

# Climeworks

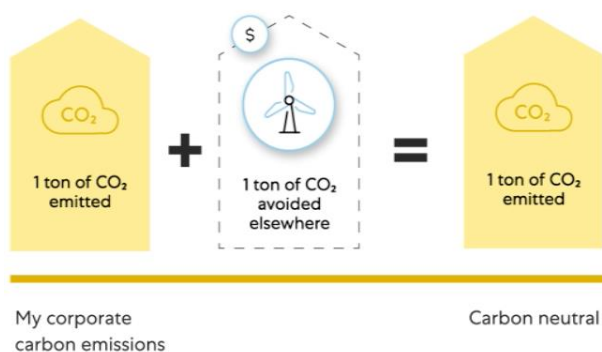
## 39 Ways to Save the Planet

### Climeworks

Climeworks is a Swiss environmental company which has produced a technology to directly reverse some greenhouse gas emissions by direct air capture of CO<sub>2</sub>, sometimes referred to as carbon capture and storage (CCS). It is an important and significant point to emphasise that *reversing* CO<sub>2</sub> emissions differs from *offsetting* them.

#### Carbon offset

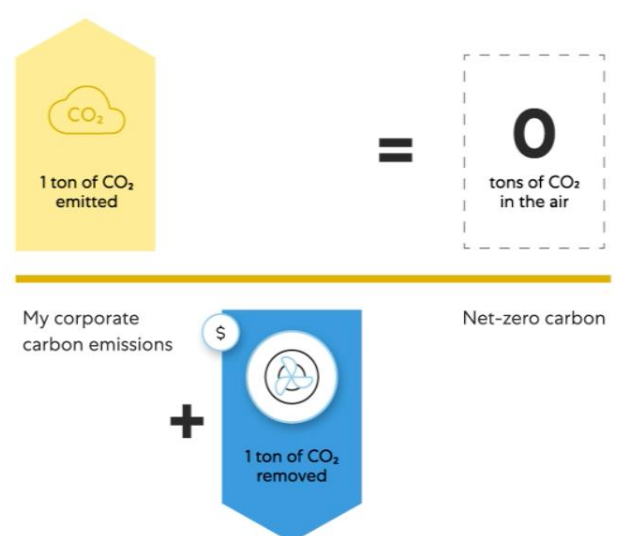
I purchase offset credits to neutralize my emissions.  
The current level of emissions **is maintained**.



- ✗ Not net-zero goal compatible
- ✗ Your emitted CO<sub>2</sub> remains in the air

#### Carbon removal

I purchase removal credits to remove my emissions.  
The current level of emissions **is reduced to zero**.



- ✓ Additionality guaranteed
- ✓ Your emitted CO<sub>2</sub> is removed again from the air

Figure 1 © Climeworks

1. Using Figure 1 explain the distinction between carbon offsetting and carbon removal from the atmosphere.

Carbon offsetting has come under recent criticism for not being feasible at scale, and for diverting public attention away from the need to reduce CO<sub>2</sub> emissions in the first instance, from source. However, Climeworks specialises in carbon **removal**.

Climeworks captures and permanently removes CO<sub>2</sub> from the air. The company see the gas 'as an asset' and has 14 direct air capture facilities, including one which is the world's first commercial facility. These plants are designed to directly capture CO<sub>2</sub> from the atmosphere by fans which suck ambient air through vents into a collector. CO<sub>2</sub> then sticks to highly selective internal filters and is siphoned off before being heated to 100°C. The captured carbon is then mixed with water and is pumped deep underground, where it mineralises and forms solid carbonate, turning into stone. This is a long-term store of CO<sub>2</sub> — moving it from the atmosphere into the lithosphere.

2. Using Figure 2 below, this resource, and the BBC episode [Swiss Air](#), explain how a Climeworks air capture plant works.

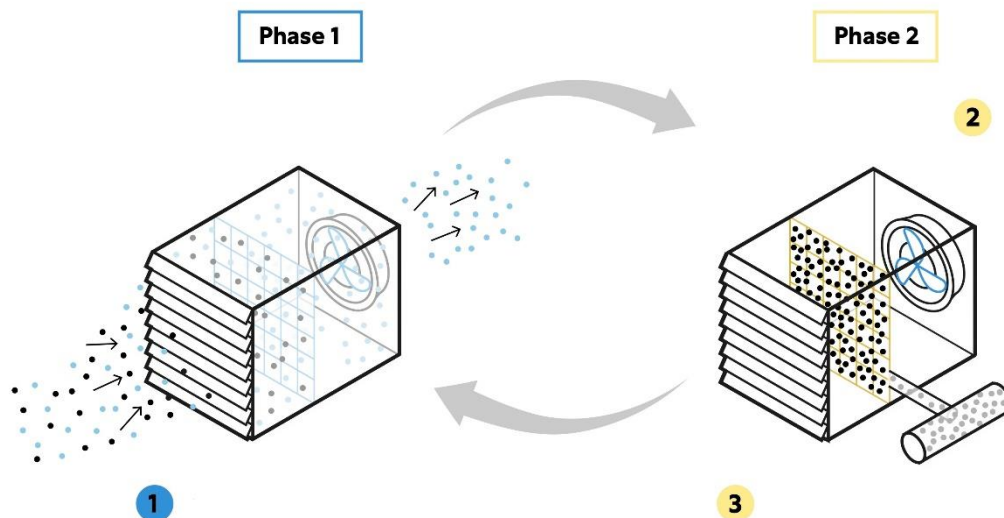


Figure 2 © Climeworks

Worldwide, there are only 3 start-ups who work in carbon capture from the air, and Climeworks is the first company to have paying customers. Climeworks have the ultimate goal of removing 1% of global annual CO<sub>2</sub> emissions by 2025. However, in order for the company to grow in the future Climeworks will need customers who will want to pay to sequester (as well as remove) CO<sub>2</sub>.

## Swiss Air

In 2017 Climeworks built the world's first commercial air capture plant in Hinwil (a Canton of Zurich) in Switzerland. This particular plant has 18 fixed fans and is built on top of a waste facility — called KEZO. When waste is burnt underneath energy is created from processed heat and it is used to power the CO<sub>2</sub> direct air capture plant above.

Once captured the high purity CO<sub>2</sub> is piped to nearby greenhouses and is used to grow fruit and vegetables. The greenhouse of Gebrüder Meier Primanatura AG reported a 20% increase in productivity from the pumped CO<sub>2</sub>.

The challenge is to continue to lower costs to make the process economically viable. Due to the high start-up cost (of between \$3 and \$4 million) it currently costs \$600 to remove 1 tonne of CO<sub>2</sub>. In order to scale-up with figure needs to be closer the \$100 per tonne of CO<sub>2</sub>. If successful, this will allow the company to scale-up the process to the GT (gigatonnes) level.

This sort of innovation is essential as, by 2050, we will need to remove 10 billion tonnes of CO<sub>2</sub> from the atmosphere every year in order to limit the worst effects of global warming.

## Climeworks and Microsoft

Climeworks announced in 2021 that its carbon dioxide removal solution was being incorporated into Microsoft's carbon removal portfolio. This portfolio aims for Microsoft to reach negative emissions by 2030 and to remove the company's historic emissions entirely by 2050. In January 2021 Lucas Joppa, Chief Environmental Officer at Microsoft, [announced in a blog](#) that the computer tech corporation have become both a customer (by donation) and an investor (through the Climate Innovation Fund) in Climeworks. The fund helped build the Hellisheiði direct air capture plant in Iceland which is different from its predecessor in Switzerland as it the world's first **at-scale** commercial, fully renewable carbon capture and mineralisation plant. CO<sub>2</sub> is captured from air in Hellisheiði and then

Carbfix, a partner company, mixes it with water whilst pumping it underground for rapid mineralization.

3. Using the 6 cards below to add labels onto this simplified diagram for the Hellisheiði direct air capture plant in Iceland.

Climeworks	Geothermal power plant	CO <sub>2</sub> free air
Carbfix	Ambient air	Concentrated CO <sub>2</sub>

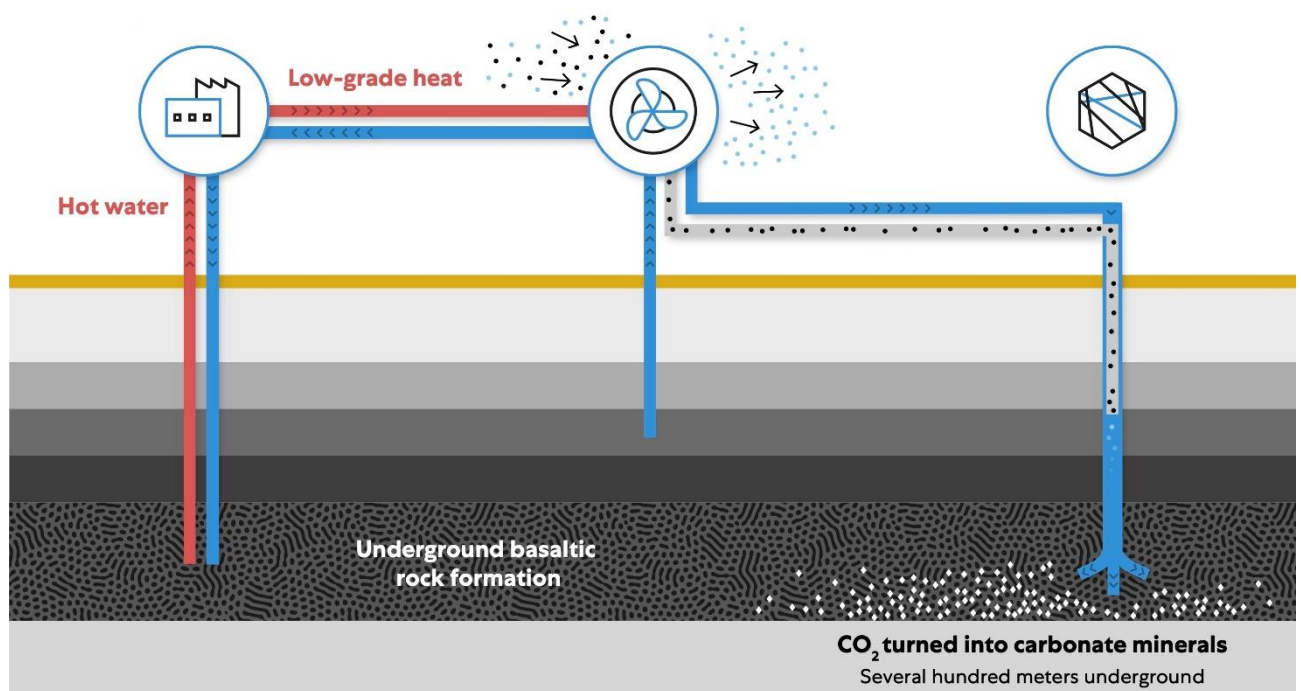


Figure 3 © Climeworks

### Further reading

- How capturing CO<sub>2</sub> from air can combat climate change (video) [www.ft.com/video/7cff9383-798f-4cc1-8df7-aebf63380df3](http://www.ft.com/video/7cff9383-798f-4cc1-8df7-aebf63380df3)
- How Climeworks' technology works [www.climeworks.com/](http://www.climeworks.com/)
- The Swiss company hoping to capture 1% of global CO<sub>2</sub> emissions by 2025 [www.carbonbrief.org/swiss-company-hoping-capture-1-global-co2-emissions-2025](http://www.carbonbrief.org/swiss-company-hoping-capture-1-global-co2-emissions-2025)
- The Tiny Swiss Company That Thinks It Can Help Stop Climate Change [www.nytimes.com/2019/02/12/magazine/climeworks-business-climate-change.html](http://www.nytimes.com/2019/02/12/magazine/climeworks-business-climate-change.html)

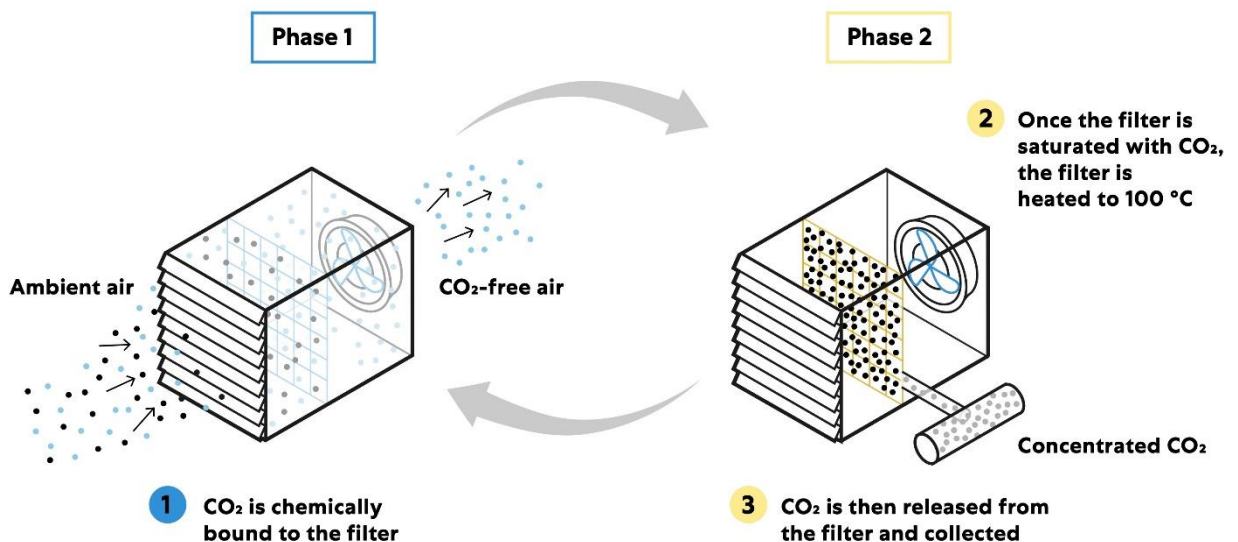
- Climeworks's solution is part of Microsoft's plan to reach negative emissions [www.climeworks.com/news/this-negative-emission-plan-by-microsoft-marks-an-important](http://www.climeworks.com/news/this-negative-emission-plan-by-microsoft-marks-an-important)
- Offset start-ups devise smart ways to trap carbon [www.ft.com/content/52c51902-f770-4c2e-9166-47def2bcf76c](http://www.ft.com/content/52c51902-f770-4c2e-9166-47def2bcf76c)

## Suggested questions for Swiss Air

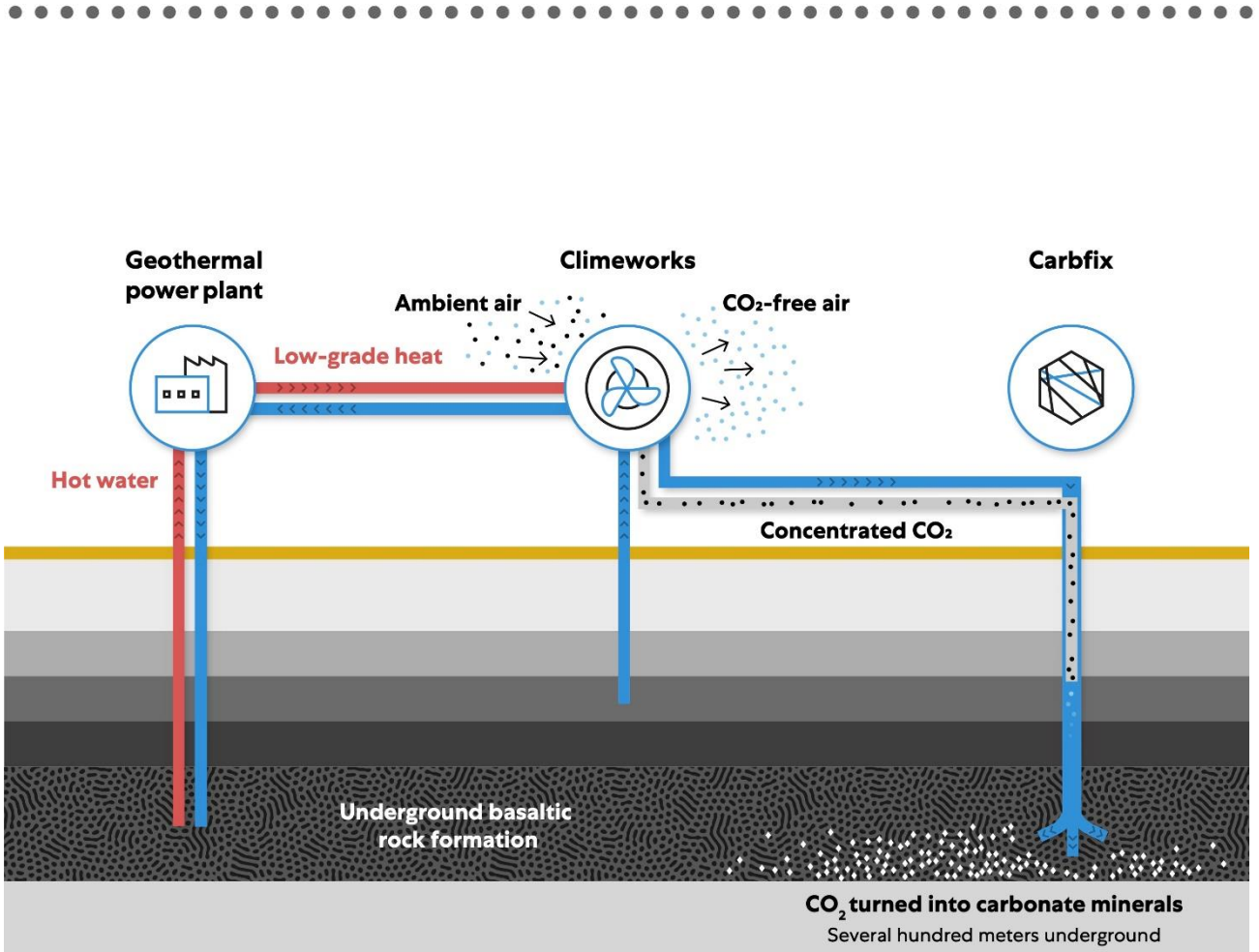
- According to Christoph Gebald, how big could the industry be in the thirty years' time?
- Which museum in London has an exhibition on 'taking carbon dioxide out of the atmosphere on the global scale'?
- Which three European countries are mentioned as having dozens of devices that suck in carbon dioxide' rendering it harmless?

## Answers

- Carbon offsetting is when a company or individual compensate for their CO<sub>2</sub> emissions by joining a CO<sub>2</sub> reduction scheme, such as Climeworks, in order to balance out their carbon footprint. This neutralises the emitted CO<sub>2</sub> but crucially does not alter historic emissions, nor does it reverse the changes already underway to the Earth's climate. Carbon removal is different. If credits are purchased from Climeworks the effects from CO<sub>2</sub> emissions will be reversed, representing one way to achieve Net-zero by 2050.
- Basic diagram labels are included below (more is expected, to be sourced from this resource and the BBC episode Swiss Air).



- 6 cards are correctly labelled on the next page, more detail can be added from the [Orca webpage](#) on the Hellisheiði direct air capture plant.



**An RGS-IBG expert**

Go to [What our experts say](#) to hear further analysis from Dr Samuel Krevor (below) and Professor Nilay Shah from Imperial College London, and Professor Jon Gluyas from Durham University.

