

The Geothermal Technologies Office (GTO) accelerates deployment of clean, domestic geothermal energy by supporting innovative technologies that reduce the cost and risks of development. This abundant resource generates energy around the clock and has the potential to supply more than 100 GWe of electricity – a full 10% of the United States’ energy demand. By optimizing the value stream for electricity production and cascaded uses, the Office aims to make geothermal energy a fully cost-competitive, widely available, and geographically diverse component of the national energy mix.

## What We Do

GTO funds activities across a full scale of technology readiness to drive the growth of cost-competitive energy applications.

- ✓ Invest in **Research and Development** for innovative technologies and methods that improve the process of identifying, accessing, and developing geothermal resources.
- ✓ Facilitate **Demonstrations** that support field site validation to overcome technical obstacles and mitigate risk.

Address **Market Barriers** by solving non-technical challenges, such as environmental permitting, demand for subsurface data, and analysis of our investments.

## Program Goals/Metrics

- Demonstrate the capability to develop and sustain a 5 MW Enhanced Geothermal Systems reservoir by 2020.
- Lower the levelized cost of electricity from newly developed geothermal systems to \$0.06/kWh by 2030.

## FY 2016 Priorities

- GTO’s flagship initiative, the revolutionary **Frontier Observatory for Research in Geothermal Energy (FORGE)**, announced selections for candidate sites and collaborative operations teams in FY 2015. The \$35-million initiative constitutes a first-of-its-kind dedicated field laboratory designed to establish a

commercial pathway to large-scale, economically sustainable enhanced geothermal systems (EGS).

- The **Hydrothermal** program initiated Play Fairway Analysis awards in 2014. This technique, adapted from the oil and gas sector, maps exploration risks and probabilities from existing data. The effort is aimed at assessing exploration risk to identify new resources on a regional scale. In FY 2016, these awards will undergo a downselect process for validation drilling at the most prospective areas for new geothermal exploration and development.
- A **Subsurface Engineering Crosscut** activity is advancing a better understanding of how energy technologies interact in the subsurface. The initiative crosscuts program offices across DOE to engage with national laboratories, industry, and other stakeholders.
- The **Low Temperature and Coproduced Resources** program introduces a new geothermal funding priority in *Deep Direct Use*, an emerging technology to maximize geothermal system efficiencies and value streams. *Deep Direct Use* integrates electricity conversion with a full range of cascading industrial and commercial applications for large-scale production. In addition, the program awarded Mineral Recovery projects in FY 2014 to find a replicable model for extracting lithium and other critical materials from the subsurface.

(Dollars in Thousands)	FY 2014 Enacted	FY 2015 Enacted	FY 2016 Enacted
Enhanced Geothermal Systems (EGS)	27,100	32,100	45,000
Hydrothermal	10,300	12,500	13,800
Low Temperature and Coproduced	4,700	6,000	8,000
Systems Analysis	3,700	3,900	3,000
NREL Sitewide	0	500	500
<b>Total, Geothermal Technologies</b>	<b>45,800</b>	<b>55,000</b>	<b>71,000</b>

## Key Accomplishments

- In FY 2015, the Energy Department’s Geothermal Data Repository (GDR) received its 500th submission since its launch in March 2012. The GTO deployed the GDR to store all of the data collected from office-funded projects, but also to help accelerate the research and development of geothermal energy resources by providing researchers, academia, and industry with access to this project information.
- In FY 2015, the GTO wrapped Phase I of its Play Fairway Analysis (PFA) effort, with promising results. The concept of the PFA has been used to identify potential locations of blind hydrothermal systems, areas warranting future exploration and to describe geothermal opportunities in rift-zone settings. This tool incorporates the regional or basin-wide distribution of known geologic factors besides heat flow that control the occurrence of a particular example of a geothermal system. Conducting PFA in unexplored or underexplored basins or regions or using new play concepts in basins with known geothermal potential is central to this effort.
- In FY 2015, the AltaRock Newberry EGS demonstration project completed, achieving numerous technical firsts. The AltaRock team demonstrated the first multi-zone EGS stimulation utilizing a novel chemical diversion technology, increasing the volume of rock that is available for fluid circulation and ultimately heat extraction. The team confirmed the creation of a new EGS reservoir in the low permeability rock surrounding the injection well. Additionally, AltaRock developed and employed a first-of-its-kind pumping system using custom-made Baker Hughes pumps to allow a wide range of injection rates and pressures during stimulation. Finally, in order to monitor the evolution of their reservoir and monitor for seismic impacts, AltaRock deployed the most sensitive telemetered seismic array of any project in the GTO portfolio.
- In FY 2015, the GTO launched a massive effort to produce an analytical report outlining a vision for the future of the geothermal industry in the coming decades. The GeoVision report will highlight the potential economic, environmental, and social benefits of geothermal energy.
- In FY 2015, a first-in-the-world hybrid geothermal-solar facility in Fallon, Nevada successfully combined 33 MW geothermal and 26 MW photo voltaic with an additional 2 MW Concentrated Solar Power at the Stillwater Hybrid Geothermal-Solar site. With Idaho National Lab and the National Renewable Energy Laboratory, GTO entered into agreement with Enel Green Power to explore potential and quantify the benefits of integrating geothermal energy with solar as a replicable strategy.



Images: top, DOE EGS demonstration at Newberry Volcano, Oregon. Source: *Elisabet Metcalfe*; lower, Enel Stillwater hybrid geothermal-solar facility in Fallon, Nevada. Source: *Enel Green Power North America*