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Exxon's Business Ambition Collided with Climate Change Under a Distant Sea

Throughout the 1980s, the company struggled to solve the carbon problem of one of the biggest gas fields in the world out of concern for climate impacts.

By Neela Banerjee and Lisa Song
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In 1980, as Exxon Corp. set out to develop one of the world's largest deposits of natural gas, it found itself facing an unfamiliar risk: the project would emit immense amounts of carbon dioxide, adding to the looming threat of climate change.

The problem cropped up shortly after Exxon signed a contract with the Indonesian state oil company to exploit the Natuna gas field in the South China Sea—big enough to supply the blossoming markets of Japan, Taiwan and Korea with liquefied natural gas into the 21st century.

Assessing the environmental impacts, Exxon Research and Engineering quickly identified Natuna's greenhouse gas problem. The reservoir was contaminated with much more carbon dioxide than normal. It would have to be disposed of somehow—and simply venting it into the air could have serious consequences, Exxon's experts warned.

Exxon's dawning realization that carbon dioxide and the greenhouse effect posed a danger to the world collided with the company's fossil fuel ambitions.

"They were being farsighted," recalled John L. Woodward, who wrote an internal report in 1981 on Natuna's climate implications.

"They weren't sure when CO_2 controls would be required and how it would affect the economics of the project."

Since 1978, long before the general public grew aware of the climate crisis, Exxon had worked at the cutting edge of emerging climate science. At first, Exxon's internal studies had described climate change as an important but somewhat distant problem. Now, sooner than expected, climate considerations were affecting strategic business decisions. Natuna was one example; another was Exxon's proposed leap into synthetic fuels.

Releasing Natuna's carbon pollution would make it "the world's largest point source emitter of CO_2 and raises concern for the possible incremental impact of Natuna on the CO_2 greenhouse problem," declared an October 1984 report from Exxon's top climate modeler, Brian Flannery, and his boss Andrew Callegari.

Documents and other evidence uncovered by InsideClimate News also show that Exxon calculated that Natuna's emissions would have twice the climate impact of coal. The company

spent years researching possible remedies, but found them all too costly or ineffective, ICN's eight-month investigation found.

Exxon managers saw the problem as both technically vexing and environmentally fraught. Not only was there carbon dioxide to be dealt with, it was mixed with toxic, flammable hydrogen sulfide, a contributor to acid rain.

"I think we generally agree that we are seeking a method of disposing of the off gases in a manner which will minimize the risk of environmental damage," wrote Exxon's manager of environmental affairs Alvin M. Natkin in an October 1983 letter to Natuna project executive Richard L. Preston. "We must also have the data which will be convincing not only to ourselves but also to the international environmental community that the method selected is environmentally sound."

The company consulted with leading scientists, including NASA's pioneering expert James E. Hansen, to understand the effect on atmospheric CO_2 concentrations if the gas from Natuna were released. It sent staff to facilities at Dalhousie University in Halifax, Canada to simulate the diffusion of the gas into ocean water. Over the years, Exxon scientists developed mathematical models to assess the options.

Because the project was so complex and expensive, the Natuna staff presented regular updates, including details of the CO_2 issue, to Exxon's board of directors, whose members were drawn almost entirely from the company's upper management.

Some Exxon directors accepted the emerging climate consensus. Others were less sure of the science, but agreed that as popular attention to global warming mounted, releasing Natuna's greenhouse gases into the air could turn into a public relations debacle, former employees said.

Either way, directors repeatedly told project staff Natuna could not proceed unless the CO_2 was handled in a cost-effective way that did not harm the atmosphere.

"Their concerns kept getting stronger," said a former employee with knowledge of the project, who asked for anonymity because the issue remains sensitive even years later. "Their attitude went from, 'Maybe we have to remove the CO_2,' to, as the years went by, their saying, 'This project cannot go ahead unless we remove the CO_2.'"

In 1984, Lee Raymond joined Exxon's board of directors. A senior vice president, Raymond's responsibilities included overseeing Exxon Research and Engineering, which conducted the Natuna studies. In the summer of 1985, ER&E prepared documents for Raymond about a study that examined disposing Natuna's CO_2 into the ocean, an Exxon memo shows.

Eventually, Raymond would rise to become chairman and chief executive, and to lead a public campaign discrediting the scientific consensus on climate change and fighting measures to control greenhouse gas emissions.

In the meantime Exxon, now known as ExxonMobil, appears to have kept its years of climate-related deliberations about Natuna mostly to itself. Exxon only began to disclose climate risks to its shareholders years after it first weighed Natuna's risks, federal filings show.

ExxonMobil declined to answer specific questions for this article. In July, when ICN questioned him for an earlier article about Natuna, spokesman Richard Keil said, "It is company policy not to comment on potential commercial operations."

The Carbon Footprint

First discovered by the Italian oil company Agip in the early 1970s, the Natuna gas field lies about 700 miles north of Jakarta and holds about 46 trillion cubic feet of recoverable methane, or natural gas. But the undersea formation also contains 154 trillion cubic feet of other gases, mostly CO_2.

To liquefy Natuna's methane for shipping, it must be supercooled. At those low temperatures, the carbon dioxide would freeze into dry ice and clog equipment, so it had to be removed. The question was where to put it.

The Indonesian government and the state-run oil company had no issue with releasing the CO_2 into the air, former Exxon staff said. But awareness of carbon dioxide's impact on global temperatures had been seeping through Exxon, from its rank-and-file engineers to its board of directors.

"Within Exxon in those days, there were probably two to three believers in global warming for every denier or those who emphasized the uncertainty," said another former Exxon Research executive, who asked not to be identified for fear of reprisal.

Among the key people searching for a solution was Gilbert Gervasi, the Natuna project manager, who worked in Houston under executive Richard Preston for Esso Eastern, the unit that oversaw projects in East Asia. Gervasi spearheaded the effort from the early to mid-1980s to figure out how big Natuna's carbon footprint would be and what to do about it.

In a Feb. 3, 1981 letter to Gene Northington at Research and Engineering, Gervasi challenged a "rough calculation" that Northington had made of the CO_2 emissions from producing Natuna's gas and burning it as fuel. Northington's math showed Natuna's total CO_2 emissions would be "no higher than what would be emitted by burning" an equivalent amount of coal, Gervasi wrote.

After conducting what he described as "more rigorous" calculations, Gervasi concluded "that the total release of CO_2 from producing Natuna gas and burning of the LNG manufactured from the gas would be almost twice that emitted by burning an equivalent amount of coal."

Six months later, Research and Engineering sent Gervasi a report, entitled "Possible Climate Modification Effects of Releasing Carbon Dioxide to the Atmosphere from the Natuna LNG Project." It commissioned assessments of Natuna by seven eminent atmospheric scientists, including the climatologists Helmut Landsberg of University of Maryland and NASA's Hansen.

The report, written by John Woodward, a high level engineer at Exxon Research, presented a mixed message. Natuna would constitute a "small fraction of worldwide CO_2 budget," it found. But it also found that "emissions are nonetheless substantial by several comparisons."

Disposal Options

Woodward examined the option of flaring the CO_2 after it had been stripped from the natural gas.

Although not combustible, the CO_2 had to be flared rather than simply vented because it was mixed with hydrogen sulfide, which is often burned to convert it to safer compounds. But flaring would not eliminate Natuna's greenhouse gas emissions.

Next, Woodward looked at releasing the CO_2 into seawater around Natuna, a process known as sparging. The gas from the Natuna well would be piped to a nearby platform where the valuable methane would be separated from the waste CO_2 and the toxic hydrogen sulfide. Those unwanted gases, in turn, would then be sent from the platform to a pipe about 300 feet below on the ocean floor. The pipe would be arranged in a circle 6 miles in diameter and the gas would be bubbled out of perforations every six to 10 feet, like aerating an aquarium.

Woodward said that in 1982 he visited the oceanography department at Dalhousie University in Nova Scotia to use their equipment to collect data for sparging models. Dalhousie had a tank about 40 feet high and 10 feet wide, filled with ocean water. Researchers released CO_2 at the bottom of the tank, and Woodward measured the size and quantity of the bubbles at various depths as they rose to the surface to understand how the gas dissipated.

In the end, the hydrogen sulfide released with the CO_2 stymied the sparging idea, Woodward said. Exxon worried that a toxic plume might kill fish and result in bad press.

Back to Square One

The Natuna project staff and Research and Engineering specialists probed for answers through the 1980s, sometimes revisiting the approaches that Woodward had examined.

In October 1983, Gervasi sent a letter and background paper on Natuna to about a dozen staff and executives from different branches of the corporation to develop "a study program which over the next 1-2 years will put Exxon in a position to reach a final decision on the environmental aspects of the project."

The background paper laid out options to dispose of the CO_2, none of them optimal. Releasing the waste gases into the air remained the simplest, cheapest method. "However, this raises environmental questions concerning the 'greenhouse' effect of the CO_2," the paper said.

Gervasi's paper said the only effective way to dispose of carbon dioxide and hydrogen sulfide without harming the atmosphere or ocean would involve injecting the gases underground into the Natuna formation itself or a nearby reservoir. But that option appeared prohibitively expensive.

Thwarted by cost or environmental impact, Exxon returned to mathematical models over the next two years to home in on a suitable approach.

By February 1984, Exxon Research began modelling once more the feasibility of sparging.

The scientists found that the ocean would release the CO_2 into the atmosphere, probably in 10 years or sooner. Further, increased CO_2 would raise the acidity of the ocean water, damaging the local environment. "Our conclusion is that atmospheric discharge is preferable to seawater sparging," Flannery and others concluded.

Study after study returned Exxon back to square one with Natuna: it held the rights to an enormously promising field but was unable to develop it because it was unwilling to pump so much CO_2 into the air.

The scientists' conclusions were reflected in papers prepared for a 1985 meeting with Lee Raymond on Exxon Research's activities.

Their synopsis said: "We modeled the sub-sea disposal of CO_2 in the shallow basin near the Natuna site and found that retention in the sea is only about a decade, as opposed to 1000 years if the CO_2 is disposed in the deep ocean. We recommend that the sub-sea sparging of CO_2 not be implemented since it offers little advantage over direct atmospheric release."

By the late 1980s, Exxon started to explore pumping the CO_2 back into the Natuna formation, the safest option but probably the priciest.

The company found a cost-effective method to dispose of half of Natuna's CO_2 underground, but calculated that the rest of the CO_2 would still be the equivalent of half of Canada's annual greenhouse gas emissions, said Roger Witherspoon, a former Program Officer in Corporate Contributions in the Public Affairs department.

Company officials asked Witherspoon to find a way to plant 100,000 trees annually to offset Natuna's remaining CO_2 emissions. The total acreage would eventually equal the size of Connecticut, Witherspoon said.

As Witherspoon researched the options starting around 1993, Exxon had embarked on a public campaign casting doubt on climate science as a basis for strong policy actions. Internally, the attitude was different.

"It was that greenhouse gas buildup could pose a threat to our business," said Witherspoon, a longtime journalist who worked at Exxon's Texas headquarters from 1990 to 1995. "You didn't want climate change caused by oil and gas. So the responsible thing to do was offset any greenhouse gases you were putting into the atmosphere."

Witherspoon said Exxon started his tree planting plan, but he does not know how long it lasted.

Exxon continued to investigate possibilities for responsibly disposing of Natuna's CO_2. The project remains dormant, but Exxon never gave up. After an on-and-off relationship with Indonesia, the company still holds the license, which is up for renewal next summer.