climeworks

Climeworks' technology evolution

Empa, "Mining the Atmosphere"

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Senior Manager Sorbent Structures

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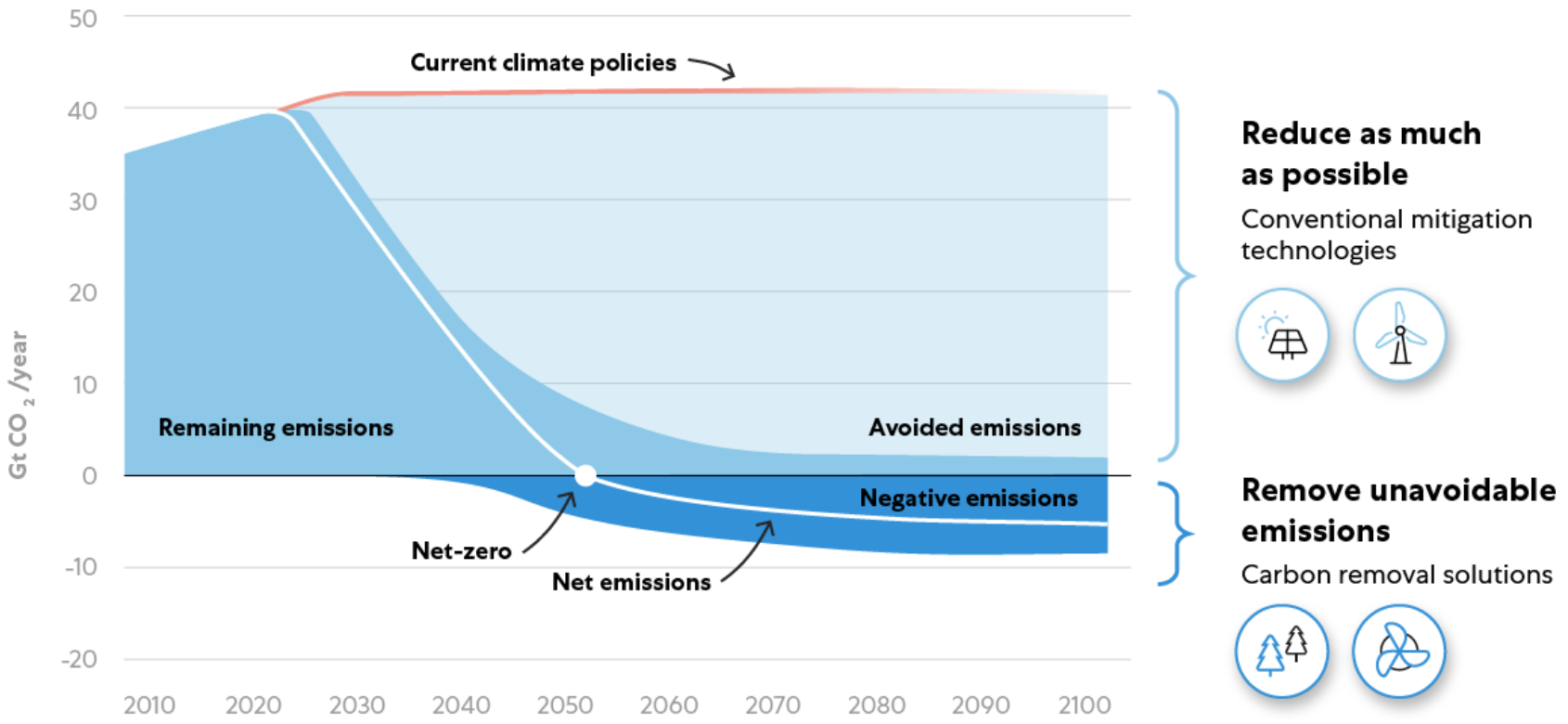
Net zero requires carbon dioxide removal



- Based on all IPCC scenarios, **CO_2 must be removed from the air** to keep global warming within 1.5°C.
- Companies need to accelerate emissions reduction while starting to invest in **removals for your residual emissions.**

Source: Adapted from IPCC (2022) & United Nations Environment Programme (2021)

Climeworks snapshot

Since
2009
>15 DAC facilities
Including the world's only commercial DAC+S facility Orca

400+
Climeworkers
dedicated to fighting **global warming**

> 120,000
hours operational experience

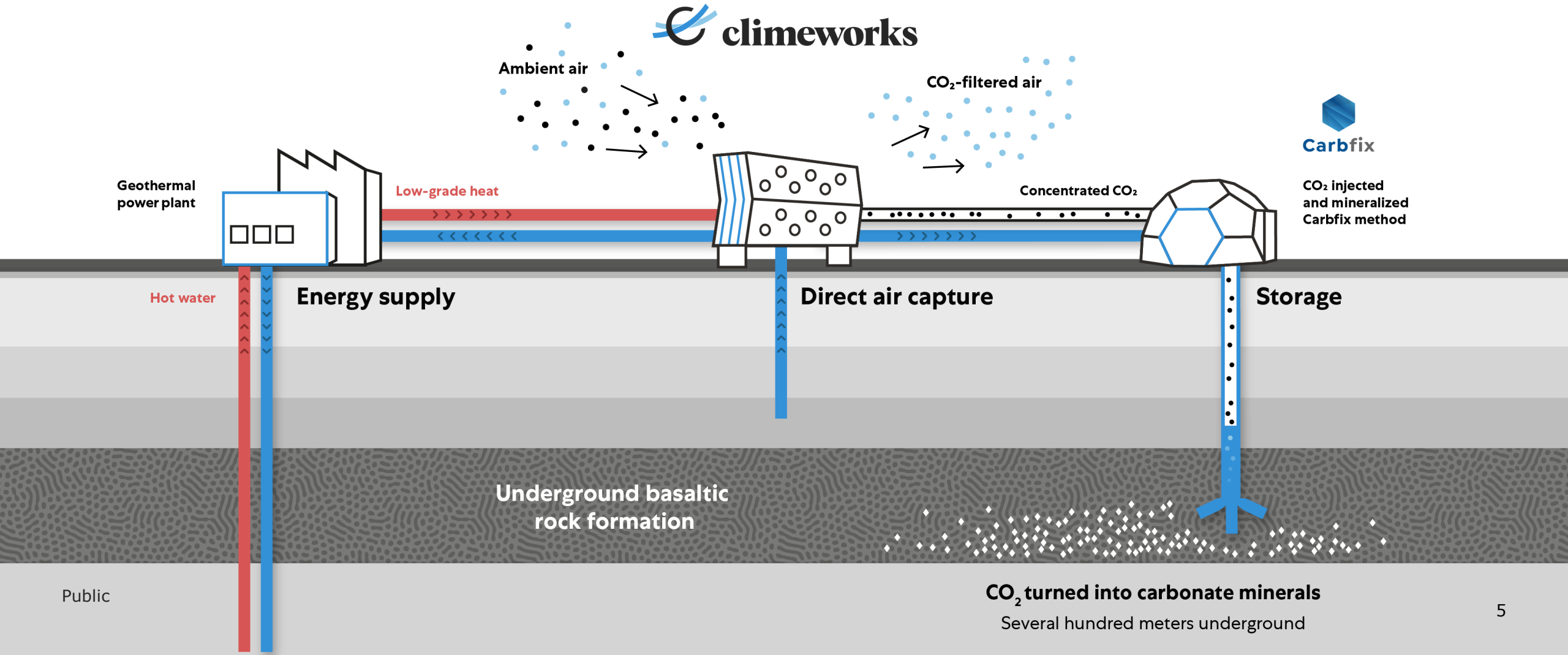
$810m
raised

10x
scale-up steps already delivered multiple times

This is how our technology solution looks

Direct air capture and mineralization

Energy supply, direct air capture and storage (shown here: Climeworks' Orca)



Our business model: CO_2 removal as a service

Microsoft · Swiss Re · BCG · shopify

LGT · SWAROVSKI · Square · verdane

stripe · ocado · amag · Audi

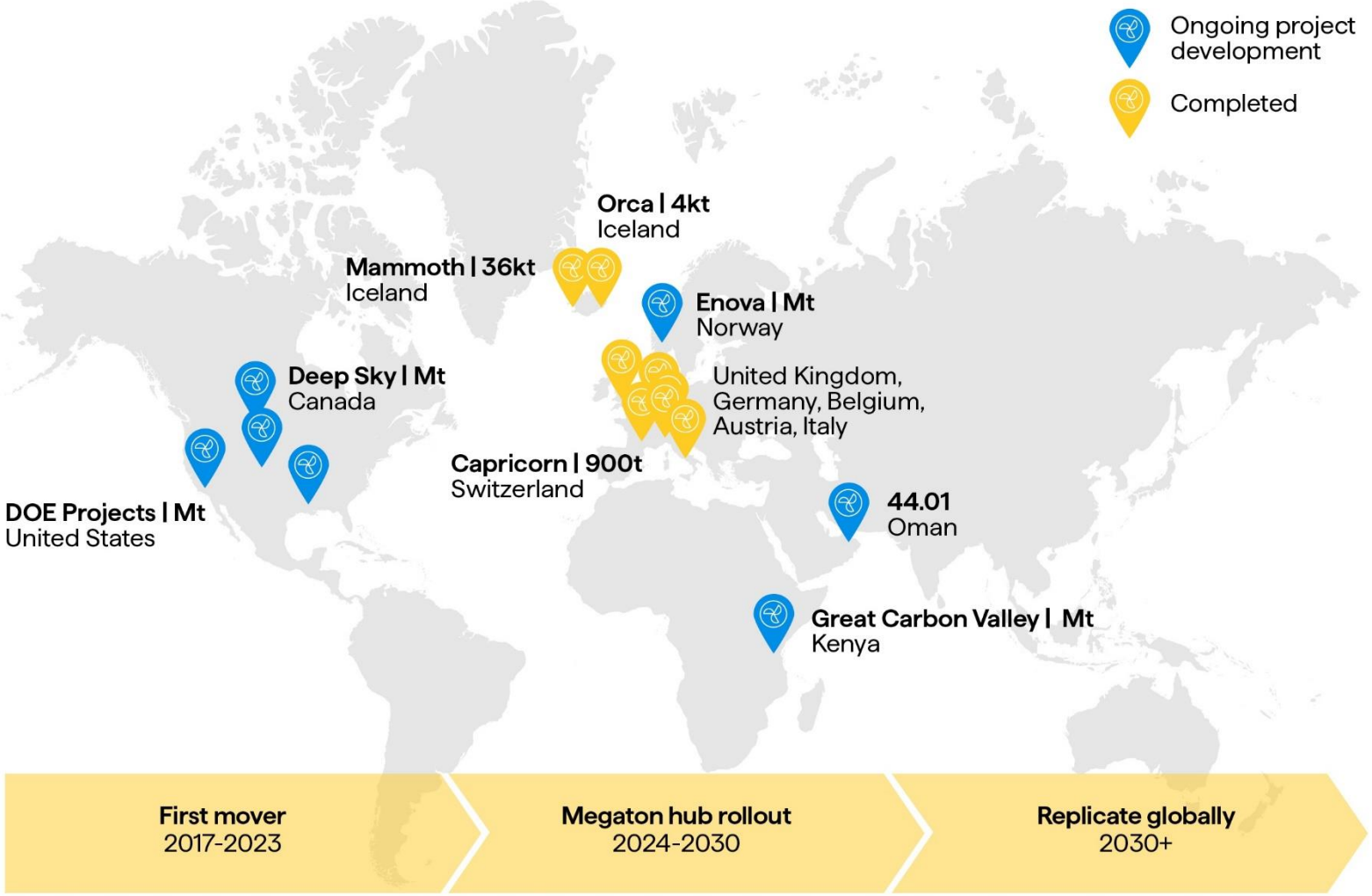
For companies

High-quality CO_2 removal as part of corporate emissions reduction roadmaps to achieve net zero and beyond.

For individuals

CO_2 removal as a service for individuals to remove emissions and enable DAC's scale-up: www.climeworks.com/subscriptions

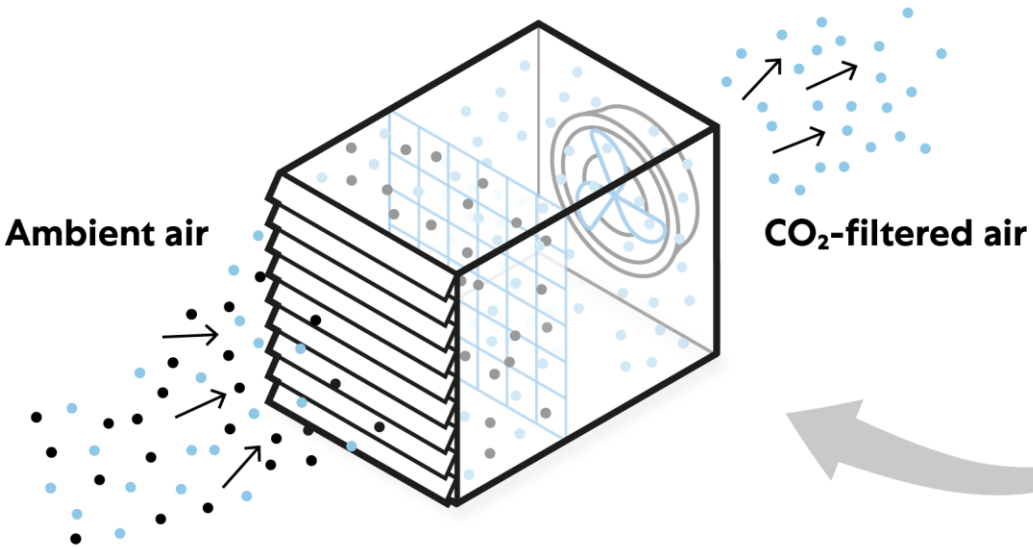
Climeworks projects worldwide



How our technology works

Phase 1

Adsorption: CO_2 is bound on the surface of a material

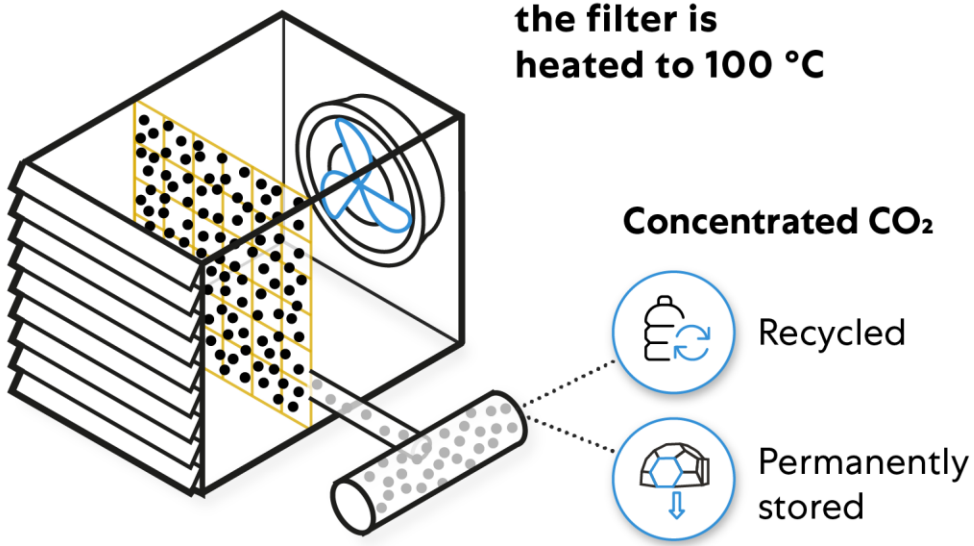


1 CO_2 is chemically bound to the filter

Phase 2

Desorption: CO_2 is released

2 Once the filter is saturated with CO_2, the filter is heated to 100 °C

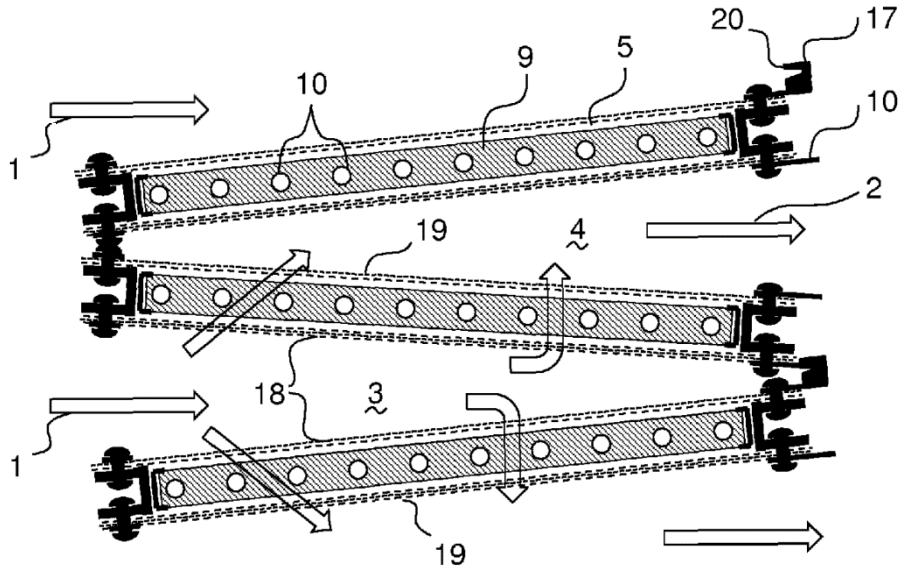


3 CO_2 is then released from the filter and collected

Looking inside: optimization problems

Adsorption

Challenge:
Load highly dilute 400 ppm CO_2 in air onto a sorbent quickly, efficiently, without prohibitive pressure drops

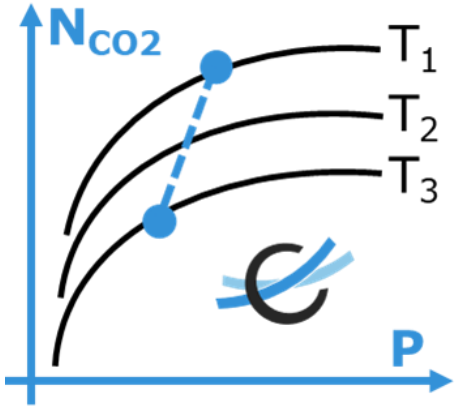


sorbent

Desorption

Challenge:
Unload CO_2 as fully & as purely as possible, using a minimal amount of renewable electricity and heat

Temperature-vacuum swing regeneration process



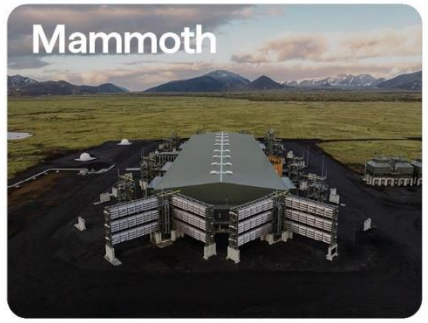
Our technology evolution

2014

2017

2021

2024

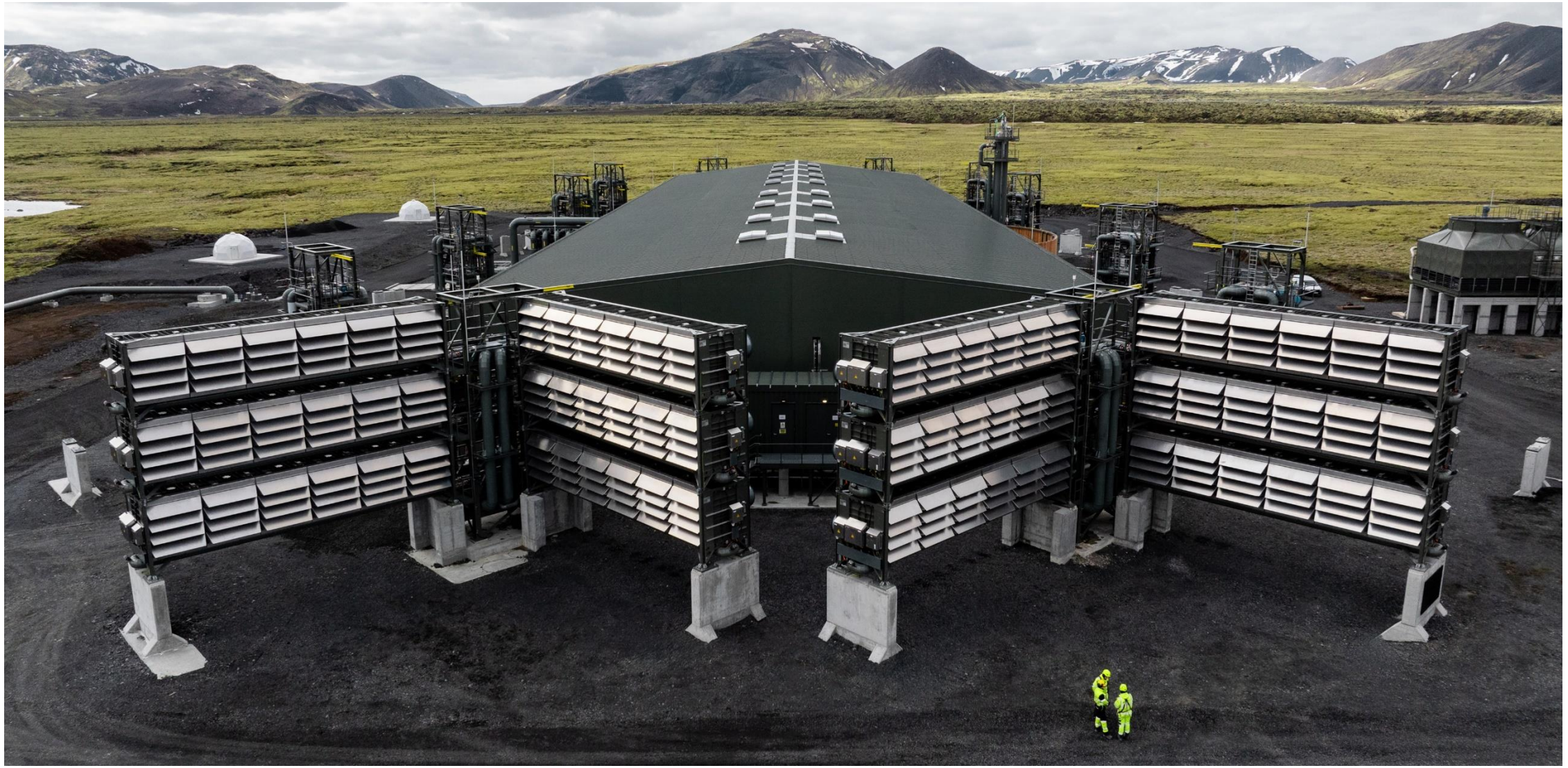


2024

Gen 1

Gen 2

Latest Gen 2 plant: Mammoth



3
years of customer delivery of CDR

120,000
hours of operational DAC experience

7
years of field experience

5th May 2024
Mammoth first CO_2 removed

200
million data points processed daily by Climeworks engineers

Certified
under the Puro Standard - a worldwide first

Our technology evolution

2014

2017

Gen 1

2021

2024

2024

Gen 2

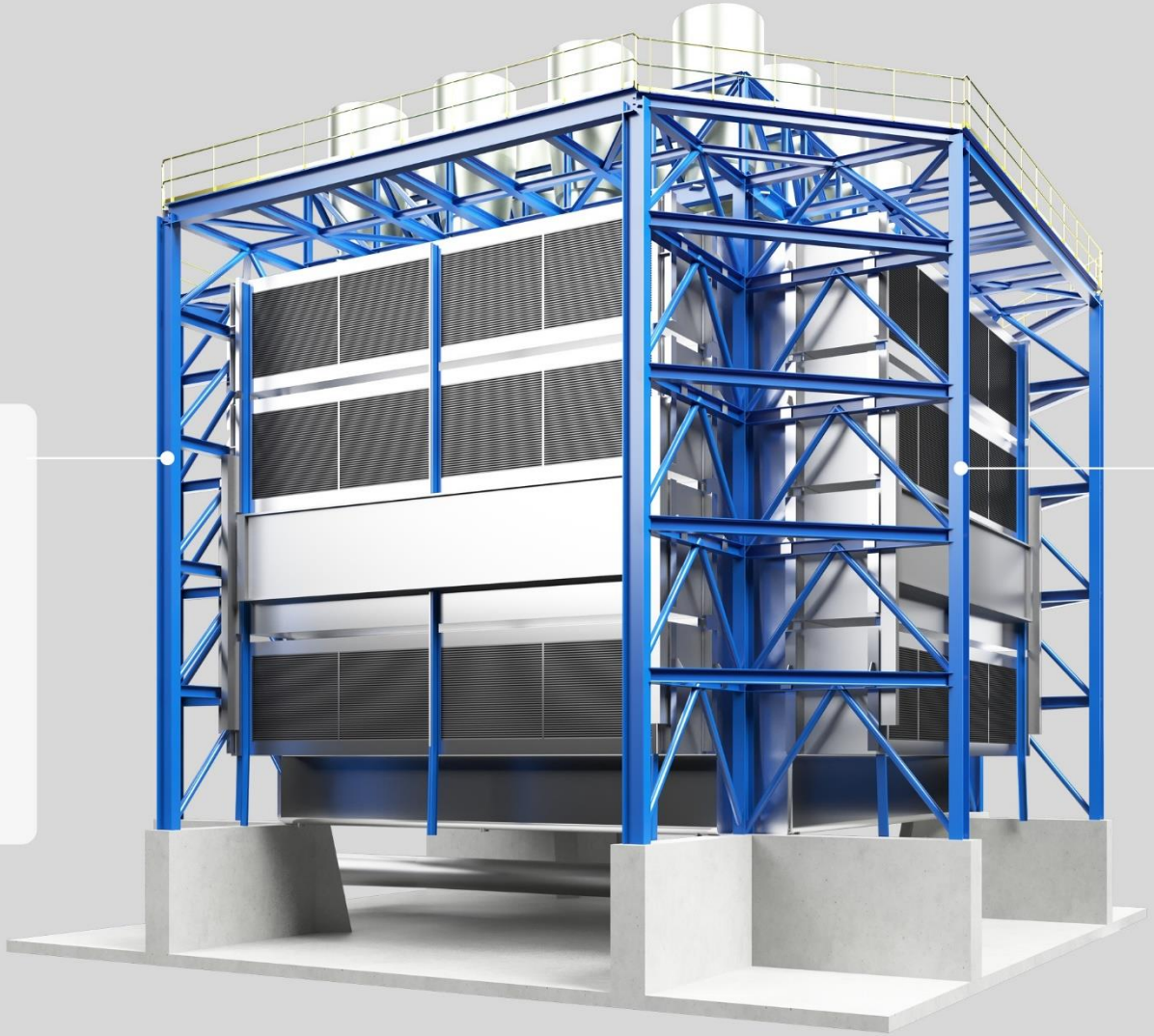
*2019

Gen 3

Generation 3

New system layout

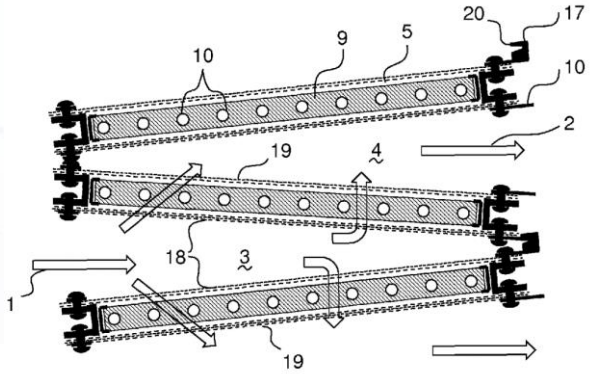
- Improved energy utilization
- Increase robustness
- Reduced footprint

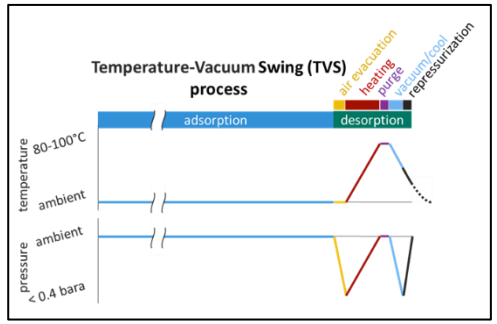


Different sorbents allowing for:

- Faster kinetics
- Higher throughput
- Faster desorption

R&D approach at Climeworks





Sorbent

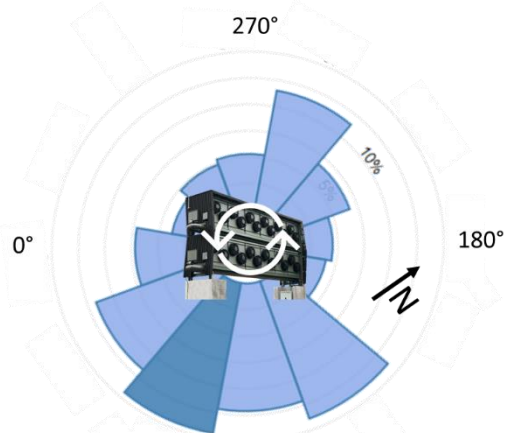
Sorbent Structure

Collector/ Plant

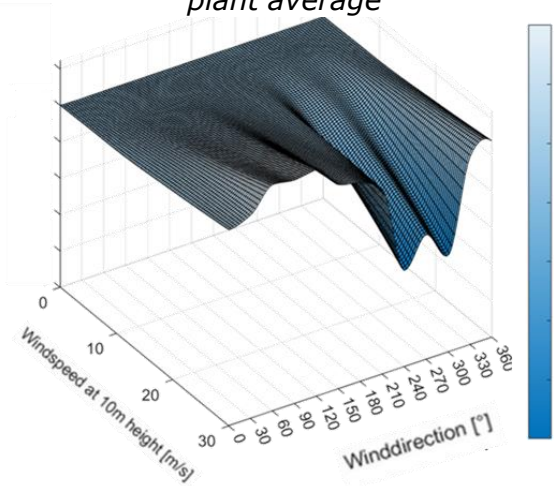
Process

R&D informed by field experience

Plant design

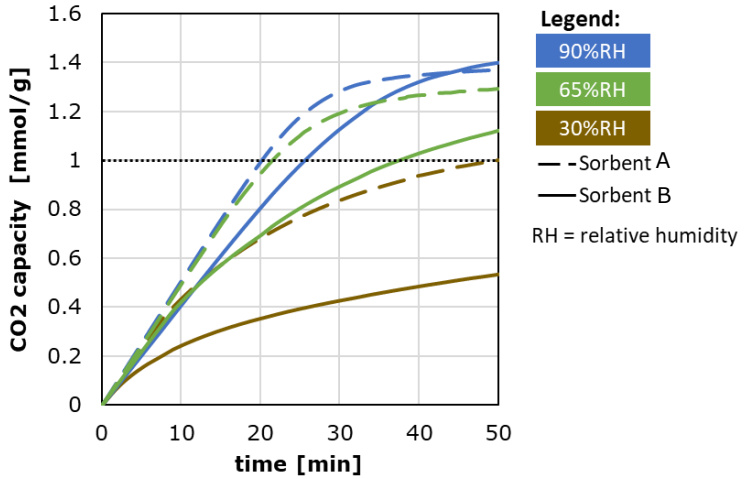


Air volume flow rate rel. to calm conditions
plant average

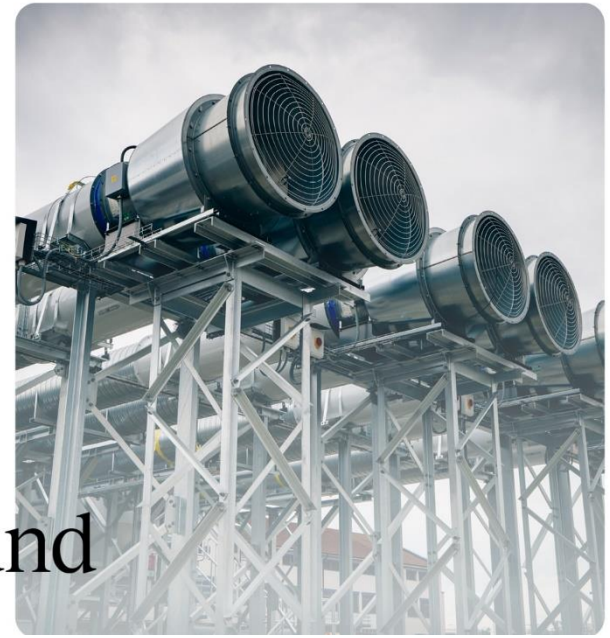


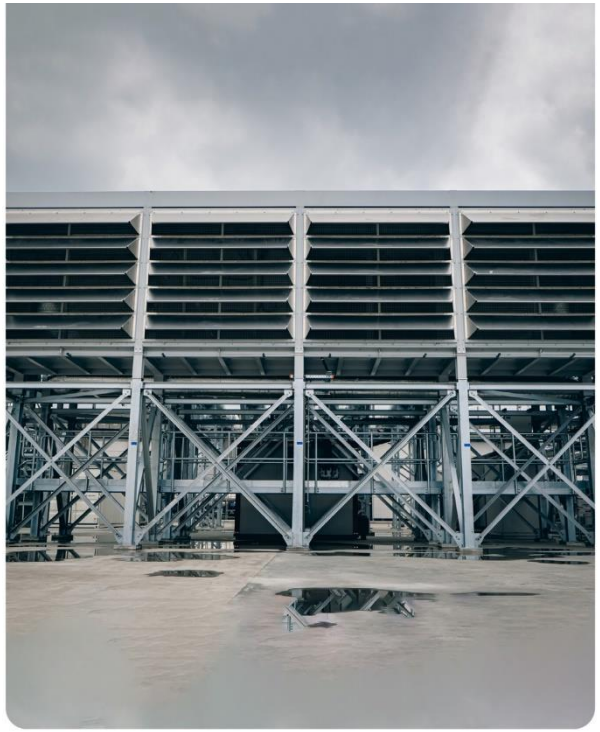
Materials of construction

Real World Conditions



Gen 3 full-scale prototype: operational since May 2024





Basel, Switzerland

Gen 3 in numbers

Achievements

↑ Increase capture capacity	**+100%** CO_2 capture
↑ Filter material lifetime expectation	**3x** material lifetime
↓ Reduce energy consumption	**-50%** energy
↓ Reduce overall cost	**-50%** cost

Climeworks plans continuous DAC capacity increase

Iceland
Hellisheiði

4,000 tons
per year

Iceland,
operational

Orca

2021
Enable scale-up

Iceland
Hellisheiði

+36,000 tons
per year

Iceland,
operational

Mammoth

2023 - 2024
Commercially proven

USA
Louisiana, California,
North Dakota

Multi-megaton range

Historic US DAC Hub
announcement

2026 - 2030
Industrialization

Global

Gigaton range

TBC

2050
Large-scale industrialization

- Most advanced DAC player with real **field experience**
- World's **largest DAC+S facility** in commercial operations
- Over 120,000 hours of **operational experience** in diverse climatic conditions
- A clear strategy to **scale removal capacity** to megaton scale by 2030 and gigaton scale by 2050

*from 2027 onwards and is subject to changes.

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Over 9000 Gt of storage capacity potential