

Enhanced Geothermal Shot™: Unlocking the Power of Geothermal Energy

Overview

The U.S. Department of Energy's (DOE) Energy Earthshots™ Initiative aims to accelerate breakthroughs of more abundant, affordable, and reliable clean energy solutions.

Achieving the Energy Earthshots targets will help America break down the biggest remaining scientific and technical barriers to tackling the climate crisis and reach the Biden-Harris Administration's goal of net-zero carbon emissions by 2050 while creating good-paying union jobs and growing the economy.

The Opportunity

Geothermal energy—the “heat beneath our feet”—currently provides 3.7 gigawatts of electricity in the United States, enough to power more than 400,000 homes. Still, this is just a small portion of this resource's vast, nearly inexhaustible potential. A substantial amount of geothermal energy is not accessible with current technology, meaning that energy is stuck below ground. Research and innovation to advance enhanced geothermal systems (EGS) drilling and engineering can unlock those resources and put new, clean, dispatchable electricity on the grid. EGS uses humanmade reservoirs to help create the fluid flow necessary to bring hot geothermal water to the surface for electricity production.

There is enough technical EGS potential in the United States to meet the electricity needs of the entire world. Capturing even a small fraction of this resource via wide-scale commercial deployment could affordably power more than 40 million American homes and businesses. Investments in EGS will also exponentially increase opportunities for geothermal heating and cooling solutions nationwide.



Goal: The Enhanced Geothermal Shot is a departmental-wide effort to dramatically reduce the cost of EGS by 90%, to \$45 per megawatt-hour (MWh) by 2035.¹



90% Reduction



2035

¹ Derived from the National Renewable Energy Laboratory's Annual Technology Baseline [Atb.nrel.gov/electricity/2022/geothermal](https://atb.nrel.gov/electricity/2022/geothermal)

The Enhanced Geothermal Shot™ will work toward this goal by aggressively accelerating research and development to:



DRIVE DOWN COSTS
of drilling, cement, well casing, and other materials and equipment.



ADVANCE ENGINEERING TECHNIQUES to drill longer, wider wells faster and with more wells in each area.



COLLECT MORE AND BETTER-QUALITY DATA to better understand the subsurface and more accurately predict the best locations for geothermal drilling.



HELP ENSURE NEW RESERVOIRS and all geothermal fluids are contained to specific subsurface areas.

The geothermal industry has the potential to become a powerhouse of U.S. economic growth, with particular benefits for rural communities. Geothermal jobs, especially in construction—which currently makes up 57% of the geothermal workforce—cannot be outsourced. In addition, the geothermal and oil and gas industries share many similarities, presenting an opportunity to transition a skilled workforce as well as tools and best practices from fossil

fuels to clean energy. Expanding geothermal energy can also help communities historically impacted by fossil fuel production and use transition to clean energy.

Achieving the Enhanced Geothermal Shot will go a long way toward reaching President Biden's goals of 100% carbon-pollution-free electricity by 2035 and net-zero emissions across the U.S. economy by 2050.

How do enhanced geothermal systems work?

The presence of heat, permeability, and fluid underground creates natural geothermal systems. In traditional geothermal systems used for electricity generation today, small underground pathways conduct fluids through the subsurface, carrying energy in the form of heat to the earth's surface when conditions are just right. At the surface, that energy can be captured to drive turbines and generate electricity.

Sometimes conditions are not suitable for bringing that energy to the surface—specifically, when the rocks are hot but not very permeable and contain little water. Carefully injecting fluid into the hot rocks enhances the size and connectivity of fluid pathways by reopening fractures. This is what's known as an enhanced geothermal system (EGS). Once created, an EGS functions just as a traditional geothermal system does: The fluids travel up wells, carrying energy in the form of hot fluid to the surface, where it drives turbines to generate electricity.

Alignment of Resources

The Enhanced Geothermal Shot is a DOE research, development, and demonstration effort. DOE is partnering with the National Science Foundation to provide complementary research and workforce development programs to reach the goals of the Shot.

Stakeholder Engagement

DOE plans to engage with federal, state, and local officials, community groups, industry, and others on activities associated with the Enhanced Geothermal Shot. Visit the DOE [Geothermal Technologies Office website](#) for updates and opportunities to get involved.

