Interview Dirk Nuber, Climeworks

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Bert Beyers: What is your job at Climeworks?

Dirk Nuber: In principle, I wear two hats. One hat is probably the more important one. I am the Chief Project Development Officer. The task of project development is to look for locations for upcoming direct air capture and storage plants and then develop them to the point where we can build the plants. And the second hat: I run an office in Germany that is attached to our headquarters in Switzerland. Climeworks Germany in Cologne currently has around 25 employees.

Let's talk about Direct Air Capture (DAC). Your largest facility is in Iceland. How does it work?

It is indeed an imposing facility. It has two tasks. One is to take the CO_2 out of the air. And the second component, which is almost as important for the future: to compress and fossilise the CO_2 in the ground. But we don't do that ourselves. That is done by our partner Carbfix. They basically make the technology to mineralise CO_2 in the basalt soil in Iceland or elsewhere in the world. The DAC technology that Climeworks has developed can be thought of as a large filter or hoover. These are filter boxes filled with a capture material that binds CO_2 to itself. We suck a lot of air through there, with fans. Then CO_2 has to be expelled from the filter. The CO_2 is expelled by applying heat, up to about 100 degrees. The CO_2 is then available to be pressed into the soil.

Climeworks' job is to build the machines?

Not only. To get the machines running, you need an incredible number of things around them. You need the storage, you need the renewable energy to run the DAC machines. The actual product in terms of a sale is then actually not this machine, but negative emissions that we create by taking CO_2 out of the air and compressing it into the ground.

Who are your customers?

At the moment, the customers are mainly from the banking, insurance and software industries, Microsoft and Swiss Re are among them. Audi is also a client of ours. They are pioneers who use this negative emissions product to achieve their climate strategies.

I read that you don't like to work with oil companies. Is that true?

That is correct. We have a very differentiated view on this. Oil companies do not have the best reputation when it comes to climate change. Of course, oil companies also safeguard their own business. So that the customers, who are like all of us, can still drive cars and fly. Will the business live on? We don't think so. In fact, our technology is still far too inefficient to capture the CO_2 produced by the oil companies, and it is not designed to do so. But we know that the oil companies have a lot of know-how and expertise that we will need in the future. They know geology and storage sites, old oil and gas deposits are very good, safe CO_2 storage sites. Oil companies do global projects and big financing. They can handle all the supply chains. That's why they are actually important partners. If it weren't for this product, which is harmful to climate change.

The topic is actually reputation?

Mainly. But it's also about company philosophy. Our CO_2 storage is too valuable for anyone to continue operating a gas plant or an LNG terminal. There are other technical options that can capture the CO_2 much more cheaply. That is not our market. Our market is to capture the historical emissions from the air, or the ones you can't avoid. For example, in cement plants.

At the cement plant, you could go directly to the flue gas flow to capture the CO_2 there.

That's right.

How much energy do you need with your technology to take one tonne of CO_2 out of the atmosphere?

That is a very good question. It depends, for example, on where the location is. Also what technology we use. At the moment, we still use too much energy to get that tonne of CO_2 out of the air. We need electricity, but most of the energy we use is actually low-temperature heat, which we need to drive the CO_2 out. This energy can come from geothermal energy, for example, or we use waste heat from biomass power plants or industrial waste heat. We are striving to reduce the electricity and heat required for our direct air capture technology as much as possible and there are still huge efficiency gains to be made.

Why is this topic difficult for you?

Because every time we communicate something like that, we have already outdone ourselves. The goal is clear, the technology has to be optimised, the costs have to come down. We have to come down on the cost curve to meet the regulated market for CO_2 trading. And there we are talking about about 200 US dollars per tonne of CO_2 . But that will still take a few years.

Why 200 US dollars?

There are regulated CO_2 markets in different countries. When trading in the EU, for example, the price is currently going up, to around 80 or 100 euros. In other countries, the price is already higher. There is also the so-called voluntary market. We are selling our product on this market at the moment. And there the price is much higher. You personally can offset through our website. There, the price is more like 1,000 US dollars per tonne. It is expected that these costs will come down and the two markets, the regulated and the voluntary, will settle at around 200 US dollars per tonne. If we break through that mark, we have the opportunity to enter that regulated market. That is the expectation of most companies that that will happen in the next ten years.

You also need a lot of water to take CO_2 out of the air. Can you say how much per tonne?

That is also difficult to name. We actually need a relatively large amount of water, but I can't give you a figure per tonne. I don't know it by heart at the moment. In Iceland we need a lot of water for sequestration. We also lose water as steam that goes into the air. And then, of course, we need cooling water. We also produce water ourselves - in the CO capture process$_2$. But that is not enough. In the future, however, water consumption will be reduced, also because we will use less energy.

How big is your current facility in Iceland?

The DAC capacity is 3,500 to 4,000 tonnes. The next plant will be around 35,000 tonnes per year. However, there are still losses on the way from interception to the borehole, where the CO_2 is injected. There are also carbon emissions in the construction of the plant itself, for example for the concrete or the steel we use there. These emissions are also deducted so that the customer is only charged for the net CO_2 quantities that we inject into the ground.

Scaling, i.e. the expansion of CO_2 removal, is very important to you. Where do you stand at the moment?

I would say the DAC industry is at the very beginning, a drop in the ocean. It's a new technology that we have to optimise to get it up and running for the size of the project. And of course the market still has to develop. The scaling must go ahead. We always talk about the goal of achieving 1 gigatonne by 2050. So taking 1 gigatonne of CO_2 out of the air per year and pressing it into the ground.

You as a company?

We as a company. But we are not the only ones. We assume that: From 1 gigatonne onwards, the whole thing will have an impact on the climate. And until then? Sure, every tonne is good, but it's still relatively little, even measured against the emissions that will continue to be produced. We talked about the oil and gas industry earlier. Up to the 1 gigatonne mark, we will be able to achieve relatively little against climate change.

So it's a long way.

A long way.

Could one speak of a utopia?

If you want to see it negatively, you can of course see it that way. All in all, a lot of building blocks are needed, all of which have to be built. Recently, another dramatic report was published by the Intergovernmental Panel on Climate Change (IPPC). We will have to find many solutions. For example, planting trees - must be done. But that will not be enough to curb global warming. Maybe there will be another technology one day. But for now, there is no other solution than to drive DAC into this scaling, stop climate change and hopefully reverse it at some point.

You already have a business model and have raised a few million.

A few hundred yes.

But for the business to become big, it needs more. And so far, DAC is the most expensive way to absorb CO .2

Yes, that is correct.

So why do you do this when it is cheaper to capture CO_2 at the smokestack of a coal-fired power plant, for example?

If you see it as a competing technology, then that would be the right conclusion. We see it a bit differently, the science also sees it differently. The capture at the so-called point sources, that should be done at industries that cannot be decarbonised at the moment. But carbon should just stay in the ground in the long term. What we're talking about is a historical loading of CO_2 in the atmosphere. Even if you clean out all the smokestacks, so to speak, and capture all the CO_2 , you can't remove the existing CO_2 in the atmosphere that way. For that you need Direct Air Capture to reduce the historical CO_2 emissions in the atmosphere. Otherwise we will not reach the 1.5 degree target. Incidentally, the IPCC report also says that we have reached the point where normal measures such as renewable energies and carbon capture from chimneys are no longer sufficient.

Your company is now about ten years old, when will you reach black figures?

Not immediately, that's clear. As long as we still have to grow so fast and so much, it will take quite a while. The goal will be reached when

we fall below the 200 US dollar per tonne CO_2 mark. Or even before that. Depending on how the markets develop. That is when we will probably be in the black.

How do you see your competitors? Occidental has announced that it will build a DAC plant with the capacity of 1 million tonnes per year.

Competition is a good thing. If our competitors are successful, it means that the DAC market will also be successful. On the other hand, if one of our competitors or we ourselves are not successful, it is always bad for the others. Then doubts arise and it is no longer so clear whether something like this can really be successful. That's why we organise a DAC Summit once a year in Zurich, for example, to which we invite all our competitors. There we discuss the problems of the market and those of the technology, up to a certain point of course. We are competitors, but we know that we have a common goal and a common market. Sure, it's a strong statement: 1 million tonnes is what Occidental wants to achieve in the next few years.

What is your goal?

We also want to achieve that (1M tonnes of CO_2 capture per year) by 2030. We are a bit more cautious to be able to work our technology development into this scale up road map. From a pilot plant straight to 1 million tonnes: That's a bold step. If it works, it's a great thing for the market and the climate. But then we are also under pressure. At the moment I would say we are the world market leaders because we were the first to achieve negative emissions in Iceland. If Occidental actually does it, it's good for humanity and for the market and for the climate, I would say. We will come under pressure because we will have to follow suit. We will then also have to build a large plant with the corresponding economic efficiency. But at the moment we see ourselves as the market leader and we want to stay that way.

What else will you personally see from the technology?

In the next ten years, that's relatively easy. At Climeworks, I will probably see millions of tonnes. We will operate the first plants in the US and then develop more sites around the world. The market will also continue to develop. I will also hopefully see a lot happening with the industry that emits the CO_2 to reduce emissions. Unfortunately, I will also see that environmental and climate damage

will become more serious. We will all see that. But I think there will be a strong growth curve over the next few years and it will continue to be a lot of fun.