

The Second Steps -- Big Oil's Transition

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1. Introduction

I am definitely not an apologist for the Petroleum Industry. This is mainly because there is really nothing to apologize for. For the large majority of the 20th Century, they provided valuable products to our society, and these products enabled a better quality-of-life among the industrialized world's citizens. When climate change was discovered in the latter half of the 20th Century, they argued strongly against it, which is exactly what any other large industry in a capitalistic society would do when faced with a threat.

However, climate change is real and it poses an existential threat to the world if we don't deal with it effectively. Major petroleum corporations have realized this and many are attempting to provide solutions. This paper is about that, and also a major solution that they invented, that could well strongly mitigate our climate change crisis by pulling the primary long-lived greenhouse gas (carbon dioxide) out of the atmosphere and sequestering it for Millennia.¹

Like in the first "The Second Steps..." paper this one has a protagonist. It is also taken from the same book, See reference 2 below.

2. Oxy

Vicki Hollub is the chief executive officer of Occidental Petroleum, which has set a goal to become carbon neutral by 2050 and carbon negative after that. The first woman to run a major US oil company, Hollub is attempting to do the impossible: to reinvent an oil company's purpose and thus the industry's image. She says Oxy, as the company is widely known, will then become a carbon management company rather than the carbon extraction company that it is now. 'Our contribution to the world can be a differentiated approach,' she says.²

Instead of drawing carbon out of the vast Permian basin, she wants to capture the excess carbon dioxide in the air and bury it back underground. Scientists are now certain that such a draw down is necessary if the world is to meet its climate goals. The world doesn't just need to reach zero emissions, it needs to go negative.

If she succeeds, it'll be quite a change for an industry that has played a crucial role in almost every major global event in the last 100 years. Humanity's utter dependence on securing access to oil - much more so than other commodities - made it central to twentieth-century business, politics and power. That disproportionate importance came with some nasty side effects: it led key players to start wars to ensure control over oilfields; it subjected vast populations to the 'resource curse' that wasted natural wealth; it enabled the installation of despots that then committed crimes against humanity; and it created crony capitalists who sowed doubt about climate science.

¹ See "The Second Steps, Carbon Capture and Sequestration," which should be posted on Energy Central five days before this paper.

² Akshat Rathi, Climate Capitalism, Section 8, The Reformer, Copyright, Greystone Books, 2024

Nonetheless, there is no denying oil's role in shaping modern civilization and bestowing it with prosperity - albeit unequally. Despite decades of alarm from environmentalists about its negative impacts, a lack of cheaper, cleaner alternatives has helped oil keep a tight grip on the world. No material comes close to being packed with the amount of energy oil holds in a single barrel. And engineers have used the last century to finely tune the machines that can extract the stored energy with great ease - in engines that are so small they can fit in the palm of a hand or so big that they can move mountains.

Hollub's strategy isn't to abandon oil altogether. But it is an explicit acknowledgement that oil's time at the top of the energy ladder is finally up. Oil will continue to play an important role, especially in some sectors such as aviation, where alternatives aren't available, but it will have an increasingly diminishing role. State-owned oil companies, which today produce the majority of the world's oil, are yet to reckon with this prognosis, but it's only a matter of time as global governments tighten climate constraints.

And Hollub is not alone in this assessment. Most major international oil companies have set goals to drastically cut emissions, with the likes of Shell and BP also having committed to reaching net-zero emissions before 2050. The energy crunch created following Russia's invasion of Ukraine has caused some of these companies to stretch out their time selling oil and gas, but none has abandoned its long-term target.

Reaching that goal will mean reducing oil and gas production or shrinking the company itself until it disappears. In 1990 eight of the top twenty in the Fortune 500 list of the US's largest corporations by revenue were oil companies. In 2023, even in a year that followed high oil prices and helped oil companies to hit record profits, only three remained in this position. It's not going to be easy changing a 150-year industry that bears a huge responsibility for the warming gases sitting in the atmosphere. But it's also not the first time the industry has had to reckon with changing politics and technology...

3. Direct Air Capture of CO₂

Hollub was named CEO in the same year the Paris Agreement was signed. The world for the first time accepted the urgency of addressing the climate crisis and a new era in global politics was born.

In 2018 the Pope invited Hollub and a few other leaders in the energy industry to the Vatican for a conference called Energy Transition and Care for Our Common Home. At the conclusion of the meeting the Pope addressed the group directly: 'This is a challenge of epochal proportions,' he said. 'Civilization requires energy, but energy use must not destroy civilization.' He called on Hollub and her kin to use their 'skills in the service of two great needs in today's world: the care of the poor and the environment'.

When she returned, something had changed. 'The meeting materially affected her,' said a close collaborator of Hollub's. 'She came back from Rome and thought differently about her role as a CEO and the value proposition of Oxy to the world.'

Hollub expected that the world would continue to consume oil for decades to come, but it could not have the greenhouse gas impact that it was currently producing. Oxy was the world's leading company when it came to injecting carbon dioxide to increase oil production. But that carbon dioxide was currently being mined from other underground fields, even as an excess of the gas in the atmosphere was becoming a problem.

She realized that she could kill two birds with one stone, if she stopped mining for carbon dioxide in underground fields and instead mined it from the air. And, as it happened, there was a Canadian start-up called Carbon Engineering that was looking to scale up that very technology, called direct air capture.

Here's how a direct air capture plant works. Large fans suck huge volumes of air and pass it over corrugated sheets. The sheets are coated with a solution that reacts with carbon dioxide in the air, leaving behind a carbon-rich solution. That solution is then brought into contact with quicklime (or calcium oxide), which reacts to form pellets of calcium carbonate. These pellets are then heated to about 1,000°C to release carbon dioxide as a pure stream of gas and recreate quicklime, which can then be used for another cycle to capture more carbon dioxide from the air. The pure stream of greenhouse gas is then injected deep underground and kept out of the atmosphere.

Within months of meeting the Pope, Oxy made an investment in Carbon Engineering. And by 2019 Hollub had a plan for scaling up its technology. Oxy would build a Carbon Engineering plant in its Texas oilfields that would capture and store as much as 1 million metric tons of carbon dioxide from the air and be classed as negative emissions. If she injected more carbon dioxide in the fields than was currently being extracted, the accounting could mean oil coming from those fields could be considered 'carbon negative'.

The process behind direct air capture is similar to conventional carbon capture except that the concentration of carbon dioxide in the two streams is vastly different. The exhaust of a coal power plant, for example, contains about 10% carbon dioxide. The atmosphere, on the other hand, is made up of merely 0.04% carbon dioxide. And just as it gets harder to search for a red M&M in a sea of blue M&Ms, so the process of capturing carbon dioxide from a very dilute stream is much harder than capturing it from a concentrated stream.

The main difficulty Hollub faced was that the plant would cost hundreds of millions of dollars to build and then hundreds of millions each year to keep running. As a first-of-its-kind plant, the cost of capturing each ton of carbon dioxide was expected to be in excess of \$200. That, in turn, would raise the cost of each barrel of carbon-negative oil by many tens of dollars, relative to a conventional barrel. Who would pay that premium? Only months before Oxy announced its plan to build the direct air capture plant, a new rule in California had created a market for carbon-negative oil. If all went to plan, Oxy might even make a profit from building the very first large-scale direct air capture plant.

Among US states, California has long stood out for its environmental leadership. And within its government departments that have led on climate, the California Air Resources Board (CARB) deserves outsized credit for enabling that leadership. For much of its existence since 1967, CARB was focused on cutting air pollution in California's rapidly growing cities. In the 2000s, as the climate alarm bells became louder, it was given the mandate to set greenhouse gas regulations.

With transportation contributing to the biggest share of California's emissions, CARB recognized that there was no way to meet the state's climate goals without drastically cutting transport emissions. Its answer to the problem was the creation of the low-carbon fuel standard (LCFS), a cap-and-trade program whereby CARB sets a cap on the emissions from the transport sector and brokers trade credits for each ton of carbon dioxide reduced using an alternative in the form of hydrogen, biofuels or electric cars.

Trading of LCFS credits started in 2011. The cost of each ton of carbon dioxide avoided through the cap-and-trade program has been steadily rising through the years, as CARB reduces the cap. In 2020, for example, credits traded for an average price of \$200 per ton.

The success of the program led to its expansion. In 2018 California committed to reaching net-zero emissions by 2045. CARB realized that, even as the number of non-petrol cars was growing, emissions from aviation were not trending in the right direction, however, and in 2019 it duly allowed the use of direct air capture as part of its LCFS trading.

In other words, by the time it made its announcement, Oxy felt quite confident that it could get as much as \$200 for each ton of the carbon dioxide it was going to capture. That would write off the expense it would incur in the process of extracting the gas from the air. Better still, a separate US federal tax credit for burying carbon dioxide and aiding oil extraction would bring in another \$35 per ton. Combined, the project would be in the green.

The plant's construction began in 2023, and it was more good news. The Inflation Reduction Act passed in the previous year provides additional incentives for direct air capture. That's yet another revenue stream that Hollub can tap. The bill also increased the sum companies can get for burying CO₂ to extract more oil. At the same time, corporations with net-zero goals are also increasingly looking to bury carbon dioxide that they have to otherwise emit through air travel for their executives.

If everything goes to plan, the plant will be in operation by 2025 and it will be a rare case of an emissions-cutting technology generating profits from the very first large-scale plant. Hollub says that she can't keep up with demand for carbon. As the oil industry moves away from the business of extracting oil and gas, it is having to reinvent itself. In getting to this point, Hollub has found that economies of scale help, deploying cash carefully enables you to ride out difficult times, and the importance of finding new markets. Oxy is scaling up direct air capture to bring down technology costs, it is using the cash from current oil production to support the transition, and it is finding new sources of revenue through burying carbon instead.

Final author's comment: If major oil corporations are successful in deploying major carbon capture and sequestration (CCS) projects as described above, it will provide two major benefits: (1) it will provide the technology for humanity to draw down the carbon dioxide (the major greenhouse gas) concentration in our atmosphere, thus mitigating climate change, and (2) it will correct the near-sighted vision of major corporations to allow them to focus on the distant-future, rather than on next year's earnings report.