Opinion: Chile must expand its geothermal capacity to meet ambitious renewable energy goals

By Pete Polonsky
December 2024

What do Johnny Cash and the electricity sector of Chile have in common? Both could benefit immensely from a 'ring of fire.' While Cash reaped the benefits of his #1 hit song, Ring of Fire, released over six decades ago, the potential of the Pacific Ring of Fire to generate geothermal energy for Chile has largely been untapped.

The Pacific Ring of Fire refers to the region circling the Pacific Ocean where tectonic plates meet, responsible for more volcanic activity than anywhere else in the world. Part of this ring of fire, the Andean mountains in Chile have about 3,000 volcanoes, over 100 of which are active and could generate geothermal energy. While these volcanoes hit the news dramatically when they erupt, as the eruption in April 2015 of the Calbuco volcano did, they are also 'hot' spots for geothermal exploration and development. The Cerro Pabellón geothermal power plant, built in the plateaus of the Atacama Desert in Northern Chile, is one such example.

However, this 83-megawatt (MW) plant is the only example of large-scale geothermal development in Chile, which so far has not capitalized on the massive potential for geothermal energy, a renewable, abundant, and clean energy resource. Chile has set goals to achieve 70% renewable energy generation by 2030 and carbon neutrality by 2050. Today, Chile is well on track with approximately 64% of electricity generation from renewables, the rest coming from a mix of coal, oil, and natural gas. Over one quarter of generation is from hydroelectricity, however, which is becoming less reliable as climate change increases the severity and frequency of severe weather events like droughts and floods.

To meet Chile's decarbonization goals, the country must invest in the development of its geothermal industry and expand the capacity of geothermal energy in its power sector. Estimates of geothermal potential in Chile range from 3,800 MW to 16,000 MW, which could increase existing geothermal capacity 45 to 190 times over and theoretically replace all existing fossil fuel capacity. While there are logistical and fiscal challenges to geothermal development, the opportunity to fully replace reliance on importing coal, oil, and natural gas cannot be overlooked.

Geothermal energy could play a substantial role in the future decarbonized electric grid. While initial capital expenditures for exploring and building resources are higher than other renewables like wind and solar, geothermal power plants have a smaller footprint and provide baseload power with a very high capacity factor of at least 90% - meaning the power plants are generating electricity for more than 90% of the year, compared to typical ranges of 20-40% for wind and solar resources. Thus, the levelized cost of electricity over a geothermal power plant's lifetime is comparable to wind and solar. In this way, geothermal can provide a sufficient balance of baseload power in lieu of fossil fuels or hydroelectricity to complement variable renewables.

Another distinct advantage of geothermal energy is its applicability for direct use applications in heating and other industrial applications. Given that about 36% of Chile's secondary energy consumption is in the heating sector, this could be a gamechanger for the energy sector. Further, geothermal energy could be directly used in the mining industry, one of Chile's largest sectors, and could revolutionize lithium production in the country (and writ larger, in the Lithium Triangle). This is particularly salient as Chile seeks to ramp up lithium production and is exploring new extraction methods. Geothermal brine extraction could offer a cleaner alternative to existing techniques, with the potential to mitigate land use, water consumption, and direct emissions.

On top of these applications, excess geothermal energy is a prime candidate for the development of green hydrogen. As a geothermal energy plant could generate electricity around-the-clock, at times when electricity consumption is much lower (e.g., overnight), excess energy could be converted to green hydrogen and support the burgeoning green hydrogen industry in Chile.

So, what's standing in the way of geothermal development? The primary challenges to development include high upfront investments in exploration and development, the buildout of large-scale transmission to support more capacity, and sufficient community acceptance of the resource.

Regarding the first two issues, the public sector must lead the charge from a regulatory perspective, encouraging private sector investment and partnering with industries in both the geothermal and mining sectors to overcome these challenges. There have been breakthroughs in exploration techniques, such as using a GIS-based model that requires low costs and limited data and using electromagnetic imaging technologies that enhance exploration, that should be leveraged to reduce upfront costs. On the business side, embracing geothermal development could also encourage the development of a robust geothermal industry that could become an international player in South America and beyond.

While public buy-in on addressing climate change is nearly unanimous in Chile, most areas with geothermal resource potential are in Indigenous peoples' territories, and local buy-in on exploration and development for geothermal resources should not be overlooked. In future development of geothermal resources, Chile should follow the example of its existing geothermal power plant at Cerro Pabellón, which has been recognized for its positive impact in delivering reliable electricity to the local Indigenous community that previously had insufficient energy access. In marketing the development of geothermal energy, the industry and government should highlight geothermal energy's role as an indigenous, green resource and embrace it in a cooperative relationship with the environment.

Chile has pursued more favorable geothermal policies in the 21st century, including easing restrictions on shallow geothermal projects that could be ripe for direct use applications. To meet today's challenge and boldly address climate change, Chile must push further and become a global leader in geothermal energy.

About Pete Polonsky:

Pete Polonsky (he/him) is a graduate student at the Scripps Institution of Oceanography at UC San Diego, studying climate science and policy with a focus on energy policy. Prior to moving to San Diego for graduate school, Pete worked on energy policy in the public sector in Hawaii for four years. He is originally from Winston-Salem, North Carolina.

Pete is available for contact via email at polonskypete@gmail.com or via LinkedIn at https://www.linkedin.com/in/pete-polonsky/.

Disclaimer: The opinions and views expressed herein are the author's only and should not be construed as representing the Scripps Institution of Oceanography or UC San Diego.

About the Geothermal Energy Advancement Association:

GEAA is a not-for-profit association that advocates increased investment for the development of Geothermal Energy and increased awareness of this sustainable source as the only true near zero-carbon baseload energy for power, heat and hot water.

The Association offers leadership and a dialogue in the energy transition debate. GEAA is a voice for all and is open to all those interested in advancing geothermal energy and all those interested in supporting the role in transitioning to a world using less fossil fuels with a clear objective of reducing carbon emissions and helping reverse the alarming effects of Climate Change and support global initiatives like the UN Paris Climate Accord.

Home | GEAA Geothermal