

## Inside Climate News

### Exxon's Own Research Confirmed Fossil Fuels' Role in Global Warming Decades Ago

Outfitting its biggest supertanker to measure the ocean's absorption of carbon dioxide was a crown jewel in Exxon's research program.

By Neela Banerjee, Lisa Song and David Hasemyer  
September 17, 2015

In 1981, 12-year-old Laura Shaw won her seventh-grade science fair at the Solomon Schechter Day School in Cranford, N.J. with a project on the greenhouse effect.

For her experiment, Laura used two souvenir miniatures of the Washington Monument, each with a thermometer attached to one side. She placed them in glass bowls and covered one with plastic wrap – her model of how a blanket of carbon dioxide traps the reflected heat of the sun and warms the Earth. When she turned a lamp on them, the thermometer in the plastic-covered bowl showed a higher temperature than the one in the uncovered bowl.

If Laura and her two younger siblings were unusually well-versed in the emerging science of the greenhouse effect, as global warming was known, it was because their father, [Henry Shaw](#), had been busily tracking it for Exxon Corporation.

“I knew what the greenhouse effect was before I knew what an actual greenhouse was,” David Shaw, Henry’s son, said in a recent interview.

Henry Shaw, who died in 2003, was one of the Exxon scientists engaged in an ambitious quest to comprehend the potentially devastating effects that carbon dioxide emissions could have on the climate. From the late 1970s to the mid-80s, Exxon scientists worked at the cutting edge of [climate change](#) research, documents examined by InsideClimate News show. This history of that research emerged from an eight-month investigation by InsideClimate News.

Exxon documents show that top corporate managers were aware of their scientists’ early conclusions about carbon dioxide’s impact on the climate. They reveal that scientists warned management that policy changes to address climate change might affect profitability. After a decade of frank internal discussions on global warming and conducting unbiased studies on it, Exxon changed direction in 1989 and spent more than 20 years discrediting the research its own scientists had once confirmed.

After reading the first chapter of InsideClimate News’ series on Exxon’s carbon dioxide research, the company declined to answer specific questions. In an email, Exxon spokesman Richard D. Keil said he would no longer respond to inquiries from InsideClimate News, and added, “ExxonMobil scientists have been involved in climate research and related policy analysis for more than 30 years, yielding more than [50 papers in peer-reviewed publications](#).”

## Building the Team

Henry Shaw was part of an accomplished group at Exxon tasked with studying the greenhouse effect. In the mid-70s, documents show that Shaw was responsible for seeking out new projects that were “of national significance,” and that could win federal funding. Others included [Edward E. David, Jr.](#), a former science advisor to President Richard Nixon, and [James F. Black](#), who worked on hydrogen bomb research at Oak Ridge National Laboratory in the 1950s.

Black, who died in 1988, was among the first Exxon scientists to become acquainted with the greenhouse effect. Esso, as Exxon was known when he started, allowed him to pursue personal scientific interests. Black was fascinated by the idea of intentionally modifying weather to improve agriculture in arid countries, said his daughter, Claudia Black-Kalinsky.

“He believed that big science could save the world,” she said. In the early 1960s, Black helped draft a National Academy of Sciences report on weather and climate modification. Published in 1966, it said [the buildup of carbon dioxide in the atmosphere](#) “agrees quite well with the rate of its production by man’s consumption of fossil fuels.”

In the same period, a report for President Lyndon Johnson from the President’s Science Advisory Council in 1965 said the burning of fossil fuels “may be sufficient to produce measurable and perhaps marked changes in climate” by the year 2000.

By 1977, Black had become a top technical expert at Exxon Research & Engineering, a research hub based in Linden, N.J., and a science advisor to Exxon’s top management. [That year he made a presentation](#) to the company’s leading executives warning that carbon dioxide accumulating in the upper atmosphere would warm the planet and if the CO<sub>2</sub> concentration continued to rise, it could harm the environment and humankind.

“The management committee consisted of the top level senior managers at Exxon. The chairman, the president, the senior vice presidents, corporate wide,” [N. Richard Werthamer](#), who worked at Exxon Research, said in a recent interview with InsideClimate News. “The management committee only has a limited amount of time and they’re only going to deal with issues that are of relevance to the corporation as a whole. They’re not interested in science per se, they are interested in the implications, so it was very significant.”

In those years, the evidence of global warming justified neither panic nor complacency. “A lively sense of urgency,” is what the National Academy of Sciences (NAS) [called for in a 1977 report](#) that contained a comprehensive survey of what was understood about global warming at that time.

The NAS report said that it would be understandable if the uncertainties of climate science elicited a cautious response from researchers and policymakers. But “if the decision is postponed until the impact of man-made climate changes has been felt, then, for all practical purposes, the die will already have been cast,” it concluded.

Shaw heard these conclusions in October 1977 at a meeting in Atlanta organized by scientists and officials from the Carter administration who had formed a “study group on global environmental effects of carbon dioxide,” [he told Exxon colleagues in a memo two weeks later](#).

The NAS report had concluded that the climatic effects of rising carbon dioxide “may be the primary limiting factor on energy production from fossil fuels over the next few centuries,” Shaw wrote, quoting the report’s central conclusion almost verbatim.

Along with an awareness of the science, Shaw gained a sense of opportunity, Exxon documents show. The U.S. Energy Department, which had only been created in 1977 in response to a global oil shortage, was launching a research program into carbon dioxide’s effects and planned to disburse about \$9 million to research laboratories, Shaw learned.

At the time, two major uncertainties plagued climate science: how much of the CO<sub>2</sub> in the air came from fossil fuels as opposed to deforestation? And how quickly could the oceans absorb atmospheric CO<sub>2</sub>? The scientists at the Atlanta meeting considered it crucial to investigate those questions immediately, Shaw wrote.

Both issues were vital to the oil industry’s future. If deforestation played as great a role as fossil fuels in CO<sub>2</sub> accumulation, then responsibility for reducing carbon dioxide emissions would not fall entirely on the energy industry. If the oceans could slow the greenhouse effect by absorbing more CO<sub>2</sub>, there would be time before the fossil fuel industry had to adjust.

In a [memo to a colleague in March 1978](#), one of Shaw’s bosses, [Harold N. Weinberg](#), wrote: “I propose that Exxon be the initiator of a worldwide ‘CO<sub>2</sub> in the Atmosphere’ R&D program... What would be more appropriate than for the world’s leading energy company and leading oil company [to] take the lead in trying to define whether a long-term CO<sub>2</sub> problem really exists, and if so, what counter measures would be appropriate.”

But Weinberg’s vision proved too ambitious for Exxon.

Exxon Research “considered an independent research program but concluded that the amount of effort required and the scope of disciplines involved made it impractical for a single institution to attack this problem alone,” Walter R. Eckelmann, an executive at the Science & Technology Department at Exxon headquarters in New York wrote to a senior vice president.

Eckelmann’s letter was one of many instances when Exxon’s CO<sub>2</sub> research would reach beyond Exxon Research & Engineering in New Jersey and to executives at the company’s New York headquarters, documents show.

Exxon’s extensive research was driven by the threat accumulating CO<sub>2</sub> posed to the company’s core business, according to participants and documents.

“My guess is they were looking for what might happen if we keep burning fossil fuels; what that would mean to them,” said [Taro Takahashi](#), an adjunct professor at Columbia University’s Lamont-Doherty Earth Observatory. Takahashi, who spent his career studying climate change,

collaborated on a research project with Exxon in the late 1970s to early 80s and used data from the research in several studies he later published in peer-reviewed journals.

The project he worked on—outfitting an ocean tanker to measure the ocean’s absorption of carbon dioxide—was a crown jewel in Exxon’s research program.

## **Groundbreaking Experiments**

Bold research projects were not uncommon at Exxon, which in the 1970s considered gradually shifting from oil to become a diversified energy company. Through its research units, Exxon explored ways to encourage more efficient consumption of petroleum and a wide range of alternative fuels. After company scientist Elliot Berman found a way to slash the cost of making photovoltaic solar cells by 80 percent, Exxon’s chairman Clifton Garvin publicized how he heated his family swimming pool with solar power to show support for energy diversification.

To nudge greater innovation, Garvin hired Edward E. David, Jr. in 1977 to run Exxon Research. David had spent two decades at Bell Labs, a leader in the blue-sky research that led to big leaps in technology, and eventually became its director of research. While serving as Nixon’s science advisor from 1970-’73, White House staff taught him about climate science as part of a report on energy and electricity issues, one former staff member recalled.

At Exxon, David opened the door wide to studying carbon dioxide.

In a letter to David and 14 other Exxon Research executives in December 1978, Shaw spelled out why Exxon should take on carbon dioxide research—specifically, with the ambitious ocean-sampling initiative.

“The rationale for Exxon’s involvement and commitment of funds and personnel is based on our need to assess the possible impact of the greenhouse effect on Exxon business,” Shaw wrote. “Exxon must develop a credible scientific team that can critically evaluate the information generated on the subject and be able to carry bad news, if any, to the corporation.

“We see no better method to acquire the necessary reputation than by attacking one of the major uncertainties in the global CO<sub>2</sub> balance, i.e., the flux to the oceans and providing the necessary data.”

Scientists knew the oceans had some ability to absorb CO<sub>2</sub> and potentially neutralize climate change. Any CO<sub>2</sub> that made its way from the atmosphere into the deep oceans—more than 50 to 100 feet below the surface—would be sequestered away for hundreds of years. But they also knew the rate of absorption was limited, and determining the exact rate was crucial for understanding the oceans’ ability to delay the greenhouse effect.

## **Exxon’s Floating Lab**

Exxon delved into the oceans’ role by installing a state-of-the-art lab aboard the *Esso Atlantic*, one of the biggest supertankers of the time.

Exxon planned to gather atmospheric and oceanic CO<sub>2</sub> samples along the *Esso Atlantic*'s route from the Gulf of Mexico to the Persian Gulf. If the sensors revealed a deep enough oceanic sink, or absorption, the fossil fuel industry might have more time before it had to make tough decisions about its role in warming the planet.

“We couldn't account for everything because the exchanges between the atmosphere and the oceans weren't fully understood,” Edward Garvey, Shaw's main researcher on the tanker project, said in an interview. “Our goal was to complete the carbon cycle to understand where global carbon production would end up and then make forecasts of how the system would react in the future.”

The experiment began on August 8, 1979, when Garvey oversaw the equipping of the *Esso Atlantic*, which was docked by the Lago Refinery in Aruba, an island in Dutch West Indies.

Werthamer, Shaw's boss in 1980-81, said the project wouldn't have happened without Shaw's initiative.

“Henry Shaw was a very forceful guy, quiet, he didn't hit you over the head, but he presented his case in ways that made it hard to not agree with it,” Werthamer said in a recent interview. “He had the political savvy to put it over and the technical savvy to make it happen.”

While the company had the wherewithal to carry out the study on the oceans, it lacked the expertise. So Exxon recruited two experts, [Wallace Broecker and Takahashi](#), his colleague at Columbia University's Lamont-Doherty Geological Observatory.

Takahashi said he made it clear that he and [Broecker](#) would not compromise their scientific integrity. “The one condition that was not negotiable was we shall publish our results to the open public no matter the results,” he said in an interview.

Exxon scientists and managers involved with the project agreed.

“The tanker project was intended to provide valid, legitimate, scientific data, unassailable hopefully, on key questions in atmospheric chemistry [of] CO<sub>2</sub> emissions,” Werthamer said. “Henry's additional goal was to make Exxon a credible participant in that research and in the dialogue that would inevitably follow...He wanted Exxon to be respected as a valid player and have Exxon's opinions solicited, and participate in discussions on policy, rather than have the issue suddenly dumped with Exxon's back turned.”

Responding to ICN's questions about the tanker research last week, Exxon spokesman Richard Keil said it “was actually aimed at increasing understanding of the marine carbon cycle – it had nothing to do with CO<sub>2</sub> emissions.”

But from the beginning of the research, documents show, its participants described it differently.

In a memo to Harold Weinberg on July 3, 1979, Shaw described in detail the tanker's route and its instruments, explaining that "this will provide information on the possible growth of CO<sub>2</sub> in the atmosphere."

In a [November 1979 memo](#) to Weinberg, he wrote, "It behooves us to start a very aggressive defensive program in the indicated areas of atmospheric science and climate because there is a good probability that legislation affecting our business will be passed."

Depending on its findings, the research might provide an escape valve from the carbon problem, or point to some new direction in energy.

The research "could well influence Exxon's view about the long-term attractiveness of coal and synthetics relative to nuclear and solar energy" David wrote in a November 1979 letter to senior vice president [George T. Piercy](#).

Exxon's enthusiasm for the project flagged in the early '80s when federal funds fell through. Exxon Research cancelled the tanker project in 1982, but not before Garvey, Shaw and other company engineers [published an initial paper in a highly specialized journal](#) on the project's methodology.

"We were anxious to get the word out that we were doing this study," Garvey said of the paper, which did not reach sweeping conclusions. "The paper was the first of what we hoped to be many papers from the work," he said in a recent email. But the other publications never materialized.

Takahashi later [co-authored a study in 1990](#) partially based on the tanker data that said land-based ecosystems—boreal forests, for example—absorbed more atmospheric CO<sub>2</sub> than the oceans. He used Exxon's tanker records again in 2009, [in an updated study that compiled 30 years of oceanic CO<sub>2</sub> data from dozens of reports](#). This time, his team concluded the oceans absorb only about 20 percent of the CO<sub>2</sub> emitted annually from fossil fuels and other human activities. The paper earned Takahashi a "Champions of the Earth" prize from the United Nations.

Other research ideas that bubbled up in those days were even more imaginative.

Shaw and Garvey sketched out a second project to determine how much carbon dioxide in the atmosphere was attributable to fossil fuels as compared to deforestation. Shaw's team proposed measuring the carbon isotopes—a chemical fingerprint—in 100 bottles of vintage French wine over time. To ensure data quality, they would only sample wine from long-established vineyards that kept careful records of temperatures and growing conditions. In the same file was a New York Times review by wine critic Frank Prial of classic Bordeaux vintages, including a \$300 Lafite-Rothschild bottle from 1945.

"The C-isotope studies of biological material also appear useful and novel," David Slade, the head of the Energy Department's carbon dioxide research, wrote to Shaw in a May 1979 letter.

“We congratulate (with some envy) Exxon’s resourcefulness in selecting aged wines as the biological material.”

## **Implications Become Clearer**

As Exxon worked to reduce the uncertainties of climate science, its employees developed a sophisticated understanding of the potential effects of rising CO<sub>2</sub> concentrations, documents show. They understood that the Earth’s poles would warm more quickly than the rest of the planet, and how a reduction in ice and snow cover would change the planet’s ability to reflect sunlight.

They also discussed among themselves and with corporate executives other potential effects of climate change, including an increase in weeds, pests, and human migration, the documents show.

Some of the company’s highest-ranking executives were told of the studies and of estimates about when the impact of global warming might be felt. On November 9, 1979, Edward David wrote a three-page letter to senior vice president Piercy explaining the importance of the ocean investigations.

In January 1980, Science & Technology’s Eckelmann wrote to senior vice president [M.E.J. “Morey” O’Loughlin](#) that his unit “feels that the build-up of carbon dioxide in the atmosphere is a potentially serious problem requiring the results of a huge worldwide research effort before quantitative predictions can be reached on the probabilities and timing of world climate changes.”

Piercy and O’Loughlin seemed particularly interested in following the emerging climate science, [internal documents indicate](#). In a memo to Werthamer and Shaw in June 1980, Weinberg wrote that Piercy “questioned him closely” at an Exxon meeting about the movement of carbon dioxide between the atmosphere and the oceans.

## **Outside Experts Take Notice**

During this time, Exxon was building a reputation for expertise on carbon dioxide, prompting government and industry to seek its input on the issue. As early as 1979, the American Petroleum Institute formed a CO<sub>2</sub> and Climate Task Force, and Exxon sent Shaw to the group’s meetings as its representative, according to documents. The other industry members were Sohio, Texaco, and Shell. They often met in a conference room at LaGuardia Airport.

Shaw was a regular on advisory committees and government task forces, rubbing shoulders with many leading climate scientists, including NASA’s James Hansen and Columbia’s Stephen Schneider, whom Exxon even considered as a possible recruit, according to one document.

U.S. government officials expressed their appreciation to Exxon for the company’s contributions, calling it a valued partner.

In a letter to Shaw in May 1979, David Slade, the head of the Energy Department's Carbon Dioxide and Climate Research program, wrote: "This represents very responsible action, which we hope will serve as a model for research contributions from the corporate sector."

Two years later, Slade's successor in President Ronald Reagan's administration, Frederick A. Koomanoff, wrote: "We feel that Exxon should be commended for their initiatives to investigate the carbon dioxide issue."