Carbfix – Permanent CO_2 mineral storage

The Carbfix process captures and permanently removes CO_2. The technology provides a complete carbon capture and storage solution, where CO_2 dissolved in water – a sparkling-water of sorts – is injected into the subsurface where it reacts with favourable rock formations to form solid carbonate minerals via natural processes.

Carbfix is a research and innovation driven technology which has, since 2007, been led by Reykjavik Energy, the University of Iceland and CNRS in Toulouse, as well as several other universities and research institutes. The Carbfix process has been applied to significantly reduce CO_2 and H_2S emissions from the Hellisheiði Power Plant since 2014, following successful pilot-scale injections in 2012. The technology can be adapted to other carbon emitting industries, such as steel, iron and cement production.

Carbfix has been operated as an independent subsidiary of Reykjavík Energy since 2019. It has been proven to be an economic and environmentally friendly solution for the permanent removal of these gases.

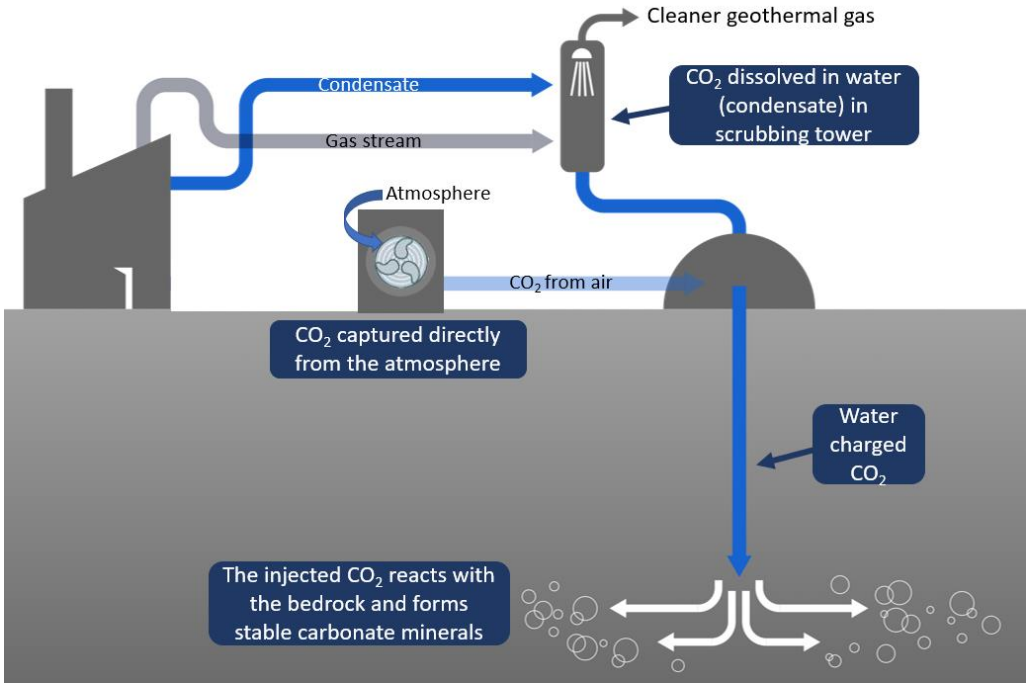

Fig. 1 *Ongoing activities at the Hellisheidi Geothermal Power Plant where CO_2 and H_2S are captured and separated from the other geothermal gases from the plant, dissolved in condensed steam and injected into the subsurface for permanent mineralisation. CO_2 is also captured directly from the atmosphere in cooperation with the Swiss company Climeworks and co-injected with the other gases.*

CO_2 capture for Carbfix can be carried out via different processes:

- Gases from the **Hellisheidi Geothermal Power Plant** are captured in a dedicated water scrubbing tower with an annual capacity of about 15,000 tonnes of CO_2 and 6,000 tonnes of H_2S, about 30% and 75% of the plant's emissions respectively. The capture capacity at the power plant will be scaled up to reach near zero-emissions in the coming years.
- Direct air capture (DAC). A DAC demonstration plant from the Swiss clean-tech company Climeworks has been operating since 2017 with the capacity to capture about 50 tons of CO_2 annually. Preparation for scaling the annual DAC capture up to ~4000 tons of CO_2 is underway.
- Carbfix will work in combination with any other CO_2 capture technology provided it delivers CO_2 in high concentration.

The CO_2 is dissolved in water and injected into basaltic formations at >400 m depth where the fluid reacts with the bedrock and forms stable carbonate minerals in less than two years. The injected fluids are monitored in nearby wells 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 analysed. Cost of industrial scale CarbFix operations at Hellisheidi are less than $25/ton, which is comparable with current price of ETS carbon quota and far cheaper than conventional CCS methods.

Further research and innovation carried out within Carbfix aim at:

Lowering costs and provide added value to the technology by co-capturing and injecting other environmentally hazardous gases.

Applying the Carbfix technology in other industrial sectors such as steel, iron, cement, hydrogen production and waste-to-energy.

Establishing flexible carbon storage hubs that are capable of receiving large quantities of CO_2 transported by ships or pipelines.

Scaling up DAC operations in Iceland to remove atmospheric CO_2 and contribute to negative emissions in greater capacities.

Moving CO_2 mineral storage to offshore regions, exploring the numerous advantages including the vast storage capacity of sub-marine basalts and the use of seawater for injection.

Implementing the technology in different geological setting in other field sites e.g. in Germany, Italy and Turkey through the EU funded GECO project.

Further information

For more information about Carbfix, please visit www.carbfix.com.

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