European Commission

Aerial view of the project

INNOVATION FUND

Driving clean innovative technologies towards the market

CCGeo: Closed Carbon Geothermal Energy

All images © CCGeo

The Innovation Fund is 100% funded by the EU Emissions Trading System

Project summary

The CCGeo project aims to produce near-zero carbon power and heat from gas dissolved in water extracted from geothermal wells. To this end, the project creates a closed loop geothermal power plant using the process of Internalization of Carbon Compounds (ICC). By implementing this new technology on a geothermal plant, the project will lay the groundwork for scaling-up the efficient usage of low-temperature geothermal resources and for demonstrating the potential to eliminate nearly all of the greenhouse gas (GHG) emissions associated with a conventional technology.

COORDINATOR
AAT Geothermae d.o.o.

LOCATION
Draškovec, Croatia

SECTOR
Renewable heating/cooling

AMOUNT OF INNOVATION FUND GRANT
EUR 4 498 659

RELEVANT COSTS
EUR 7 497 765

STARTING DATE
01 December 2021

PLANNED DATE OF ENTRY INTO OPERATION
Q4 2022

A novel combination of existing technologies to exploit geothermal energy

The project is using a novel combination of existing technologies to generate electricity and heat from the geothermal brine and from the natural gases dissolved into it, and to sequester the produced carbon dioxide back in the same subterranean reservoir from which the brine is extracted. It will generate near-zero carbon power and heat by adding to conventional geothermal plants the ICC process to exploit the natural gas dissolved in water extracted from a geothermal well. This is an advancement from conventional geothermal plants, which typically treat and/or vent into the atmosphere the unavoidable dissolved gases produced when exploiting geothermal brine. With the ICC process, the full energy potential of the geothermal resource is utilized without emitting GHG or decreasing the energy production efficiency.

The project is being developed on the existing geothermal plant producing energy from the heat of the geothermal brine (based on a process called Organic Rankine Cycle or ORC) and awarded by the European Commission in the NER300 programme in 2014 and supported by the Republic of Croatia.

The closed-loop geothermal process includes five main steps: (1) extraction of a geothermal fluid (the brine); (2) separation of dissolved natural gas from the geothermal fluid; (3) utilisation of the gas for the co-generation of electricity and heat; (4) extraction of CO_2 from the exhaust gases; and, (5) compression of the recovered CO_2 and injection into the geothermal reservoir from which it was extracted.

This will translate into 8 200 hours of constant baseload operation with a net power production of 22 357 MWhe and net heat of 29 250 MWhth per year.

The benefits of tapping into low temperature geothermal resources

The ICC technology enables the utilisation of low to medium temperature (approx. 100°C) geothermal resources without emitting greenhouse gases or decreasing the efficiency of the energy production. The project has the potential to eliminate 98% of the GHG emissions associated with a conventional technology.

The ICC technology brings multiple technical and environmental benefits, as the technology is based on induced release of geothermal brine from the reservoir and it maintains the balance of pressure in the subsurface thanks to the reinjection of the entire brine and gas. By using low temperature brine, the technology also lowers the maintenance costs due to less aggressive brine and lower tear on equipment.

The heat will be sold at a significantly lower price compared to the current fossil fuel heating source, which also represents an important benefit for the local economy in terms of cost, sustainability, and independence from imports.

The project site offers space for solar panels that would reduce the internal power consumption of the plant, thereby increasing the net power delivered to the grid.

Scale-up potential in Croatia

Geothermal potential of the Pannonian Basin in Croatia is significant and yet poorly exploited until now. The ICC technology can be further deployed on the project site by adding three production lines that are powered by additional three geothermal doublets. Moreover, the Pannonian Basin has the potential for 25-50 further ICC projects at full scale.

At larger industry level, depleted oil and gas fields containing water and dissolved gases with a temperature range of 80-120°C can potently be transformed via the ICC technology into a GHG-free baseload heat and power production sites. The existing data gathered during oil and gas extraction will reduce the development risk of the projects.