller had delivered an early warning about the possible climate risks of burning fossil fuels at the Energy and Man Symposium hosted by the American Petroleum Institute and Columbia University.

"In the absence of quantitative knowledge, however, research aimed at defining this problem is needed, together with watchful measurement of world temperatures and atmospheric CO2 concentrations," the carbon dioxide section of the 1964 Interdepartmental Energy Study report concluded.

While many unknowns remained in climate science at the time, the federal government knew enough by 1964 to recommend further research and the development of technologies that could control CO2 emissions from fossil fuels.

Dr. Hornig's 1968 address brought the federal government's early climate change concerns right to the electric utility industry's doorstep. It wasn't the last warning the industry would receive during the 1960's.

Dr. Glenn T. Seaborg, chairman of the U.S. Atomic Energy Commission, voiced similar concerns one year later, when he addressed EEI's 1969 Annual Convention. Seaboard said:

Take the matter of air pollution. While fossil-fueled power plants emit Sulphur, nitrogen, and carbon oxides to the atmosphere, nuclear power does not add these pollutants to our increasing burden of air pollution. Efforts are underway to reduce the Sulphur content of fossil fuels, but no methods are known of eliminating the carbon dioxide that results from combustion, and many scientists see its increase in the atmosphere as a long-term problem of major consequence.

That same year, Ralph H. Mislop, vice president of Portland General Electric Company (PGE), and chairman of EEI's Public Relations Committee, gave a speech to the Outdoor Seminar on Oregon's Environment:

Nuclear energy can eliminate the growing concern scientists have over the increasing CO2 concentration in the earth's atmosphere, and the possible long-term effects of consequent higher earthly temperature.

Like Seaborg, Mislop understood that scientific concerns about CO2 emissions posed a potential problem for electric utilities, but also saw an opportunity to advance nuclear power as an alternative to fossil fuels (an argument which utilities that own nuclear power plants continue to make in 2017).

By the end of the 1960's, the electric utility industry had heard from two top federal scientists and one of their own executives about the possible risks that CO2 emissions from burning fossil fuels could one day pose to the climate, and were involved in the development of federal government reports that led the White House to weigh in on the potential threat. During the 1970's, documents show that the industry did more than just listen to these climate concerns.

The 1970s: Electric utilities, climate change, and the Energy Crisis

At the 1971 Annual Convention of the Edison Electric Institute, Dr. Carroll L. Wilson, a professor from the Sloan School of Management at the Massachusetts Institute of Technology, again sounded the alarm about climate change:

It is likely that the principal impact in terms of climate change will arise if it does from the combustion of hydrocarbons. If a consensus arose that we had to limit or curtail the use of hydrocarbons because of their impact on climate, the implications would be enormous. Our only present alternative would be nuclear power and an electric energy society. Obviously, the implications for the electric power industry are enormous.

Wilson spoke of global warming, melting sea ice, and rising oceans as among the possible long-term effects of the buildup of CO2 emissions from fossil fuel combustion, and he identified several areas where further research was needed on CO2 emissions and climate change.

"In what I have said about carbon dioxide and will say later about other products of combustion, one may ask why we know so little and why our models are so primitive," he said. "The real reason is that no one has cared."

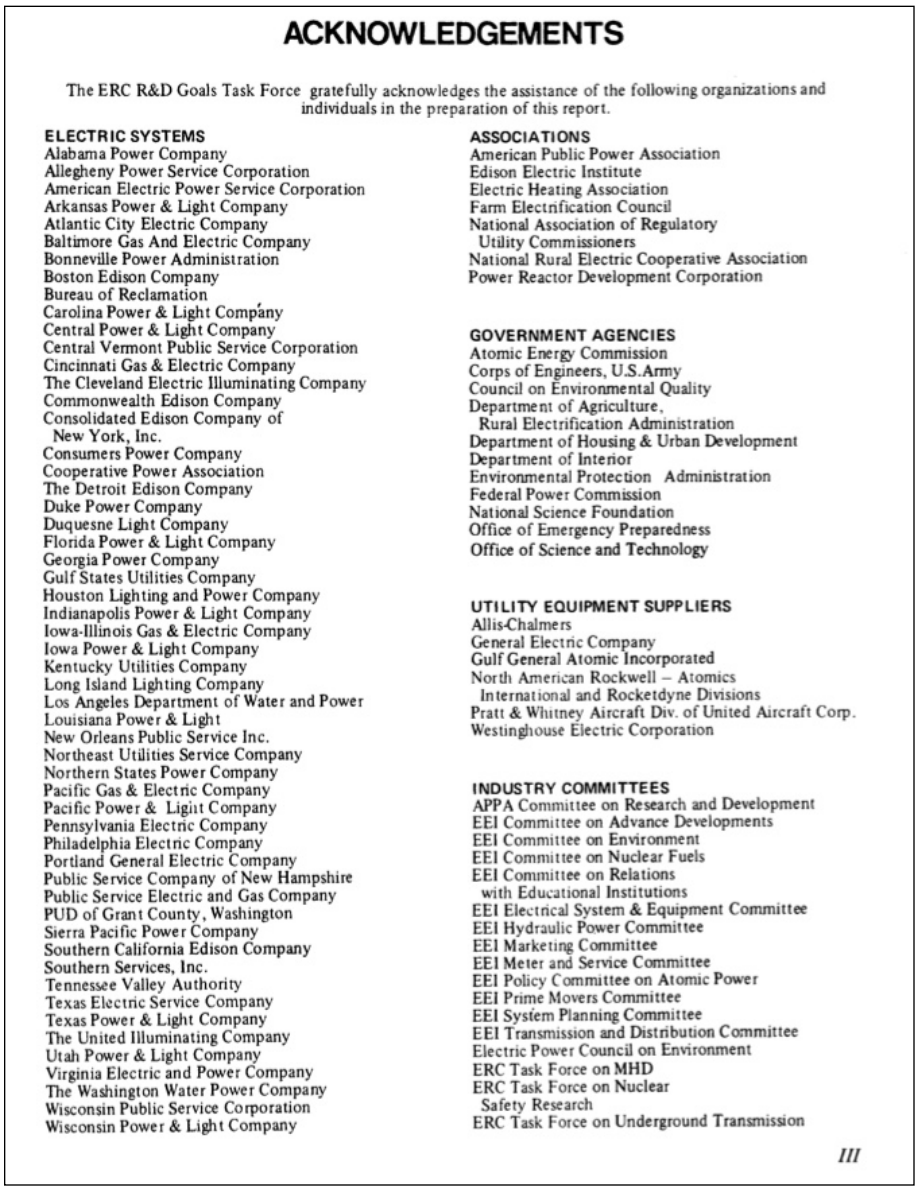
Wilson's address at EEI's annual convention occurred in June of 1971, and that same month electric utilities showed they cared enough about the possible threat posed by climate change to include long-term research into climatological "effects of CO2" and other power plant emissions in the industry's long-term research and development goals.

1971: The electric utility industry included climate research in its long-term R&D goals

The Electric Research Council's 1971 report, "Electric Utilities Industry Research and Development Goals Through the Year 2000," was the result of contributions from more than 50 of the nation's electric utilities, as well as representatives from industry associations,

research organizations, and government regulators. One goal was to "Develop ecosystem and climatological models to predict the long-term effects caused by power generation." The report also contained a description of the problem:

"Is man detrimentally modifying, on a long-term basis, his environment?" is a difficult question to answer. This supporting goal is aimed at answering the portion of the question as it relates to power generation. Investigations should include research into carbon dioxide sources and sinks, effects of moisture, the greenhouse effect as modified by particulates, and development of meteorological models which would allow predictive determination of the effects of power generation on our environment.



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Iowa-Illinois Gas & Electric Company
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Public Service Company of New Hampshire
Public Service Electric and Gas Company
PUD of Grant County, Washington
Sierra Pacific Power Company
Southern California Edison Company
Southern Services, Inc.
Tennessee Valley Authority
Texas Electric Service Company
Texas Power & Light Company
The United Illuminating Company
Utah Power & Light Company
Virginia Electric and Power Company
The Washington Water Power Company
Wisconsin Public Service Corporation
Wisconsin Power & Light Company

ASSOCIATIONS
American Public Power Association
Edison Electric Institute
Electric Heating Association
Farm Electrification Council
National Association of Regulatory Utility Commissioners
National Rural Electric Cooperative Association
Power Reactor Development Corporation

GOVERNMENT AGENCIES
Atomic Energy Commission
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Department of Interior
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EEI Prime Movers Committee
EEI System Planning Committee
EEI Transmission and Distribution Committee
Electric Power Council on Environment
ERC Task Force on MHD
ERC Task Force on Nuclear Safety Research
ERC Task Force on Underground Transmission

III

Acknowledgement section in Electric Research Council's 1971 report

The report budgeted a total of $1.5 million in 1971 dollars to study the "1) Long-term effects of power plants. 2) Effects of CO2 3) Effects of electromagnetic fields." Those investments were budgeted to begin in 1976. A total of $100,000 was allocated annually for each year from 1976 to 1980. Another $1 million was allocated for the time period between 1981-2000.

An appendix more specifically allocated $500,000 over 20 years to:

Develop macro and micro meteorological models to determine effects of CO2, micro particles, and massive

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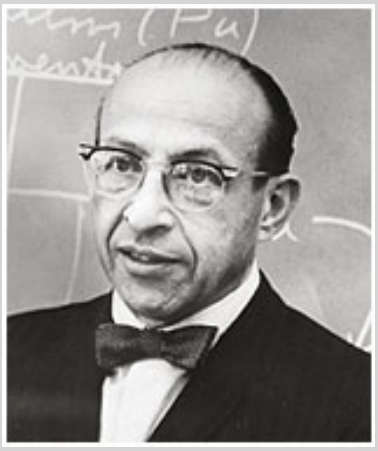
Acknowledgement section continued in Electric Research Council's 1971 report

heat emissions into the atmosphere caused by electric power generation.

This modest budget represented a small fraction of the average $1.1 billion per year research and development program set forth in the report. But it shows that by 1971, the electric utility industry took scientific concerns about the possible effects of power plant emissions on the climate seriously enough to factor the issue into its long-term plans for the remainder of the century.

Administration of the industry's new R&D plan would require the launch of a new entity, the Electric Power Research Institute (EPRI), that had been in development since 1965 and formally launched in 1972.

Meet Chauncey Starr, one of the electric utility industry's "merchants of doubt"



Chauncey Starr. Credit: Rensselaer Polytechnic Institute

On May 12, 1972, Dr. Chauncey Starr wrote to J.K. Horton and Shearon Harris to "outline some of my thoughts on the Electric Power Research Institute." At the time, Horton was chairman of Southern California Edison Company. Harris was CEO of Carolina Power & Light, which later became Progress Energy and ultimately merged with Duke Energy in 2012, and he also served at the time as chairman of the Edison Electric Institute.

Harris "led the movement through EEI to have utilities fund an expanded research effort by collecting a surcharge on each kilowatt-hour sold," according to a Carolina Power & Light company history. The result of EEI's effort was the Electric Power Research Institute (EPRI). Harris also played a "key role" in the selection of Starr as the Electric Power Research Institute's founding president.

In his 1972 letter to Horton and Harris, Starr wrote that EPRI's reliance on money collected from electric utility customers would carry with it great responsibility:

The EPRI will be a quasi-public corporation with a particularly sensitive ethical responsibility as a trustee of public funds. Although presumably the individual state public utility commissions would approve the contributions of each operating utility to EPRI, there will in fact be no official public body directly responsible for reviewing its activities. Nevertheless, because it will undoubtedly be subject to public scrutiny, it should be prepared to publicly justify its activities…

At the time of Starr's selection as EPRI's founding president, he was already veteran of the Manhattan Project and nuclear power industry. In 1971, he had written about CO2 emissions and the "greenhouse effect" in an article that appeared in *Scientific American*:

The combustion of fossil fuels, not matter how efficiently done, must always produce carbon dioxide. Its concentration in the atmosphere has increased from some 290 parts per

million to 320 within the past century and may increase to 375 or 400 parts per million by the year 2000. Thus the carbon dioxide ultimately but slowly returns to the biosphere in some nonpolluting form. Its effects while it resides in the atmosphere are not now predictable, although theoretically the increased carbon dioxide should cause a "greenhouse effect" by reducing the infrared heat loss from the earth and perhaps raising the global temperature one degree Celsius by the year 2000.

Starr wrote in *Scientific American* about nuclear power as the "saving technological development," and he described solar as a promising but not yet economical source of future power:

If only a few percent of the land area of the U.S. could be used to absorb solar radiation effectively (at, say, a little better than 10 percent efficiency), we would be meet most of our energy needs in the year 2000.

He also pointed to hydrogen as a possible alternative to fossil fuels and solution to the CO2 problem:

If carbon dioxide additions to the atmosphere were determined to be harmful, there is an ultimate but costly technological solution: we could use nuclear electric power to manufacture hydrogen by the electrolysis of water. Hydrogen would make an ideal fuel because its combustion yields water as an end product.

EPRI's association with Starr would continue until his death in 2007. In his later years, Starr served on the board of directors of the George C. Marshall Institute and Science and Environmental Policy Project, organizations that were funded for a time by ExxonMobil that sought to sow doubt about climate science. During the 1990s and 2000s, Starr attached EPRI's name to reports and other documents that attacked the scientific findings of the Intergovernmental Panel on Climate Change, and perpetuated the myth that "Human Activity [Is] Not Causing Global Warming."

Starr later received brief mention in Harvard historian Naomi Oreskes' book, "Merchants of Doubt," which documented the role of a small number of experts in aiding various industries efforts to deny the dangers of acid rain, climate change, and even smoking.

Further research by the Energy and Policy Institute reveals that Starr established relationships with both the tobacco and utility industries after he wrote a controversial 1969 paper on risk assessment.

Starr claimed that people accept "voluntary" risks from activities like smoking 1,000 times greater than "involuntary" risks from electric power generation. He also told a 1969 gathering of the National Academy of Engineering that his research supported:

… the reasonable assumption that advertising the virtues of an activity increases the public acceptance of a greater level of risk. This, of course, could subtly produce a fictitious benefit-risk ratio as may be the case for smoking.

His work soon drew attention from Helmut Wakeham, then Vice President of Corporate Research and Development for the tobacco company Philip Morris. Internal documents show that in 1971 and 1972, Wakeham and Philip Morris pursued research based off of Starr's work to benefit the tobacco industry.

Starr later represented EPRI at the 1981 International Workshop on the Analysis of Actual Versus Perceived Risks, where he made comments that caught the attention of R.J. Reynolds and other tobacco companies. One internal tobacco industry document noted that Starr faulted experts who voiced concerns about the risks of smoking "for leaving out 'the benefits that the individual gets out of smoking.'" Another inter-office correspondence from Philip Morris opined that the "bias" of anti-smoking research presented at the workshop, "was so strong that Dr. Chauncey Starr, considered the 'father' of risk analysis was moved to comment that papers were all lacking an essential element - evaluation of the social and psychological benefits of the risk in question -- without which any analysis is meaningless."

In his 1972 letter to electric utility executives Harris and Horton, Starr had envisioned that, "EPRI will be a quasi-public corporation with a particularly sensitive ethical responsibility as a trustee of public funds." Starr and EPRI later broke the public trust by spreading disinformation about smoking and climate change to benefit the tobacco and utility industries.

1977: A senior Electric Power Research Institute official testified before Congress on the possible climate change risks of increased use of coal

On July 27, 1977, Dr. Cyril Comar, then director of the environmental assessment department of EPRI, testified at a hearing held by the Subcommittee on the Environment and the Atmosphere of the U.S. House of Representatives. A portion of his testimony was included in the September 1977 edition of the EPRI Journal, along with an excerpt from the hearing charter found below:

> ***"If this turns out to be of major concern, then fossil fuel combustion will be essentially unacceptable…"***
>
> ***- Dr. Cyril Comar, director of EPRI, testimony to Congress, 1977***

"We are trying to assess whether research on environmental problems related to the President's National Energy Plan is adequate and appropriate. . . . Clearly, there are many problems with burning coal for energy. The Subcommittee must deal with some of the policy implications of these problems, especially two. First, we must address the research necessary to get us the technical information we need. Second, we must address how this information can be made useful. . . . Until these questions are answered, we must not irretrievably commit ourselves - we must leave open the option of a non-fossil energy economy, perhaps nuclear, perhaps decentralized, low (or"soft") technology."

Comar testified that increased attention was being given to a number of problems related to coal, including "the longer term effects on climate, particularly from carbon dioxide." He told members of Congress:

In my opinion, the highest priority should be given to research on direct health effects of coal combustion, followed closely by ecosystem effects (primarily the acid deposition problem). Of high priority is the possible severe consequences of carbon dioxide release on climatic change (the greenhouse effect). But this is a longer-term problem that can be studied by modeling projections - at least to give upper and lower bounds of changes in global temperatures that could be caused. If this turns out to be of major concern, then fossil fuel combustion will be essentially unacceptable, an important justification for expanding the nuclear and solar energy options.

H.J. Young, senior vice president of the Edison Electric Institute, also testified at the hearings, where experts presented considerable evidence about the possible threat to the climate posed by CO2 emissions from burning fossil fuels.

The September 1977 issue of the EPRI Journal also included an interview with Dr. Merril Eisenbud, the director of the Laboratory for Environmental Studies at the New York University Medical Center and a member of EPRI's Advisory Council. Merril shared his views on CO2 emissions and climate change with the EPRI Journal:

Although public discussion has centered on the health effects of sulfur oxides and particulates, Eisenbud believes that these emissions from coal-burning plants can be controlled. Instead, he is concerned about rising levels of another emission, carbon dioxide (CO2), which is released when coal, or any other fossil fuel, is burned.

''I'd say the greatest potential risk to the environment from greater coal use is that the CO2 concentrations in the atmosphere may increase to the point of causing global climatic changes. The concentration has been rising for a century, but scientists are not sure what the consequences of the continued accumulation may be. However, the consequences of the 'greenhouse' effect are so serious you don't dare take a chance."

As Eisenbud explains it, "If we're going to go fossil fuel rather than nuclear, the increase of CO2 is going to continue, and one can project that if it continues into the next century, it may increase the global temperature sufficiently to cause profound climatic changes. Polar ice could melt to such an extent that coastal cities could eventually be under more than 100 feet of water." The catastrophe could occur, he says, with just an extrapolation of the present growth rate of fossil fuel use into the mid-twenty first century.

On October 28, 1977, an internal memorandum titled, "The CO2 Issue in One Page," was also delivered to Dr. Walt Esselman, then the senior vice president at EPRI. Two other senior EPRI officials, Dr. Ralph M. Perhac and Dr. Cyril Comar, were copied in on the memo.

The memo was prepared by a young Dr. Chuck Hakkarinen, who would go on to a career with EPRI until his retirement in the early 2000s. Hakkarinen recalled later his work on the memo in a 2013 oral history interview with the American Institute of Physics. He shared a

copy of the memo with the Energy and Policy Institute via email, along with a brief recollection of his work on it.

"The recipient (Dr. Walt Esselman), was a Senior Vice President at EPRI at the time, who asked me over lunch one day in the company cafeteria to provide him a short brief on the then-emerging climate change issue," Hakkarinen said in his email. "This memo was the result."

"A simplistic climate model developed at Princeton predicts a 2 increase in the global mean temperature if CO2 is doubled," Hakkarinen wrote in his 1977 memo. That's within the range of what scientists continue to predict today. However, Hakkarinen also pointed to other models from the time that, "Predicted incerases (sic) range from 0.7 to 9.60C for other models."

"Uncertainty" was a focus of Hakkarinen's memo. However, he also addressed the question of how much CO2 emitted from fossil fuels ended up in the Earth's atmosphere. "About 50% of the fossil carbon emissions apparently have been balanced (at least since the mid-50's) by a flow of atmospheric CO2 to the oceans and/or land," he said. In other words, half of the CO2 still ended up in the atmosphere. This too is consistent with today's knowledge, though the latest research warns that these CO2 sinks may eventually overflow amid rising emissions.

1978: EPRI funded "two studies of the CO2 problem" and took a trip on Spaceship Earth

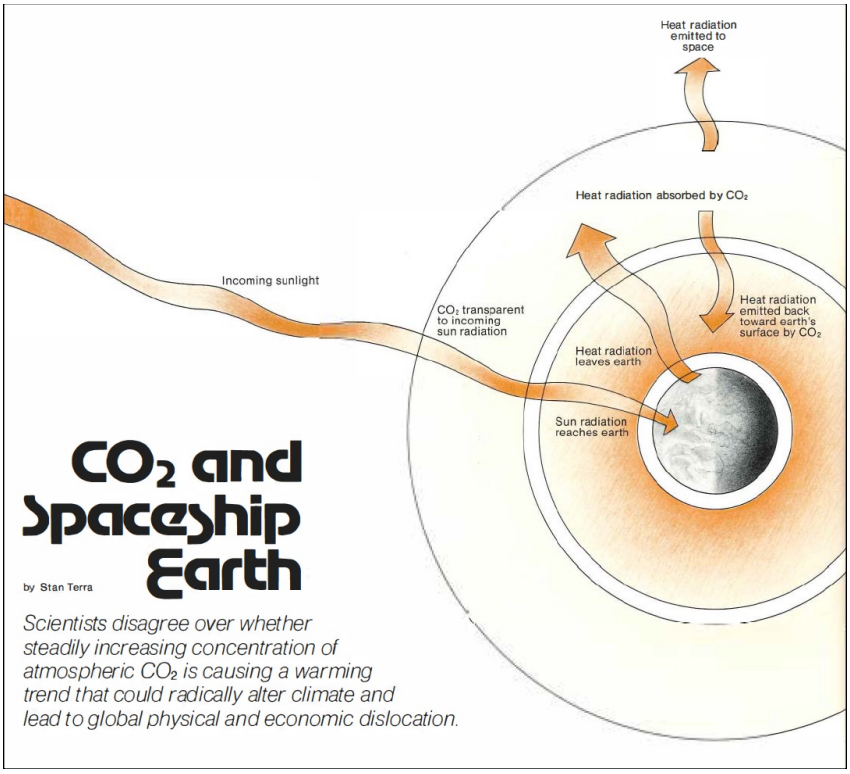
The first issue of the *EPRI Journal* published in 1978 carried another warning from scientists about the possible climate impacts of coal and fossil fuels from the previous year:

One issue that received increased attention was the possible effect of carbon dioxide (CO2) on the earth's atmosphere. The National Academy of Sciences published a report expressing concern that increasing levels of CO2 from fossil-fuel-burning power plants and other sources might cause permanent global climatic change. The report warned that this so-called greenhouse effect should be watched closely. If further study indicates that this climatic change is a likely possibility, it could have a dramatic long-term effect on the future use of coal and other fossil fuels for energy production and

might indicate increasing use of nuclear power or other alternative sources. Environmental research in this area will undoubtedly increase.

A little over a year after the premier of the first *Star Wars* film, the July/August 1978 edition of the EPRI Journal also included an in-depth feature article titled, "CO2 and Spaceship Earth."

"So far, EPRI has funded two studies of the CO2 problem: a state-of-knowledge study by John Laurmann of the mechanical engineering department at Stanford University and a more comprehensive investigation by Radian Corp.," one section of the article said.



"CO2 and Spaceship Earth" article in EPRI July/August 1978 journal

A summary of Laurmann'sresearch was included:

Laurmann states in his report that projections of the extent of global climatic change from fossil-fuel generated CO2 "are uncertain and controversial, due in large measure to ignorance of the physical mechanisms involved." He notes, however, that the apparent evidence "suggests the need for the immediate introduction of remedial measures to bring about a smooth transition to non-carbon based energy sources in the next 50 years." But he adds that because the uncertainties in climate change predictions are extremely large, actual climate change "may be negligible or, to the contrary, more critical than the most probable estimate indicates."

Laurmann presented research based on his work for EPRI at a 1978 International Institute for Applied Systems Analysis workshop, "Carbon Dioxide, Climate and Society," that was co-

sponsored by the United Nations Environment Programme, World Meteorological Organization, and Scientific Committee on Problems of the Environment.

As InsideClimate News first reported in 2015, Laurmann later gave a presentation on climate change research to a 1980 meeting of an American Petroleum Institute task force that met during the late 1970s and early 1980s to discuss the problem of CO2 emissions. He also did climate change research for the Gas Research Institute during the 1980s.

The EPRI Journal also summarized the Radian Corp. report that EPRI sponsored, which found that "the United States contributed 28 percent of the world's CO2 from fossil fuel combustion in 1973 and that predictions point to a 19-28 percent U.S. contribution by 2025."

"The largest contributors to CO2 emissions in the United States are the utility, transportation, and industrial sectors," the summary said. "In 1974, their contributions were 26, 27, and 38 percent, respectively."

Radian Corp. warned that by the year 2000, the utility industry would surpass these other sectors to become the top U.S. source and account for 30-40 percent of domestic CO2 emissions.

"The United States cannot solve the potential problem by unilaterally decreasing or eliminating CO2 emissions," according to the EPRI Journal's summary of Radian Corp.'s conclusions. "An international effort will be required."

The same 1978 EPRI Journal article, "CO2 and Spaceship Earth," also included extensive quotes and analysis from climate experts.

"Scientists disagree over whether steadily increasing concentration of atmospheric CO2 is causing a warming trend that could radically alter climate and lead to global physical and economic dislocation," a subheadline said. Still, the tone of the article made the possible threat sound dire.

The article opened with a 1957 quote from Dr. Roger Revelle, the pioneer of modern climate science who was an early mentor to Al Gore, which read, "Human beings are carrying out a

large scale geophysical experiment of a kind that could not have happened in the past nor be repeated in the future." It then turned its attention to a 1977 National Academy of Sciences (NAS) report that was led by Revelle. "The principal conclusion of this study is that the primary limiting factor on energy production from fossil fuels over the next few centuries may turn to be climatic effects of the release of carbon dioxide," said a quote from the NAS report. The NAS report, "should not be taken as a red light on coal use, but rather as 'a flashing yellow light,'" said another quote from Dr. Thomas Malone of Butler University.

"Possible consequences" of climate change fueled by CO2 and other greenhouse gas emissions, such as nitrous oxides, were reviewed in this *EPRI Journal* article:

The greenhouse effect may lead to a global warming trend; a change in climate and rainfall patterns, with consequent dislocation of established agriculture zones and attendant economic disruption; a melting of sea ice, or in the extreme, of the polar ice caps, which could flood coastal regions. These possible consequences have prompted concerns and study in the scientific community and research support from the federal government.

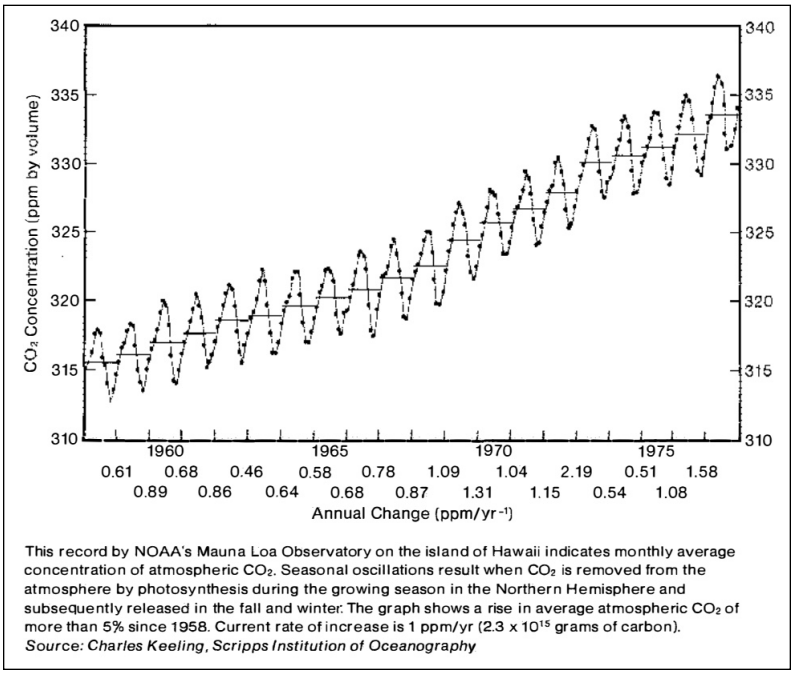
A "marked interest" in climate change at the federal level of government was noted, as were some early international efforts to study the issue in more depth. The article discussed the launch of a multi-million dollar Department of Energy program, and the National Climate Act to establish a comprehensive climate change policy and program that was soon passed by Congress and signed by President Jimmy Carter in 1978.

"The carbon dioxide problem is one of the most important worldwide environmental issues," said Dr. George Woodell of Ecosystems Center at the Marine Biological Laboratory in Woods Hole in the article.

The article noted areas of agreement that existed among climate scientists:

The most widely accepted theory holds that man-induced influences on the atmosphere - mainly, the generation of CO2 from fossil fuel combustion - will cause a significant rise in global temperatures over the next 25-200 years.

However, the author questioned whether temperatures would actually rise in response to rising CO2 levels. For example, the article suggested that a global warming trend could lead to more cloud cover, which could in turn have an offsetting cooling effect.



This record by NOAA's Mauna Loa Observatory on the island of Hawaii indicates monthly average concentration of atmospheric CO_2. Seasonal oscillations result when CO_2 is removed from the atmosphere by photosynthesis during the growing season in the Northern Hemisphere and subsequently released in the fall and winter. The graph shows a rise in average atmospheric CO_2 of more than 5% since 1958. Current rate of increase is 1 ppm/yr (2.3 x 10^{15} grams of carbon).
Source: Charles Keeling, Scripps Institution of Oceanography

CO2 levels illustrated in "CO2 and Spaceship Earth" article in EPRI July/August 1978 journal

A debate over whether efforts to curb CO2 emissions could wait until "uncertainties" in the science were resolved was also featured.

At stake was the possible risk that waiting too long to act could lock in harmful levels of climate change.

The views of proponents of a "wait-and-see" approach were presented through Dr. Helmut Landsberg. Landsberg was known as a vocal critic of other leading scientists, such as Dr. Stephen Schneider, who raised the early alarm about climate change among policymakers and in the media. Elsewhere though, Landsberg wrote of his agreement with Schneider on "... the inescapable conclusion that air and thermal pollution has to be controlled because of the potential for unwanted regional, if not global, climate consequences."

EPRI seemed to take a particular interest in Landsberg's work during the 1970s. An archive of his papers, now maintained by the University of Maryland, includes correspondence with EPRI from 1974-1980. Exxon also consulted with Landsberg during the early 1980s as part of its assessment of the climate risks of a major natural gas project, as InsideClimate News previously reported in 2015.

Other scientists mentioned in the 1978 *EPRI Journal* article viewed the CO2 problem with more urgency. It paraphrased the words of Dr. J. Murray Mitchell, a senior research climatologist with NOAA:

Mitchell warns that if we wait until signs are clear that a warming trend has begun before we start phasing out our fossil fuel use, the damage will already have been done in the 50 or so years it would take for a fuel transition. And the consequences, he says, "would endure for thousands of years after the fossil fuels have been consumed!"

> ***"If we wait to let the atmosphere perform the carbon dioxide experiment, we will finally learn how well our models have served in making the predictions of climate change - but then it will be too late to do much about it if a warmer earth should prove to be a sadder earth."***
>
> ***-Dr. William Kellogg of the National Center for Atmospheric Research quoted in "CO2 and Spaceship Earth" article in EPRI July/August 1978 journal***

At the end of the same *EPRI Journal* article came a section ominously titled, "Will it be too late?" A sense of urgency underlined the words of scientists quoted there too:

"There is almost no aspect of national and international policy that can remain unaffected by the prospect of global climatic change," said Dr. George Woodell of the Ecosystems Center at the Marine Biological Laboratory. "Carbon dioxide, until now an apparently innocuous trace gas in the atmosphere, may be moving rapidly toward a central role as a major threat to the present world order."

"If we wait to let the atmosphere perform the carbon dioxide experiment, we will finally learn how well our models have served in making the predictions of climate change - but then it will be too late to do much about it if a warmer earth should prove to be a sadder earth," said Dr. William Kellogg of the National Center for Atmospheric Research.

1979: Electric Power Research Institute contributed to a government report that warned of the parallels between the issues of smoking and climate change

One year later, Ralph Perhac of EPRI served on the advisory panel for the Congressional Office of Technology Assessment's report on the "Direct Use of Coal." While a disclaimer in the report noted that participation on the advisory panel did not constitute an endorsement,

Perhac still played a role in its creation and likely would have been aware of its overall findings. The report projected a doubling of coal use in the U.S. by the year 2000, and assessed the associated benefits and risks, including possible environmental and health impacts.

It warned:

Some emissions may prove to be inadequately regulated because of scientific uncertainty concerning the cause and significance of their effects. Emissions of sulfur dioxide, nitrogen dioxide, carbon dioxide (CO2) and fine particulate will all increase significantly by the end of the century under a high coal scenario and present or pending regulations. Increases in coal-related air pollution may cause or aggravate three potential environmental problems whose magnitude and importance cannot yet be evaluated adequately. Additional evidence of these problems could force a reappraisal of our environmental control strategy or even our commitment to increased coal development.

Regarding coal use and potential climate change, the report said, "Coal is the fossil fuel of greatest concern because of its large reserves and high carbon content; presumably, the faster coal use increases the sooner a critical point will be reached and the more difficult it will be to switch to nonfossil fuels."

This report included an interesting discussion of the similarities in the debates over how to address the possible effects of CO2 emissions and smoking:

Some of the more spectacular impacts that have been attributed to coal development — for example, the warming of the Earth's atmosphere by increasing levels of carbon dioxide (CO2) (a possible long-term effect), or the thousands of premature deaths attributed to the particulate sulfate products of sulfur dioxide (SO^2) emissions (an effect said to be occurring now)— represent risks rather than certainties. Scientists disagree sharply on the extent of the risks, greatly increasing the difficulty of developing environmental policies. Part of this disagreement involves sharply differing opinions about the quality of data and the validity of analytical methodology. Part also involves more basic philosophical differences about the nature of "proof.': Because many environmental relationships are drawn from circumstantial and statistical evidence, considerable judgment must be used in determining when a "postulated" relationship turns into a "probable" one, and finally, into a "proven" one. The long fight

to conclusively prove a relationship between smoking and cancer is a classic example; many environmental cause-and-effect relationships follow the same Iines.

Still, the report noted that carbon dioxide was an exception to the rule of erring on the side of caution when it came to regulating pollution:

Despite the serious uncertainties involved in identifying air pollution impacts and their causes, all but one of the major pollutants from coal combustion have sufficiently recognized impacts and means of control to have warranted Federal regulation of their emissions. The exception is Carbon dioxide, which at current and expected ambient levels displays no direct or immediate adverse impacts on human health or on the biota but may conceivably represent the greatest long-term danger from an increase in the use of coal or other fossil fuels.

Ultimately, the 1970's proved to be a decade of increased interest in climate change among industry and government circles. By the end of the decade, Exxon and the American Petroleum Institute's early forays into the issue were also well underway. But the 1970's also proved to be a turning point that would lock in the nation's reliance on coal for the coming decades.

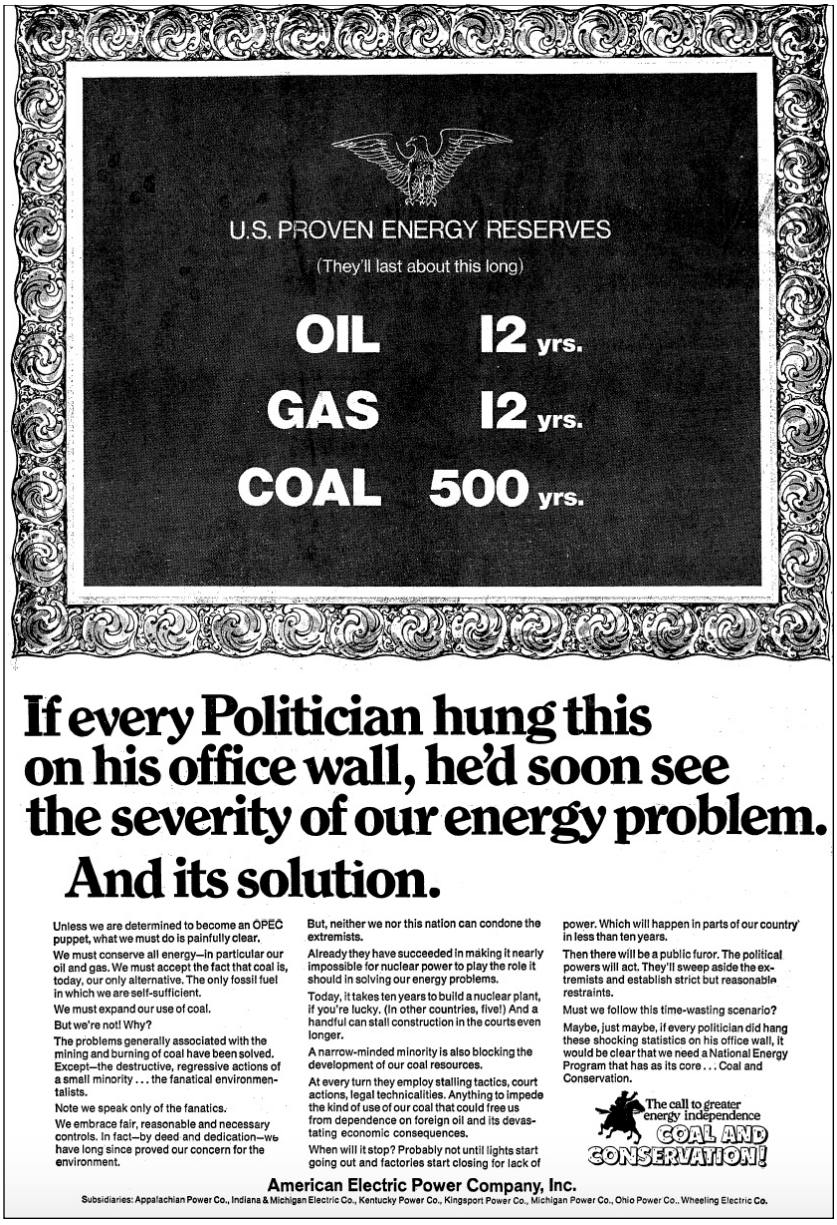
As Peter Glaser, a longtime attorney for the coal and electric utility industries, and several of his colleagues later wrote, the oil embargo imposed on the U.S. by the Organization of Petroleum Exporting Countries (OPEC) had made energy independence a top priority in Washington, D.C. Congress put checks in place to curb the use of oil and natural gas in power plants.

"Thus, even as Congress and EPA began to act on environmental issues and Congress authorized initial studies into climate change allegations, energy planners 'turned back to coal as an intermediate term (fifty to 100 years) or long-term (more than 100 years) energy source.'," Glaser et al wrote in 2011.

Electric utilities actively advocated for the increased use of coal. American Electric Power ran advertisements during the 1970s that promoted "coal and conservation" as a solution to the Energy Crisis. One 1976 AEP ad in *The New York Times* said, "We must expand our use of coal."

"The problems generally associated with the mining and burning of coal have been solved," the same AEP ad claimed. "Except-the destructive, regressive actions of a small minority… the fanatical environmentalists."

Of course, the CO2 problem that AEP and other electric utilities included in the industry's long-term research and development plans in 1971 had not been solved. Similar AEP ads appeared in other publications too, including *The Washington Post* in 1974 and *Ebony* magazine in 1976.



American Electric Power advertisement in *The New York Times*, 1976

Another path was possible. There was also interest within the electric utility industry in developing renewable energy technologies, such as solar power, during the Energy Crisis of the 1970s. "Fifty-three electric utilities are either sponsoring or planning 220 individual solar research projects," a 1976 EPRI survey found.

In 2016, fossil fuels still accounted for 65 percent of utility-scale power generation, due largely to the investments electric utilities have made in coal and natural gas in the decades since 1968 - when they were first warned about climate change.

1980-1988: A new morning in America... for coal and utility-backed climate change research

EPRI greeted the dawn of the 1980s with a paper by Dr. L.A. Sagan on the "Impact of Increased Use of Coal on Health and the Environment." Sagan wrote that, "The United States - and the world in general - can anticipate a tremendous increase in the use of coal over the next 20 years."

"Certainly, an increase in coal use has the potential for causing a wide range of undesirable effects," he acknowledged. One of the potential "undesirable effects" that Sagan addressed was "climatic change."

Over the past 2 to 3 years, a noticeable interest in CO2 emissions (and in atmospheric CO2 levels) has developed. The interest centers around the concern that high CO2 levels in the troposphere would block thermal radiation from the earth's surface, thereby increasing surface temperatures. Such temperature increases could cause major global climatic perturbations. Many climatologists feel that a 1 to 2 degree rise in temperature might not be serious. A 4 to 5 degree rise, however, could be disastrous.

Sagan did not specify whether he was referring to Fahrenheit or Celsius in his discussion of global temperatures, though Celsius is the system generally used by climate scientists.

Sagan referenced the CO2 research by J.A. Laurmann that EPRI had sponsored during the 1970s. He also dwelled on "uncertainties" in scientific projections of future climate change. Interestingly, Sagan expressed uncertainty about projections for future energy demand and the mix of fossil fuels. Sagan did not mention that these are areas over which U.S. electric utilities exercise significant control, domestically if not globally, both through their business operations and considerable political influence. In an industry where planning revolves around power plants with a shelf lives measured in decades, making long-term predictions about future energy demand and sources has also long been part of business as usual.

"The contribution from geothermal or solar technologies cannot be expected to be significant over the next 20 years," Sagan claimed. "Under any energy use projection, coal plays a significant role, and at least a doubling of coal use by the end of the century seems likely."

Two years earlier, in 1978, a report, "Domestic Policy Review of Solar Energy," was delivered to President Carter. It said, "With appropriate private and government support, solar energy could make a significant contribution to U.S. energy supply by the end of the century." The report said that solar could provide 20 percent of the nation's power by 2000. This assumed a "Maximum Practical effort" to develop solar, coupled with a scenario of higher future oil prices. Carter established a goal of obtaining 20 percent of the nation's energy from the sun by 2020. He also installed a solar hot water heater at the White House. This vision of a "Maximum Practical effort" to ramp up solar power was not shared by the new President Ronald Reagan, who famously removed Carter's solar installation from the White House.

"Certainly, fossil-fuel burning will result in changes in atmospheric CO2 concentrations but, with the present uncertainties in our knowledge, we cannot judge what the changes will be, what they will do to climate, or what the effect on society will be," Sagan said.

Still, Sagan wrote, "...the question of climatic change cannot be ignored."

On "climatic change" and a broader set of possible environmental problems posed by increased use of coal, Sagan recommended a policy of further research:

At best, we can identify potential hazards to the physical and biological environment and we can carry out a continuing research program to assess that potential in order to take corrective actions where needed. Such a research effort is actively underway by both industry and governmental groups. Hopefully, that research will provide the data needed to insure the environmental acceptability of increased coal use.

Here, Sagan downplayed the fact that EPRI and the electric utility industry were already aware of existing research that warned of the possible threat that increased use of coal posed to the climate.

1982: EPRI began to fund the work of Dr. Charles Keeling and the Scripps Institution of Oceanography

EPRI's sponsorship of research on climate change continued in the 1980s. In 1982, it began to sponsor the work of Dr. Charles Keeling and the Scripps Institution of Oceanography during their "darkest days of funding problems" under Reagan administration. Keeling had long worked with Scripps to monitor CO2 levels in the earth's atmosphere, work that he began in the late 1950s and continued until his death in 2005.

Keeling's relationship with EPRI continued into the 1990s, according to records maintained by Scripps. Keeling later recalled the "incredible windfall" that EPRI's funding provided to their research:

... we were able, in less than a year, to simulate how prescribed oceanic and terrestrial processes specifically affected atmospheric CO2 at each of our observing stations. By the fall of 1985, we had identified the major sources and sinks of atmospheric CO2 likely to be causing the variations seen in our data. Four years later, this work, which without EPRI support would probably never have been completed, resulted in four articles totaling nearly 200 pages, setting forth virtually all that we knew at the time from measurements of atmospheric CO2.

Keeling and his colleagues presented some of this research at a 1983 symposium on "The Global Carbon Cycle" that was sponsored by the Department of Energy, EPRI, the Gas Research Institute (GRI), and the National Oceanic and Atmospheric Administration. Ralph Perhac of EPRI and John A. Laurmann, who by then worked for GRI, "provided invaluable advice in selecting topics for presentation and identifying potential speakers," a reminder of the extent to which industry has long participated in and influenced the federal government's climate change research. In 1986, the proceedings were published as a book, "The Global Carbon Cycle: A Global Analysis," with a Congressional perspective from then Senator Al Gore.

Also in 1983, the *EPRI Journal* confirmed that CO2 would be part of EPRI's R&D program for the next decade.

1984: The Edison Electric Institute sponsored two reports on CO2

The Edison Electric Institute (EEI) also continued to weigh in on the issue of climate change during the 1980s. For example, EEI sponsored two 1984 reports by futurists Jennifer Jarrat and Joseph Choates. One report was titled, "Carbon dioxide: Potential Emerging Global Hazard." The other report was named, "Atmospheric Trace Gases: Policy Implications for American Industry."

Copies of these 1984 reports are hard to find today, but the Energy and Policy Institute was able to locate later examples of EEI-sponsored reports by Jarratt and Coates, including research they presented at a 1985 meeting of the Air Pollution Control Association that is discussed in the next section. The Energy and Policy Institute will post an update once copies of the EEI-sponsored reports from 1984 are obtained.

1985: EPRI and Southern Company host a conference session on the "Effects of Increasing CO2"

Also in 1985, the 78th Meeting of the Air Pollution Control Association (APCA) took place in Detroit, Michigan in 1985. A "Preliminary Technical Agenda" for the event included a session titled, "Effects on Increasing CO2." Michael Miller of the Electric Power Research Institute served as chairman for the session, and a Southern Company official, Victoria Douglass, served as vice chairman. Douglass, who later changed her last name to Sullivan, was employed by Southern Company until 2010, when she was hired by the American Coalition for Clean Coal Electricity - a longtime opponent of legal limits on CO2 emissions from power plants that is backed by the same utility.

The Energy and Policy Institute obtained a copy of the conference session proceedings from a university library, which confirmed that Miller and Douglass chaired the session. Some of the research that was presented was sponsored by EEI and EPRI, though EPRI's role was only disclosed when some of their research was later published in the *APCA Journal*.

One paper, "Greenhouse gases in the atmosphere: What do we know?," that was presented featured work by two researchers, Greg Marland and Ralph Rotty, with the Institute for Energy Analysis at Oak Ridge Associated Universities. When their paper was later published

in the *APCA Journal*, it included a disclosure that, "This work was supported by the Electric Power Research Institute, Palo Alto, California under Agreement RP2141-7." In 1984, the *EPRI Journal* mentioned that contact number RP2141-7 allocated $150,000 to Oak Ridge Associated Universities for "Critical Assessments In Current Carbon Dioxide Research."

"Concern over the increasing concentration of carbon dioxide in the atmosphere and its potential effect on the earth's climate has been widely expressed since at least 1957," Marland and Rotty noted. As evidence, they cited a key piece of climate change research from 1957 by Roger Revelle and Hans Suess - research that decades before drew a response from scientists at Humble Oil, which later became ExxonMobil.

Marland and Rotty's 1985 paper then focused on the increased concern about emissions of a broader set of greenhouse gases that followed publication of a landmark 1983 Environmental Protection Agency (EPA) report, "Can we delay a greenhouse warming?" They warned these other emissions could lead to additional global warming, on top of what was already projected to result from increased levels of CO2 in the earth's atmosphere. The paper included a deeper discussion of nitrous oxide, or N2O, emissions.

"Anthropogenic alteration of atmospheric N_2O occurs largely as a consequence of emissions during fossil fuel burning and because of application of fixed nitrogen fertilizers and discharge of sewage," wrote Marland and Rotty.

They also noted some of the uncertainties that prevailed at the time. For example, the paper said that, "There is clearly a need for more data on N2O production from fossil fuel burning." However, Marland and Rotty also explained that, "Although data are still meager, our understanding of the atmospheric budget of nitrous oxide has increased dramatically over the last decade." They noted that, "This balance makes it clear that anthropogenic fluxes are now a major portion of the total and that the potential for an increasingly large impact on the atmosphere is significant."

Rotty also teamed up with David Reister, another colleague from Oak Ridge Associated Universities, on a second paper, "Use of Energy Scenarios in Addressing the CO2 Question," that was presented during the session co-chaired by EPRI and Southern Company. The version of their paper published later in the *ACPA Journal* disclosed that, "The work reported

here was funded by the Electric Power Research Institute in cooperation with the U.S. Department of Energy."

"The concern is that as we continue to exploit the vast deposits of fossil fuels the atmospheric carbon dioxide concentration will continue to rise and will reach levels that result in disruptive climate changes," Rotty and Reister wrote.

Marland and Rotty found that an emphasis on "conservation and renewable" energy could push back the timeline for a doubling of atmospheric CO2 levels, whereas a rise in global energy use powered by fossil fuels could move that timeline up.

"Even though much can be accomplished by shifting to alternative energy systems, it remains true that effective control on the rates of CO2 growth a century from now must begin with planning and action in the very near future," Marland and Rotty concluded.

Futurists Jennifer Jarrat and Joseph F. Coates also presented a less scientific assessment, "The Greenhouse Effect: It Implications for Industrial and Government Policy," at the same ACPA conference session chaired by EPRI and Southern Company.

"The work on which this paper is based was sponsored by the Electric Edison Institute," they disclosed. "However, this report, and the points of views expressed in it, remain solely the responsibility of the authors."

Jarratt and Coates opened with two imaginary climate change scenarios for a "worst and best case future." The best case scenario "assumed major changes could occur in less than 25 years and solar energy could in that time take a huge bite out of carbon dioxide emissions worldwide."

They also noted that:

The Department of Energy, Electric Power Research Institute, and others, have commissioned studies of control technologies which would remove carbon dioxide from the stack and either store it or use it in a way which would prevent its early emission to the atmosphere.

However, Jarratt and Coates said that these studies concluded that carbon capture and sequestration (CCS) was yet not economically feasibly, a lesson that continues to remain true in 2017, as evidenced by Southern Company's costly failed experiment with CCS in Kemper county.

> ***"There is a need to brighten and broaden the future of public debate on the issue, which has been gloomy, at best … The potential for misinformation and misunderstanding on a complex issue is high."***
>
> ***-Jennifer Jarrat and Joseph F. Coates in "The Greenhouse Effect: Its Implications for Industrial and Government Policy" presented at the 78th Meeting of the Air Pollution Control Association, 1985***

"There is a need to brighten and broaden the future of public debate on the issue, which has been gloomy, at best," Jarratt and Choates said. "The potential for misinformation and misunderstanding on a complex issue is high."

1985: The Edison Electric Institute writes a letter about climate change to members of Congress

A letter to Congress shared views attributed to the Environmental Dialogue Group, which as "convened by the Edison Electric Institute, consists of twelve participants: six from electric utility industry and six from national environmental organizations." The letter referred to a January 15, 1985 workshop where the group discussed "the scientific understanding and possible environmental impacts of the measured increases of atmospheric carbon dioxide and other trace gases."

"As a result of our deliberations, the Group reached a deep appreciation of the complexity and wide ranging implications of global atmospheric warming and the options the world community must explore and decide upon, if a response is to be made in time for a positive result," the letter reported.

A "Statement of Concern" placed top priority on further research to address what remained unknown about the potential threat of climate change at the time. It also stressed that international organizations "could play an important role in providing information about the problem of greenhouse warming, and would have to play some role in any solution should

one be necessary." This statement came several years prior to the formation of the International Panel on Climate Change in 1988.

"Of importance in this international dimension is the adoption of development of energy efficient technologies," the letter said. "This issue is complicated by the need to accommodate increased per capita use in developing countries."

1986: EPRI reviewed the climate change research it had sponsored since the 1970s

The June 1986 edition of The EPRI Journal included an editorial on the "The Scientific Unknowns of CO2."

"Usually, it is only with hindsight that an action appears to be undeniably the preferred policy option," wrote Rene H. Males, then vice president of EPRI's energy analysis and environment division. He referred to work the Department of Energy was doing at the time to build on scientific understanding of climate change, as well as EPRI's "much more modest research" on the issue.

> ***"Theories of global warming are gaining broad acceptance in the scientific community, with many experts predicting significant change within 50 years … The sweeping consequences of accumulating greenhouse gases may turn out to be the greatest environmental problem of modern times."***
>
> ***-"Earth's Climate in Transition" article in EPRI's June 1986 journal***

The same issue of the EPRI Journal featured an in-depth article on "The Greenhouse Effect: Earth's Climate in Transition."

"Theories of global warming are gaining broad acceptance in the scientific community, with many experts predicting significant change within 50 years," read a subheading. "The sweeping consequences of accumulating greenhouse gases may turn out to be the greatest environmental problem of modern times."

The article included a concise review of EPRI-sponsored "research efforts in the area of greenhouse gases and climate change" between 1978 to 1986. It covered the research

mentioned earlier in this report, and a five-day Scripps conference with "40 leading scientists" that EPRI sponsored in 1985.

The June 1986 edition of the EPRI Journal mentioned that a study on "the potential effects of climate change on electric utilities" was underway, using Florida Power & Light as a case study. The study was co-sponsored by EEI, EPA, EPRI, and the New York State Energy Research and Development Authority. Two years later, in 1988, the EPRI Journal reported on the findings of this groundbreaking study, which also included a case study of New York's electric utility system.

"The conclusion drawn from these analyses is that climate changes possible over the next 30 years may significantly affect the electric utility industry," said the 1988 article.

One of the key takeaways from this study was that utilities would come out ahead if they incorporated climate change predictions into their long-term plans. It mostly focused on the potential need to increase electricity generation capacity in order to meet higher demand spurred by higher temperatures, an approach that seemed to frame climate change adaptation as a business opportunity for electric utilities that planned ahead, rather than something that would require a reduction in fossil fuel combustion and carbon pollution.

The *EPRI Journal* noted that the research did not analyze a number of climate-related risks that electric utilities could one day face. For example, it did not assess the threat that sea level rise could pose to coastal power plants.

The June 1986 edition of the EPRI Journal also reviewed the prevailing opinions of the time on how best to address climate change:

Many observers are beginning to discuss responses to potential climate change. Three basic views characterize the debate: we do not know enough yet about the fundamental processes to respond effectively; we should apply what we do know now to mitigate the changes; we should accept that climate change is inevitable and start immediately to adapt…

It quoted leading scientists mentioned earlier in this report on the same question.

> ***"we do know that the decisions we make today will have implications far into the future … The memory of the fossil fuel era will be with the earth for tens of thousands of years."***
>
> ***-Dr. Charles Keeling in "Earth's Climate in Transition" in EPRI's June 1986 journal***

"If uncertainty is a ground for no action," said Dr. Stephen Schneider, the scientist who warned the public about climate change back in the 1970s, "then we would have no insurance companies and no armies."

"We don't know how fast the changes now under way will come or how far they will take us, but we do know that the decisions we make today will have implications far into the future," said Dr. Charles Keeling, the EPRI-backed CO2 tracker at Scripps. "The memory of the fossil fuel era will be with the earth for tens of thousands of years."

1987: EEI revisits "The Greenhouse Effect"

In the spring of 1987, EEI revisited the "The Greenhouse Effect" in an *Electric Perspectives* article by Dr. Joe Edmonds of the Batelle Pacific Northwest Laboratories, Dr. Michael Farrell of Oak Ridge National Laboratory and Dr. Boyd Strain of Duke University. The three scientists noted a significant shift in the ongoing debate over the issue:

Twenty years ago, the "greenhouse effect" was only the subject of speculation among a few scientists. Today, as evidence for it accumulates, the greenhouse issue is debated not only among scientists, but also in federal government reports, Congressional hearings, and major newspapers and magazines. It is being taken seriously....

The article suggested that a temperature increase of 3 to 8°F (or 1.7 to 2.8°C) "would leave little doubt about the reality of the warming trend and humanity's responsibility for it."

It went on to say:

But a wait-and-see approach might be short-sighted. It is not at all clear yet just how closely increases in the atmospheric temperature follow increases in greenhouse gases. Some scientists suggest that the

capacity of the ocean to absorb heat could delay for many years the full impact of a greenhouse effect on land and air temperatures.

One implication of that argument is that the global temperature rise over the past 100 years may be just the start of a much larger increase, irreversibly ordained by the stuff we've already put into the air. That argument implies that if we wait until we're sure that we've caused a real problem, the problem may already much be much larger than we realize…

The writing was on the wall.

"The emergence of a real greenhouse problem would have serious impacts on the utility industry, among others," the *Electric Perspectives* article said.

"Worldwide, electric utilities accounted for about 30 percent of global CO2 release in 1975; U.S. utilities alone emitted some 10 percent of the total," the authors noted.

"Electric utilities and other industrial sources might well be required to curtail fossil fuel combustion and/or capture carbon dioxide from waste gases and dispose of it," they also warned.

> ***"eventually we will have to come to some kind of balancing: must we slow emissions of greenhouse gases or not? We can't wait forever to decide."***
>
> ***-Dr. Joe Edmonds of the Batelle Pacific Northwest Laboratories, Dr. Michael Farrell of Oak Ridge National Laboratory, and Dr. Boyd Strain of Duke University in "The Greenhouse Effect" in EEI's 1987 Spring journal***

Still, the article claimed that there was "a general (but not unanimous) agreement among researchers and members of the national and international policy communities that the time was not yet ripe to establish policies in the arena of CO2 and climate change."

However, the authors also identified a relatively short window of time before inaction could prove "damaging":

At this point, there appears to be at a least a five-to-ten year window in which to conduct further research on CO2 and the greenhouse issue - that is we can postpone decisions at least that long without

fear of damaging the world's climate beyond repair, particularly if international initiatives currently underway to control CFC emissions are successful.

They concluded that "eventually we will have to come to some kind of balancing: must we slow emissions of greenhouse gases or not? We can't wait forever to decide."

1988: EPRI recognized the "growing consensus" on climate change

One year later, in 1988, an editorial in the *EPRI Journal* by George M. Hidy, then Vice President of EPRI's Environmental Division, opened with the line, "There is a growing consensus in the scientific community that the greenhouse effect is real."

Combustion-generated carbon dioxide may indeed cause significant warming of the atmosphere over the next half-century, and other heat-absorbing gases are expected to hasten the process. The environmental consequences of such global warming are not well understood but are hypothesized to include changes in aridity, agricultural practice, forest growth, and sea level rise. At current rates of worldwide fossil fuel use, there is a possibility that such changes will disrupt the biosphere as we know it and force regions or nations to adapt to new climate patterns. Even more disconcerting is the possibility of destabilization of the earth's entire weather system, resulting in conditions that are not currently forecastable. These issues have raised the public awareness of global warming from the scientific workplace to the realm of international public policy.

However, Hidy expressed skepticism about the ability of the world to transition to cleaner energy alternatives.

"Meeting the worldwide requirements for energy consumption by shifting away from fossil fuel use is a prospect that seems impractical, given the heterogeneity of global economics and society's apprehension about alternatives, such as nuclear power," he said. Hidy stressed "adaptability" as the solution to what he viewed as the possible but still uncertain future effects of climate change.

Still, Hidy understood that the electric utility industry bore a share of the responsibility for creating and ultimately solving the problem:

The electric utility industry finds itself in a peculiar position in dealing with the potential of global warming. Utilities are said to be responsible, in some degree, for the problem because they burn fossil fuels; but at the same time, electricity will be crucial to effective adaptation to projected changes. Thus the industry's involvement includes not only the question of emission reduction but also the incorporation of climate change in its long-term planning for electricity needs. EPRI has expanded its research program to develop an improved scientific basis for deciding such courses of action.

The same issue of the *EPRI Journal* featured another in-depth article on the issue, this time titled "The Politics of Climate Change." The article began, "As consensus builds that man is changing the earth's climate, policymakers are turning their attention to the issue and exploring potential responses."

As consensus builds that man is changing the earth's climate, policymakers are turning their attention to the issue and exploring potential responses.

The greenhouse effect, once a subject of purely scientific inquiry, is rapidly emerging as an important public policy issue. The U.S. Congress reportedly devoted more time in 1987 to hearings on climate issues than it did to acid rain. Last December the Global Climate Protection Act of 1987 became law, requiring the president, through the Environmental Protection Agency, to develop and propose to Congress a coordinated national policy in this area. The law also calls for the State Department to seek international cooperation in limiting climate change and to work within the United Nations to promote the early designation of an international year of global climate protection. President Reagan and General Secretary Gorbachev included in their December 1987 summit communique an initiative to "promote broad international and bilateral cooperation in the increasingly important area of global climate and environmental change." The World Meteorological Organization and the United Nations Environment Program recently

"The Politics of Climate Change" in EPRI's 1988 June journal

Like EEI's article from one year before, the EPRI Journal noted, "The greenhouse effect, once a subject of purely scientific inquiry, is rapidly emerging as an important public policy issue." It mentioned the passage of 1987's Global Climate Protection Act, which required the EPA "to develop and propose to Congress a coordinated national policy in this area." The new law also instructed "the State Department to seek international cooperation in limiting climate change..."

The article took note of a joint communique from President Reagan and Soviet leader Mikhail Gorbachev that included a plan to "promote broader international and bilateral cooperation in the increasingly important of global climate and environmental change." Plans to form a "joint panel to study the potential impacts and responses to climate change" were highlighted, apparently a reference to what became the IPCC. The electric utility industry's earlier call for a global effort to study and ultimately address the problem of climate change was starting to be answered by 1988.

As for the "uncertainties" that the industry's earlier efforts on the issue often obsessed over, the article warned that "as the history of environmental regulation amply demonstrates, policymakers are quite capable of taking acting on issues long before all the relevant scientific uncertainties are resolved." The *EPRI Journal* was effectively summarizing a version of what is known as the "precautionary principle" in the environmental policy world.

Members of Congress quoted in the article explained their belief that this approach was appropriate in the case of climate change. For example, Senator John Chafee (R-RI) warned:

We must act on the information we have now. Each day of delay placed us further down the path that threatens our very existence. We may be committing ourselves to environmental changes that are irreversible. By the time we have more information, it may be too late.

As the *EPRI Journal* acknowledged, "Because of the lag time in the earth's climate machine, we may have already set changes into motion whose full effects have yet to be felt."

"Computer models predict that a buildup of greenhouse gases in the atmosphere equivalent in heat-trapping capability to a doubling of pre-industrial level of CO2 will commit the earth to a rise in average temperature of 1.5 to 4.5°C," the article also noted. Nearly 30 years later, in 2017, scientists continue to make the exact same prediction.

"Some researchers believe that greenhouse gas emissions to date have already committed the earth to a warming of .5 to 1.5°C," it also said.

In terms similar to what EEI's *Electric Perspectives* article said one year before, the *EPRI Journal* reviewed the available options as "more research is needed before we can respond

effectively; climate change is inevitable, and we should prepare to adapt; we should start immediately to mitigate the changes."

"Uncertainties" were also a focus of the article, but it recommended that, "'what if' studies are useful for understanding what might be at stake if climate does change and how adaptive response might work." One example highlighted was the EPRI-sponsored research into the possible effects of climate change on electric utilities:

Rising seas and other results of a global warming could have implications for utilities as well as in areas ranging from plant siting to load profiles and the availability of hydro resources. EPRI recently cofunded a study on possible impacts of climate change on utility operations. Although such changes, if unanticipated, could be very costly to individual utilities, the study found that the costs could be significantly reduced with appropriate planning.

How industry chose to respond to the problem could have far reaching implications, the article noted.

"If the industrial leadership isn't there, this problem won't be solved," said a quote from Rafe Pomerance of the World Resource Institute.

While the electric utility industry had responded to early government and scientific concerns about climate change with a modest research and development effort, by 1988 the issue had emerged firmly onto the public stage. The prospect of legal limits on CO2 and other heat-trapping emissions from power plants was suddenly very real for electric utilities that had invested heavily in fossil fuels during the 1970s and '80s. Some within the industry would soon respond with disinformation campaigns designed to manufacture doubt about the causes and risks of climate change.

1989 and Beyond: The Decades of Denial

In March of 1989, William McCollam, Jr., the president of EEI, testified on the "issue of global climate change" before the U.S. Senate Natural Resources Committee. McCollam said that "the electric utility industry does not intend to ignore the possibility that a warming trend may be occurring."

"It is possible that an increase in concentration of atmospheric which absorb the outgoing infrared radiation could result in a rise in average global temperature," McCollam said. He also acknowledged that climate change "could have significant effects on agriculture, rainfall, sea level, storm events, demography, and human health."

However, McCollam claimed that "our knowledge is currently so limited that we cannot yet judge with any accuracy what might be the results of continued increases in greenhouse gases."

"... we believe that any plan calling for urgent and extreme action to reduce CO2 emissions is premature at best," McCollum said. EEI would soon go to great lengths to sow further doubt about climate science, and obstruct public policy efforts to reduce CO2 emissions.

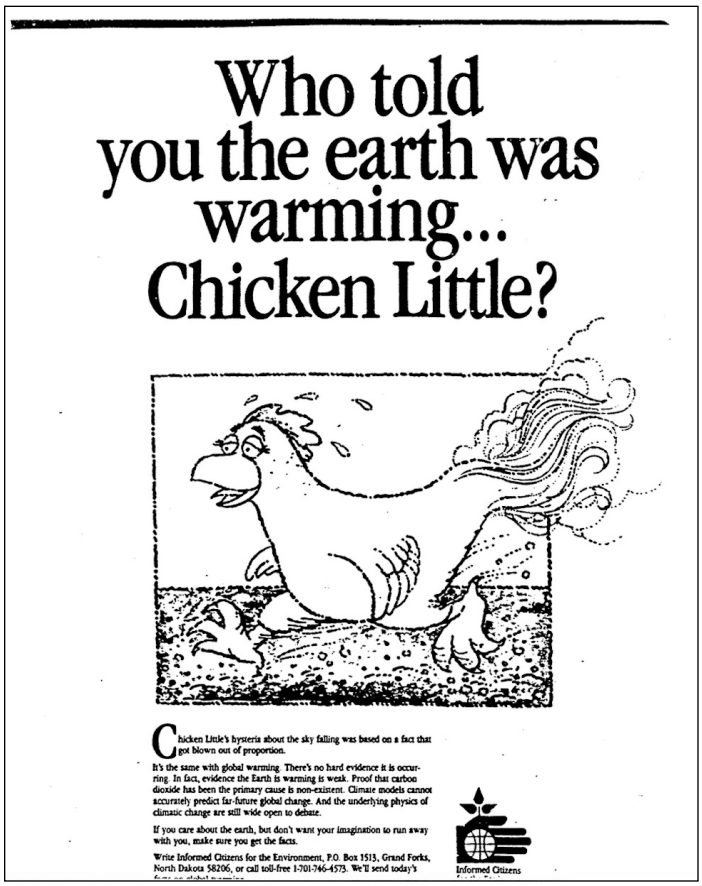
By 1989, political attacks on climate change science and solutions that would continue in the coming decades had begun to take shape. In the pages of the Executive Intelligence Review, a publication of conspiracy theorist Lyndon Larouche, the greenhouse effect was described as a hoax. Larouchies Carol White and Rogelio Maduro interviewed climate change skeptic Dr. Patrick Michaels, and Maduro later took credit for an subsequent increase in mainstream media coverage of the views of Michaels and other skeptics.

Michaels soon caught the eye of some powerful electric utility interests. He spoke at meetings of the EEI and Western Fuels Association in 1989, according to a copy of his CV published by the Society of Environmental Journalists. Michaels soon played a role in the electric utility industry's efforts to manufacture doubt about the causes and risks of climate change. From 1992-1995, Michaels received $25,000 from EEI for a "Literature Review of Climatic Change and Updates." In 1992, EEI featured Michaels' work in *Electric Perspectives.*

EEI's funding of Michaels was just one component of the electric utility industry's disinformation campaign against climate science, perpetrated to prevent legal limits on CO2 emissions from fossil fuel power plants.

Electric utilities try to put climate science on ICE

In 1991, the *New York Times* reported on leaked internal documents that exposed a detailed public relations campaign to "reposition global warming as theory (not fact)." Dubbed the Information Council on the Environment (ICE), the campaign was backed by EEI, Southern Company, and the Western Fuels Association, as well as coal interests that included Peabody Holding Company and National Coal Association. It featured ads that bore headlines like, "Who told you the earth was warming… Chicken Little?"



Informed Council on the Environment's advertisement, 1991

The ads included a P.O. Box to write to for more information, which came in the form of a letter from Dr. Patrick Michaels.

This sudden direct attack on the validity of climate science came a mere four years after EEI acknowledged the accumulation of evidence in its 1987 "Greenhouse Effect" article in *Electric Perspectives*. It also came just three years after the EPRI Journal declared in 1988 that, "There is a growing consensus in the scientific community that the greenhouse effect is real."

Documents titled, "I.C.E. Test Market Proposal" detailed the plan to:

1. Demonstrate that a consumer-based media awareness program can positively change the opinions of a selected population regarding the validity of global warming.

2. Begin to develop a message and strategy for shaping public opinion on a national scale.

3. Lay the solid groundwork for a unified national electric industry voice on global warming.

Internal polling recommended that ICE target "older, less-educated males" with radio ads, and the campaign included ads prepared to air on the Rush Limbaugh Show. It also recommended the campaign target "younger, low-income women" with magazine ads.

Informed Council on the Environment's advertisement, 1991

Test markets for the ICE campaign were to include locations where the "market derives a majority of electricity from coal." The "creative strategy" included the following:

The radio creative will directly attack the proponents of global warming by relating irrefutable evidence to the contrary, delivered by a believable spokesperson in the radio broadcast industry.

The print creative will attack proponents through comparison of global warming to historical or mythical instances of gloom and doom. Each ad will invite the listener/reader to call or write for further information, thus creating a data base.

A letter from Bill Brier of EEI to O. Mark De Michele, then President and CEO of Arizona Public Service Company, shared the results of "pre-test telephone interviews with 500 adults in Flagstaff" about global warming that found "80% claim the problem is somewhat serious while 45 percent it is very serious."

"With this high level of awareness and concern in Flagstaff it will be interesting to see how the science approach sells," Brier wrote. "My concern is that the absence in the messages of reasonable approaches to solving the problems of global warming may reduce their effectiveness."

Brier noted that ICE was informed of APS's right to distance itself from the campaign, and De Michele did just that in a 1991 interview with the *Arizona Daily Sun*.

"The subject matter is far too complex and could be far too severe than the ads make of it to be dealt with in a slick radio ad," De Michele said.

Once exposed, the ICE campaign had a relatively brief shelf life, but the campaign's deceptive strategy would be revived by future disinformation campaigns backed by the electric utility industry.

The Global Climate Coalition

In December of 1989, Southern Company employee J. Robert Minter wrote a letter to a member of Congress to arrange to introduce the Global Climate Coalition (GCC), which as *The New York Times* later reported "led an aggressive lobbying and public relations campaign against the idea that emissions of heat-trapping gases could lead to global warming." A list of early GCC members from that year included American Electric Power Company, Consumers Power Company, EEI, Pacific Gas & Electric Company, and Southern Company Services, Inc.

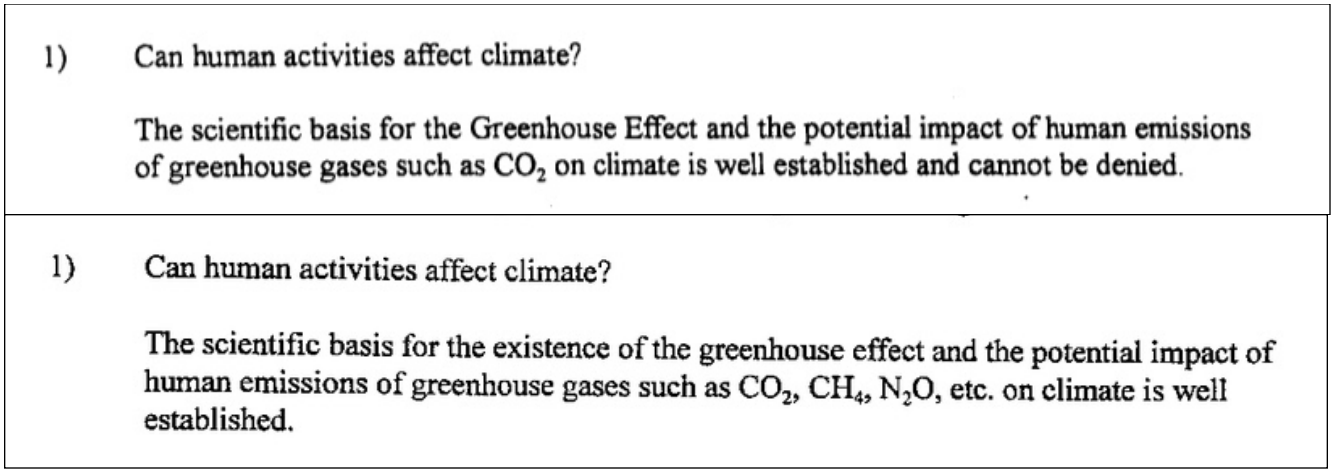
Documents show that the GCC deliberately spread misleading information about climate science, and withheld information that debunked the views of industry-backed climate change skeptics like Dr. Patrick Michaels.

In December of 1995, Lenny Bernstein of the Mobil Oil Corporation submitted "what I hope is the final draft of the primer on global climate change science we have been working on for the past few months" for review by members of the of the GCC's Science and Technical Advisory Committee (STAC).

"The scientific basis for the Greenhouse Effect and the potential impact of human emissions of greenhouse gases such as CO2 on climate is well established and cannot be denied," one line from Bernstein's draft primer said.

Bernstein's draft was reviewed at a January 1996 STAC meeting, according to minutes that were circulated by Southern Company. The meeting also took place at Southern Company's office in Washington, DC. An updated version of the primer marked "DRAFT - APPROVED BY STAC" was also circulated.

"The scientific basis for the existence of the greenhouse effect and the potential impact of human emissions of greenhouse gases such as CO2, CH4, N2O etc. on climate is well established," the STAC- approved draft said. STAC members chose to remove Bernstein's language that this scientific basis "cannot be denied."



1) Can human activities affect climate?

The scientific basis for the Greenhouse Effect and the potential impact of human emissions of greenhouse gases such as CO_2 on climate is well established and cannot be denied.

1) Can human activities affect climate?

The scientific basis for the existence of the greenhouse effect and the potential impact of human emissions of greenhouse gases such as CO_2, CH_4, N_2O, etc. on climate is well established.

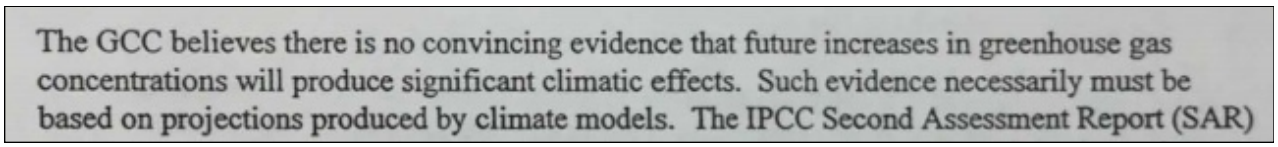
Global Climate Coalition members removed language that the scientific basis for the greenhouse effect "cannot be denied"

An "attendees list" from that same STAC meeting included a number of representatives from the electric utility industry:

- Robert Gehri of Southern Company
- Eric Kuhn of Cinergy Corp. (now Duke Energy)
- John Holt of National Rural Electric Cooperative Association
- Jerrell Smith of Union Electric (now Ameren)
- Chuck Hakkarinen of EPRI
- P.J. Womeldorff of Illinois Power Company (now Ameren)
- Roy Hamne of Duke Power
- John Kinsman of EEI

Also present at the meeting were Mobil's Bernstein, and representatives from the Alliance of Automobile Manufacturers, American Petroleum Institute, and National Mining Association, and Western Fuels Association.

A few months later, in November of 1996, the Global Climate Coalition published "An Overview" where it outlined its public position on climate change. "The GCC believes that there is no convincing evidence that future increases in greenhouse gas concentrations will produce significant climatic effects," said one line in the position statement. Gone was any reference to the "well established" science on the potential climate impacts of CO2 and other greenhouse gas emissions, science that Bernstein had earlier concluded "cannot be denied."


The GCC believes there is no convincing evidence that future increases in greenhouse gas concentrations will produce significant climatic effects. Such evidence necessarily must be based on projections produced by climate models. The IPCC Second Assessment Report (SAR)

Global Climate Coalition's public position on climate change, Global Climate Coalition publication, 1996

Bernstein's earlier draft primer on climate science also included a section that critiqued a number of the "contrarian theories" espoused by Dr. Patrick Michaels and other vocal climate skeptics.

"The contrarian theories raise interesting questions about our total understanding of climate processes, but they do not offer convincing arguments against the conventional model of greenhouse gas emission-induced climate change," Bernstein said.

"... Michaels' questions about the temperature record are not convincing arguments against any conclusion that we are currently experiencing warming as the result of greenhouse gas emissions," Bernstein concluded.

That entire section was dropped at the January 1996 STAC meeting.

"Most suggestions were to drop the 'contrarian' part," the minutes prepared by Southern Company said. "This idea was accepted and that portion of the paper will be dropped. The ideas brought out in the 'contrarian' section may be dealt with in a future paper."

John Kinsman of EEI also gave a presentation, "Global Climate Change Science -- Review of Recent Developments," that reviewed the work of the IPCC.

The GCC's attacks on climate science advanced its goal of opposing national and international limits on greenhouse gas emissions.

"Existing scientific evidence does not support actions aimed solely at reducing or stabilizing greenhouse gas emissions," the GCC website claimed in 1998. "The Coalition does support actions to reduce greenhouse gas emissions or to increase greenhouse gas sinks that are justified for other economic or environmental reasons."

A backgrounder on "Science and Global Warming" found on the same website included the GCC's version of the history of climate change concerns:

In the past two decades, many scientists have raised concerns about the future of the earth's climate. In the 1970s, leading scientists raised concerns about global cooling, leading to predictions of a coming ice age. A few scientists still recognize a cooling potential.

In the mid-1980s, concern shifted to global warming, with a number of scientists stating their belief that the Earth was warming as a result of an increasing concentration of greenhouse gases in the atmosphere. Some scientists predicted dramatic increases in temperature, which would lead to the melting of polar ice-caps, rising of sea levels, and other catastrophic events. Today, after several years of investigation, many of these dire predictions have been moderated.

This misleading account ignores the fact that GCC members from the fossil fuel and utility industries knew about the possible climate-altering effects of CO2 emissions by the 1960s, and were engaged in research and lobbying on the issue by the 1970s.

Southern Company eventually left the GCC in 2000, and the group disbanded in 2002 amidst public opposition to its tactics and a wave of corporate defections. But by that time the damage was done. The GCC had achieved its goal of keeping the U.S. out of the international Kyoto Protocol to limit greenhouse gas emissions, and President George W. Bush had caved into industry pressure and abandoned his campaign pledge to regulate CO2 emissions.

Electric Utility Funding for Dr. Wei-hock "Willie" Soon

Electric utility funding for climate skeptic Dr. Wei-hock "Willie" Soon began in the 1990s and continued up until 2015, according to the information that's been disclosed to date. In 1996, the *EPRI Journal* announced EPRI's sponsorship of research by Sallie Baliunas and Willie Soon of the Harvard Smithsonian Center for Astrophysics, and Eric Posymentier of Long Island University. The research examined the roles of solar irradiance and greenhouse gas emissions on temperature changes that occurred between 1880 and 1993.

"They found that the temperature variations predicted by their model account for up to 92% of the temperature changes actually observed over the time period - by far the closest match yet achieved," the EPRI Journal reported. "Their results also suggest the sensitivity of climate to the effects of solar irradiance is about 27% higher than its sensitivity to forcing by greenhouse gas emissions."

Baliunas, Posmentier, and Soon disclosed funding from fossil fuel interests for the paper, including money from the American Petroleum Institute, Mobil Foundation and the Texaco Foundation. API and EPRI sponsored another paper that Baliunas and Soon published with another researcher in 1994.

As noted earlier in this report, Chauncey Starr also attached EPRI's name to the work of Baliunas, Soon, and other climate skeptics during the 1990 and 2000s through his role on the George C. Marshall Institute's board of directors. Starr served as EPRI's founding president

during the early 1970s and stayed on board with EPRI until his death in 2007.

Soon has received more than $1.2 million from fossil fuel and electric utility interests since 2001, according to records obtained from the Smithsonian by the Climate Investigation Center and Greenpeace. That total doesn't include the money he received from EPRI and fossil fuel interests during the 1990s.

DISCOVERY

Basic science and innovative engineering at the cutting edge

Global Climate Change: Sunspots Revisited

For nearly two centuries, scientists have speculated about the possible effect of sunspots on global climate, but the mechanism that might be involved has remained a matter of considerable controversy. A central question is how total solar irradiance—the amount of energy received by the earth from the sun—is affected by sunspot activity, which follows an 11-year cycle.

It has been commonly assumed that total solar irradiance would decrease as the number of dark sunspots increased. Direct satellite measurements of irradiance, however, have shown just the opposite to be the case. This means that given more sunspots, more energy is delivered to the atmosphere and global temperatures should rise. Building on this new understanding, recent research, sponsored in part by EPRI, indicates that looking at the combined effects of changes in solar irradiance and increases in atmospheric greenhouse gases offers the best explanation yet for the observed rise in average global temperature over the last century.

According to current theory, sunspots occur in pairs as magnetic disturbances in the convective plasma near the sun's surface. Magnetic field lines emerge from one sunspot and reenter at the other spot. During periods of increased magnetic activity, the sun is brighter and more charged particles are emitted from the solar surface.

Not only does the increased brightness of the sun tend to warm the earth, but also the solar wind shields the atmosphere from cosmic rays, which produce carbon 14. Because of this effect, measuring carbon 14 in tree rings offers a way of inferring the sun's magnetic history. Studies of changes in both the magnetic field coverage and the brightness of nearby stars have also provided a better understanding of the connection between the sun's magnetism and changes in its irradiance.

Using this information and a global climate model based on energy conservation, Sallie Baliunas and Willie Soon of the Harvard-Smithsonian Center for Astrophysics and Eric Posmentier of Long Island University constructed a profile of atmospheric climate "forcing" due to combined changes in solar irradiance and emissions of greenhouse gases between 1880 and 1993. They found that the temperature variations predicted by their model accounted for up to 92% of the temperature changes actually observed over the period—by far the closest match yet achieved. Their results also suggest that the sensitivity of climate to the effects of solar irradiance is about 27% higher than its sensitivity to forcing by greenhouse gases.

An intriguing sidelight to this discovery is the implication that, at times, the sun's influence on climate may be dramatically greater. Studies of the sun and other stars show that they spend about a quarter of their time in a magnetically quiescent state with very few sunspots. The last such event on our sun occurred in the late seventeenth century and was associated with an extended period of unusually cold temperatures known as the Little Ice Age. No one has yet found a way to predict when such an episode might recur.

■ *For more information, contact John Maulbetsch, (415) 855-2438.*

Sunspots mark changes in the sun's magnetic activity.

4 EPRI JOURNAL September/October 1996

"Global Climate Change: Sunspots Revisited" in EPRI's 1996 September/October journal. Research by Sallie Baliunas and Willie Soon was highlighted. EPRI also announced its sponsorship of their research in the journal.

More than $400,000 of that total came from contributions Southern Company made between 2008 and 2015. The Smithsonian agreed not to disclose Soon's funding from Southern Company "without express written consent." Soon published a total of 11 papers, described as "deliverables" and paid for by Southern Company, without disclosing his financial ties to the utility company.

"Without exception, the papers question the extent, severity, cause or existence of man-made climate change," according to a review by InsideClimate News.

One funding agreement also stipulated that the Smithsonian provide Southern Company "an advance written copy of proposed publications regarding the deliverables for comment and input, if any, from SCS."

Finally, in April of 2015, Southern Company informed reporters that, "Our agreement with the Smithsonian Astrophysical Observatory expires later this year and there are no plans to renew it."

The scandal prompted U.S. Senators Edward Markey, Barbara Boxer, and Sheldon Whitehouse to send letters to 100 fossil fuel and electric utility companies and industry-backed groups in 2015, in an effort to:

… determine whether they are funding scientific studies designed to confuse the public and avoid taking action to cut carbon pollution, and whether the funded scientists fail to disclose the sources of their funding in scientific publications or in testimony to legislators.

No response was ever reported. Since then, the Smithsonian disclosed that Soon received more anonymous funding in 2016 through the dark money portal known as Donors Trust.

Electric utilities' two-faced approach to climate change

Since 1988, electric utilities have continued to fund some credible climate change research through EPRI. During the 1990s and 2000s, EEI also encouraged electric utilities to support voluntary federal government initiatives aimed at reducing CO2.

However, EEI explicitly framed these voluntary efforts as a means to avoid mandatory legal limits on CO2 emissions. For example, EEI warned members that, "If we do not work now toward the goal of achieving voluntary GHG emissions reduction, we run the risk of facing stringent mandatory regimes…"

In 1999, Southern Company promoted its tree planting program as a way to capture and store CO2 emissions.

Efforts like these allowed utilities to say they were doing *something* about the problem even as their CO2 emissions increased and their disinformation campaigns against climate science continued.

Electric utility industry opposition to EPA limits on CO2 emissions

Documents show that the electric utility industry has played a role in the opposition to EPA limits on CO2 emissions since the late 1990s. As the Union of Concerned Scientists has noted, by 1998 the EPA had asserted its legal authority under the Clean Air Act to limit greenhouse gas emissions from power plants. Nearly two decades later, in 2017, the EPA remains unable to enforce limits on these emissions, due largely to years of opposition from electric utility and fossil fuel interests and their political allies.

For example, documents show that representatives from EEI and NRECA participated in a 1999 meeting convened by the American Petroleum Institute to coordinate a joint industry response to the threat of EPA regulation of greenhouse gas emissions. In 2001, Haley Barbour, then a lobbyist for Southern Company and the Electric Reliability Coordinating Council, sent a memo to the Bush administration officials opposing regulation of CO2 emissions. A short time later President George W. Bush informed Congress that, "I do not believe, however, that the government should impose on power plants mandatory emissions reductions for carbon dioxide, which is not a 'pollutant' under the Clean Air Act." As a presidential candidate, Bush had characterized CO2 as a pollutant and promised to require "all power plants" to reduce CO2 emissions. Thomas Kuhn, the president of EEI and a major fundraiser for the Bush campaign, also reportedly engaged in "ferocious lobbying" on the issue.

Electric utilities were dealt a blow in 2007, when the Supreme Court affirmed the EPA's legal authority to regulate CO2 emissions. But through the Utility Air Regulatory Group, utilities continued to use the courts to fight to strip the EPA of its legal authority to regulate CO2 emissions under the Clean Air Act until 2014.

In 2015, under President Barack H. Obama's administration, the EPA finally finalized its first-ever limits on CO2 emissions from power plants, dubbed the Clean Power Plan. But documents show that Southern Company and the coal and utility-backed American Coalition for Clean Coal Electricity recruited Republican state attorneys general to oppose the EPA's

efforts. Many other utilities, as well as EEI, have fought the Clean Power Plan from behind the scenes through their membership in or support of the Utility Air Regulatory Group. In 2016, the Supreme Court put the new limits on CO2 on hold while the ensuing legal battle played out.

The election of Donald J. Trump for president in November of 2016 would soon lead to the rollback of EPA's Clean Power Plan, and the withdrawal of the U.S. as an active partner in the global Paris climate agreement.

2017: Electric utilities and climate change under the Trump administration

After the 2016 election, electric utilities worked to secure their influence with the new administration. EEI helped to fund Trump's transition to power, and one of the group's top lobbyists landed a job as Secretary of Energy Rick Perry's chief of staff. Several electric utilities - NextEra Energy, Southern Company, and Xcel Energy - helped to fund President Trump's inauguration and in exchange received access to administration officials at inaugural events. President Trump soon put a lobbyist for Southern Company in charge of environmental law enforcement at the Department of Justice.

Some electric utilities continue to fund powerful special interest groups that are lobbying the Trump administration to target climate science and roll back key U.S. climate change policies, including the Clean Power Plan and Paris climate agreement.

Electric utilities continue to back attacks on climate change science and solutions

The following table identifies electric utility companies' and EEI's ongoing funding efforts to sow doubt about climate science and/or oppose limits on CO2 emissions through their memberships in four special interest groups - the Utility Air Regulatory Group, U.S. Chamber of Commerce, American Legislative Exchange Council, and American Coalition for Clean Coal Electricity.

	UARG	US Chamber	ALEC	ACCCE
Ameren	X	X		
American Electric Power	X	X		X
CMS (Consumers Energy)	X			
Dominion	X	X	X	
DTE Energy	X			
Duke Energy	X		X	

	UARG	US Chamber	ALEC	ACCCE
EEI	X	X	X	
Entergy		X		
Exelon		X		
FirstEnergy	X			
PPL	X			
Sempra Energy		X		
Southern Company	X	X		X
WEC Energy Group	X			

These groups continue to advance the agenda of some of their electric utility members on climate change.

Utility Air Regulatory Group (UARG)

This report already touched on UARG's role in the industry-backed lawsuits that led the Supreme Court to put the EPA's Clean Power Plan on hold while litigation played out. In addition, in 2017, UARG weighed in on the Trump administration's efforts to repeal and possibly replace the Clean Power Plan. UARG demanded that any replacement or revisions must significantly weaken the EPA's earlier approach under the Clean Power Plan. Specifically, UARG argued that any required CO2 reductions "must be achievable by the individual electric generating units subject to the rule." While the Clean Power Plan encouraged the use of renewable energy and energy efficiency to reduce CO2 emissions, UARG's approach would benefit utilities that rely on fossil fuels to generate electricity by taking these truly clean energy sources off the table.

U.S. Chamber of Commerce

In January of 2017, Christopher Guith, a senior vice president for policy at the U.S. Chamber's Global Energy Institute, discussed the future of energy policy under the Trump administration at an event in Kentucky:

"...climate has never been, well at least in the last 10 years, about scientific facts," Guith said. "It's been about religion."

The U.S. Chamber's policy priorities for 2017 include plans to, "Oppose EPA efforts to regulate greenhouse gases under the existing Clean Air Act, including the endangerment finding." The endangerment finding is the EPA's official scientific finding that greenhouse gas emissions and climate change endanger public health and the environment, and it provides the EPA with the legal authority to limit these emissions. The U.S. Chamber's lobbying in 2017 also supports the Trump Administration's effort to roll back the Clean Power Plan.

Environmentalists and public interest groups are calling on companies that support the Paris climate agreement to #DroptheChamber, but so far no electric utilities have answered the call in 2017.

American Legislative Exchange Council (ALEC)

In 2017, ALEC renewed its controversial position on the causes of climate change, found in a longstanding statement of the group's Energy Principles:

Global Climate Change is Inevitable: *Climate change is a historical phenomenon and the debate will continue on the significance of natural and anthropogenic contributions.*

ALEC has also backed the Trump administration's moves to exit the Paris climate agreement, and the group has long opposed any limits on CO2 emissions. It celebrated President Trump's selection of former Oklahoma attorney general Scott Pruitt - a climate denier and longtime opponent of the Clean Power Plan with close ties to electric utility interests like AEP - to lead the EPA.

A lobbyist for Vistra Energy, a subsidiary of Energy Future Holdings, continues to serve on the American Legislative Exchange Council's Private Enterprise Advisory Council, alongside officials from ExxonMobil and Peabody Energy. An NRECA official serves as private chair for ALEC's group's Energy, Environment, and Agriculture Task Force.

Some electric utilities like American Electric Power have quit ALEC amidst public opposition to the group's well-documented record of climate change denial. However, the latest information available indicates that EEI and some electric utilities - including Dominion Energy and Duke Energy - continue to back ALEC's agenda.

American Coalition for Clean Coal Electricity (ACCCE)

President Trump's EPA administrator Scott Pruitt announced a controversial plan to conduct a politically motivated review of climate science during a June 2017 meeting with the leadership of the American Coalition for Clean Coal Electricity, which counts coal and utility interests among its dwindling membership. American Electric Power, Southern Company, and several electric cooperatives are the only utilities that remain members of the group, which continues to lobby for the repeal of EPA limits on CO2 from power plants.

Some of these same electric utilities have faced growing pressure from their own investors to clean up their acts on climate change.

Electric utilities continue to resist shareholder proposals on climate change

In 2017, major electric utilities - including AES Corp., Dominion Energy, DTE Energy, Duke Energy, PPL, and Southern Company - resisted growing calls from investors to develop plans to align their business models with Paris climate agreement goal of limiting global warming to 2°C, embodied by the Paris climate agreement. EEI highlighted its role as an industry leader in opposing stronger rules for disclosing climate change-related risks to investors.

Still, PPL shareholders passed one climate change proposal with 57 percent support, over the company's opposition. Other climate change proposals also received stronger from electric utility company shareholders support than similar ones in the past.

Conclusion: Electric utilities continue to repeat the mistakes of the past

Electric utilities remain reliant on fossil fuels to produce 65 percent of their power in 2017, due to the investments they have made in coal and natural gas-fired power plants over the nearly 50 years since that first 1968 warning about the threat that CO2 emissions could one day pose to the climate.

Today we live with some of the climate impacts of CO2 emissions that scientists warned electric utilities about during the 1970s and 1980s: higher temperatures, rising seas, and melting ice in Antarctica.

Electric utilities knew long ago about the risks of delaying action to address climate change, but continued to invest in new coal generation - the largest emitter of CO2 - until around 2013. The industry continues to repeat the mistakes of the past, today evidenced by a rush to build new natural gas power plants and pipelines that puts our climate at further risk. Experts warn that while replacing old coal-fired power plants with natural gas helps to reduce CO2 in the short-term, the industry could soon need to shift away from gas to meet the Paris climate agreement goal of limiting global warming to 2°C or less.

Way back in 1976, AEP's advertising campaign claimed that "the problems generally associated with the mining and burning of coal have been solved," even though the company was likely aware of scientists' warnings about the unsolved problem of CO2 emissions. As recently as 2012, the utility-backed ACCCE ran similar pro-coal ads the closed with the line, "Clean coal. Now is the time."

Today, EEI is working to frame the electric utility industry's risky gamble on natural gas as "clean" even though natural gas is still a fossil fuel and a source of heat-trapping CO2 and methane emissions. A leaked 2017 communications memo from EEI confirmed that it is trying to position the utility industry's gas investments as "sunshine peakers" that "go hand-in-hand with renewable energy" and are part of a "low-carbon future."

It is true that total annual CO2 emissions from the electricity utility industry have declined from the peak in the mid-2000s, as utilities have retired old coal-fired power plants and invested in cleaner electricity sources. However, the industry's yearly CO2 emissions remained higher in 2016 than in 1988 and 1989, largely to utility-backed efforts in the years since to deny the causes and risks of climate changes and block legal limits on CO2 emissions from power plants.

Research has shown that electric utilities could face serious financial repercussions if ever held liable for the climate change damages incurred by their power plant emissions. The New York State Office of the Attorney General has reached settlements with three major electric utilities and coal producer Peabody Energy after investigations into whether these companies adequately disclosed financial risks related to climate change to investors. It is also investigating ExxonMobil along similar grounds.

Most Americans strongly support legal limits on CO2 from power plants, and studies show that renewable energy can provide 80 to 100 percent of our electricity in the coming years. Hope remains that the electric utility industry can finally clean up its CO2 emissions, even if it must be dragged kicking and screaming along the way.