

Carbon Removal and Reaching Zero Emissions

with **Steve Oldham**
Carbon Engineering



Have you ever heard about 'Carbon removal'? Or 'negative emissions'? The FULLCOVER team hadn't either, or at least until Steve Oldham's presentation last November at the Web Summit in Lisbon. We talked to Steve to find out more about this and what his company, Carbon Engineering (CE), is doing to help save the planet.

It was inevitable that we first discussed climate change; both agreeing it is indeed the most pressing issue facing our planet right now. Steve is adamant: "We need as many solutions as possible. There are no magic bullets or bad ideas. CE's vision on how to address climate change is to combine a feasible and gradual reduction in emissions with a substantial programme for removing CO₂ from the atmosphere."

With people tending to focus on reducing current emissions and ignoring the problem of legacy CO₂, Steve believes an international programme to remove CO₂ from the atmosphere is essential, as well as a workable solution to reduce and then eliminate emissions. He explains: "We can't stop using fossil fuels overnight and we are not able to implement renewable electricity in every location around the world. Neither can we completely eliminate emissions from aviation or agriculture in the near future. While we can remove CO₂ from the atmosphere to compensate for those sectors' emissions, this doesn't mean we shouldn't still build electric cars or use renewable electricity. We should move forward with measures to address climate change emissions, while combining them with carbon removal."



Design of Carbon Engineering air contactor (that could capture about a million tons of CO₂ per year)

How it works

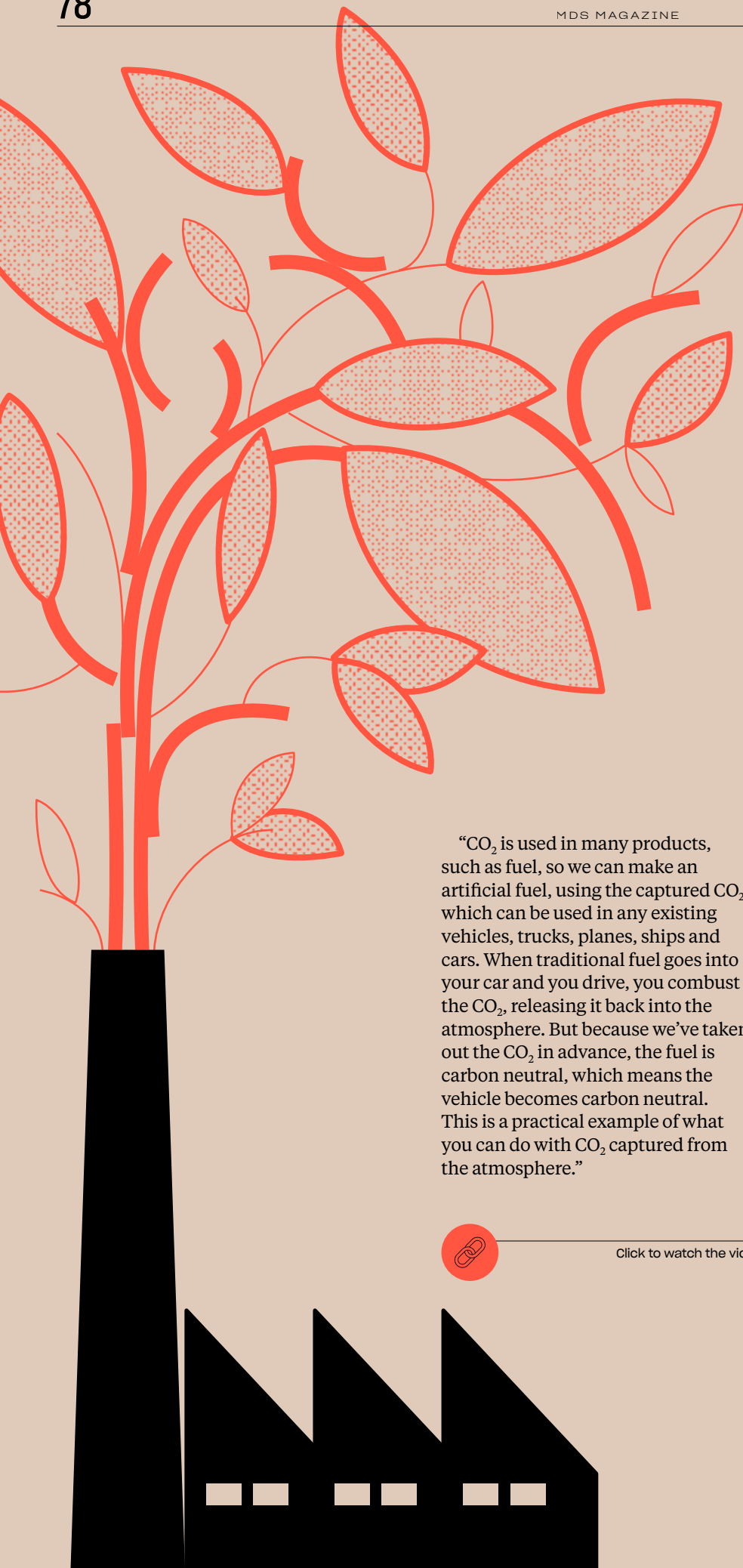
Countries are establishing a target of 0% emissions for 2050 – something many view as a utopia. Steve does not agree. He believes the first 20-30% of emission control will be relatively straightforward – reducing waste and excess energy, turning down the thermostat, driving less etc. The next 40% can be achieved, but it's much more difficult, like replacing electricity suppliers with renewable providers (and this will differ from country to country). As for the last 20-30%, he says: "These are areas that might have high heat processes, for example those that make cement to construct buildings, or the agricultural practices used to feed populations. Here it's really hard to decarbonise without a massive impact on our way of life."

"We believe you can't get to a net zero figure without removing CO₂ from the atmosphere, known as negative emissions or carbon removal. We urge governments, companies, everyone – to decarbonise what you can as quickly as you can, and then use negative emissions to address those sectors that are too difficult or high cost, or too important to our way of life." Steve mentioned that CE is designing and engineering its first commercial scale Direct Air Capture (DAC) facility in the US Permian Basin, where

CO₂ will be stored underground permanently. But how is this done? He explains: "CO₂ is stored underground – precisely where it came from. The problem is we've removed carbon from underground and put it in the atmosphere, so to solve this problem, we have to put it back underground again. There is enough storage capacity worldwide."

And how does the technology work? Steve explains: "We use a four step chemical process; the first essentially uses chemical reactions to capture somewhere between 17-18% of CO₂ from the air, and then the three further steps concentrate the CO₂ until it reaches 100% density. The chemical reactions induced by each step concentrate the CO₂ more as you go along. Another key part of our technology is that each step remakes the chemical used in the previous step, so as we go through the process, it not only concentrates the CO₂, but also recycles the chemicals. This means the plant runs using the same set of chemicals, with no need to update, replace or continuously pump new chemicals into it."

Surprising as this technology may be, there's more to come. Steve continues: "Once the CO₂ is captured from the air, you can do one of two things with it; bury it underground, creating those negative emissions we just talked about, or make a product."



“CO₂ is used in many products, such as fuel, so we can make an artificial fuel, using the captured CO₂, which can be used in any existing vehicles, trucks, planes, ships and cars. When traditional fuel goes into your car and you drive, you combust the CO₂, releasing it back into the atmosphere. But because we’ve taken out the CO₂ in advance, the fuel is carbon neutral, which means the vehicle becomes carbon neutral. This is a practical example of what you can do with CO₂ captured from the atmosphere.”



[Click to watch the video](#)

Pros (and cons?)

While an apparent ‘life saving’ solution, it seems odd that it’s not more widespread – as we speak, only three companies in the world (including CE) use this technology. These companies, FULLCOVER learns, target specific sectors; one of them for instance, focuses on the beverage industry, while CE is focused on developing large-scale Direct Air Capture plants to produce synthetic fuel for transportation, or to bury CO₂ underground to help companies and governments reach annual targets to reduce or address their CO₂ emissions.

Would such limited development also be due to high costs or some controversy around the process? According to Steve, apparently not: “I wouldn’t say people fear the technology or the application – there are people who say that if the technology exists to pull the carbon out from the atmosphere, you’re giving everyone on the planet an excuse to no longer care about their emissions. It’s like encouraging people to take a moral gamble – an excuse not to decarbonise.”

In his opinion, this criticism is flawed; not only does Steve believe in harnessing all efforts to reduce carbon emissions, but he says the reasoning fundamentally ignores the problem of legacy CO₂. “If you don’t undertake carbon removal, you’re not addressing the 150 years’ worth of legacy CO₂.”

Another reason why direct air capture, to date, has not been implemented widely is because the cost is too high. A US government study estimated the cost would be \$600-\$1000 a ton. Steve adds: “We’re only now, in the last year, convincing people we have a solution at a much lower cost point and expect to reach around \$150 a ton for capture and burial.”

As often happens, price is a key driver, yet Steve is confident about CE’s price point, for three reasons: “First, we have a [pilot plant](#) that’s been running since 2015, where we have been measuring, improving, collecting

data and learning everything about our technology. We know how efficient it is. Second, our plant has no consumable costs, so you save money. Third, our four step process involves equipment that's widely used in other industries today. We're not inventing any new machinery, but buying pieces that are out in the market, where the costs are known. These three factors make it easy to estimate and be confident in our cost structure."

Forty million trees

Looking to the near future, CE will start building a one-megaton Direct Air Capture plant in Texas. When running, its climatic impact will be equivalent to that of 40 million trees, so the big milestone for this year is to conclude the financing phase and move onto construction. "CE wants to build the first plant to demonstrate this technology works at large scale and is sustainable. Having confirmed the costs, hopefully everyone will want to use it. However, we believe that global governments and companies will want to see the technology working, at scale, at the Texas plant before that happens. We're focusing very strongly on the Texas plant, getting it up and running and then sharing the technology with anyone who wants to use it to help address climate change."

Risk mitigation solution

There's no doubt this technology is highly relevant within the risk and insurance sector. Steve doesn't hesitate: "One of the biggest risks industry and people face, and that concerns all, is climate change. With our technology, you can eliminate any emission from anywhere in the world, at any moment in time."

"As companies look at how to address the risks associated with carbon footprint issues, their financial results and customer base, and as governments look to tackle the overall problem of climate change, our solution provides a way forward to manage all these difficult elements. For your area, this is a solution that allows any company, any government, to adopt measures to reach 100% decarbonisation. So from a risk mitigation point of view, it's very relevant."

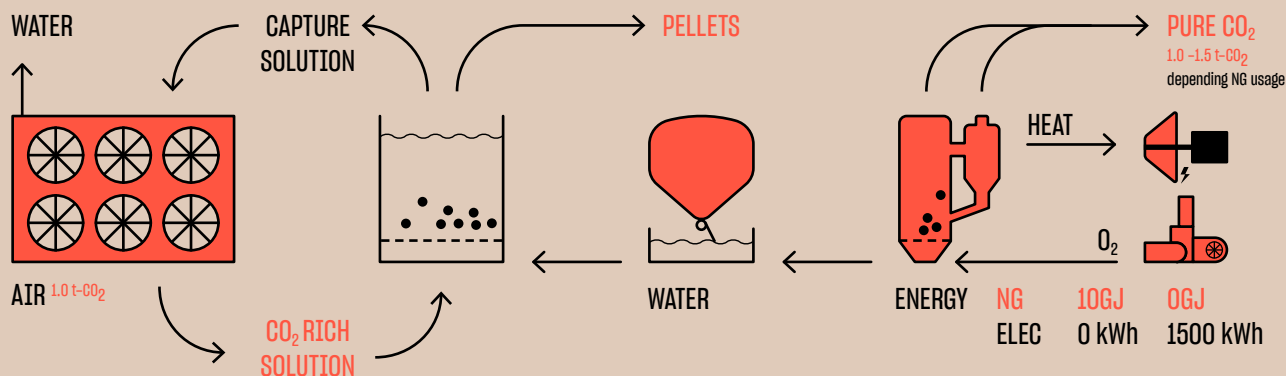
FULLCOVER cannot agree more. As Steve says, carbon removal may not, or will not, be the only solution to reaching the 2050 0% emissions goal, but it will certainly be a major contributor to getting there. ●



Steve Oldham serves as CE's CEO. Steve brings more than 20 years of executive experience to CE's team, stemming from previous positions in technology, robotics, and aerospace sectors. He has played a lead role in a number of 'Canada firsts' in technology commercialization, including the first robot performing brain surgery, the first commercial radar satellite, robots that clean the inside of nuclear reactors, and satellites that service and repair other satellites. Steve holds a bachelor's degree in mathematics and computer science from the University of Birmingham in England.



Carbon Engineering's Direct Air Capture technology – Watch Video



CE's Direct Air Capture process, showing the major unit operations

