



## Notice of Funding Opportunity

**Title:** Office of Energy Efficiency and Renewable Energy (EERE), Geothermal Technologies Office (GTO) – Innovative Methods to Control Hydraulic Properties of Enhanced Geothermal Systems

**Website:** <https://www.grants.gov/web/grants/view-opportunity.html?oppld=333196>

**Funding:** Total: \$12,000,000. Maximum awards: \$500K-\$6M, depending on project.

**Dates:** Application Submission Deadline: June 15, 2021

**Summary:** The focus of this FOA is the development and deployment of disruptive technologies and techniques that will affect fluid flow within enhanced geothermal systems (EGS) fracture networks, or reservoirs, which are the “engine” that drive geothermal heat production. EGS requires the ability to control the flow of fluids through and throughout the created reservoir. Standard approaches for altering flow through a reservoir are borehole centric where flow control into or out of a well is centrally managed from the wellbore. This FOA is specifically focused on the development of novel technologies and techniques that can be used to control flow regimes outside of the wellbore, within the reservoir, and to mitigate undesirable flow and heat transfer rates that degrade the performance of EGS reservoirs. Successful projects will develop targeted and controllable in-reservoir fracture permeability modification systems / methods that yield long-term reservoir productivity improvements with the ability to reverse imparted effects. The research and development (R&D) activities to be funded under this FOA will support the government-wide approach to the climate crisis by driving the innovation that can lead to the deployment of clean energy technologies, which are critical for climate protection. Specifically, this FOA focuses on critical aspects of reservoir management needed for wide-spread commercialization of EGS technologies which directly supports the Biden Administration’s goals for a clean energy future.

### Project Topic Areas:

#### Topic Area 1: Innovative Methods to Control Hydraulic Properties of Enhanced Geothermal Systems

The goal of this FOA is to develop and demonstrate technologies that can alter fluid flow through targeted areas within an EGS reservoir. The technology developments targeted in this FOA are intended ultimately to bring EGS technology closer to market. Strategic goals identified in the GeoVision Roadmap, outline a compilation of technical, economic, and institutional actions that the entire geothermal community including DOE, Industry, and Academia must address in order for geothermal technologies to play a larger role in the Nation’s energy supply. GeoVision Roadmap entails Key Action 1.4: Improve geothermal energy resource recovery, and Key Action 1.5: Improve geothermal resource and asset monitoring, modeling, and management.

Released in 2019, Frontier Observatory for Research in Geothermal Energy: A Roadmap (the FORGE Roadmap) outlines the key technical challenges necessary for EGS to become a reliable and reproducible energy supplier nationwide. The critical research areas and core R&D actions from the FORGE roadmap relevant to this FOA are outlined in the following: Reservoir Management - Research that supports efforts to sustain the long-term heat exchange in the system; Engineer solutions to compromised networks or other unwanted changes in reservoir permeability that can disrupt operation. Technology-focused EGS Subprogram / FOA Goals include the following: Develop and demonstrate technologies that can affect the flow through fracture networks within the reservoir and away from the wellbore, for an indeterminate amount of time, to increase the performance of EGS reservoirs; Demonstrate at least 2 innovative methods for affecting fracture flow within the reservoir; Demonstrated ability to eliminate short circuits, quickly and efficiently conduct successful re-stimulations, and to verify these achievements through measurement of variables such as flow rate, temperature, geochemistry, seismicity, tracer return curves, or pressure drop through the fracture system. These metrics track specific success indicators along the EGS technology development spectrum that are relevant to the higher-level goals.

### Funding:

EERE expects to make a total of approximately \$12,000,000 of federal funding available for new awards under this FOA, subject to the availability of appropriated funds. EERE anticipates making approximately 2 to 10 awards under this FOA. EERE may issue one, multiple, or no awards. Individual awards may vary between \$500,000 and \$6,000,000. The cost share must be at least 20% of the total allowable costs for research and development projects and must come from non-federal sources unless otherwise allowed by law.

Topic Area Number	Anticipated Number of Awards	Anticipated Minimum Award Size for Any One Individual Award (Fed Share)	Anticipated Maximum Award Size for Any One Individual Award (Fed Share)	Approximate Total Federal Funding Available for All Awards	Anticipated Period of Performance (months)
Topic Area 1	2-10	\$500,000	\$6,000,000	\$12,000,000	24-36



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### **Project Requirements:**

This FOA requires dramatic innovation; GTO seeks leading-edge concepts that are advanced sufficiently to be tested. Small-scale field testing should occur during the life of the proposed project, if TRL level permits. If the technology is not ready for small-scale field testing, applicants will be required to perform scaled lab testing approaches that will demonstrate functionality in a lab environment akin to a field setting. Solutions that do not require removing a well from operation are preferred.

There are no preconceived notions of what these solutions could or should be; examples of the types of interventions of interest include, but are not limited to: Fluids or fluid additives that can increase bulk fluid viscosity if specific fluid flow velocities are reached, reducing mass transport through a targeted fracture network; Fluids or fluid additives that can solidify in close proximity to other fluids to control fracture interference and potential “fast paths”; Solutions that preferentially precipitate in zones, away from the wellbore of higher fluid velocity to lower hydraulic conductivity within the formation – beyond traditional diverter materials; Fluids or fluid additives that can control formation leak-off into the matrix rock; Chemical or other treatments that allow selective hydraulic conductivity improvements; and Interventions that do not rely on the injection of fluids or additives but can induce fracture aperture changes in the reservoir, away from the injection and production wells.

DOE expects the following metrics to be met: Capable of consistent/indefinite operation at formation temperatures up to 275 deg C and demonstrated ability to reverse interventions when required by operating conditions; Capability to alter fracture conductivity in-formation, at least 100 m away from the wellbore in which the intervention is implemented; Ability to test/illustrate/measure successful flow alteration through at least one reservoir-scale fracture by at least a factor of 10 and facilitates improved system efficiency and/or reverses adverse thermal degradation/loss of output.

### **Eligible Applicants:**

U.S. citizens and lawful permanent residents; State, local, and tribal government entities; DOE/NNSA FFRDCs; Foreign entities, whether for-profit or otherwise; Incorporated consortia, which may include domestic and/or foreign entities; For-profit entities, educational institutions, and nonprofits are eligible to apply for funding as a prime recipient or subrecipient. Nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995 are not eligible to apply for funding. Each incorporated consortium must have an internal governance structure and a written set of internal rules. Upon request, the consortium must provide a written description of its internal governance structure and its internal rules to the EERE Contracting Officer. Unincorporated Consortia, which may include domestic and foreign entities, must designate one member of the consortium to serve as the prime recipient/consortium representative.

All prime recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a state or territory of the United States and have a physical location for business operations in the United States. If a foreign entity applies for funding as a prime recipient, it must designate in the Full Application a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a state or territory of the United States to be the prime recipient. The Full Application must state the nature of the corporate relationship between the foreign entity and domestic subsidiary or affiliate. Federal agencies and instrumentalities (other than DOE) are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient. A foreign entity may receive funding as a subrecipient.