Geothermal bubbles up as another way to fight climate change

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Geothermal power currently provides only a tiny fraction of the nation's electricity. But as states ramp up their transitions to renewable electricity, some leaders see a big role for geothermal as a stable, renewable power source.

Used in the United States since 1960, geothermal plants pipe steam or

hot water from deep wells to power turbines that produce electricity. Harnessing underground heat is more expensive than developing wind or solar energy, but experts say the dependable output from sources like geothermal is critical to shore up the grid at times where the sun isn't shining or the wind isn't blowing.

Many state leaders have focused on battery storage or preserving nuclear plants to complement their wind turbines and solar panels. Some are starting to view geothermal—which currently provides less than half of a percent of the country's power—as an underutilized power source that can be accessed 24/7.

"(The capacity for geothermal power) is hugely greater than what we're generating right now," said Roland Horne, the Thomas Davies Barrow professor of earth sciences at Stanford University. "It's not intermittent, it runs all the time, and that's a very compelling advantage."

Experts say that nearly every Western state could tap into more geothermal power, with potential to produce as much as 5% of the national electricity supply using existing technology. Some emerging systems, if successful, could raise that figure as high as 15%, backers say.

Earlier this summer, Colorado Gov. Jared Polis, a Democrat who chairs the 22-member Western Governors' Association, announced the group would be launching an initiative to explore expansion of the "underdeveloped" resource. The association will study permitting challenges, workforce issues, markets and mapping, among other factors.

"[Wind and solar] will likely continue to be the biggest workhorses of powering the grid, but we see a role for low-cost geothermal electric as part of that baseload solution as we phase out coal and natural gas," Polis

said in an interview. "There's no doubt in my mind that it will play a significant role in the energy future of the West."

Backers of geothermal energy acknowledge that scaling up the industry likely will require significant public support. That could include guaranteed loans for uncertain well-drilling operations, regulatory overhauls and staffing investments, or even mandates for more "baseload" power plants—whose output remains steady—from renewable sources. While early efforts to support geothermal have enjoyed broad bipartisan support, it's unclear how far lawmakers are willing to go to tilt the scales in its favor.

As with most energy sources, some geothermal projects have faced pushback from locals who oppose development in certain areas. A tribe in Nevada has fought a proposed project that it fears will damage hot springs it considers sacred, while a plant in Hawaii has long faced community opposition due to noise and hydrogen sulfide leaks.

Meanwhile, states in every region could use geothermal technology to heat and cool buildings, even in areas where the resource is not sufficient to power an electrical plant. Experts say that geothermal heat pumps could reduce the emissions created by natural gas furnaces and other fossil fuel-based heating systems. Earlier this year, lawmakers in New York and Massachusetts passed measures to encourage the adoption of geothermal heating and cooling.

Looking for consistency

To access geothermal power, engineers must find permeable rock with fractures that contain hot fluid. Most sites that meet that threshold are in the West.

Nevada sources more than 9% of its power from geothermal energy,

while California approaches 6%, according to the U.S. Energy Information Administration. Those two states produce about 95% of the nation's geothermal power, with Hawaii, Idaho, New Mexico, Oregon and Utah contributing much smaller amounts.

Geothermal experts say Nevada leaders have made a strong commitment to the industry, creating an efficient regulatory system that has allowed production to grow.

"The regulations are clear-cut, but they're not overly complicated," said Cortney Luxford, fluid minerals program manager with the state's Commission on Mineral Resources. "It doesn't take us long to process permits."

Industry leaders say California's regulations also are clear, though more restrictive. Many other states, though, lack the experience and staffing needed to oversee the kind of drilling operations necessary for geothermal power. Some industry supporters hope the governors' group's initiative on the issue will create more consistency.

"Standardization would be very helpful," said Nick Goodman, CEO of Cyrq Energy, a geothermal producer with plants in four states. "The permitting challenges that geothermal faces are more onerous than wind and solar, and WGA could help make sure the agencies can do their work and assess these permits."

In Colorado, lawmakers passed a measure earlier this year to put geothermal energy on an equal footing with solar power. The law limits fees that governments may impose on geothermal systems, promotes consumer education and requires the state's energy office to include geothermal as a resource that utilities may use in emissions reduction plans.

Colorado state Sen. Rob Woodward, the Republican who co-sponsored the bill, said it will largely help to enable small-scale residential heating and cooling. He intends to sponsor legislation in the next session to research and support large-scale electrical generation.

"The scientists I've talked with think we could put three or four of these plants in Colorado with existing technology," he said. "Think of it almost as a replacement for a coal-fired power plant. It runs and runs and runs 24/7."

Meanwhile, legislators in West Virginia passed a law this year to establish a regulatory program for geothermal energy. Experts say the state has great potential for geothermal heating and cooling, but lawmakers see it as a promising power source as well.

"West Virginia is beginning to realize that we need to not have all our eggs in one basket (with fossil fuels) as we've traditionally had, but we want to develop a variety," said state Del. Bill Anderson, the Republican who co-sponsored the bill. "Hopefully we find that this is one more tool in our toolbox to create a better climate situation as well as a stable electrical grid."

Advantages and challenges

In addition to its constant power supply, geothermal energy requires less space than wind and solar projects, some of which have drawn backlash for converting land from agriculture and forest uses.

"Geothermal is all underground," said Woodward, the Colorado lawmaker. "Wind and solar take up a lot of space, impact birds and wildlife, and many times take over otherwise productive farmland."

Many supporters think that a growing geothermal industry could make

use of the drilling equipment and workforce that's serving the oil and gas industry today, while also putting decommissioned fossil fuel plants back to work and perhaps even tapping into abandoned oil wells.

Despite those potential advantages, experts say geothermal energy will need government help to reach its potential.

For starters, drilling and running a geothermal plant is more expensive than installing a wind turbine or solar panel. Backers of geothermal argue that states with clean energy mandates should require a certain percentage of that power to come from baseload sources, such as nuclear, hydropower and geothermal.

"California has built so much solar, if that solar is not available, it becomes very challenging for the grid," said Goodman, the geothermal industry executive. "Recognizing the value of that baseload power that is needed to supplement wind and solar is going to be important for the market."

Uncertainty also is a major deterrent. It can cost millions of dollars to drill a well, and not every site turns out to be suitable. The U.S. Department of Energy used to defray that risk by reimbursing companies for their costs when wells weren't successful, but that program shut down in the early 1980s, said Amanda Kolker, laboratory program manager for geothermal with the National Renewable Energy Laboratory.

"We still don't have any kind of risk mitigation in the U.S.," she said. "Geothermal does need some sort of government of public-private intervention."

Some supporters said states could supercharge geothermal development if they committed to covering the costs of drillers for wells that can't be turned into energy.

"When (companies) drill a number of wells that don't turn out, that adds to the overall cost of what geothermal might be," said Horne, the Stanford professor. "Having the government hold that risk was very successful in the '80s to foster expansion of geothermal."

Backers of geothermal also called on state lawmakers to make it easier to build transmission lines. In many cases, promising sources of geothermal power are located far from the power grids needed to bring them to the market.

Industry leaders credited state efforts, mostly through university systems, to map the sites where geothermal sources lie close to the surface.

Heating and cooling

Compared with using it to generate electricity, harnessing geothermal power to heat and cool buildings is relatively simple and can be done almost anywhere. Heat pumps can use warmth from underground to heat buildings in the winter and draw heat back underground during the summer.

"One of the top uses for electricity and natural gas is for running air conditioners and heating homes," said Woodward, the Colorado lawmaker. "(Geothermal heat pumps) should eliminate 80 to 90% of a home's demand for heating and cooling power."

Lawmakers in New York passed a law earlier this year that allows utilities to create networks to distribute geothermal heat, much like gas lines that operate today.

Earlier this year, Massachusetts legislators instructed state regulators to make it easier to replace gas heating systems with renewable sources, such as geothermal energy. And in New York, lawmakers approved a tax

credit to encourage homeowners to install geothermal heat pumps. The state also passed a law earlier this year that allows utilities to create networks to distribute geothermal heat, much like gas lines that operate today.

"It's seen as a way of getting to whole neighborhoods at a time," said Bill Nowak, a board member with the New York Geothermal Energy Organization. "More than one building can use the same borehole or system, and folks are really seeing that as a way to scale things up."