



The mounting of the first four collectors at the Orca Direct Air Capture plant, Reykjavik, Iceland. Credit: Climeworks.

Take a Look at the Future—Now

By Mark Fogarty

What does a direct air capture facility look like? How big is the plant? How many people work there and where do they live? How much carbon can it sequester?

Climework's Orca plant, outside Reykjavik, Iceland, was launched in September 2021 and is working now, (though news reports say the harsh winter climate impeded work last winter) so it is possible to get a glimpse at what a functioning DAC plant looks like, and what it does.

For instance, the plant measures 1700 square meters, which according to an online conversion calculation comes to 18,300 square feet, a good size. And the total sequester number for Iceland's rift zone could be as much as 400 gigatons of carbon, also a good size.

You can get a look at it, and a lot of other information, at the video of the plant launching [here](#). If you want to skip the speeches, start at minute 43.

And while Climeworks declined my request for an interview, they were generous enough to answer a series of questions I sent them. And while some of the answers were general instead of

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specific, it still feels like valuable information for the readers of *Tribal Carbon Solutions*.

Here's the Q&A:

How many people work at Orca? Are there shifts?

We have full-time staff that work normal office hours and some ad-hoc staff for specific tasks.

Is there housing onsite or nearby or do they live in Reykjavik or elsewhere?

The on-site staff lives in and/or around Reykjavik.

How long does it take to do one "process," from getting the water in the process to passing on the removed carbon to your partners that sequester it?

Regarding how long it takes until the filter in one of the collector containers is fully saturated with CO₂ and heated up, the duration of a full capture cycle depends on various parameters. The first phase (adsorption) takes hours, whereas the second phase (desorption) takes minutes.

Do you use other materials other than water in the process? Do you have to heat the water or is it already superheated naturally?

Climeworks' generation 2 technology used at the Orca requires geothermally heated water to heat the collector containers for desorption (approx. 100 degrees Celsius). We aim to limit and reuse water as much as possible. For more information about the water requirements for the CO₂ mineralization process, you can visit the Carbfix FAQ page [here](https://www.carbfix.com/faq): <https://www.carbfix.com/faq>.



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How much carbon have you removed to date? How much do you do in a week?

Orca is the world's first and, to date, largest direct air capture and storage (DAC+S) plant. With a nominal capture capacity of up to 4,000 tons of carbon dioxide per year, it is Climeworks' largest facility in operation.

Last year in June, we announced the groundbreaking of our newest and largest DAC+S facility, called Mammoth. With a nominal CO₂ capture capacity of roughly 36,000 tons per year when fully operational, Mammoth represents a demonstrable step in Climeworks' ambitious scale-up plan: multi-megaton capacity in the 2030s, on track to deliver gigaton capacity by 2050.

What are your projections going forward a month, year, decade?

Our technology scale-up roadmap can be summarized as follows:

- Last couple of years: we scaled our facilities by a factor of 5-10x.
- 2022-2030: scale-up factor of 5-10x every 2-3 years, which will get us on track for megaton capacity by 2030.
- 2030 onwards: scale-up factor of 10x every 10 years, which is a rate similar to solar PV, and hence setting course to crack multi-megaton capacity by 2040 and gigaton capacity by 2050.

We are seeing such a strong market demand that the first next step will be

to supply volume to the market with a scale-up factor of 10x based on a known technology (Orca) and we are already working on the next technology stage that will support global roll-out to be operational in 2027. The following steps will incorporate major technological innovations that are already in development.

What is the capacity of your well or pore to hold carbon? Might it be filled eventually and you'd move on to another?

It has been estimated that the active rift zone in Iceland could store over 400 gigatons of CO₂. Its ideal conditions make Iceland the perfect site to start with. On a global scale, the potential for CO₂ storage is even larger. For more questions regarding storage, please head to Carbfix's website.

What kind of MVR do you use for verification?

Climeworks, Carbfix, and independent quality and assurance leader DNV developed the world's first full-chain certification methodology dedicated to carbon dioxide removal via direct air capture and underground.

With this methodology, Climeworks and Carbfix aim to contribute to the standardization and scale-up of high-quality, permanent removals.

There have been a handful of methodologies developed for capture components, use or storage components of industrial removals, but none of them included the full DAC+S chain, nor have they been put to the test with a third-party verification or produced certified CDR.

By certifying our methodology, DNV concluded that our CDR service is:

- Reported accurately, avoiding any chance of double counting or inclusion of removals that cannot be supported by measured data,
- Measured accurately and reflecting the net emissions removed after adjusting for emissions resulting from plant construction, operation, and disposal in compliance with ISO 14064-2 Standards,
- Strict, transparent, and accountable to the monitoring procedure in place to detect any involuntary release of CO₂ and changes within the storage reservoir that may risk the permanence of CO₂ storage.

The methodology is publicly available [here](#).

How big is the physical plant? Is it 100 x 100, say, or 200 by 200?

Orca's land area is 1'700 m², whereas Mammoth's land area will be 22'000 m².



The first collector being lifted by a crane. Credit: Climeworks.

