Insight

A Look at How Geothermal Fits in the Renewable Energy Puzzle

DAN GOLDBECK | MARCH 2, 2020

- Despite relatively minimal use currently, geothermal energy has some important benefits: As a natural, renewable energy source it is cleaner than fossil fuel plants while also being more reliable than other renewables such as wind and solar.
- Geothermal plants face a unique set of challenges, however: They are geographically limited and bring higher per-unit capital costs than the usual baseload plants, and the regulatory hurdles under the current permit process can take up to a decade to complete.
- Research suggests that a greater commitment to researching more advanced technologies in concert with regulatory consolidation – reforms included in current legislation – could yield a "26-fold" increase in the amount of geothermal energy produced in coming decades.

This week, S. 2657, or the "Advanced Geothermal Innovation Leadership (AGILE) Act," heads to the Senate floor. As the title suggests, the AGILE Act – as it currently stands, at least – puts forward a series of policies to promote the development of geothermal energy production. While the bill could form part of a broader energy reform—the American Energy Innovation Act (AEIA)—it is worth considering the potential of, and barriers to, geothermal energy in particular. A body of recent research suggests that further unlocking geothermal energy's potential could provide a safe, reliable, and clean addition to the nation's overall energy mix, although regulatory barriers stand in the way of its expansion.

Geothermal energy, simply put, uses the latent heat underground to produce steam that, in turn, powers a turbine that generates electricity. A geothermal system can either draw steam directly from underground heated water sources or transfer the heat of non-water underground materials to above-ground water. The underground heat can also be pumped up and used as a direct heat source that does not require electricity or combustible fuels to produce.

In terms of power generation, geothermal has comparative advantages over other energy sources. The process does not produce harmful emissions, and much of whatever by-product that comes from it can be safely repurposed to other ends. Since the earth's heat is always "on," it does not have the intermittency issues associated with some other renewable sources such as wind and solar. In fact, per the most recent Energy Information Administration data, its generation capacity factor (the ratio of power actually produced compared to its maximum potential) is roughly two times as efficient as wind and three times as efficient as solar.

Despite these advantages, however, geothermal currently accounts for merely 0.4 percent of the nation's utility-scale electricity generation. A combination of basic physical and economic disadvantages contribute to this under-utilization. As one can imagine, the development and drilling of a potential site is capital-intensive. The Department of Energy (DOE) estimates that capital costs can be roughly $2,500 per installed kilowatt; by way

of comparison, typical oil and natural gas plants cost roughly $900 per installed kilowatt. It also requires wells of heat that, by geologic happenstance, are only located in specific areas. Further development of drilling methods could open up a broader set of potential sites, but it is nevertheless limited to areas with the necessary geologic activity.

This geographic limitation issue also means most potential sites are in the West and, generally, on federal lands. With federal control comes additional permitting and leasing hurdles that involve various agencies at federal and state levels. Under current requirements, it could take upwards of 10 years to develop a site. Much of the stagnation from this process is the result of repeating the permit process with multiple agencies individually, even if the relevant specifications and data have already been reported to another agency. Since each application takes its own requisite amount of time, this duplication draws out each stage of the development process. A 2019 DOE report estimates that simply streamlining the regulatory hurdles could more than double the expected capacity by 2050 and that further unlocking the technological challenges "could increase geothermal power generation nearly 26-fold from today."

The geothermal provisions of the expected AEIA address some of these challenges. On the technology side, the bill includes a host of new programs and funding to further incentivize research in developing more advanced systems. On the regulatory side, the primary reform is to have the Bureau of Land Management (BLM) coordinate the currently various and disparate permit review processes that potential plants face from the Environmental Protection Agency, Department of Defense, and Forest Service. The National Renewable Energy Laboratory projects that this coordination could cut the average review process for typical plants by two years (from eight down to six). There is precedent for this sort of improvement: The Energy Policy Act of 2005 established essentially the same program for oil and gas wells and cut that application process "from 81 to 61 days or roughly 25%."

Geothermal will never be the panacea for our energy and environmental concerns—but neither will any other energy source for that matter. In an implicit acknowledgment of this reality, an announcement last week from the AGILE Act's primary sponsors, Senators Lisa Murkowski (R-AK) and Joe Manchin (D-WV), now sets up the bill to be a vehicle for the AEIA, which includes areas such as nuclear energy, battery storage, and carbon capture. Considering, however, that geothermal is relatively cleaner than such baseload sources as coal and gas *and* relatively more reliable than more ubiquitous "clean" sources such as wind and solar, it has the potential to become a more substantial piece of the nation's energy portfolio. Additional research efforts and policy reforms, including those in current legislation, can help unlock that potential.