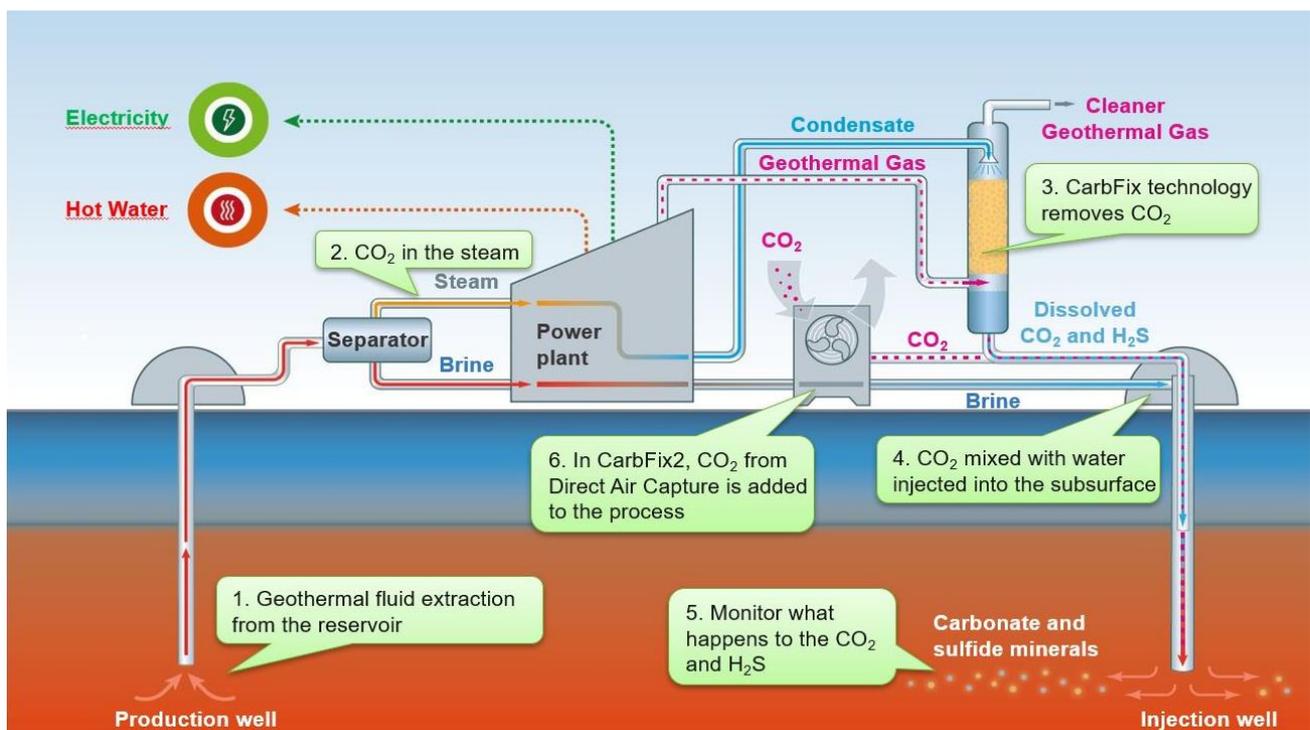


THE CARBFIX PROJECT

The technology developed in CarbFix demonstrates the ability to capture otherwise emitted CO₂ and turn it into carbonate minerals in the subsurface in less than two years.

CarbFix differs from other carbon storage projects in two significant aspects. First, it provides a complete carbon capture and storage (CCS) solution at a single operating power plant. Second, in contrast to most projects, its goal is to petrify carbon by accelerating the transformation of CO₂ into stable carbonate minerals (e.g. calcite) as rapidly as possible. Once CO₂ is transformed into carbonate minerals it has been permanently removed from the atmosphere because carbonate minerals are stable on a geological time-scale. Industrial scale CO₂ capture and storage has been ongoing within CarbFix since 2014 at The Hellisheidi Geothermal Power Plant, following successful pilot-scale injections in 2012.

Current activities within CarbFix aim at lowering capture costs and provide added value to the method by co-capturing and injecting other environmentally important gases. Research related to exploring the use of seawater as the gas capture medium is furthermore ongoing along with efforts aimed at combining the CarbFix method with direct air capture (DAC). These activities are the main focus of the recent EU funded CarbFix2 project.



Overview of the Hellisheidi Geothermal Power Plant. The EU funded CarbFix2 project incorporates a DAC unit into the plant's production cycle, where CO₂ is captured from air and co-injected with geothermally derived CO₂ into the subsurface. An intensive multidisciplinary monitoring is conducted to verify safe and permanent storage of the CO₂.

Project technical description & implementation

CO₂ capture in CarbFix is currently carried out through two different processes:

- 1) Industrial scale capture from otherwise emitted CO₂ at The Hellisheidi Geothermal Power Plant. CO₂ and H₂S are co-captured in a scrubbing tower and injected into nearby basaltic formations at >1000 m depth. Annual capacity is approximately 12,000

tons CO₂ and 6,000 tons H₂S which constitute 1/3rd and 2/3rd of the power plant's emissions respectively.

- 2) Pilot scale direct air capture (DAC) through a system developed by Climeworks. Key advantages of Climeworks' DAC technology are its location independency and that it mostly relies on energy in the form of heat (~100°C) which is available as a by-product in numerous industrial processes. A DAC demonstration unit has been installed by The Hellisheidi Geothermal Power Plant allowing access to a suitable heat source and the CO₂ injection infrastructure. The pilot plant started up in October 2017 and is estimated to capture 50 tons of CO₂ annually.

CO₂ from both capture processes is injected into the basaltic bedrock at Hellisheidi. There, the movement of the injected gases is monitored, and their fate is modelled using state of the art simulation tools. In accordance with a pre-defined traffic-light protocol, preventive steps are followed to minimize risks of induced seismicity. Any induced seismicity that occurs due to injection activities is monitored and analyzed.

Off-shore CO₂ storage

Within CarbFix, important steps are being taken in preparing for offshore carbon mineralization in basalts. There are numerous advantages in applying the CarbFix method to submarine basalts. First, there is far more storage available in porous sub-marine basalts than required for the geologic storage of all the anthropogenic CO₂ that will ever be produced. Second, this is an environmentally safe solution to the global CO₂ challenge; the carbonation of subsurface marine basalts is a natural process that is widespread across the global oceans.

FUNDING AND PARTNERS

CarbFix was founded by Reykjavik Energy, The University of Iceland, CNRS, and Columbia University in year 2007. Amphos 21 and Climeworks later joined the consortium.



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CLIMEWORKS
Capturing CO₂ from air

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