

# Study: Geothermal energy could be generated from captured CO<sub>2</sub>

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Alireza Rangriz Shokri explains his work to fellow researchers with the U of A's Future Energy Systems, using a 3D printed cube to explain how CO<sub>2</sub> and brine can be used to fill in gaps in underground formations of porous rock. Credit: Future Energy Systems

University of Alberta research is making new strides in discoveries about capturing and storing carbon—while also yielding a high-value end product from carbon dioxide.

A process that injects the greenhouse gas deep below ground, then circulates it to extract heat and [geothermal energy](#), has proven viable in a feasibility study by U of A researchers.

The discovery moves the technology a step closer to pilot testing and ultimately to becoming part of a low-carbon economy, said Alireza Rangriz Shokri, a research associate in the Faculty of Engineering who conducted the study.

"This is a step forward to commercializing the technology, and if successful, it's a potential breakthrough for sustainable energy production," he said.

## Beyond carbon capture and storage

Known as CO<sub>2</sub> plume geothermal or CPG technology, the process is an exciting development that extends beyond the concept of just capturing and sequestering CO<sub>2</sub>, he added.

"The science of carbon capture has traditionally focused on CO<sub>2</sub> [storage](#) and less on CO<sub>2</sub> utilization such as extracting the geothermal energy. But doing both at the same time is novel for today's technology."

The heat and geothermal energy extracted from the CO<sub>2</sub> could be used to generate electricity and become a revenue stream that helps offset the costs of [carbon capture](#) and storage, Shokri noted.

"It's one of the main obstacles: currently, storing CO<sub>2</sub> doesn't generate revenue. We're just disposing of it underground, so there's no end product. But if we generate [geothermal power](#) from the process, it has the potential to be used in several ways."

That could include powering pumps used to inject CO<sub>2</sub> underground, or

CO<sub>2</sub> storage facilities eventually having the capacity to sell electricity to industrial or residential markets.

Shokri, who presents his findings during Energy Week at the U of A, conducted the feasibility study at Aquistore. The Saskatchewan facility is the world's most comprehensive field lab for researching stored CO<sub>2</sub>.

He used numerical tools, lab and field data to examine the injection history of CO<sub>2</sub> storage operation at Aquistore and to validate his simulations with field measurements, including downhole injection pressure and temperature. He then used his model to assess the CO<sub>2</sub> circulation process, identifying key performance variables such as produced volumes of CO<sub>2</sub> and brine—the salty water that could dissolve the greenhouse gas.

His work showed that the process was both viable and safe.

"We were able to show that at the end of its life cycle, CPG permanently sequesters 100 percent of the injected CO<sub>2</sub> in the geological reservoir, and the CO<sub>2</sub> is not going to escape into the air."

## **Pilot test would be world's first**

The findings will now go through an assessment to determine suitability for pilot testing, and it will be a world first if it moves to that phase.

"No one has done a CPG pilot test to show we could extract geothermal energy using CO<sub>2</sub>."

Equally exciting is how the project has expanded knowledge about CO<sub>2</sub> storage in general, he added.

"The results from our study will also help improve our understanding

about things like intermittent and long-term energy storage. It all builds towards making CO<sub>2</sub> storage a safe and workable solution."

Collaboration with other researchers around the world also provided the geothermal expertise needed to test the CPG technology, said Shokri: "It's a valuable transfer of knowledge; we learn from each other."

His [work](#) is also part of Future Energy Systems, a cross-disciplinary research and teaching network at the U of A working to develop innovations for [energy](#) transition.

Provided by University of Alberta

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