

## Clean Domestic Power

The U.S. Department of Energy's (DOE's) Geothermal Technologies Program (GTP) is committed to developing and deploying a portfolio of innovative technologies for clean, domestic power generation. GTP conducts research, promotes development, and builds partnerships to establish geothermal energy as a significant contributor to America's future electricity generation. Geothermal energy, a virtually untapped energy resource from the heat of the earth, is more important than ever before because it has a small environmental footprint, the ability to produce energy consistently around the clock, and emits little or no greenhouse gases. By developing, demonstrating, and deploying the advancement of innovative technologies, GTP's efforts are helping stimulate the growth of the geothermal industry within the renewable energy sector, and encouraging quick adoption of technologies by the private and public sectors.

### Funding Opportunity Announcements

GTP funds research, development, demonstrations, and analytical activities through Funding Opportunity Announcements (FOAs). Research projects are performed under cost-shared awards to private companies and academic institutions via competitive solicitations and through work with DOE national laboratories.



Desert Peak Geothermal energy plant near Fallon, NV, site of a GTP EGS demonstration project. *Photo credit missing from pdf sent us.*

## The Forefront of Innovation

Geothermal energy is at the forefront of innovation with exciting research, development, and demonstration projects underway across the United States.

### Enhanced Geothermal Systems

Naturally occurring geothermal systems, known as hydrothermal systems, are defined by three key elements: heat, fluid, and permeability at depth. Enhanced Geothermal Systems (EGS) are manmade reservoirs, created where there is hot rock but little to no natural permeability or fluid saturation. In an EGS, fluid is injected into the subsurface at low pressures, which causes pre-existing fractures to re-open. This increased permeability allows fluid to circulate throughout the rock and transport heat to the surface where electricity can be generated. While this technology is still under development, EGS technology has been successfully realized on a pilot scale in Europe.

### Enhanced Geothermal Systems Demonstration Projects

GTP is funding projects in Alaska, California, Idaho, Nevada, Oregon, and Utah in conjunction with industry, academia, and national laboratories to demonstrate the technical and economic feasibility of creating and sustaining Enhanced Geothermal Systems.

EGS offers the opportunity to access an enormous, domestic, clean energy resource estimated to be in the range of 100-500 GWe. A Massachusetts Institute of Technology (MIT) study released in 2007 predicted that in the United States alone, 100 GWe of cost-competitive capacity could be provided by EGS in the next 50 years.<sup>1</sup>

<sup>1</sup> Massachusetts Institute of Technology (MIT). 2006. *The Future of Geothermal Energy*. Cambridge, Massachusetts. [http://geothermal.inel.gov/publications/future\\_of\\_geothermal\\_energy.pdf](http://geothermal.inel.gov/publications/future_of_geothermal_energy.pdf)

To take advantage of this vast resource, GTP promotes and invests in industry, academia and the national laboratories to develop and demonstrate EGS throughout the United States.

Hydrothermal and Resource Confirmation

To accelerate the discovery and utilization of the U.S. Geological Survey’s estimated 30,000 MWe of undiscovered hydrothermal resources in the western United States, GTP is developing advanced geothermal exploration technologies. Improving our ability to accurately predict temperature and permeability at depth from the surface can substantially lower resource confirmation risks and reduce upfront geothermal development costs. Locating undiscovered geothermal resources will support the near-term expansion of renewable energy because once found, hydrothermal resources can be brought online quickly using current



Geothermal energy plant at The Geysers near Santa Rosa in Northern California, the world’s largest electricity-generating geothermal development. Photo from Calpine Corporation, NREL/PIX 17270

Table Subhead

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1	Table body. Dual fuel (flexible or bi-fuel) vehicles, regardless of vehicle size class as long as the vehicle meets the AFV definition of EAct 1992
2	Dedicated light duty AFVs
1	Every 450 gallons of pure biodiesel (equivalent to 2,250 gallons of B20) used in diesel vehicles; cannot exceed 50 percent of EAct requirements Fuel cell vehicle
1	Other vehicles achieving significant reduction in petroleum consumption

technologies. Advanced exploration technologies include remote sensing and new geophysical surveys. GTP also invests in reducing operating costs through demonstrations of innovative power conversion technologies and systems. These new geothermal demonstration projects will validate the performance of new technologies and establish financial and technical baselines.

Co-Production

In the United States, an average of 10 barrels of water is produced with every barrel of oil. Currently treated as a waste product, the majority of co-produced water and steam are warm enough to generate electricity. This could provide additional value streams to extend the life of mature oil and gas fields, while adding a significant, clean source of electricity to America’s energy portfolio.

The National Geothermal Data System

The National Geothermal Data System seeks to reduce up-front risks to geothermal developers by providing a distributed system linking geothermal data sets across the country. Assessing and categorizing the nation’s geothermal resources and linking all data in a publicly accessible data system will stimulate the growth of the geothermal industry.

Education and Collaboration

GTP is establishing education and workforce development projects to meet the needs of a growing geothermal industry through research, university curriculum development, and co-sponsored internship programs. As a founding member of the International Partnership for Geothermal Technology, DOE plans to increase technology transfer and expand international market penetration.