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Can aquaculture gain steam from geothermal energy?

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By Jen A. Miller

China, Iceland and the United States are only just beginning to tap into geothermal energy as a resource for seafood production

Geothermal energy could be a growing resource for seafood production. Matorka in Iceland harvested almost 1,300 metric tons of mostly Arctic char and some steelhead trout in 2021. Photo courtesy of Matorka.

As the global food supply chain slowly progresses on carbon-cutting initiatives, a fresh focus is being placed on somewhat old technology. While geothermal energy has been around for decades (first making inroads in the United States in the 1970s) – and still only accounts for less than 1 percent of energy sourcing for aquaculture globally – its potential to efficiently regulate aquaculture water temperatures is intriguing.

Geothermal energy is a renewal energy source that comes from the sub-surface of the earth, and comes in forms humans can tap through things like geysers, hot springs and hydrothermal vents. It can often be found close to tectonic plate boundaries, where the earth's sub-surface has the best chance of popping through.

According to a February 2021 study published in ***Geothermics (https://www.sciencedirect.com/science/article/pii/S0375650520302078?via%3Dihub)***, 21 countries are now using geothermal heat sources to farm fish, crustaceans, amphibians and reptiles. Overall, the use of geothermal heat sources for aquaculture has also increased more than 13 percent since 2015.

Frank van Roest, investment director at **Aqua-Spark (https://www.aqua-spark.nl/)**, a global investment fund based in the Netherlands, says geothermal-powered aquaculture is attractive for several reasons, and not just because of lower environmental impacts. For land-based aquaculture, geothermally heated waters can be cheaper and less complicated to use.

"If you look at RAS facilities, just making sure the water quality and water temperature are right is a huge cost in terms of both capital expense and operation expense," he said.

In 2016, Aqua-Spark company invested in **Matorka (https://matorka.is/)**, a land-based aquaculture farm in Grindavík, Iceland, that began operations in 2017. In 2021, the company harvested almost 1,300 metric tons of mostly Arctic char (*Salvelinus alpinus*) and some steelhead trout (*Oncorhynchus mykiss*), and they plan on harvesting about 1,600 this year. Van Roest said Matorka has the capability to nearly double that production.

> ***Where [geothermal] is available, it can play a role as long as it is developed correctly and associated mineral content monitored and possibly necessary water treatment applied.***

"If you look at what Matorka is doing, they're a land-based farm but one of the advantages of Iceland is the ability to access high-quality fresh water" in addition to abundant geothermal energy, he said. The company has also tapped into Iceland's robust fish exporting infrastructure and ships its product mostly to North America and Europe. The pandemic has complicated plans and slightly slowed its growth, but Matorka has been flexible and quick to change plans to meet current demands, he added. For example, they started out working directly with restaurants, but shifted to more retail clients during the pandemic to support new demand for customers who wanted to prepare fish at home versus going out to eat.

Matorka also benefited from Iceland's already robust geothermal energy infrastructure, according to Árni Páll Einarsson, chief operating officer of Matorka. Geothermal power facilities generate about 25 percent of the country's electricity and accounts for 66 percent of Iceland's primary energy use, **according to the National Energy Authority of Iceland (https://nea.is/geothermal/)**.

“Geothermal energy is quite well known and stable in Iceland, so for Matorka, which is committed to its sustainable production practices, this was an easy choice as it is environmentally friendly, sustainable and economical,” Einarsson told the *Advocate*.

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Algica, an algae-based product created from nutrients exiting recirculating aquaculture systems, has the company poised to upscale production.

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Globally, China leads the way in geothermal-powered aquaculture (its government has targeted geothermal development as a source of clean energy to reduce reliance on coal), followed by the United States, Iceland, Italy and Israel.

For U.S. aquaculture, geothermal energy has played a part since the 1970s, starting in the Imperial Valley of California and the Snake River Plain in Idaho. Idaho alone produces 2 to 2.5 million pounds of tilapia plus ornamental fish today, explained Gary Fornshell, who recently retired from the University of Idaho Extension, where he served as an extension educator.

“Aquaculture here in Idaho is unique because we have both cold water and geothermal water resources, and we grow a variety of species that you wouldn’t necessarily associate with this part of the country,” he said, including alligators. Idaho’s aquaculture sources are also non-consumptive since the water used is then returned to the source, and its geothermal wells are artesian (on the cold water side, spring water for trout farms work by gravity).

This kind of aquaculture is “is affordable and sustainable because there are no pumping costs,” he said. Idaho has tapped into geothermal energy to power everything from greenhouses to farms to colleges to colleges. The Idaho State House is also the only U.S. state capital heated by geothermal energy.

However, the expansion of geothermal aquaculture is hampered in Idaho by two factors: First, drilling new wells is prohibited. Secondly, while aquaculture farmers do well with tilapia, they have been resistant to switching to higher-value products. “That requires consideration of developing markets and learning how to grow those species. It’s almost like starting a whole new business,” Fornshell said.

As the overall geothermal market continues to grow (from $4.6 billion in 2018 to an anticipated $6.8 billion by 2026, according to **Allied Market Research** (https://www.alliedmarketresearch.com/geothermal-power-market)), geothermal aquaculture is most likely to follow.

“It will not solve all our problems, but it is certainly a viable, stable energy source that can be a part of solving some of the world’s environmental problems,” said Einarsson. “Where [geothermal] is available, it can play a role as long as it is developed correctly and associated mineral content monitored and possibly necessary water treatment applied.”

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