

CLIMATE SOLUTIONS

This UFO-like structure could help Europe transform its energy

A geothermal effort to displace coal and gas takes hold in Central Europe

By [Michael Birnbaum](#)

November 1, 2022 at 6:00 a.m. EDT

CIGLENA, Croatia — Hidden in the rolling hills of the Croatian countryside, a futuristic structure that looks a little like a flying saucer is what backers say is the hope for the region’s emissions-free future.

In a part of Europe that still generates much of its electricity by burning natural gas and coal, some green advocates say they should look deep beneath their feet to harness the power of the earth’s core. Croatia and its neighbors sit on top of a patch of unusual geology where the vast heat at the center of the world has an especially easy time coming close to the surface.

The result is a high concentration of potential emissions-free geothermal energy, one that can form the base of a carbon-free electricity grid, unlike wind and solar power, which don’t typically generate power around-the-clock. The UFO-like Velika Ciglena geothermal plant is the first of its kind in Croatia, and backers believe the technology could eventually power much of the country’s needs, as well as in neighboring countries that have similar geology, such as Austria, Hungary and Serbia.

“There is a huge potential to generate a lot of electricity out of this. There is a huge potential for district heating. And there is a huge potential for agriculture,” said Marijan Krpan, the chief executive of the Croatian Hydrocarbon Agency, the state agency that oversees drilling in the country. Krpan said he hopes geothermal energy could eventually generate a third of the country’s power demand.

Geothermal energy’s backers are gaining momentum around the world, as the technology improves and societies seek every avenue to reduce the emission of harmful greenhouse gases into the atmosphere. Among other virtues, advocates say, geothermal energy has a relatively small footprint, generating far more electricity per square foot than either wind or solar power, both of which require a lot of land to create power in any quantity. And geothermal power doesn’t have the same waste or safety risks as nuclear energy, a rival emissions-free source for electricity.

So advocates are advancing geothermal projects around the world, wherever the earth’s crust is conducive. In Paris, geothermal wells are heating elegant 19th-century apartment blocks. In the rugged mountains of eastern California, a major new geothermal power plant opened in August. In Iceland, a tiny island nation that sits atop countless hot springs, geothermal plants are being used to power the [world’s biggest carbon capture effort](#), an innovative attempt to pull carbon out of the air and pump it into the ground.

And in Croatia, there has been a flowering of projects after the government changed regulations in 2016 to allow the country’s thousands of disused oil and gas wells to be reused for geothermal projects. The northern part of the country is part of the geothermal-rich Pannonian basin, a region where continental plates collided about 16 million years ago, then folded back on themselves repeatedly, creating fractured rock that allows heat to rise from the earth’s molten core close to the surface.

“It’s a treasure,” said Zeljka Sladovic, the founder of GeoDa Consulting and a longtime consultant on geothermal projects in Croatia. For decades, the geologist worked for Croatia’s oil and gas industry, since the country was long rich with both of those resources.

Now the oil has largely run out, and the country imports most of its gas. But the detailed underground maps left over from decades of fossil fuel exploration can help geothermal investors find good prospects.

In Croatia, that has meant projects that generate heat for entire districts in towns that have centralized heating infrastructure instead of furnaces or boilers in each building. Farmers are using the technology to warm their greenhouses. And the first geothermal power plant opened last year in the middle of a cornfield just outside Ciglena, a village of about 300 people that is about 20 miles from the Hungarian border.

The Velika Ciglena power plant is an unlikely futuristic addition to a pastoral landscape. Weathered 19th-century churches back onto farmland and forest, and jouncing roads twist their way from Croatia’s elegant capital of Zagreb, which is an hour away. The installation is dominated by 44 massive silver fans, each about 20 feet across, and spinning parallel to the ground, that cool the water before it is pumped back into the ground.

“We showed to the world and to the sector that Croatia’s geothermal potential is useful,” said Dragan Jurilj, one of the investors who helped build the power plant and who now operates it amid an ownership dispute with his former Turkish partners.

The plant can generate about 17 megawatts of power, although because of the way Croatia's grid is operated, it's currently limited to 10 megawatts. At the installation's higher end, that's equivalent to about the electricity generated by about 94 football fields of solar panels, on a plot of land that is less than a tenth of that.

Skeptics of the efforts say that solar and wind generate power more cheaply, especially in Croatia, where the geothermal water isn't as hot as it is in more volcanic places like Iceland.

"I'm not sure that it makes sense from an economic point of view," said Neven Duic, the president of the International Center for Sustainable Development of Energy, Water and Environment System, a Zagreb-based research group, who said he thought that more modest geothermal projects, such as municipal heating plants, would generate fewer profits but might make more social sense than electricity.

But as the climate warms, backers of geothermal energy say that it can be a good hedge against the weather extremes that can sometimes threaten aboveground renewable energy sources. Europe had its warmest summer on record this year, drying up rivers and draining hydroelectric dams of their energy source, for instance.

And now that Russia has caused an energy shortage in Europe by cutting off natural gas supplies, there is fresh impetus to invest in every form of homegrown power.

"This is our own resource. You don't have to haggle about it with anybody. What's better than having our own energy in our backyard?" said Dragutin Domitrovic, who served as construction manager when the Velika Ciglena power plant was being built and now runs Calida Aqua, a geothermal consulting group.

Geothermal energy typically works by drilling a well a mile or two into the ground and pumping up water that has been heated by the energy of the earth's core. The heat is used to make steam that spins turbines, generating electricity. Then the cooled water is pumped back down into the ground. In many areas of Croatia's Pannonian region, the water is boiling a little more than a mile down and gets hotter the deeper a well is drilled.

Hotter water leads to more electricity. But there is wide variability from site to site, drilling wells is expensive, and often it's impossible to know in advance whether a drill hole will yield good enough water. That can scare off investors.

"This is a game which is not for the feeble-minded. But with patience you can be there," said Domitrovic, who said that with European energy prices as high as they were this summer, he thought that many geothermal projects would break even in seven to 10 years.

Croatian authorities are eager to press forward. Several new permits for geothermal power plants have been issued in recent months. And the leaders of the government office that oversees the process, the Croatian Hydrocarbon Agency, want to make their focus even clearer by changing their name, which comes from the fossil fuel era.

"We would like to change the name to the Geoenergy Agency," said Krpan, its chief executive.