Financial Assistance
Notice of Funding Opportunity
Part 1

U.S. DEPARTMENT *of* ENERGY

Department of Energy (DOE)
Office of Geothermal
Next-Generation Geothermal Field Tests and Geothermal Resource Characterization and Confirmation
Notice of Funding Opportunity Number: DE-FOA-0003472

First Round Letters of Intent Due: March 27, 2026
First Round Applications Due: April 30, 2026

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Before You Begin

Navigating the Notice of Funding Opportunity

To reduce the burden on applicants in the Notice of Funding Opportunity (NOFO) process and limit the length of the NOFO information requests, DOE has separated the NOFO into two parts.

The NOFO Part 1 describes the specific DOE programmatic goals and evaluation criteria, eligibility, and other components that are specific to each funding opportunity. The NOFO Part 2 includes the fixed DOE requirements that generally do not change from NOFO to NOFO, including standard information for the application phase, expectations for award negotiations, and post-award requirements. Applicants must review both the NOFO Part 1 and the NOFO Part 2 prior to applying. To facilitate navigation, you will find links throughout this document to additional information found in Part 2.

Applicants must take several required one-time actions before applying to this NOFO. Some of these actions may take several weeks, so it is vital applicants build in enough time to complete them. Failure to complete these actions could interfere with application or negotiation deadlines or the ability to receive an award if selected. If you have previously completed the necessary registrations, make sure your registration is active and up to date. All registrations are free. Please refer to NOFO Part 2, *Get Registered*, for additional information.

This announcement is published with NOFO Part 2 version 2.

I. Basic Information

A. Key Facts

Issuing Agency	Department of Energy, Office of Geothermal
Funding Opportunity Title	Next-Generation Geothermal Field Tests and Geothermal Resource Characterization and Confirmation
Announcement Type	Initial
Funding Opportunity Number	DE-FOA-0003472
Funding Instrument	Cooperative Agreement
Assistance Listing Number	81.087
Funding Opportunity Description	The field test activities to be funded through this Notice of Funding Opportunity (NOFO) seek to advance DOE's goals and commitment to pushing the frontiers of science and engineering, advancing energy addition, and unleashing American energy innovation. This NOFO may remain open for up to 72 months, with review cycles possibly occurring approximately every year, while funding lasts. The details of this NOFO (including descriptions of closed Topic Areas) are subject to change in future review cycles.
Program Goals & Objective(s)	This NOFO targets field-scale tests at depths and temperatures appropriate for full-scale project development. These tests are intended to support research and development (R&D), testing, and evaluation of next-generation development technologies and approaches, and the applicability of those approaches in select real-world conditions. Additionally, this NOFO targets exploration drilling activities required to gather data to support the characterization and potential confirmation of promising next generation and hydrothermal prospects for electrical power production. These projects will directly support the DOE's emphasis on learning-by-doing and helping to identify and focus R&D priorities. In the end, the knowledge gained from these tests will support future private sector funding decisions regarding the development approach and the location for development.

KEY DATES

Notice of Funding Opportunity Issue Date:
February 25, 2026

Letter of Intent Deadline:
March 27, 2026

Informational Webinar:
TBD

Application Deadline:
April 30, 2026

Anticipated Selection Notification Date:
July 30, 2026

Anticipated Award Date:
September 30, 2026

Estimated Period of Performance:
October 1, 2026 – September 30, 2031

	Strategic goals for this NOFO are derived from the *GeoVision* Roadmap[1] and the Office of Geothermal's (OG) Multi-Year Program Plan.[2]
Topic Areas	• Topic Area 1: EGS Field Tests • Topic Area 2: Closed Loop Field Tests—Drilling Required (CLOSED: Topic Area 2 is CLOSED) • Topic Area 3: Closed Loop Field Tests—No Drilling Required (CLOSED: Topic Area 3 is CLOSED) • Topic Area 4: Super-Hot/Supercritical EGS Field Tests (CLOSED: Topic Area 4 is CLOSED) • Topic Area 5: Direct Use/Thermal Field Tests (CLOSED: Topic Area 5 is CLOSED) • Topic Area 6: Drilling for Next-Generation and Hydrothermal Resource Exploration, Characterization, and Confirmation
Eligible Applicants	• Domestic Entities (Institutions of higher education; for-profit entities; nonprofit entities; state and local government entities; and Indian Tribes, as defined in section 4 of the Indian Self-Determination and Education Assistance Act, 25 U.S.C. § 5304. • DOE/NNSA federally funded research and development centers (FFRDCs) are eligible to apply for funding as a prime and/or subrecipient. • Non-DOE/NNSA FFRDCs are eligible to participate as a subrecipient but are not eligible to apply as a recipient. • Federal agencies and instrumentalities (other than DOE) are eligible to participate as a subrecipient but are not eligible to apply as a recipient. • A foreign entity may submit an application to this NOFO, but the application must be accompanied by an explicit written waiver request. Likewise, if the applicant seeks to include a foreign entity as a subrecipient, the applicant must submit a separate explicit written waiver request in the application for each proposed foreign subrecipient.
eXCHANGE URL and Helpdesk	https://eere-eXCHANGE.energy.gov EERE-ExchangeSupport@hq.doe.gov—include NOFO name and number in the subject line.

[1] U.S. Department of Energy. 2019. "*GeoVision*: Harnessing the Heat Beneath Our Feet." DOE/EE-1306. U.S. Department of Energy. https://doi.org/10.2172/1879171.
[2] U.S. Department of Energy. 2022. "Geothermal Technologies Office Multi-Year Program Plan."

1. Funding Details

Multiple Topic Areas

Approximate total available funding including all Topic Areas: $171,500,000 across FY2023, FY2024, FY2025

*Subject to availability of appropriations

Topic Area 1: EGS Field Tests

- Approximate total available funding: Up to $100,000,000 across FY2023, FY2024, FY2025
- Approximate number of awards: 4–10
- Approximate dollar amount of individual awards: $10,000,000–$25,000,000
- Minimum cost share required: 20%
- Approximate award project period: 36–60 months
- Anticipated length of budget periods: 12–24 months

Topic Area 2: Closed Loop Field Tests—Drilling Required (CLOSED FOR THIS ROUND. NO APPLICATIONS WILL BE CONSIDERED)

Topic Area 3: Closed Loop Field Tests—No Drilling Required (CLOSED FOR THIS ROUND. NO APPLICATIONS WILL BE CONSIDERED)

Topic Area 4: Super-Hot/Supercritical EGS Field Tests (CLOSED FOR THIS ROUND. NO APPLICATIONS WILL BE CONSIDERED)

Topic Area 5: Direct Use/Thermal Field Tests (CLOSED FOR THIS ROUND. NO APPLICATIONS WILL BE CONSIDERED)

Topic Area 6: Drilling for Next-Generation and Hydrothermal Resource Exploration, Characterization, and Confirmation

- Approximate total available funding: $71,500,000 in FY2025
- Approximate number of awards: 8–18
- Approximate dollar amount of individual awards: $4,000,000–$8,000,000
- Minimum cost share required: 20%
- Approximate award project period: 12–48 months
- Anticipated length of budget periods: 12–24 months

2. Period of Performance

DOE anticipates making awards comprised of one or more budget periods. If applicable, project continuation will be contingent on DOE's Go/No-Go decision. For a complete list and more information on the Go/No-Go review, see the NOFO Part 2, *Award Administration Information*. Funding for all budget periods, including the initial budget period, is not guaranteed.

B. Executive Summary

The projects selected under this Notice of Funding Opportunity (NOFO) target field-scale tests at depths and temperatures appropriate for full-scale project development. These tests are intended to support R&D, testing, and evaluation of next-generation development technologies and approaches and the applicability of those approaches in select real-world in situ conditions. Additionally, this NOFO targets exploration drilling activities required to gather data to support the characterization and potential confirmation of promising next-generation and hydrothermal prospects for electrical power production. These projects will directly support the DOE's emphasis on learning-by-doing and helping to identify and focus R&D priorities. In the end, the knowledge gained from these tests will support future funding decisions regarding the development approach and the location for development.

Strategic goals for this NOFO are derived from the *GeoVision* Roadmap and OG's Multi-Year Program Plan.

C. Agency Contact Information

Office of Geothermal
U.S. Department of Energy
1000 Independence Ave SW
Washington, D.C. 20585

For questions relating to this specific NOFO, please send emails to NextGen_GeoDrilling@ee.doe.gov.

DISCLAIMER: Applicants are discouraged from submitting information considered proprietary unless it is deemed essential for proper evaluation of the application. If the application contains information that the applicant organization considers to be trade secrets, information that is commercial or financial, or information that is privileged or confidential, the pages containing that information must be identified as specified in the application instructions. When such information is included in the application, it will be withheld from public disclosure to the extent permitted by law, including the Freedom of Information Act, with the understanding that the information will be used or disclosed only for evaluation of the application. The information contained in the application will be protected by DOE from unauthorized disclosure, consistent with the need for merit review of applications of financial assistance awards to assure the integrity of the competitive process and the accuracy and completeness of the information. If a federal financial assistance award is made as a result of or in connection with an application, the federal government has the right to use or disclose the information to the extent authorized by law. This restriction does not limit the federal government's right to use the information if it is obtained without restriction from another source.

II. Eligibility

To be considered for substantive evaluation, an applicant's submission must meet the criteria set forth below. If the application does not meet these eligibility requirements, it will be considered ineligible for any award and removed from further evaluation. DOE will not make eligibility determinations for potential applicants prior to the date on which applications to this NOFO must be submitted. The decision whether to apply in response to this NOFO lies solely with the applicant. The information

included here is specific to eligibility requirements for this NOFO. For eligibility requirements applicable to all NOFOs, please consult the NOFO Part 2, *Eligibility*.

A. Eligible Applicants

To be considered for substantive evaluation, an applicant's submission must meet the criteria set forth below. If the application does not meet these eligibility requirements, it will be considered ineligible and removed from further evaluation.

1. Domestic Entities

Domestic entities are eligible to apply as recipients or subrecipients. The following types of domestic entities are eligible to participate as a recipient or subrecipient of this NOFO:

- Institutions of higher education;
- DOE FFRDCs;
- For-profit organization;
- Nonprofit organization;
- State and local governmental entities; and
- Indian Tribes, as defined in section 4 of the Indian Self-Determination and Education Assistance Act, 25 U.S.C. § 5304[3]

Participant Limitations

Participation of the following entities are limited as follows:

- Non-DOE FFRDCs are eligible to participate as a subrecipient but are not eligible to apply as a recipient.
- Federal agencies and instrumentalities (other than DOE) are eligible to participate as a subrecipient but are typically not eligible to apply as a recipient.

To qualify as a domestic entity, the entity must be organized, chartered, or incorporated (or otherwise formed) under the laws of a particular state or territory of the United States or under the laws of the United States; have majority domestic ownership and control; and have a physical place of business in the United States.

2. Foreign Entity Participation

In general, foreign entities are not eligible to apply as either a recipient or subrecipient. In limited circumstances, DOE may approve a waiver to allow a foreign entity to participate as a recipient or subrecipient.

A foreign entity may apply to this NOFO, but the application must be accompanied by an explicit written waiver request. Likewise, if the applicant seeks to include a foreign entity as a subrecipient, the applicant must submit a separate explicit written waiver request in the application for each proposed foreign subrecipient. Please see NOFO Part 2, *Application Content Requirements,* for the requirements

[3] "**Indian Tribe**," for the purposes of this NOFO and as defined in in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. § 5304), means any Indian tribe, band, nation, or other organized group or community, including any Alaska Native village or regional or village corporation as defined in or established according to the Alaska Native Claims Settlement Act (85 Stat. 688) [43 U.S.C. § 1601, et seq.], which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians.

for submission of a foreign entity waiver request. The applicant does not have the right to appeal DOE's decision concerning a waiver request.

Foreign Entity Participation
A foreign entity is eligible to apply for funding as a recipient if it designates in the application a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a state or territory of the United States to be the recipient. The application must state the nature of the corporate relationship between the foreign entity and domestic subsidiary or affiliate.

Foreign entities may request a waiver of the requirement to designate a subsidiary in the United States as the recipient in the application (i.e., a foreign entity may request that it be the recipient). To do so, the applicant must submit an explicit written waiver request in the application.

NOFO Part 2, *Application Content Requirements*, lists the information that must be included in a request to waive this requirement. The applicant does not have the right to appeal DOE's decision concerning a waiver request.

Performance of Work in the United States
All work for the awards under this NOFO must be performed in the United States. To request a waiver of this requirement, the applicant must submit an explicit waiver request in the application. Absent an approved waiver, such costs will not be allowable under the award. NOFO Part 2, *Application Content Requirements*, lists the requirements for submission of a foreign work waiver request.

Ineligible Participants
The following entities are ineligible for participation in this NOFO as a recipient, subrecipient, or subcontractor.

- In accordance with 2 CFR 200.214, entities banned from doing business with the U.S. government such as entities debarred, suspended, or otherwise excluded from or ineligible for participating in federal programs.
- Entities identified on Department of the Treasury Office of Foreign Assets Control's Specially Designated Nationals list are prohibited from doing business with the U.S. government and are not eligible. See OFAC Sanctions List Service (treas.gov).
- 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.

Entity of Concern Prohibition
Entities of Concern are prohibited from participating in projects selected under this NOFO (see NOFO Part 2, *Eligibility, Other Eligibility Information, Entity of Concern Prohibition*, section for details and definitions).

B. Limitation on Number of Applications Eligible for Review

An entity may submit more than one application to this NOFO, provided that each application describes a unique, scientifically distinct project.

C. Cost Sharing

Applicants are expected to follow through on estimated cost share commitments proposed in their applications if selected for award negotiations. Please refer to the NOFO Part 2, *Eligibility*, for more information on Cost Sharing.

1. Cost Share Requirements

The cost share must be at least 20% of the total project costs[4] for research and development and demonstration projects.[5]

Applications that do not meet the minimum required cost share will be deemed ineligible during the initial compliance review and will not be further reviewed. The cost share must come from non-federal sources unless otherwise allowed by law.

The cost share percentage is calculated by dividing the cost share by the total allowable project costs for the award where the total allowable project costs include government share (including FFRDC costs if applicable) and cost share. To help applicants calculate proper cost share amounts, DOE has included a cost share information sheet and sample cost share calculation in the NOFO Part 2, *Eligibility—Cost Sharing, Cost Share Calculation Examples*.

2. Unallowable Cost Share Sources, NOFO Specific

The unallowable cost share sources identified here are specific to this announcement. Refer to NOFO Part 2, Eligibility—*Cost Sharing, Unallowable Cost Share Sources*, for unallowable cost share sources applicable to all NOFOs.

D. FFRDC Eligibility Criteria

1. DOE FFRDCs as the Applicant

A DOE FFRDC is eligible to apply for funding under this NOFO. If a DOE FFRDC is selected for award negotiation, the proposed work will be authorized under the DOE work authorization process and performed under the laboratory's Management and Operating (M&O) contract.

2. DOE and Non-DOE FFRDCs as a Subrecipient

As long as they have no conflict, DOE and non-DOE FFRDCs may be proposed as subrecipients on another entity's application subject to the following guidelines.

Authorization for non-DOE FFRDCs

The federal agency sponsoring the FFRDC must authorize in writing the use of the FFRDC on the proposed project, and this authorization must be submitted with the application. The use of a FFRDC must be consistent with its authority under its award.

[4] Total project costs are the sum of the government share, including FFRDC costs if applicable, and the recipient share of project costs.
[5] Energy Policy Act of 2005, Pub. L. 109-58, sec. 988. Also see 2 CFR 200.306 and 2 CFR 910.130 for additional cost sharing requirements.

Funding, Cost Share, and Subaward with FFRDCs

The value of and funding for the FFRDC portion of the work will not normally be included in the award. DOE FFRDCs participating as a subrecipient on a project will be funded directly through the DOE Work Authorization process in accordance with DOE O 412.1A. Non-DOE FFRDCs participating as a subrecipient will be funded through an interagency agreement with the sponsoring agency.

Although the FFRDC portion of the work is excluded from the award, the applicant's cost share requirement will be based on the total cost of the project, including the applicant's, the subrecipient's, and the FFRDC's portions of the project.

All DOE FFRDCs are required to enter into a Cooperative Research and Development Agreement[6] (CRADA) or, if the role of the DOE FFRDC is limited to technical assistance and intellectual property is not anticipated to be generated from the DOE FFRDC's work, a Technical Assistance Agreement (TAA), with at least the recipient. A fully executed CRADA or TAA must be in place or be compliant with a Master Scope of Work process prior to the FFRDC starting work directly allocable to the Financial Assistance award.

A CRADA is used to ensure accountability for project work and provide the appropriate management of IP, e.g., data protection and background IP. A Data Management Plan is not suited for this purpose.

Limit on FFRDC Effort

The scope of work to be performed by the FFRDC should not be more significant than the scope of work to be performed by the applicant.

III. Program Description

A. Program Purpose

The field test activities to be funded through this Notice of Funding Opportunity (NOFO) seek to advance DOE's goals and commitment to pushing the frontiers of science and engineering, advancing energy addition, and unleashing American energy innovation.

Geothermal resources can be found nationwide and represent vast domestic energy potential; however, only a fraction of this potential has been realized due to technical and non-technical barriers that constrain industry growth.

The U.S. Department of Energy's (DOE) Office of Geothermal (OG) 2019 *GeoVision* and subsequent analyses demonstrate that, with aggressive technology improvements, geothermal power generation could provide 300 gigawatts-electric (GWe) or more of firm, flexible power to the U.S. grid by 2050.

The Topics in this NOFO cover several next-generation approaches to geothermal development as well as a single Topic directed at drilling related to exploration, characterization, and confirmation activities

[6] A cooperative research and development agreement is a contractual agreement between a national laboratory contractor and a private company or university to work together on research and development. For more information, see https://www.energy.gov/gc/downloads/doe-cooperative-research-and-development-agreements.

that will gather data to support both next-generation and conventional hydrothermal resource development for potential electrical power generation. For the purposes of this NOFO, the term "next-generation geothermal" is used to refer to both enhanced geothermal systems and closed-loop geothermal technology spaces.

Through the advancements at DOE's Utah Frontier Observatory for Research in Geothermal Energy (FORGE) and recent commercial development, enhanced geothermal systems (EGS) are the most mature of the next-generation geothermal technologies and currently offer the greatest potential for power generation per drilled foot. During EGS development, subsurface permeability is enhanced via safe, well-engineered reservoir stimulation processes that re-open pre-existing fractures and/or create new ones. These open conduits increase permeability and allow fluid to circulate throughout the hot rock. The fluid transports the otherwise stranded heat to the surface where reliable, secure renewable electricity can be generated with current power generation technologies.

In addition to EGS, closed-loop development approaches have garnered the attention of the broader community and provide additional potential for expanding geothermal deployment. Closed-loop concepts for geothermal development include a wide range of approaches where the heat transfer fluid is contained within the wellbore and heat transfer occurs between the borehole wall and the circulating fluid. Although the approach is constrained by limited contact with the hot subsurface rock (and limited heat transfer), it does offer some desirable attributes that can complement EGS development.

Geothermal energy is used across a broad range of temperatures and applications that include both electricity production and direct use of thermal energy. Similar to the potential for electricity production, the non-electric direct use sector has enormous potential for growth that can range from basic heating and cooling to process heat for industrial applications. At the high end of electricity production are superhot systems (>375°C), which have potential to dramatically increase the power density on a per well basis, but this harsh and high temperature subsurface environment presents significant challenges in the construction and completion of wells and EGS reservoir development.

Broadly, developing subsurface resources begins in the exploration phase. This phase typically starts with surface-based observations using a variety of geological, geophysical, and geochemical approaches. The synthesis of these data provides targets for more expensive exploration activities. In the case of geothermal, more expensive exploration activities mean drilling resource characterization/confirmation wells, which require significant investment on the part of the developer— a factor that is true for next-generation as well as conventional hydrothermal development approaches.

The Topic Areas addressed under this NOFO

Topic Area 1: EGS Field Tests
Field tests at sites with potential for eventual electric power generation using EGS approaches.

Topic Area 2: Closed-Loop Field Tests, Drilling Required **(CLOSED FOR THIS ROUND)**
Field tests at sites with potential for eventual electric power generation using closed-loop approaches where new well drilling or additional drilling in an existing well will be required.

Topic Area 3: Closed-Loop Field Tests, No Drilling Required **(CLOSED FOR THIS ROUND)**
Field tests at sites with potential for eventual electric power generation using closed-loop approaches where existing wells are used with no additional drilling (workover operations are allowed).

Topic Area 4: Super-Hot/Supercritical Field Tests (CLOSED FOR THIS ROUND)
Field tests using next-generation approaches (EGS or closed-loop) at locations where superhot/supercritical temperatures (>375°C) are expected.

Topic Area 5: Direct Use/Thermal Field Tests (CLOSED FOR THIS ROUND)
Field tests at sites using next-generation approaches (EGS or closed-loop) where the eventual application would be for direct use of the thermal energy and not electric power generation.

Topic Area 6: Drilling for Next-Generation and Hydrothermal Resource Exploration, Characterization, and Confirmation
Drilling of reservoir depth resource exploration, characterization, and confirmation well(s) to gather data, information, and tests for next-generation or hydrothermal development, where sufficient site-specific data are available to suggest the potential for geothermal energy production. Preference will be given for previously unexamined geologic formations or locations.

B. Program Goals and Objectives

The field tests enabled via this NOFO will help fill an important gap in global technology markets and innovation systems. Overcoming the frequently cited "valley of death," where promising early-stage technology concepts fail (Figure 1), remains a challenge because of the high-risk nature of initial scale-up in conjunction with uncertain markets. This difficulty leads to underinvestment[7] because the financing required for commercial deployment is not available from low-cost institutional capital sources without first de-risking technology at scale.[8]

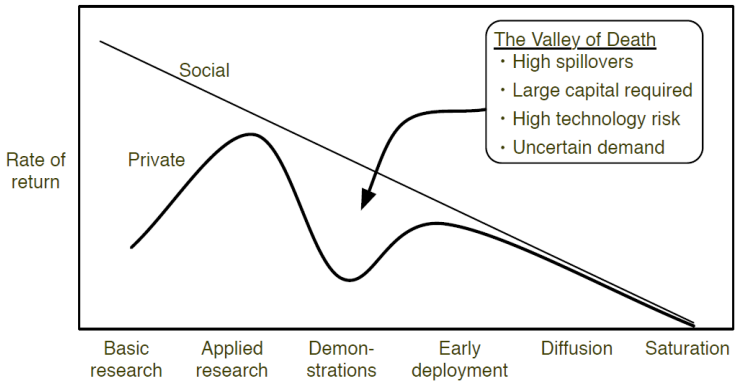

Figure 1: Innovation Stages and the Valley of Death (Nemet, Kraus, and Zipperer, 2016)

Adding further complication, advancing new geothermal technologies requires field tests with a variety of technologies working in conjunction, many of which are not considered commercial[9,10,11,12] and require significant funding for scale-up. In addition, these technologies are dependent on external factors including supply chains, engineering standards, successful local and federal permitting,

[7] Nemet, Kraus, and Zipperer. "The Valley of Death, the Technology Pork Barrel, and Public Support for Large Demonstration Projects." German Institute for Economic Research. 2016.
[8] Alexander, Brenton. "The New Infrastructure Bill Looks To Solve A Clean Energy 'Valley Of Death.'" Forbes. 2021.
[9] Gordon Kingsley, Barrt Bozeman, and Karen Coker. "Technology transfer and absorption: An R&D value-mapping approach to evaluation." Research Policy, 25(6):967–995, 1996.
[10] David C. Mowery. "The changing structure of the US national innovation system: Implications for international conflict and cooperation in R&D policy." *Research Policy*, 27(6):639–654, 1998.
[11] P. Spath and H. Rohracher. "'Energy regions': The transformative power of regional discourses on socio-technical futures." *Research Policy*, 39(4):449–458, 2010. ISSN 0048-7333.
[12] Chris Hendry and Paul Harborne. "Changing the view of wind power development: More than bricolage." *Research Policy*, 40(5):778–789, 2011.

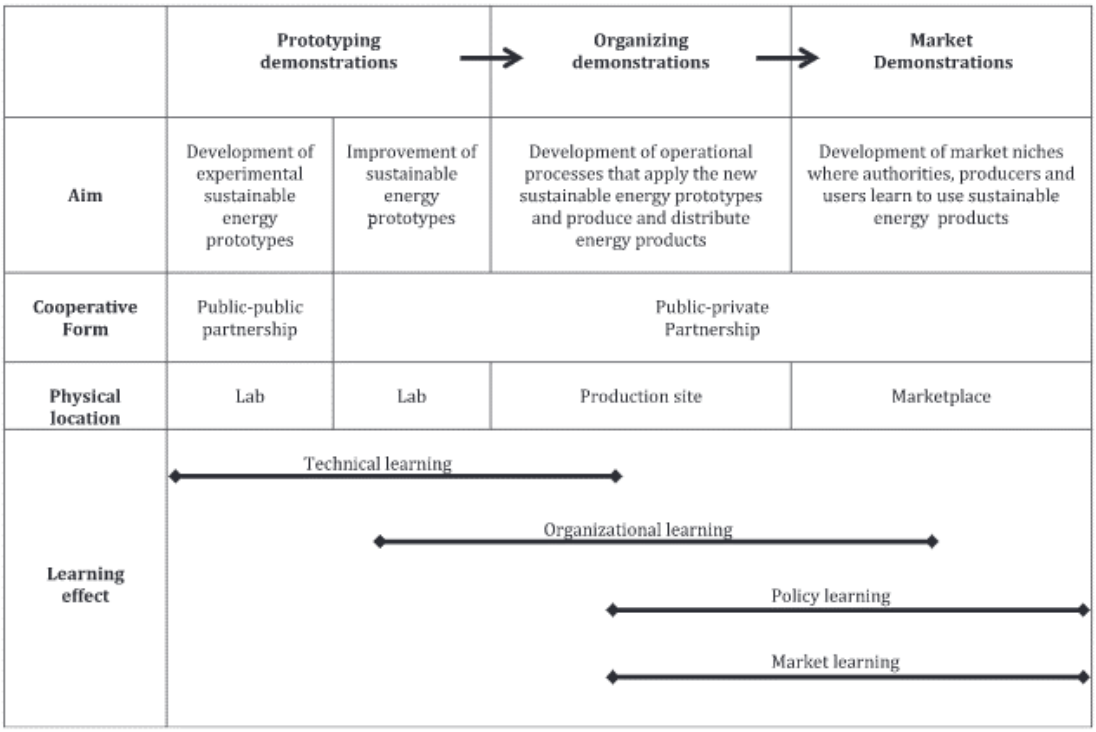

Figure 2: Model of renewable and sustainable energy demonstration project learning (Bossink, 2017)

environmental reviews and impact assessments, and stakeholder engagement. The combined need for these factors to align often creates significant risk for project failure.

Field tests address these needs by:

- Proving reliability and performance ultimately de-risking the technologies;
- Offering learning opportunities;
- Identifying potential challenges not apparent at smaller scales;[13]
- Informing "dominant" designs[14] for upscaling;
- Providing opportunities for collaboration; and
- Establishing best practices and standardized processes.

Researchers focused on progressive learning across renewable and sustainable energy projects[15,16] identify the importance of **technical learning** to first iterate on improvements to technologies involved in full-scale field tests and then subsequent **organizational and market learnings** where applying technical learning curve benefits leads to scale up, operational processes, the development of market niches, and improved effectiveness and efficiency (Figure 2).

With respect to the specific intent of this NOFO, **technical learning** may include:

[13] Devendra Sahal. "Technological guideposts and innovation avenues." *Research Policy*, 14(2):61–82, 1985.
[14] James Brown and Chris Hendry. "Public demonstration projects and field trials: Accelerating commercialization of sustainable technology in solar photovoltaics." *Energy Policy* 2009;37(7):2560–73.
[15] Bart A.G. Bossink. "Learning strategies in sustainable energy demonstration projects: What organizations learn from sustainable energy demonstrations." *Renewable and Sustainable Energy Reviews*, 131: 110025, 2020. ISSN 1364-0321.
[16] Bart A.G. Bossink. "Demonstrating sustainable energy: A review-based model of sustainable energy demonstration projects." *Renewable and Sustainable Energy Reviews*. 77: 1349–1362, 2017. ISSN 1364-0321.

- Identification and descriptions of actions by which the proposed subsurface technologies or methodologies will be advanced (e.g., best technical practices, operational lessons learned, or subsequent technological refinements).

Similarly, **organizational learning** specific to this NOFO may include, but is not limited to:

- A plan for hypothesis testing or learning-by-doing, developing, and refining in-the-field operational strategies that improve the efficiency and repeatability of EGS deployment; and
- Identification and description of all relevant stakeholders.

Market learning specific to this NOFO may include, but is not limited to:

- For projects where **eventual electrical power generation** is anticipated, estimates of power production capacity from the proposed field test/demonstration;
- For projects where **eventual thermal power production** is anticipated, estimates of thermal power potential from the proposed field test /demonstration; and
- Consideration and analysis of the size of the potential market opportunity (i.e., local and regional electricity demands and local and regional heating demands, respectively, for electricity-focused field tests and thermal power field tests).

Government-supported field tests focused on technical and organizational learning, which are most crucial for this NOFO, provide a unique opportunity to leverage the benefits of field tests with low risk. Given the opportunity to learn-by-doing during these supported tests and ultimately standardize technical strategies, projects become positioned ideally to advance to the next critical pre-commercialization step—creating and learning about the market, which enables commercial deployment at scale supported by private financing.

Many different approaches are under development or proposed for next-generation geothermal resources, but few of these technologies or methods have enjoyed opportunities to test in situ from a systems perspective, in different combinations, and under a variety of geologic settings and conditions. The opportunities for field-based, iterative testing are limited because of the high costs of subsurface operations. As a result, a menu of mid-Technology Readiness Level (TRL) approaches stand ready for hypothesis testing in the field to prove their reliability.

As noted previously, the invaluable opportunity to learn-by-doing and innovate next-generation geothermal systems through field testing at scale can lead to equally transformative changes in deployment and acceptance of next-generation geothermal nationwide.

The subsequent sections include detailed technical descriptions of the NOFO Topic Areas.

C. Expected Performance Goals

OG funds research, development, and demonstration projects to facilitate technology validation and field testing, reduce cost, and improve performance of next-generation geothermal technologies. In particular, the economic viability of next-generation geothermal depends on developing and improving enabling technologies and gathering data that provide a detailed characterization of target resources and an understanding of rock mass behavior and permeability enhancement.

The objective of this NOFO is to identify and develop next-generation geothermal field tests in a variety of geologic formations and subsurface conditions that will act:

- As exemplars, proving reliability and performance and ultimately de-risking the suites of technologies required to develop and sustain next-generation geothermal reservoirs;
- As experiments from which to learn (learn-by-doing), to use the upscaled opportunity to identify new problems that are not apparent at smaller, lab-based scales;
- As an opportunity to hypothesis test and validate a design approach for the geological conditions where projects are located and extended to broader next-generation geothermal development; and
- As opportunities for collaboration, such that best practices can be established and general operational processes can be standardized and improved.

All work for projects selected under this NOFO must be performed in the United States.

This NOFO may remain open for up to 72 months, with review cycles occurring approximately every year, while funding lasts. The "rolling" nature of this announcement is meant to accommodate the community of applicants, who may need time to find the appropriate mix of experience to develop effective teams and to identify high potential sites, perform critical due diligence on those sites, and accommodate operational restrictions on sites before applying. In addition, DOE recognizes a perennial challenge for the relatively small geothermal industry with respect to the availability of personnel to commit to the DOE NOFO application and project management process. Requirements for Topic Areas currently closed are subject to change.

Strategic Goals

Strategic goals for this NOFO, highlighted in Table 1 below, are derived from the *GeoVision* Roadmap and subsequent analysis[17] and from OG's Multi-Year Program Plan (MYPP), as noted.

Table 1: NNOFO Requirements and Applicable OG Goals

NOFO Requirements

- Topic Areas 1, 2, 3, and 4 must provide a description of potential use cases if the resource were to be fully developed, an estimate of the thermal power and the equivalent electrical power (using defensible electrical conversion efficiencies for the resource and the power conversion technology) expected during the flow testing, and the rationale that the output can scale to meet the needs of an eventual application.
- Topic Area 5 must provide a description of potential use cases if the resource were to be fully developed, an estimate of the thermal power (using defensible estimate for the resource) expected during the flow testing, and the rational that the output can scale to meet the needs of an eventual application.
- Topic Area 6 must provide sufficient surface-based exploration data that suggests the presence of a possibly viable geothermal resource to support a drilling program that will ultimately lead to the drilling of a confirmation well and a description of the potential use case if the anticipated resource were to be fully developed.

[17] Enhanced Geothermal Shot Analysis for the Geothermal Technologies Office.

2023 Enhanced Geothermal Analysis	**Cost reduction for EGS: $45 per megawatt hour by 2035** Aggressive pursuit of resource characterization, well construction, reservoir sustainability, and materials R&D accompanied by a "learn-by-doing" approach to EGS field tests.
GeoVision Roadmap	**SUB-ACTION 1.4.1:** Develop existing and innovative stimulation methods for improved geothermal resource recovery. **SUB-ACTION 1.4.2:** Improve zonal-isolation techniques. **SUB-ACTION 1.4.3**: Develop advanced real-time fracture modeling and mapping. **SUB-ACTION 1.4.4:** Quantify the relationship among in situ state of stress, induced seismicity, and permeability.
OG MYPP	**Subsurface Enhancement and Sustainability Goal 1:** Collect, archive, and distribute high-fidelity multiphysics data associated with stimulations of in-field, near-field, and greenfield EGS reservoirs in crystalline rock at depth. **Subsurface Enhancement and Sustainability Goal 2:** Increase the net production potential in an existing geothermal plant using advanced, targeted stimulation technologies in existing but sub-commercial wells. **Subsurface Enhancement and Sustainability Goal 4:** Refine and optimize stimulation procedures using zonal isolation for reservoir enhancement in crystalline basement rock.

Field Test Requirements: (RELEVANT TOPIC AREAS are NOTED):
Awards made under this NOFO will be cooperative agreements that may include drilling, well stimulation, data collection, modeling, and analysis. Power production is not a requirement and is beyond the scope/funding available.

Requirements include the following. Applicants should see Section VI.C.2 Technical Review Criteria for more information.

All Topic Areas other than Topic Area 6: Compliance with the "Protocol for Induced Seismicity Associated with Enhanced Geothermal Systems"
This protocol document serves as a general guide identifying steps a geothermal developer can take to address induced seismicity related to EGS development. Although the protocol is directed toward EGS, the principles apply to all geothermal development activities and can be adapted to the broader family of next-generation development approaches. Adapting the protocol includes simple planning steps that would apply to most developments, as well as more elaborate procedures that would apply under particular circumstances to a smaller number of geothermal developments. Therefore, the protocol is not intended to be a universal prescriptive approach to seismicity management, but instead a guide to project developers. The guiding principles must be incorporated into the management of all awards in this NOFO.

All Topic Areas: Reporting of All Fluids and Fluid Additives Used in Subsurface Activities
To create more transparency regarding fluids and additives used in drilling, stimulation (as applicable), and circulation during flow tests in subsurface operations, all such fluids and fluid additives must be publicly disclosed and reported to DOE. Although the FracFocus Chemical Disclosure Registry does not

currently accept reporting from geothermal wells, it should be used to guide the manner in which reporting should occur.

All Topic Areas: Drilling, Completion, and/or Well Retrofit Costs

Drilling, completion, and/or workover costs are expected, to some degree, for all projects selected under this NOFO. Applicants must provide an estimate of the project costs that will be expended in drilling, completion, and/or workover activities, and all such associated services must be fully cost shared at a level of at least the minimum required in the NOFO. The reasonableness of the project drilling costs and the proportion of those costs to the total project costs will be considered in review of submitted applications.

All Topic Areas: Communications

Stakeholder engagement and public awareness are crucial aspects of geothermal development, particularly for next-generation technologies that may not be known or understood in the community. To address this issue, applicants must reserve a portion of their budget to conduct and promote communications and outreach activities with stakeholders and the general public. This work will include listening to concerns, providing details on project plans, and sharing project successes. Engagement with local stakeholders must begin at the outset of any selected project and must be maintained on a recurring basis throughout the duration of the project.

DOE requires that each team include an "information officer" (full or part time, depending on need) whose role will center around engaging with the local community to ensure there is a direct conduit for information about the project.

All Topic Areas: Workforce

The geothermal workforce is dynamic, with skilled workers from oil, gas, or other industries frequently transitioning into geothermal depending on market conditions and project deployment (i.e., job availability). DOE aims to collect critical data on the Knowledge, Skills, and Abilities (KSAs) required of the workforce for successful execution of field projects. To support this goal, selected project recipients will be asked to submit a record quarterly of occupations of workers participating in the project. This information will be used to inform a specific end-of-project task that will identify KSAs and core competencies of workers necessary to complete next-generation geothermal projects.

All Topic Areas: Teaming

This NOFO seeks multidisciplinary teams that have demonstrated technical and financial viability to plan, develop, and operate large-scale next-generation field tests with minimum variance from the originally planned project schedule, scope, and budget.

Principal Investigators (PI) must reserve a developmental position on their team to mentor aspiring PIs (e.g., junior faculty from academia, early career national laboratory research staff, or junior industry researchers) during the execution of a large-scale field test project. This position can take any form deemed appropriate by the PI(s) but must provide access to project leadership and project management decision making. Projects undertaking construction activity are encouraged to team with the appropriate building and construction trade unions and to secure letters of commitment.

Teams are required to include industry participation and should focus on a broad range of personnel, institutions, expertise, and sector knowledge. Teams must include geothermal expertise but can include experience from other subsurface relevant sectors as well.

Topic Area 1; Topic Areas 4 and 5 (as applicable): Reservoir Stimulation

Projects that include stimulation activities that are funded under this NOFO will be expected to identify and deploy innovative and, in some cases, pre-commercial technologies to enable in situ reservoir monitoring and assessment, reservoir stimulation, flow test monitoring, and (potentially) electrical and/or thermal power production.

Due to the criticality of permeability enhancement in EGS, those projects that propose reservoir stimulation to enhance fluid flow within the reservoir rock must successfully demonstrate and execute stimulation methods and techniques that address the proposed approach to EGS development. In addition, these projects must identify a pathway to sustain sufficient fluid flow and heat extraction rates equal to those required for the proposed eventual application.

Publicly released information regarding previous DOE field projects and technical baseline for well stimulation methods used in the past can be found at https://www.osti.gov/ (e.g., final technical reports, conference proceedings, or journal articles) and on OG's website (geothermal publications page, particularly OG peer review reports). Previously funded projects dramatically advanced research, but repeated testing to demonstrate the reproducibility of field-scale EGS stimulation methods has not yet been possible, leaving technical questions regarding:

- Sufficient technical understanding of factors that contribute to success or failure of well stimulation methods in a variety of geothermal reservoirs and rock types;
- Sufficient testing of various well stimulation techniques that use various combinations of technologies and methods such as fluid injection, thermal rock-fluid interaction, chemical stimulation, zonal isolation, addition of proppants, and/or other techniques; and
- Adoption of successful EGS well stimulation techniques by the geothermal industry at commercial scale.

Several new technologies or those adopted from the oil and gas sector have shown promise for improving stimulation success and sustainability in EGS wells. In addition, a shift in the rationale surrounding EGS stimulation strategy, progressing from open-hole stimulation to isolated stimulation zones, has occurred in the last decade and shown clear advantages in modeling[18] and field tests (e.g., Cladouhos et al, 2009).[19] OG seeks to leverage these and other recent advances in EGS to support expanded development in greenfield, near-field, and in-field environments.

All Topic Areas: Consideration and Documentation of Technical, Organizational, and Market Learning

Applicants and recipients must consider and document opportunities for technical and organizational learning in their application materials and to describe learnings in Phase Reports throughout the project duration.

[18] Kennedy, B.M, D. Blankenship, T. Doe, A. Riahi, P. Fu, B. Damjanac, E. Sonnenthal, A. Finnila. 2021. "Performance Evaluation of Engineered Geothermal Systems Using Discrete Fracture Network Simulations." Lawrence Berkeley National Laboratory. https://escholarship.org/uc/item/4168d73x

[19] Cladouhos, T., Petty, S., Larson, B., Ivonetti, J., Livesay, B., Baria, R. 2009. "Toward More Efficient Heat Mining: A Planned Enhanced Geothermal System Demonstration Project." *GRC Transactions*, Vol. 33.

Technical learning for this NOFO could include identifying and describing actions by which the proposed subsurface technologies or methodologies will be advanced (e.g., best technical practices, operational lessons learned, or subsequent technological refinements) or other areas of relevance.

Organizational learning specific to this NOFO could include creating a clear methodology for hypothesis testing and/or learning-by-doing, identifying relevant stakeholders, and developing in-the-field operational strategies that improve the efficiency and repeatability of EGS deployment or other topics that advance organizational knowledge.

For market learning, economic and social benefits as well as market potential should be provided.

D. Topic Areas

1. Topic Area 1: EGS Field Tests

EGS field tests, where reservoir stimulation is employed, should evaluate and validate EGS reservoir development technologies and methods and their application in varied geologic and geographic environments including in-field, near-field, and greenfield settings. For the field tests, applicants must provide (1) a description of the potential use case if the resource were to be fully developed, (2) an estimate of the thermal power, (3) equivalent electrical power (using defensible electrical conversion efficiencies for the resource and the power conversion technology) expected during the flow testing, and the (4) rationale that the output will meet the needs of an eventual application.

Objective: Through this Topic Area, EGS technologies where reservoir stimulation techniques are employed must be tested and validated in geologic settings favorable for eventual electrical power generation. The topic is open to any potential field locations within the United States without regard to the proximity of the field test site to an existing geothermal power generation facility. These projects will focus on technical, organizational, and market learning. Applicants should closely consider the objectives outlined in Section III.B. in defining their proposed project approach and opportunities to learn-by-doing.

Projects funded under this NOFO Topic Area will test stimulation techniques and technologies in one or more wells, either existing or newly drilled. Although applications seeking to use existing wells will be considered, DOE recognizes that new wellbores specifically designed to meet the needs of the project have inherent advantages that can mitigate project risks. If existing wells are proposed for use in this Topic Area, the suitability of those wells will be considered as part of the review process. The applicant must provide demonstrable evidence that existing wells proposed for use are appropriate for the planned field testing.

Technical Requirements: This Topic Area will facilitate the testing of EGS development techniques and technologies and support potential future commercial development in well-characterized and favorable geothermal environments, where in-field, near-field, or greenfield test sites are all eligible. This Topic Area will also provide an opportunity to refine understanding of the extent of EGS resources available for new, firm geothermal power production.

Applicants can consider a variety of development techniques to effectively access and create a productive EGS reservoir in designing their projects, including but not limited to number of wells drilled,

unique completions, well orientations relative to in situ stress, stimulation approaches, and zonal isolation technology or methods. The use of available or tested prototype technologies from geothermal, oil and gas, or other relevant industries are allowable, but the TRL of proposed stimulation/isolation technologies must be at least six (6). This field test and validation effort intends that proposed technologies have been tested in relevant environments, and applicants must demonstrate as such in their applications.

The intent of this NOFO is to test and validate technologies and techniques for EGS development. Power production is not required and is beyond the scope and funding available through this NOFO. However, applicants are to provide a description of the potential use case if the resource were to be fully developed as well as an estimate of the thermal power and equivalent electrical power (using defensible electrical conversion efficiencies for the resource and the power conversion technology) expected during the flow testing associated with this field test and the rationale that the output will meet the needs of an eventual application. As part of these field tests, teams must collect and publicly share data on drilling operations, completions, flow rates, inlet/outlet temperatures, etc. to enable a thorough evaluation of the short- (1–12 months) and long- (1–20 years) term potential of the system.

Proposed sites/reservoirs should, per 42 U.S.C. 17194(d), include sites where "subsurface characterization or geothermal energy integration analysis has been conducted" and in "locations that are potentially commercially viable for enhanced geothermal systems development, while also considering environmental impacts to the maximum extent practicable." The applicant must provide rigorous and thorough technical documentation of such characterization and integration analyses in the submitted Technical Volume of the application.

All awards made under this Topic Area will include drilling, well stimulation, flow testing, data collection, modeling, and analysis.

Drilling and Site Requirements: Information obtained from existing wells in confirming the suitability of a proposed EGS site is highly valuable and provides a primary basis for resource confirmation. As such, at least one well that has been drilled to and encountered the target reservoir at a proposed site(s) would be preferred prior to an award being made by DOE under this NOFO, although this is not a requirement.

For applications where a target well or wells do not exist or where additional wells are proposed, the applicant must provide an estimate of the project costs that will be expended in drilling, completion, and/or workover activities, and all such associated services must be fully cost shared at a level of at least the minimum required in this NOFO. The reasonableness of the project drilling costs and the proportion of those costs to the total project costs will be considered during the Evaluation and Selection Process.

For sites where existing wells are proposed for use in the Topic Area, DOE seeks wells that are in good condition and capable of being put into operations relatively quickly and with minimal workover, and the applicant should provide strong evidence to such in the application.

Applicants who have proposed sites without existing wells that penetrate the target reservoir are encouraged to only apply if sufficient site-specific geologic characterization and analysis have taken place as specified in 42 U.S.C. 17194(d) (the level of data available will be reviewed as part of the Merit Review Process) or, alternatively, to apply to Topic Area 6. Additionally, if a new well or wells are proposed, the applicant must describe in sufficient detail that the new well(s) is not targeting a prime

hydrothermal resource, and the drilling activities must incorporate technology advancements aimed at reducing well construction time compared with nearby offset wells or wells of a similar nature. Specific requirements for new drilling are included in the Project Phase Descriptions of Section III.E.

Under this Topic Area, projects with existing permits or a clearly outlined pathway to securing permitting will be given preference during the Merit Review Process. The applicant or partners must demonstrate that they have, or will be able to obtain, the surface and subsurface rights necessary for geothermal resource extraction at the proposed site.

Please note that extensive site characterization work will NOT be funded under this Topic Area. Limited characterization activities directly supporting the execution of the field test (e.g., stress measurement activities supporting the stimulation design or logging during drilling operations) performed during the execution of the cooperative agreement may be allowed pending award negotiations.

2. Topic Area 2: Closed-Loop Field Tests—Drilling Required (CLOSED)

This Topic Area seeks sites where new drilling operations will be required to implement a closed loop field test. These sites can be in areas of any geology with or without existing geothermal development. For these field tests, a description of the potential use case is to be provided if the resource were to be fully developed as well as an estimate of the thermal power and the equivalent electrical power (using defensible electrical conversion efficiencies for the resource and the power conversion technology) expected during the flow testing and the rationale that output will meet the needs of an eventual application.

Objective: This Topic Area will target field tests at sites with potential for eventual electric power generation using close loop approaches where new well drilling or additional drilling in an existing well will be required. These sites can be in areas with or without existing geothermal development and target sedimentary, igneous, and/or mixed metamorphic rock. These tests will focus on technical, organizational, and market learning. As part of these field tests, teams must collect and share data on well completions, flow rates, inlet/outlet temperatures, etc., to enable a thorough evaluation of the short- (1–12 months) and long- (1–20 years) term potential of the system if commercialized.

Applicants should closely consider the objectives outlined in Section III.B. in defining their proposed project approach and opportunities to learn-by-doing.

Technical Requirements: This Topic Area will facilitate development in well-characterized sedimentary, igneous, and/or mixed metamorphic reservoirs without regard to geographic location within the United States. Further, this Topic Area will provide an opportunity to refine our understanding of the potential for closed-loop geothermal to provide new, firm power.

Applicants can consider a variety of development techniques to access and create a productive closed-loop geothermal system in designing their projects but must propose a system design where the working fluid is contained within the wellbore (or where there are negligible fluid losses) and all heat transfer occurs within or at the perimeter of the well. The TRL of proposed approach to developing a close loop geothermal system must be at least six (6). The intent of this field test is that proposed

development approaches and technologies have been tested in relevant environments and applicants must demonstrate such in their applications.

A description of the potential use case is to be provided if the resource were to be fully developed as well as an estimate of the thermal power and the equivalent electrical power (using defensible electrical conversion efficiencies for the resource and the power conversion technology) expected during the flow testing associated with this field test without flowing in situ fluids from the wellhead and the rationale that the output will meet the needs of an eventual application. As part of these field tests, teams must collect and share data on drilling operations, completions, flow rates, inlet/outlet temperatures, etc. to enable a thorough evaluation of the short- (1–12 months) and long- (1–20 years) term potential of the system.

Proposed sites/reservoirs should, per 42 U.S.C. 17194(d), include sites where "subsurface characterization or geothermal energy integration analysis has been conducted" and in "locations that are potentially commercially viable for enhanced geothermal systems development, while also considering environmental impacts to the maximum extent practicable." Rigorous and thorough technical documentation of such characterization and integration analyses must be provided by the applicant in the submitted Technical Volume of the application.

The reasonableness of the project drilling and/or workover costs and the proportion of those costs to the total project costs will be considered during the Evaluation and Selection Process.

All awards made under this Topic Area will include drilling, data collection, flow testing, modeling, and analysis.

Please note that extensive site characterization work will NOT be funded under this Topic Area. Limited characterization activities directly supporting the execution of the field test (e.g., stress measurement activities supporting well field design or logging during drilling operations) performed during the execution of the cooperative agreement may be allowed pending award negotiations.

Unique Research Requirements for Topic Area 2:

DOE, through national laboratory and university partners, initiated a program to better understand the expected performance characteristics of closed-loop geothermal development scenarios. To support these efforts, recipients that propose closed-loop field tests will need to collect data and perform complementary analysis to support the characterization of the specific closed-loop approach being proposed. Data and associated analyses (all of which must be uploaded to the Geothermal Data Repository) include but are not limited to:

- Equilibrated temperature profiles of the target well(s);
- Estimated thermal conductivity profiles of the target well(s) including any installed equipment and a description of the methods used in the estimate;
- Thermal properties of the circulating fluid; and
- Any data related to convective heat transfer within and outside of the well(s).

Drilling and Site Requirements: Information obtained from wellbores drilled in new or frontier areas is highly valuable and provides a primary basis for confirmation of the potential for any new resource. As such, at least one well that has been drilled to and encountered the target reservoir at proposed site(s) would be preferred prior to an award being made by DOE under this announcement, although this is not a requirement. For applications where a target well or wells do not exist or where additional wells are

proposed, the applicant must provide an estimate of the project costs that will be expended in drilling, completion, and/or workover activities, and all such associated services must be fully cost shared at a level of at least the minimum required in this NOFO. The reasonableness of the project drilling costs and the proportion of those costs to the total project costs will be considered in the Merit Review Process. For sites where existing wells are proposed for use in the Topic Area, DOE seeks wells that are in good condition and capable of being put into operations relatively quickly and with minimal workover, and the applicant should provide strong evidence to such in the application. Applicants who have proposed sites without existing wells that penetrate the target reservoir are encouraged to only apply if sufficient site-specific geologic characterization and analysis has taken place as specified in 42 U.S.C. 17194(d) (the level of data available will be reviewed as part of the Merit Review Process) or, alternatively, to apply to Topic Area 6. Additionally, if a new well or wells are proposed, the applicant must describe in sufficient detail that the new well(s) is not targeting a prime hydrothermal resource, and the drilling activities must incorporate technology advancements aimed at reducing well construction time compared with nearby offset wells or wells of a similar nature. Specific requirements for new drilling are included in the Project Phase Descriptions.

Under this Topic Area, projects with existing permits or a clearly outlined pathway to securing permitting will be given preference during the Merit Review Process. The applicant or partners must demonstrate that they have, or will be able to obtain, the surface and subsurface rights necessary for geothermal resource extraction at the proposed site.

Applicants must include a preliminary but thorough analysis of electrical power potential prior to and following the planned field activities as part of their application's Technical Volume.

3. Topic Area 3: Closed-Loop Field Tests—No Drilling Required (CLOSED)

Topic Area 3 focuses on closed-loop field tests using existing wellbore infrastructure. These tests can be in areas of any geology with or without existing geothermal development with near-term electrical power production potential. For these field tests, the applicant must provide a description of the potential use case if the resource were to be fully developed as well as an estimate of the thermal power and the equivalent electrical power (using defensible electrical conversion efficiencies for the resource and the power conversion technology) expected during the flow testing and the rational that the output will meet the needs of an eventual application.

Objectives: This Topic Area will target field tests at sites using existing well infrastructure, either oil & gas or geothermal, with potential for eventual electric power generation using closed-loop approaches via well conversion or retrofits; existing wellbores are required to be used. No new drilling or drilling in existing wells will be allowed in this Topic Area. These sites can be in areas with or without existing geothermal development and target sedimentary, igneous, and/or mixed metamorphic rock. These tests will focus on technical, organizational, and market learning. Applicants should closely consider the objectives outlined in Section III.B. in defining their proposed project approach and opportunities to learn-by-doing.

Technical Requirements: This Topic Area will facilitate development of closed-loop systems within existing wellbores. New well drilling or additional drilling in existing wells is not in scope, although workovers and/or recompletions are allowable. Further, this Topic Area will provide an opportunity to refine understanding of the potential for closed-loop systems to provide a cost-effective route to recomplete or retrofit existing wells for geothermal production.

Applicants can consider a variety of development techniques to access and create a productive closed-loop geothermal system in designing their projects, but must propose a system design where the working fluid is contained within the wellbore (or where the fluid losses are negligible) and all heat transfer occurs within or at the perimeter of the well. The TRL of the proposed approach to developing a closed-loop geothermal system must be at least six (6). The intent of this field test is that proposed development approaches and technologies have been tested in relevant environments, and applicants must demonstrate such in their applications.

Proposed sites/reservoirs should, per 42 U.S.C. 17194(d), include sites where “subsurface characterization or geothermal energy integration analysis has been conducted” and in “locations that are potentially commercially viable for enhanced geothermal systems development, while also considering environmental impacts to the maximum extent practicable.” Rigorous and thorough technical documentation of such characterization and integration analyses must be provided by the applicant in the submitted Technical Volume of the application.

Power production is not required and is beyond the scope and funding available through this NOFO. However, a description of the potential use case is to be provided if the resource were to be fully developed, as well as an estimate of the thermal power and the equivalent electrical power (using defensible electrical conversion efficiencies for the resource and the power conversion technology) expected during the flow testing associated with this field test and the rationale that the output will meet the needs of an eventual application. As part of these field tests, teams must collect and share

data on drilling operations, completions, flow rates, inlet/outlet temperatures, etc. to enable a thorough evaluation of the short- (1–12 months) and long- (1–20 years) term potential of the system.

All awards made under this Topic Area will include data collection, flow testing, modeling, and analysis.

Please note that extensive site characterization work will NOT be funded under this Topic Area. Limited characterization activities directly supporting the execution of the field test (e.g., casing inspection logs) performed during the execution of the cooperative agreement may be allowed pending award negotiations.

Unique Research Requirements for Topic Area 3:
DOE, through national laboratory and university partners, initiated a program to better understand the expected performance characteristics of closed-loop geothermal development scenarios. To support these efforts, recipients that propose closed-loop field tests will need to collect data and perform complementary analysis to support the characterization of the specific closed-loop approach being proposed. Data and associated analyses (all of which must be uploaded to the Geothermal Data Repository) include but are not limited to:

- Equilibrated temperature profiles of the target well(s)
- Estimated thermal conductivity profiles of the target well(s) including any installed equipment and a description of the methods used in the estimate
- Thermal properties of the circulating fluid
- Any data related to convective heat transfer within and outside of the well(s)

Wellbore and Site Requirements: ***At least one target well must exist at any proposed Topic Area 3 closed-loop field test site prior to an award being made by DOE under this NOFO.*** For the existing well(s), DOE seeks wells that are in good condition and have high mechanical integrity that is capable of being put into operations relatively quickly and with minimal workover; the applicant should provide strong evidence to such in the application. For this Topic Area, applicants will not be permitted to drill new production/injection wells or extend existing wells as part of the award.

Under this Topic Area, projects with existing permits or a clearly outlined pathway to securing permitting will be given preference during the Merit Review Process. The applicant or partners must demonstrate that they have, or will be able to obtain, the surface and subsurface rights necessary for geothermal resource extraction at the proposed site.

The reasonableness of the project well, related to non-drilling costs and the proportion of those costs to the total project costs will be considered during the Evaluation and Selection Process.

4. Topic Area 4: Super-Hot/Supercritical Field Tests (CLOSED)

This Topic Area focuses on field tests using next-generation approaches (EGS or closed-loop) at locations where superhot/ supercritical temperatures (> 375° C) are expected. These sites can be in areas with or without existing geothermal development and target sedimentary, igneous, and/or mixed metamorphic rock. For these field tests, the applicant must provide a description of the potential use case if the resource were to be fully developed as well as an estimate of the thermal power and the equivalent electrical power (using defensible electrical conversion efficiencies for the

resource and the power conversion technology) expected during the flow testing and the rationale that the output will meet the needs of an eventual application.

Objective: This Topic Area will target superhot/supercritical resources (>375°C) and acknowledges that potential development in these resources brings with it unique challenges due largely to the extreme temperatures. Through this Topic Area, next-generation technologies must be tested and validated in geologic settings favorable for eventual electrical power generation. Additionally, beyond the efforts to validate development approaches, this Topic Area also includes the requirement to obtain valuable scientific data to further the community's knowledge of these resources. The topic is open to any potential field locations within the United States without regard to the proximity of the field test site to an existing geothermal power generation facility. These projects will focus on technical, organizational, and market learning. Applicants should closely consider the objectives outlined in Section III.B. in defining their proposed project approach and opportunities to learn-by-doing.

Technical Requirements: This Topic Area will test viability of next-generation geothermal approaches (EGS and closed-loop) in well characterized, superhot/supercritical reservoirs, regardless of subsurface geologic setting by providing an opportunity to refine our understanding of the unique and high potential superhot/supercritical resources available for new, firm, flexible geothermal power production.

Applicants can consider a variety of development techniques to access and develop geothermal power systems in superhot/supercritical environments, including but not limited to unique well designs, completions, wellbore orientations, and—in the case of EGS reservoir stimulation—approaches and zonal isolation technology or methods if applicable.

Any EGS and closed-loop approach is allowable, and the use of available or tested prototype technologies from geothermal, oil and gas, mining, or other relevant industries can be employed, but the TRL of proposed stimulation/isolation technologies must be at least six (6). This field test intends that proposed technologies have been tested in relevant environments, and applicants must demonstrate as such in their applications.

The intent of this NOFO is to test and validate technologies and techniques for next-generation geothermal development. Power production is not required and is beyond the scope of and funding available through this NOFO. Applicants must include an analysis of the eventual electrical power potential prior to and following the planned activities as part of their application's Technical Volume. As part of these field tests, teams must collect and share data on drilling operations, completions, flow rates, inlet/outlet temperatures, etc. to enable a thorough evaluation of the short- (1–12 months) and long- (1–20 years) term potential of the system.

Proposed sites/reservoirs should, per 42 U.S.C. 17194(d), include sites where "subsurface characterization or geothermal energy integration analysis has been conducted" and in "locations that are potentially commercially viable for enhanced geothermal systems development, while also considering environmental impacts to the maximum extent practicable." Extensive characterization work to assess the quality and potential of the geothermal resource will not be funded under this Topic Area although it is allowable as recipient cost-share. Extensive subsurface data collection, analysis, and sharing are, however, a requirement. The collection of these data can be supported with DOE funding, such that the data are made publicly available through the Geothermal Data Repository to further the accrual of knowledge surrounding these unique systems.

All awards made under this Topic Area will include drilling, well stimulation, data collection, flow testing, modeling, and analysis.

Unique Research Requirements for Topic Area 4:
Recipients that propose super-hot/supercritical operations will need to provide or collect targeted data sets with complementary analysis to address technical unknowns associated with operations (all of which must be uploaded to the Geothermal Data Repository), including but not limited to:

- Analysis and modeling to predict the native state of the potential reservoir and the effect of drilling and heat extraction from the system
- In the case of EGS, fracture evolution as a result of subsurface activities
- Collection of fluid/gas samples to refine current thermodynamic databases (e.g., Reed & Palandri 2021)
- Estimates of stress-strain relationships of the host rock under superhot/supercritical conditions
- Geophysical datasets for detailed subsurface lithologic, rock mechanical, and structural geologic characterization.

Please note that DOE will prioritize the collection of critical subsurface data, stimulation, and stimulation analysis in this Topic Area over additional well drilling because the focus is to better understand how permeability, induced seismicity, and geochemistry evolve during stimulation and post-stimulation testing, which ultimately impact the sustainability of super-hot/supercritical systems.

Drilling and Site Requirements: Information obtained from existing wells in confirming the suitability of a proposed site is highly valuable and provides a primary basis for resource confirmation. As such, at least one well that has been drilled to and encountered the target reservoir at a proposed site(s) would be preferred prior to an award being made by DOE under this NOFO, although this is not a requirement. For applications where a target well or wells do not exist or where additional wells are proposed, the applicant must provide an estimate of the project costs that will be expended in drilling, completion, and/or workover activities, and all such associated services must be fully cost shared at a level of at least the minimum required in this NOFO. The reasonableness of the project drilling costs and the proportion of those costs to the total project costs will be considered in the Merit Review Process. For sites where existing wells are proposed for use in this Topic Area, DOE seeks wells that are in good condition and capable of being put into operations relatively quickly and with minimal workover, and the applicant should provide strong evidence to such in the application. Applicants who have proposed sites without existing wells that penetrate the target reservoir are encouraged to only apply if sufficient site-specific geologic characterization and analysis has taken place as specified in 42 U.S.C. 17194(d) (the level of data available will be reviewed as part of the Merit Review Process) or, alternatively, to apply to Topic Area 6.

Additionally, if a new well or wells are proposed, the applicant must describe in sufficient detail that the new well(s) is not targeting a prime hydrothermal resource, and the drilling activities must incorporate technology advancements aimed at reducing well construction time compared with nearby offset wells or wells of a similar nature. Specific requirements for new drilling are included in the Project Phase Descriptions.

Under this Topic Area, projects with existing permits or a clearly outlined pathway to securing permitting will be given preference during the Merit Review Process. The applicant or partners must

demonstrate that they have, or will be able to obtain, the surface and subsurface rights necessary for geothermal resource extraction at the proposed site.

The reasonableness of the project drilling costs and the proportion of those costs to the total project costs will be considered during the Evaluation and Selection Process.

Please note that extensive site characterization work will NOT be funded under this Topic Area. Limited characterization activities directly supporting the execution of the field test (e.g., stress measurement activities supporting the stimulation design or logging during drilling operations) performed during the execution of the cooperative agreement may be allowed pending award negotiations.

5. Topic Area 5: Direct Use/Thermal Field Tests (CLOSED)

Field tests using next-generation approaches (EGS or closed-loop) at locations where the eventual application would be use of the thermal energy. These sites can be in areas with or without existing geothermal development and target sedimentary, igneous, and/or mixed metamorphic rock. For these field tests, the applicant must provide a description of the potential use case if the resource were to be fully developed as well as an estimate of the thermal power expected during the flow testing and the rationale that the output will meet the needs of an eventual application.

Objective: This Topic Area targets low permeability resources that can be developed using next-generation development approaches to access resources for direct use of the thermal energy, without conversion to electricity. Through this Topic Area, next-generation technologies must be tested and validated in geologic settings favorable for commercialization. The topic is open to any potential field locations within the United States without regard to the proximity of the field test site to an existing geothermal power generation facility. These projects will focus on technical, organizational, and market learning. Applicants should closely consider the objectives outlined in Section III.B. in defining their proposed project approach and opportunities to learn-by-doing.

Technical Requirements: This Topic Area will test viability of next-generation geothermal approaches (EGS and closed-loop) in well characterized thermal resources, regardless of subsurface geologic setting, by providing an opportunity to refine our understanding of the use of next-generation geothermal approaches to support heating and cooling needs.

Awards made under this Topic Area may include drilling, well stimulation, flow testing, data collection, modeling, and analysis.

Applicants can consider a variety of development techniques to access and develop geothermal power systems for heating and cooling, including but not limited to unique well designs, completions, wellbore orientations, and—in the case of EGS reservoir stimulation—approaches and zonal isolation technology or methods if applicable.

Any EGS and closed-loop approach is allowable, and the use of available or tested prototype technologies from geothermal, oil and gas, mining, or other relevant industries can be employed, but the TRL of proposed stimulation/isolation technologies must be at least six (6). Applications that are directed at the installation of geothermal heat pump ground loops are not allowed in this Topic Area. Additionally, simply producing fluids, without application of EGS or closed-loop approaches, is not

allowed in this Topic Area. The intent of this field test is that proposed technologies have been tested in relevant environments, and applicants must demonstrate such in their applications.

The intent of this NOFO is to test and validate technologies and techniques for next-generation geothermal development. Application of the thermal energy is not required and is beyond the scope/funding available through this NOFO. Applicants must include an analysis of the eventual thermal power potential prior to and following the planned activities as part of their application's Technical Volume. As part of these field tests, teams must collect and share data on drilling operations, completions, flow rates, inlet/outlet temperatures, etc. to enable a thorough evaluation of the short (1-12 months) and long (1-20 years) term potential of the system.

Proposed sites/reservoirs should, per 42 U.S.C. 17194(d), include sites where "subsurface characterization or geothermal energy integration analysis has been conducted" and in "locations that are potentially commercially viable for enhanced geothermal systems development, while also considering environmental impacts to the maximum extent practicable."

Please note that extensive site characterization work will NOT be funded under this Topic Area. Limited characterization activities directly supporting the execution of the field test (e.g., stress measurement activities supporting the stimulation or well field design, or logging during drilling operations) performed during the execution of the cooperative agreement may be allowed pending award negotiations.

Drilling and Site Requirements: Information obtained from existing wells in confirming the suitability of a proposed site is highly valuable and provides a primary basis for resource confirmation. As such, at least one well that has been drilled to and encountered the target reservoir at a proposed site(s) would be preferred prior to an award being made by DOE under this NOFO, although this is not a requirement. For applications where a target well or wells do not exist or where additional wells are proposed, the applicant must provide an estimate of the project costs that will be expended in drilling, completion, and/or workover activities, and all such associated services must be fully cost shared at a level of at least the minimum required in this NOFO. The reasonableness of the project drilling costs and the proportion of those costs to the total project costs will be considered during the Evaluation and Selection Process. For sites where existing wells are proposed for use in this Topic Area, DOE seeks wells that are in good condition and capable of being put into operations relatively quickly and with minimal workover and the applicant should provide strong evidence to such in the application. Applicants who have proposed sites without existing wells that penetrate the target reservoir are encouraged to only apply if sufficient site-specific geologic characterization and analysis has taken place as specified in 42 U.S.C. 17194(d) (the level of data available will be reviewed as part of the Merit Review Process) or, alternatively, to apply to Topic Area 6. Additionally, if a new well or wells are proposed, the applicant must describe in sufficient detail that the new well(s) is not targeting a prime hydrothermal resource, and the drilling activities must incorporate technological advancements aimed at reducing well construction time compared with nearby offset wells or wells of a similar nature. Specific requirements for new drilling are included in the Project Phase Descriptions.

Under this Topic Area, projects with existing permits or a clearly outlined pathway to securing permitting will be given preference during the Merit Review Process. The applicant or partners must demonstrate that they have, or will be able to obtain, the surface and subsurface rights necessary for geothermal resource extraction at the proposed site.

6. Topic Area 6: Drilling for Next-Generation and Hydrothermal Resource Exploration, Characterization, and Confirmation

The purpose of this Topic Area is to support industry in accelerating geothermal development through drilling of resource exploration, characterization, and confirmation well(s). Specifically, the intent is to gather data, information, and tests of geologic formations for next-generation or hydrothermal development, where sufficient site-specific data are available to suggest the potential for geothermal energy production. Although shallow drilling (e.g., thermal gradient wells) is allowed, the drilling of reservoir depth confirmation well(s) is required, and applications that only propose shallow drilling will not be considered. These wells can target sedimentary, igneous, and/or mixed metamorphic rock. The preference is to gather data in previously unexamined formations and locations to expand the geothermally relevant database of subsurface conditions in the United States; however, applications targeting locations of existing geothermal development will be considered. A description of the potential use case if the anticipated resource were to be fully developed is required (e.g., closed-loop, EGS, or hydrothermal).

Objective: This Topic Area targets both prospective next-generation and conventional hydrothermal geothermal resources that lack a confirmation well(s) with geophysical, shallow borehole, or other relevant data that strongly suggest the presence of a geothermal resource and to substantiate the reservoir rock is suitable for the development approach proposed.

Through this Topic Area, one or more wells penetrating the target resource must be drilled and the acquisition of relevant data be obtained. If additional data are needed to site reservoir depth drilling targets, other drilling work, such as thermal gradient wells, is allowable but only to the extent they directly support deep drilling plans. Applications that only propose shallow drilling will not be considered. The topic is open to any potential field location within the United States where prior characterization activities support a reasonable probability of resource discovery and/or confirmation; however, the intent is to gather data in previously unexamined formations and locations and expand the geographic extent of geothermal development, and so the preference is for applications that target undeveloped locations. These field tests will provide technical and organizational learning opportunities through the acquisition of new subsurface data and the application of state of the art practices in geothermal drilling. Applicants should closely consider the objectives outlined in Section III.B. in defining their proposed project approach and opportunities to learn-by-doing.

Technical Requirements: Awards made under this Topic Area will include drilling, well testing, data collection, and analysis.

The future development approach must be described, and the proposed well construction and characterization efforts must be consistent with that approach. Details of the well(s) must be provided (e.g., depth, casing design, and diameter) as well as any data gathering activities (e.g., logging, coring, stress measurements, and flow testing). Recent advances in geothermal well development should be reflected and discussed in the planned activities.

Applicants are encouraged to apply only if sufficient site-specific geologic characterization and analysis have taken place to support the siting and execution of a drilling program that will ultimately support

the drilling of a characterization well (the level of data available will be reviewed as part of the Merit Review Process).

As part of this Topic Area, teams must collect and share data on drilling operations and all characterization-related activities. The collection of these data can be supported with DOE funding, such that the data are made publicly available through the Geothermal Data Repository to further the accrual of knowledge surrounding these unique systems. Following the completion of the characterization effort and subsequent analyses, the applicant must provide an assessment of the suitability of the resource for possible development.

Drilling and Site Requirements: The applicant must provide detailed well designs and anticipated costs as well as a full description of the characterization/confirmation efforts along with those estimated costs.

The applicant must describe in sufficient detail that the well(s) to be drilled and the drilling activities must incorporate technology advancements aimed at reducing well construction time compared with nearby offset wells or wells of a similar nature. Specific requirements for new drilling are included in the Project Phase Descriptions.

Under this Topic Area, projects with existing permits or a clearly outlined pathway to securing permitting will be given preference during the Merit Review Process. The applicant or partners must demonstrate that they have, or will be able to obtain, the surface and subsurface rights necessary for geothermal resource extraction at the proposed site.

The reasonableness of the project drilling costs will be considered during the Evaluation and Selection Process (see Criterion 1: Technical Merit).

E. Project Phase Descriptions

Proposed projects should be completed in distinct phases with decision points after Phase 1, 2, 3, and during Phase 4, as appropriate. Phases are described below with required objectives. Applicants do not need to complete these objectives in the order listed; some objectives may be completed in parallel depending on the proposed site. Failure to fully achieve deliverables required to progress through each decision point can lead to a negotiation of mutual termination, and failure to reach agreement can result in termination for noncompliance.

All tasks should include SMART (Specific, Measurable, Achievable, Relevant, and Timely) milestones that demonstrate achievement included at the end of each objective.

For projects selected under this NOFO, the recipient must upload all data to the DOE Geothermal Data Repository as it is generated or no later than the end of the quarter in which a complete data set is generated. The data must be sufficiently complete, in a format acceptable to DOE, and include all files required for an independent analyst to reproduce and verify the work. The data must be submitted at https://gdr.openei.org.

We recognize that applicants may be in various stages of project readiness and that the length of budget periods, timing of go/no-go decision points, and combining of phases into budget periods can be negotiated as is appropriate on a project risk basis.

1. Phase 1: Planning and Permitting

The goal of Phase 1 is to complete mission-critical technical and logistical tasks that demonstrate site viability.

- Assess All Available Site Characterization Data and Develop a Conceptual Geologic Model (if one does not already exist)
    - Recipients must compile site data into a conceptual geologic model of the proposed site (if one does not already exist). The model should include graphical representations of key characteristics that reflect site suitability for meeting OG project goals and objectives for the topic being addressed.
    - Recipients must archive site data used to support the conceptual geologic model to OG's Geothermal Data Repository, which hosts all data collected or developed by OG-funded awards.
    - **Requirements for Topic Area 4 Only**:
        - For recipients working in super-hot/supercritical environments, an outline of a plan to collect data prior to or during well recompletion or new well construction
        - Analysis and modeling to predict the native state of the potential reservoir and the effect of drilling and, if applicable, stimulation perturbations
        - Long-term effects of heat extraction from the geothermal reservoir
        - Collection of fluid/gas samples to refine current thermodynamic and reservoir fluid databases (e.g., Reed & Palandri 2021)
        - Development of stress/strain constitutive relationships of the host rock in super-hot/supercritical conditions
        - Geophysical data sets for detailed subsurface reservoir lithologic, rock mechanical, and structural geologic characterization.
- Identify Power Production Feasibility
    - Recipients must provide an updated description of a potential use case if the resource were to be fully developed and an estimate of the thermal power and the equivalent electrical power, as applicable (using defensible electrical conversion efficiencies for the resource and the power conversion technology), expected during the flow testing and the rationale that the output can scale to meet the needs of an eventual application.
- Begin Induced Seismicity Mitigation Plan (ISMP) – All Topic Areas Other Than Topic 6
    - DOE recognizes that activities across the Topic Areas may have a range of potential for induced seismicity, but all Topic Areas other than Topic 6 in this NOFO are required to develop a mitigation plan.
    - In Phase 1, recipients must initiate preliminary seismic monitoring by deploying a telemetered seismic monitoring array comprising surface and/or borehole (preferred) stations capable of recording seismic events with magnitudes as small as magnitude 0.0 (and preferably magnitudes lower) and a minimum of 30 days of recorded seismic data.
    - They must also develop an ISMP in line with DOE's best practices for addressing induced seismicity associated with EGS.
- Develop Stimulation Plan (if Applicable)

- If a reservoir stimulation is proposed, recipients must submit a plan describing in detail the proposed stimulation method and must reference an existing, comprehensive geologic model that describes the geology of the site, the presence of any mapped or possible faults, and current or historical seismicity (if any), as well as subsurface principal stress orientations and magnitudes. If critical data gaps exist, DOE will consider the acquisition of new well characterization data in order to develop a rigorous and thorough stimulation plan, if this need is clearly outlined in the application materials and budget documents. However, DOE expects that existing datasets will be used to develop the stimulation plan. All relevant geological, geomechanical, petrophysical, geochemical, geophysical, and seismological data may be considered in the development of the stimulation plan.
- The stimulation plan must also include a detailed description of the stimulation technologies and methodologies being employed. If the tools are currently under development, they **must be at a TRL of 6** to be considered for testing. Evidence of this TRL level must be provided in the stimulation plan.

- Initiate Permitting Activities
  - Recipients must develop an updated schedule and detailed budget for the completion of the relevant federal, state, and local permitting.
  - They must present updated permitting requirements and schedule to DOE and all applicable federal, state, and local permitting agencies in a Phase 1 Permitting meeting.
  - They must initiate permitting activities with all relevant federal, state, and local permitting agencies.
  - For projects proposing drilling activities, all drilling permits and regulatory approvals must be issued by appropriate permitting authorities and relevant regulatory agencies prior to the end of Phase 1.
- Establish Wellbore Readiness
  - The requirement for Phase 1 is to build on preliminary plans submitted in the application materials to develop final plans for the additional drilling, workover, recompletion of the existing candidate well(s), or new well development. For existing wells, this process can include re-entering the proposed wellbore to determine if proposed workover/recompletion plans are feasible and to develop more accurate budgets for activities to take place in Phase 2. DOE seeks wells that are in operational condition and/or require minimal intervention to allow stimulation. Note that no drilling is allowed in Topic Area 3.
  - For new wells or existing wells requiring workover, recompletion, or additional drilling, detailed operational plans and costs must be submitted to DOE during Phase 1.
  - Well-related plans will be reviewed by independent drilling experts in collaboration with DOE and must be approved by DOE prior to commencement of drilling operations.
  - During Phase 1, recipients will be permitted to release bids for subcontractors related to well-related activities, drilling, and on-site operational support and to procure required long-lead-time items.
  - Recipients are required to supply DOE with complete and detailed plans and cost estimates for well-related activities.
  - Recipients must convene a panel of external experts, which can include the external DOE experts mentioned above, to review and support the development of the well plan. Following plan development, recipients will conduct a well-operation on paper exercise with representatives from DOE present. Upon completing the exercise, final plans will be submitted to DOE for approval. DOE approval is required before drilling begins.

- Develop Environmental, Safety, and Health (ES&H) Plan
    - Plan must identify and analyze safety risks for existing and potential hazards or unsafe conditions associated with field activities.
- Begin Communications Outreach
    - Recipients should conduct communications and outreach activities with stakeholders and the general public to listen to concerns, provide details on project plans, and share project successes.
    - During Phase 1, recipients must name a full- or part-time Information Officer to direct all engagement with the local community, ensuring there is a direct conduit between the stakeholders and the project participants.

Phase 1 Reporting:

- The minimum technical requirement for Phase 1 is to obtain sufficient information and regulatory approval(s) to proceed to Phase 2 to stimulate the proposed wellbore. This information should be documented in a Phase 1 report that includes:
    - Overview of geological conditions via a summary of the existing geological model;
    - If applicable, a detailed well stimulation plan;
    - Detailed plans and costs for projects that require drilling, recompletion, or workover activities; and
    - Updated Environmental Information Volume (EIV): All reports, plans, permits, licenses, and other items required by governmental regulatory agencies for the performance of this work, including National Environmental Policy Act (NEPA) determination and documentation.

Go/No-Go: All requirements of Phase 1 must be completed, and any intractable technical or operational challenges identified or encountered in Phase 1 must be mitigated.

2. Phase 2: Well Development

The goal of Phase 2 is to initiate well development as applicable. As such, no new drilling will be allowed in projects selected under Topic Area 3.

- Initiate Well-Related Activities
    - Recipients must implement all ES&H activities outlined in their ES&H Plan(s) and check in with DOE and relevant DOE-contracted support throughout the site development program.
        - Recipients working in super-hot/supercritical environments must develop specific mitigation strategies in their ES&H Plan associated with anticipated environments.
    - Recipients must work with and consult DOE and a DOE-designated Technical Monitoring Team during well operations. Costs will be monitored in coordination with DOE to ensure projects stay within allowable cost ranges proposed in the original cost estimate.
    - Site-relevant data from all planned and DOE-approved activities will be submitted to the Geothermal Data Repository quarterly. For projects that involve drilling, an electronic data recording system must be used and logged with the full data set submitted to the Geothermal Data Repository. Additionally, EDR data must be made available for DOE to view in real time.

  - Detailed daily reports and cost tracking reports will be provided to DOE via email to the project officer on a daily basis both in PDF format and in the native format of the software used to generate the daily reports.
    Following completion of site development activities, all new or existing wells must be subjected to appropriate testing. For wells drilled as part of Topic Area 6, well tests are expected to support the intended development approach. Plugging and abandonment plans and costs must be provided for all wells not intended to support potential future site development activities.
- Revise Geologic Model
  - Recipients must refine their Phase 1 conceptual geologic site model to incorporate new characterization or monitoring data as permitted by NEPA status.
- Perform Resource Assessment of Geologic Target
  - Recipients must use data obtained from well(s) drilled into the target formation to create an initial estimate of the geothermal resource (EGS and/or hydrothermal) that has been confirmed by drilling and data collection activities.
- Revise Stimulation Plan (if applicable)
  - Recipients can revise their stimulation plan based on data and analysis collected during workover or recompletion operations (if relevant). Recipients are permitted to conduct dynamic reservoir modeling based on the refined geologic site model to inform stimulation design.
- Finalize Induced Seismicity Mitigation Plans (if applicable)
  - Recipients must finalize the ISMP, incorporating Micro Earthquake (MEQ) data and associated analysis into a completed Probabilistic Seismic Hazard Analysis, Criteria for Damage and Vibration, and Mitigation Actions for field testing.
- Finalize Required Permitting Activities (if applicable)
  - In preparation for stimulation and by the end of Phase 2, all NEPA, state, and local permits required for stimulation operations must be finalized.

Go/No-Go: All requirements of Phase 2 must be met, and any intractable technical or operational challenges encountered during drilling or field work must be adequately mitigated.

3. Phase 3: System Development and Initial Testing (Not Applicable for Topic Area 6)

The goal of Phase 3 is to complete the operations required to begin the process of extracting heat from the target reservoir. For EGS projects, this process includes all stimulation activities and initial flow testing. For closed-loop applications, this process includes activities associated with the circulation of fluid in the target well(s) and initiation of flow. Data collection and analysis of the initial testing are required for all projects, with the results to be archived and made available for public use.

Note: Recipients are expected to conduct and promote communications, education, and outreach activities with DOE, outside stakeholders, and the public to promote awareness of this initiative throughout Phase 3.

- **Phase 3A: System Development**
  - Complete activities needed to create the flow system.
  - Record and submit all relevant data to the Geothermal Data Repository. Metadata of all notable events must be included in the files.

- **Phase 3B: Testing and Analysis**
  - Perform well testing in an appropriate manner to establish a direct comparison of current well production performance to well performance before activities. DOE approval of well testing plan and procedures is required before beginning well testing operations.

- **Reporting and Publications**
  - At a minimum, the Phase 3 report should include the following data sets, which must be uploaded to the Geothermal Data Repository:
    - Any drilling or recompletion reports
    - Daily reports associated with system development
    - Relevant data
    - Well logs, as needed
    - Flow data to evaluate the developed system
    - Seismic data prior to and after initiation of operations

Go/No-Go: All requirements of Phase 3 must be met, and any intractable technical or operational challenges encountered during stimulation, seismic monitoring, or other field work must be adequately mitigated.

4. Phase 4: Reservoir Sustainability (Not Applicable for Topic Area 6)

The goal of Phase 4 is to assess and validate long-term fluid flow and heat extraction rates of the installed system.

- Perform Long-Term Flow Testing
  - Recipients must conduct flow testing for 4–6 months, commencing early in Phase 4.
- Update Power/Heat Production Estimates
  - Recipients must analyze the produced power (potential in megawatts thermal and/or megawatts electric) from the test and a projection of what the system could produce if the site was developed for commercial operations.

Go/No-Go: Initial long-term flow tests must indicate sufficient electrical and/or thermal power generation potential if developed for commercial operations.

- Collect Post-Stimulation Data
  - Non-proprietary data collected during all phases of the projects must be made available to the public through the Geothermal Data Repository.
- Prepare Reports and Publications
  - Short- and long-term flow test reports, updated electrical and/or thermal power production analysis, and/or production data should be included in a final technical report that contains all phases of the award.
  - For all wells under this NOFO, a separate retrospective well report must be prepared, including lessons learned.
    - Provide ell cost data, electronic digitally recorded data, daily reports for new wells, and ensure all data are submitted to the Geothermal Data Repository.

Go/No-Go Decision Points

The applicant must identify go/no-go decision points after Phase 1, after Phase 2, and after Phase 3 in the submitted Statement of Project Objectives. Additional milestones and/or status reviews may be added to the project during negotiations. At go/no-go decision points, DOE will make one of three decisions for each award based on the technical progress made relative to the Statement of Project Objectives, actual spending during the project period, adherence to the proposed project schedule, and continued financial viability of the project team:

- "Go": The project is on track, minimal or no modifications are required, work is acceptable, the proposed work plan for the next performance phase is acceptable, funding is available, and the project continues to be appropriate to the mission and goals of OG.
- "Hold": The project is still viewed as having a high likelihood of success; however, additional information is required before a "Go" or "No-Go" decision can be made.
- "No-Go": The project will either be put on hold or DOE may not provide further funding. This decision may be due to irresolvable technical difficulties; changes in the OG mission, goals, or portfolio; or lack of appropriated funds. Should the project be terminated, the recipient will be responsible for all final deliverables detailed in the award package.

All work for projects selected under this NOFO must be performed in the United States. See Section II. Eligibility for more information.

F. Applications Specifically Not of Interest

The following types of applications will be deemed nonresponsive and will not be reviewed or considered (see the Responsiveness Review section below):

- Applications that fall outside the technical parameters specified in Background and Context above and the Topic Areas section above.
- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).
- Applications that fall outside the technical parameters specified in Sections I.A. and I.B. of the NOFO.
- Applications that propose to conduct field test activities outside of the United States of America.
- Applications that do not intend to establish feasibility for thermal and/or electrical power production.
- Applications that propose a cost share percentage less than 20%.

G. Statement of Substantial Involvement

DOE anticipates awarding cooperative agreements under this NOFO, which include a statement of DOE's "substantial involvement" in the work performed under the resulting awards. For cooperative agreements, DOE does not limit its involvement to the administrative requirements of the award. Instead, DOE has substantial involvement in the direction and redirection of the technical aspects of the project. DOE's substantial involvement in resulting awards may include the following:

A. DOE shares responsibility with the recipient for the management, control, direction, and performance of the project.
B. DOE may intervene in the conduct or performance of work under this award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.

C. DOE may redirect or discontinue funding the project based on the outcome of DOE's evaluation of the project at the go/no-go decision point(s).
D. DOE participates in major project decision-making processes.

H. Statutory Authority

The programmatic authorizing statute is the Energy Independence and Security Act of 2007 (EISA 2007) as amended by the Energy Act of 2020, Sections 615(b) and (d) (42 U.S.C. 17194(b) and (d); 616A(c) (42 U.S.C. 17195A(c))

> (a) In General.--The Secretary shall support a program of research, development, demonstration, and commercial application for enhanced geothermal systems, including the programs described in subsection (b).
> (b) Programs.--
> (1) Enhanced geothermal systems technologies.--The Secretary shall support a program of research, development, demonstration, and commercial application of the technologies and knowledge necessary for enhanced geothermal systems to advance to a state of commercial readiness, including advances in--
> (A) reservoir stimulation;
> (B) reservoir characterization, monitoring, and modeling;
> (C) stress mapping;
> (D) tracer development;
> (E) three-dimensional tomography; and
> (F) understanding seismic effects of reservoir engineering and stimulation.
> (2) Enhanced geothermal systems reservoir stimulation.--
> (A) Program.--In collaboration with industry partners, the Secretary shall support a program of research, development, and demonstration of enhanced geothermal systems reservoir stimulation technologies and techniques. A minimum of 4 sites shall be selected in locations that show particular promise for enhanced geothermal systems development. Each site shall--
> (i) represent a different class of subsurface geologic environments; and
> (ii) take advantage of an existing site where subsurface characterization has been conducted or existing drill holes can be utilized, if possible.

Awards made under this announcement will fall under the purview of 2 CFR Part 200 as adopted and supplemented by 2 CFR Part 910.

IV. Application Content and Form

This section includes application information specific to this NOFO Part 1. Refer to the NOFO Part 2, *Application Content and Form*, for standard information that applies to all DOE NOFOs such as formatting and content requirements and funding restrictions.

A. Summary

The application process includes two phases: Letter of Intent and Full Application.

Application Submission Phase	Eligibility for Submission
Letter of Intent	***Request submission by the specified due date and time, but Letter of Intent is not required to be eligible to submit an application.***
Full Application	Each full application must be submitted by the specified due date and time (first page) to be eligible for comprehensive merit review.

B. Letter of Intent

Applicants may submit a letter of intent by the specified due date and time to announce their intent to submit an application. Applicants who do not submit a letter of intent can still submit an application. Letters of intent provide critical information and will be used by DOE to plan for the Merit Review Process. The submission should not contain any proprietary or sensitive business information. Letters of intent will not be used for down-selection purposes and do not commit an applicant to apply. Applicants are not bound to the statements made in the letter of intent; it is reasonable for project partners, locations, or other factors to change during the application development process. DOE will not provide feedback on the letters of intent.

Each applicant must provide the following information as part of the letter of intent.

Letter of Intent Content Requirements in the eXCHANGE	
Project Title	The project title should be consistently used across other application documents.
Technical Topic or Area	List the topic number and title planned for your application.
Lead Organization	Give the complete legal name of the lead organization.
Percentage Effort Performed by the Lead Organization	Provide the percentage effort to be performed by the lead organization in terms of overall budget percentage.
Organization Type	Academic; Federal Government; Federally Funded Research and Development (FFRDC); Government Owned and Operated (GOGO); Indian/Native American Tribal Government; Individual; Large Business; Non-Profit; Small Business; State and/or Local Government

Recipient Technical Point of Contact (POC)	Provide the name and title for the Principal Investigator (PI) or Lead Project Manager (LPM)].

The letter of intent includes an abstract, which should provide a truncated explanation of the proposed project. The abstract is entered in the eXCHANGE and may not exceed 600 characters. Applicants must include the following information.

Abstract Requirements	
Previous Application Submission	Identify whether the proposed project or application has been previously submitted to DOE. If not submitted previously, note as "Not previously submitted to DOE".
Senior/Key Team Members	List individuals who contribute in a substantive, measurable way to the execution of the proposed project and their proposed roles.
Proposed Subrecipients	List all subrecipients planned for the award and their locations (addresses).
Proposed Vendors or Subcontractors	List all vendors or subcontractors planned for the award.
Project Description	Description should not exceed 200 words and should provide a truncated explanation of the proposed project.

C. Application Content Requirements

Each application must be limited to a single concept. Applications must conform to the following requirements and must not exceed the stated page limits. Please refer to the NOFO Part 2, *Application Content and Form*, for a complete list of application requirements. Detailed guidance on the content and form of NOFO-specific requirements is provided following the Summary of Application Requirements table below.

1. Covered Individual Definition, Designation, and Responsibility

Several of the Application Content Requirements listed below and in the NOFO Part 2 are required of covered individuals.

For the purposes of this NOFO, a Covered Individual means an individual who (a) contributes in a substantive, meaningful way to the development or execution of the scope of work of a project proposed for funding by DOE and (b) is designated as a covered individual by DOE.

DOE designates as covered individuals any principal investigator (PI), project director (PD), co-principal investigator (Co-PI), co-project director (Co-PD), project manager, and any individual regardless of title that is functionally performing as a PI, PD, Co-PI, Co-PD, or project manager. Status as a consultant, graduate (master's or PhD) student, or postdoctoral associate does not automatically disqualify a person from being designated as a covered individual if he or she meets the definition in (a) above.

The applicant is responsible for assessing the applicability of DOE's definition of a covered individual against each person listed on the application. Further, the applicant is responsible for identifying any such individual to DOE for designation as a covered individual, if not already designated by DOE as described above.

The applicant's submission of a current and pending support disclosure and/or biosketch/resume for a particular person serves as an acknowledgement that DOE designates that person as a covered individual.

DOE may further designate covered individuals during award negotiations or the award period of performance.

2. Summary of Application Requirements

Component	File Format	Page Limit	File Name
Application for Federal Assistance (SF-424)	PDF	N/A	ControlNumber_LeadOrganization_424
Technical Volume	PDF	25 pages	ControlNumber_LeadOrganization_TechnicalVolume
Letters of Commitment	PDF	1 page each	ControlNumber_LeadOrganization_LOCs
Impacted Indian Tribes Documentation	PDF	N/A	ControlNumber_LeadOrganization_ImpactedTribes
Statement of Project Objectives	MS Word	12 pages	ControlNumber_LeadOrganization_SOPO
Project Management Plan	PDF	5 pages	ControlNumber_LeadOrganization_PMP
Budget Justification Workbook	MS Excel	N/A	ControlNumber_LeadOrganization_424A_Budget
Subrecipient Budget Justification	MS Excel	N/A	ControlNumber_LeadOrganization_424A_Subrecipient_Budget
Work Proposal for FFRDC, (see DOE O 412.1A)	PDF	N/A	ControlNumber_LeadOrganization_WP
Authorization for Non-DOE FFRDCs	PDF	N/A	ControlNumber_LeadOrganization_FFRDCAuth
Waiver for Foreign Entity Participation	PDF	N/A	ControlNumber_LeadOrganization_FEW
Performance of Work in the United States (Foreign Work Waiver)	PDF	N/A	ControlNumber_LeadOrganization_FWW
Resumes	PDF	3 pages each	ControlNumber_LeadOrganization_Resumes
Current and Pending Support (for each covered individual)	PDF	N/A	ControlNumber_LeadOrganization_CPS

Digital Persistent Identifier (for each covered individual)	N/A	N/A	Include in Current & Pending Support
Research Security Training Requirement (for each covered individual)	N/A	N/A	Include in Current & Pending Support
Transparency of Foreign Connections	PDF	N/A	BusinessSensitive_ControlNumber_LeadOrganization_TFC
Potentially Duplicative Funding Notice	PDF	N/A	ControlNumber_LeadOrganization_PDFN
Geothermal Drilling Permits and Legal Rights Documentation	PDF	N/A	ControlNumber_LeadOrganization_Permits and Lease
Data Management Plan	PDF	N/A	ControlNumber_LeadOrganization_DMP
Location(s) of Work	Excel	N/A	ControlNumber_LeadOrganization_LOW
Environmental Considerations Summary	PDF	N/A	ControlNumber_LeadOrganization_EnvSum
Environmental Impact Volume	PDF	N/A	ControlNumber_LeadOrganization_EIV
Environmental Questionnaire	PDF	N/A	ControlNumber_LeadOrganization_ENV
Disclosure of Lobbying Activities, if applicable (SF-LLL) for the prime applicant and all subrecipients	PDF	N/A	ControlNumber_LeadOrganization_SF-LLL
Certification Regarding Lobbying (OMB 4040-0013)	PDF	N/A	ControlNumber_LeadOrganization_Cert Lobbying
Summary for Public Release	PDF	1	ControlNumber_LeadOrganization_Summary
Summary Slide	MS Power Point	1	ControlNumber_LeadOrganization_Slide

3. Technical Volume

The Technical Volume must conform to the following content and form requirements. This volume must address the technical review criteria as discussed in Technical Review Criteria.

Applicants must provide sufficient citations and references to the primary research literature to justify the claims and approaches made in the Technical Volume. However, DOE and reviewers are under no obligation to review cited sources.

The Technical Volume to the application may not be more than 25 pages, including the cover page, table of contents, and all citations, charts, graphs, maps, photos, or other graphics, and must include all information below. The applicant should consider the weighting of each of the technical review criteria (see Section VI.C.2. Technical Review Criteria) when preparing the Technical Volume.

The Technical Volume should clearly describe and expand on information provided in the letter of intent.

Technical Volume Content Requirements Overview	
Section	**Approximate Percent Content of the Technical Volume**
Cover Page	N/A
Project Overview	10%
Technical Description, Innovation, and Impact	30%
Workplan in Statement of Project Objectives	40%
Technical Qualifications and Resources	20%

Cover Page:
The cover page must include all of the following:

- The project title
- Specific NOFO Topic Areas
- Technical and business POCs
- The project team, including recipient name, entity type, and names of all team member organizations
- The project location(s)
- The proposed federal funding level, cost share, and period of performance
- Senior/key personnel and other covered individuals
- Statements regarding confidentiality

Project Overview (Approximately 10% of the Technical Volume)
The Project Overview should contain the following information:

- **Background:** The applicant should discuss the background of the organization, including the history, successes, and current research and development status (i.e., the technical baseline) relevant to the technical topic being addressed in the Full Application.
- **Project Goal:** The applicant should describe, at a high level, the planned technical, deployment, and critical success factors in achieving those goals.
- **DOE Impact:** The applicant should discuss the impact of DOE funding with respect to advancement of Next-Generation Geothermal technologies and the impacts and anticipated positive outcomes that will accrue to the local population. Applicants should specifically explain how DOE funding, relative to prior, current, or anticipated funding from other public and private sources, is necessary to achieve the project objectives.
- Overview of how the project team will approach incorporating and documenting technical, organizational, and market learning opportunities during the field tests/demonstration project's period of performance.

Technical Description and Impact (Approximately 30% of the Technical Volume)
The Site and Technology Overview should contain two sections, one that provides an overview of the proposed site and a second that describes the high-level strategy for drilling, stimulation, and use of other technologies at the proposed sites to advance OG goals.

Site Information:

- **Site Characterization:**
  - The applicant should provide all relevant information and interpretations associated with site characterization needed to support the application.
  - Applicants must include a preliminary but thorough analysis of electrical and/or thermal power potential prior to and following the planned permeability enhancement activities as part of the Technical Volume.
- **Well Information:**
  - The applicant should provide all relevant information regarding existing target well(s) as applicable and suitable) for project activities. Any new well(s) should be described with respect to well design, well construction approaches, locations, and completions. The applicant should provide a high-level overview of the field configuration and why the proposed strategy was prioritized over others (e.g., to propose to recomplete one well and drill a new well).

The applicant should identify any potential constraints on community access to natural resources (e.g., water) that the project could create.

Workforce Strategy:

- **Knowledge, Skills, and Abilities (KSAs):** The applicant should propose a methodology and approach for documenting and reporting the KSAs of workers engaged in the project.

Site Strategy:

- **Drilling Plan:** The applicant should provide an overview of any initial plans on how wells will be recompleted and/or how new wells will be drilled, describing what efficiency measures will be implemented to improve on recent drilling rate increases realized at Utah Frontier Observatory for Research in Geothermal Energy (e.g., Dupriest and Noynaert, 2022 - IADC/SPE-208798-MS).
- **Next-Generation Development Plan:** The applicant should describe the initial plans for the development and testing of the proposed next-generation approach in sufficient detail to allow an assessment of the TRL levels of proposed technologies and methods (not required in Topic 6).
- **Technology Advancement:** The applicant should provide a detailed description of any other innovative technologies proposed for use during the project to help meet the goals under this NOFO (note that site characterization is not a focus of this NOFO, except in limited circumstances under Topic Area 3), including the scientific objectives associated with deployment of that technology.
- **Risks:** Risks should be clearly described in terms of the significance of technological and operational risks specific to the project. Applicants must also provide detailed descriptions of potential outcomes associated with each risk and provide detailed discussion of all relevant mitigatory actions specific to each risk identified. The applicant should discuss the risks associated with meeting OG electrical and/or thermal power production goals and the feasibility of the project to do so.
- **Induced Seismicity Mitigation:** Applicants other than those submitting to Topic Area 6 should provide their plans for compliance with the "Protocol for Induced Seismicity Associated with Enhanced Geothermal Systems" and demonstrate an understanding of the importance of clear transparent data and communications on this subject with DOE and stakeholders.

This section should also address if/how the project will secure and/or retain trained and qualified workers to meet goals, as well as how the proposed project location and underlying infrastructure and workforce will contribute to the success of the overall project.

Applicants must include an analysis of electrical power potential prior to the planned permeability enhancement activities.

Workplan (Approximately 40% of the Technical Volume)
The Workplan should include a summary of the project objectives, technical scope, work breakdown structure (WBS), project tasks, milestones, go/no-go decision points, and project schedule. A detailed statement of project objectives (SOPO) is separately requested as part of the application. The Workplan should contain the following information:

- **Project Objectives:** The applicant should provide a clear and concise (high-level) statement of the goals and objectives of the project as well as the expected outcomes.
- **Technical Scope Summary:** The applicant should provide a summary description of the overall work scope and approach to achieve the objective(s). The overall work scope is to be divided by performance periods that are separated by discrete, approximately annual decision points (see below for more information on go/no-go decision points). The applicant should describe the specific expected end result of each performance period.
- **WBS and Task Description Summary:** The Workplan should describe the work to be accomplished and how the applicant will achieve the milestones, will accomplish the final project goal(s), and will produce all deliverables. The Workplan is to be structured by performance period (approximately annual), task and subtasks, which is typical of a standard WBS for any project. The Workplan must contain a concise description of the specific activities to be conducted over the life of the project. The description must be a fuly disclosure of the project being proposed (i.e., a statement such as “we will then complete a proprietary process” is unacceptable). The applicant must prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the objectives of this NOFO. The summary provided should be consistent with the SOPO. The SOPO will contain a more detailed description of the WBS and tasks.
- **Milestone Summary:** The SOPO should provide a summary of appropriate milestones throughout the project to demonstrate progress and success. A milestone may be either a progress measure (which can be activity based) or a SMART technical milestone. SMART milestones should be Specific, Measurable, Achievable, Relevant, and Timely, and they must demonstrate a technical achievement rather than simply completing a task. Unless otherwise specified in the NOFO, the minimum requirement is that each project must have at least one milestone per quarter for the duration of the project with at least one SMART technical milestone per year (depending on the project, more milestones may be necessary to comprehensively demonstrate progress). The applicant should also provide the means by which the milestone will be verified. The summary provided should be consistent with the Milestone Summary Table in the SOPO.
- **Go/No-Go Decision Points:** The applicant should provide a summary of project-wide go/no-go decision points at appropriate points in the Workplan. At a minimum, each project must have at least one project-wide go/no-go decision point for each budget period (12 to 18-month period) of the project. The applicant should also provide the specific technical criteria to be used to evaluate the project at the go/no-go decision point. The summary provided should be consistent with the SOPO. Go/no-go decision points are considered SMART and can fulfill the requirement for an annual SMART milestone.
- **End of Project Goal:** The Workplan should include a summary of the end of project goal(s). At a minimum, each project must have one SMART end-of-project goal. The summary provided should be consistent with the SOPO.

- **Project Schedule (Gantt Chart or similar):** The applicant should provide a schedule for the entire project, including task and subtask durations, any milestones, and any go/no-go decision points.
- **Project Management:** The applicant should discuss the team's proposed management plan, including the following:
    - The overall approach to and organization for managing the work;
    - The roles of each project team member;
    - Any critical handoffs/interdependencies among project team members;
    - The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices;
    - The approach to project risk management, including a plan for securing a qualified workforce and mitigating risks to project performance including but not limited to conflicts related to siting;
    - The approach to addressing permits and other approvals, including compliance with any current permits and any permits and natural or cultural resource issues that could require discretionary permits or approvals;
    - A description of how project changes will be handled;
    - If applicable, the approach to Quality Assurance/Control; and
    - How communications will be maintained among project team members.

Technical Qualifications and Resources (Approximately 20% of the Technical Volume)

The Technical Qualifications and Resources should contain the following information:

- A description of the project team's unique qualifications and expertise, including those of key subrecipients;
- A description of the project team's existing equipment and facilities or of equipment or facilities already in place on the proposed project site that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project;
- Relevant, previous work efforts, demonstrated innovations, and how these enable the applicant to achieve the project objectives;
- The time commitment of the key team members to support the project;
- A description of the technical services to be provided by DOE FFRDCs, if applicable;
- The skills, certifications, or other credentials of the drilling, stimulation, and ongoing operations workforce;
- For multi-organizational or multi-investigator projects, describe succinctly:
    - The roles and the work to be performed by each PI and Senior/Key Personnel at the recipient and sub levels
    - Role of "aspiring PI"
    - Business agreements between the applicant and subcontractors or subrecipients
    - How the various efforts will be integrated and managed
    - Intellectual Property issues
    - Process for making decisions on scientific/technical direction
- Publication arrangements;
- Strategy to address known resources, including intellectual property and real property, constraints or challenges; and
- Communication plans.

D. Funding Restrictions

Program-specific funding restrictions applicable to awards funded under this NOFO are identified below. Standard funding restrictions are described in the NOFO Part 2, *Funding Restrictions*, section.

Applicable Funding Restrictions		
Title	**Location**	**Additional Information**
Allowable Costs	NOFO Part 2	Applicable to awards made under this NOFO
Pre-Award Costs	NOFO Part 2	Applicable to awards made under this NOFO
Performance of Work in the United States (Foreign Work Waiver Requirement)	NOFO Part 2	Applicable to awards made under this NOFO
Foreign Travel	NOFO Part 2	Foreign Travel is allowed for awards made under this NOFO
Lobbying	NOFO Part 2	Applicable to awards made under this NOFO
Equipment and Supplies	NOFO Part 2	Purchasing American-made equipment and supplies is applicable to this award.
Construction Signage	NOFO Part 2	Applicable to awards with construction activities made under this NOFO

V. Submission Requirements and Deadlines

Applicants must take several one-time actions before applying to this NOFO. Some of these may take several weeks, so it is vital applicants build in enough time to complete them. Failure to complete these actions could interfere with application or negotiation deadlines or the ability to receive an award if selected. These requirements are outlined in detail in the NOFO Part 2, *Get Registered*.

A. Required Registrations

1. Unique Entity Identifier (UEI) and System for Award Management (SAM)

You must have an active account with SAM.gov, including having a Unique Entity Identifier (UEI). SAM.gov registration can take several weeks. To register, go to SAM.gov Entity Registration and click Get Started. From the same page, you can also click on the Entity Registration Checklist for the information you will need to register.

Each applicant must:

1. Be registered in SAM.gov before submitting an application;
2. Provide a valid Unique Entity Identifier in the application; and
3. Continue to maintain an active registration in SAM.gov with current information at all times during which you have an active federal award or an application or plan under consideration by a federal agency.

DOE may not make a federal award to an applicant until the applicant has complied with all applicable UEI and SAM requirements, and if an applicant has not fully complied with the requirements by the time DOE is ready to make a federal award, DOE will determine that the applicant is not qualified to receive a federal award and use that determination as a basis for making a federal award to another applicant.

2. eXCHANGE

Register and create an account in the eXCHANGE site identified in the Key Facts section of the NOFO Part 1. This account can be used to apply to open NOFOs in eXCHANGE. To view and submit applications to open opportunities under a specific DOE office(s), you must access the instance of the system for that office. You may need to be registered in more than one to submit applications for opportunities managed by different DOE offices.

Each organization or business unit, whether acting as a team or a single entity, should use only one account as the contact point for each submission. Applicants must also designate backup points of contact. **This backup contact step is required to apply to this NOFO.**

B. Application Package

1. eXCHANGE

The application package requirements are outlined in the Application Content and Form section above. Several templates for application requirements are included in eXCHANGE. To access these materials, select the appropriate NOFO on the Opportunities page of the eXCHANGE.

Note: The maximum file size that can be uploaded to the eXCHANGE website is 50MB. Files larger than 50MB cannot be uploaded and therefore cannot be submitted for review. If a file is larger than 50MB but is still within the maximum page limit specified in the NOFO, it must be broken into parts and denoted to that effect. For example:

- TechnicalVolume_Part_1
- TechnicalVolume_Part_2

DOE will not accept late submissions that resulted from technical difficulties due to uploading files that exceed 50MB.

In addition to the eXCHANGE, the application forms and instructions are available at Funding Application and Management Forms.

Electronic Authorization of Applications and Award Documents
Submission of an application and supplemental information under this NOFO through electronic systems used by the DOE, including the eXCHANGE, constitutes the authorized representative's approval and electronic signature.

C. Submission Date and Times

All required submissions must be submitted to the eXCHANGE site (https://eere-eXCHANGE.energy.gov) no later than 5 p.m. ET on the dates provided in Key Facts section.
There may be more than one deadline, depending on whether a letter of intent is required.

Applicants are strongly encouraged to submit all required application documents at least 48 hours in advance of the submission deadline. Under normal conditions (i.e., at least 48 hours before the submission deadline), applicants should allow at least one hour to submit application documents. Once the application documents are submitted in the eXCHANGE site identified in the NOFO Part 1, applicants may revise or update that submission until the expiration of the applicable deadline. If changes are made to any of these documents, the applicant must resubmit them before the applicable deadline. DOE will not extend the submission deadline for applicants that fail to submit required information by the applicable deadline due to server/connection congestion.

D. Intergovernmental Review

This NOFO is not subject to Executive Order 12372, Intergovernmental Review of Federal Programs.

VI. Application Review Information

A. Standards for Application Evaluation

Applications that are determined to be eligible will be evaluated in accordance with this NOFO by the standards set forth in the relevant Notice of Objective Merit Review Procedure (76 Fed. Reg. 17846, March 31, 2011) and the guidance provided in the "DOE Merit Review Guide for Financial Assistance," effective October 1, 2020, which is available at: https://energy.gov/management/downloads/merit-review-guide-financial-assistance-and-unsolicited-proposals-current.

B. Responsiveness Review

The following applications will be deemed nonresponsive and will not be reviewed or considered:

- Project concepts or approaches not based on established scientific principles.
- Project concepts or approaches identified specifically as NOT of interest (see Section III.F. Applications Specifically Not of Interest above).

C. Review Criteria

1. Compliance Criteria

All applicant submissions for applications must:

- Comply with the applicable content and form requirements listed in Application Content Requirements and Submission Requirements and Deadlines of the NOFO Part 1 and 2;
- Include all required documents;
- Be uploaded successfully in the eXCHANGE site indicated in the Key Facts section above, including clicking the "Submit" button; and
- Comply with the submission deadline stated in Key Facts.

DOE will not review or consider submissions submitted through means other than the eXCHANGE indicated in Key Facts, submissions submitted after the applicable deadline, or incomplete submissions.

Applicants may submit a letter of intent by 5:00 p.m. ET on the due date listed on the Key Facts section to be eligible to submit an application. Applicants who do not submit a letter of intent are still eligible to submit an application.

Applicants are strongly encouraged to submit all required application documents at least 48 hours in advance of the submission deadline. Under normal conditions (i.e., at least 48 hours before the submission deadline), applicants should allow at least one hour to submit application documents. Once the application documents are submitted in the eXCHANGE site identified in the Key Facts section, applicants may revise or update that submission until the expiration of the applicable deadline. If changes are made to any of these documents, the applicant must resubmit them before the applicable deadline. DOE will not extend the submission deadline for applicants that fail to submit required information by the applicable deadline due to server/connection congestion.

2. Technical Review Criteria

Letters of Intent

Letters of Intent are evaluated based on completeness and timing of submission relative to the submission deadline.

Applications

Applications will be evaluated against the technical review criteria shown below. All sub-criteria are of equal weight.

Review Criterion Overview	
Criterion	**Weight**
Technical Merit and Impact	45%
Project Approach	30%
Team and Resources	25%

Criterion 1: Technical Merit and Impact (45%)

This criterion involves consideration of the following factors:

Technical Merit

1. Degree to which the proposed drilling, next-generation development, and other operational plans are clearly described, including adequate discussion of technological and operational risks specific to all proposed field activities, as well as mitigatory actions and/or contingencies;
2. Degree to which data from existing data sources are available to substantiate site characterization;
3. Degree to which existing wells can be used, where applicable, and the level of workover/recompletion needed for wells to be suitable for use;
4. For projects requiring new wells, the degree to which state-of-the-art drilling approaches are incorporated to reduce costs and increase average daily Rate-of-Penetration;
5. Degree to which the estimated drilling costs relative to the total project costs are reasonable;
6. The current state of permitting for the project and the degree to which the proposed location will be fully permitted within Phase 1 of the project;
7. For those projects proposing electrical power generation, the degree to which the project shows potential for possible commercially viable electrical power in the future;
8. For those projects proposing thermal power production, the degree to which the project shows potential for possible commercially viable thermal power production in the future; and
9. Sufficient technical detail in the application to assess whether the proposed work is technically meritorious, including relevant data, calculations, and discussion of prior work with analyses that support the viability of the proposed work.

Impact of Technology Advancement

1. The degree to which the project supports OG objectives, including the Multi-Year Program Plan and OG's cost and technology targets (i.e., *GeoVision* and subsequent analyses);
2. Extent to which the project supports specific topic area objectives;
3. Potential impact of the project on advancing the state of the art;

4. Extent to which the project facilitates stakeholder relationships across new or existing stakeholders to gain technical buy-in and increase potential for future deployments; and
5. Extent to which the project expands the geographic footprint of commercially exploitable geothermal resources.

Criterion 2: Project Approach (30%)

This criterion involves consideration of the following factors.

Project Approach, Workplan, and SOPO

1. Description of benefits from technical, organizational, and market learning opportunities of field tests in complex geothermal settings;
2. Degree to which the approach and critical path have been clearly described and thoughtfully considered;
3. Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood the proposed Workplan and SOPO will succeed in meeting the project goals;
4. Degree to which drilling, completion, and/or well retrofitting costs proposed are reasonable in the context of the proposed project; and
5. Degree to which the project will be fully permitted by the end of Phase 1.

Project Management

1. Adequacy, reasonableness, and soundness of the project schedule, as well as annual go/no-go decisions prior to a budget period continuation application, interim milestones, and metrics to track process;
2. Adequacy of the identification of project risks, including but not limited to possible labor and community opposition or disputes and “timely” and appropriate strategies for mitigation and resolution;
3. Soundness of a plan to expeditiously address environmental, siting, and other regulatory requirements for the project; and
4. Adequacy of proposed project management systems, including the ability to track scope, cost, and schedule progress and changes;

Baseline, Metrics, and Deliverables

1. Level of clarity in the definition of the baseline, metrics, and milestones; and
2. Relative to a clearly defined project baseline, the strength of the quantifiable metrics, milestones, and mid-point deliverables defined in the application, such that meaningful interim progress will be made.

Criterion 3: Team and Resources (25%)

This criterion involves consideration of the following factors.

1. Capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a high probability of success;
2. The qualifications and relevant expertise of the individuals on the team with respect to managing large-scale field-based projects;
3. Comprehensiveness of expertise and perspectives of the team and the involvement of industry partners that will amplify impact;
4. Sufficiency of the facilities and relevant technical experience to support the work;

5. The clear identification of key personnel including project management experts and information officers to communicate directly with stakeholders;
6. Degree to which roles and responsibilities of key personnel are clearly defined;
7. Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan; and
8. Reasonableness of the budget and spend plan for the proposed project and objectives.

D. Other Selection Factors

In addition to the above criteria, the Selection Official may consider the following program policy factors in determining which applications to select for award negotiations:

1. The degree to which the proposed project exhibits technological diversity when compared with the existing DOE project portfolio and other projects selected from the subject NOFO;
2. The degree to which the proposed project, including proposed cost share, optimizes the use of available DOE funding to achieve programmatic objectives;
3. The level of industry involvement and demonstrated ability to accelerate technology deployment;
4. The degree to which the proposed project is likely to lead to increased high-quality employment and manufacturing in the United States;
5. The degree to which the proposed project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty;
6. The degree to which the proposed project, or group of projects, represent a desired geographic distribution (considering past awards and current applications);
7. The degree to which the proposed project adds to the known geothermal resource base (i.e., new wells should expand beyond already discovered hydrothermal resources);
8. The degree to which the proposed project will employ procurement of U.S. iron, steel, manufactured products, and construction materials;
9. The degree to which environmental or regulatory permitting certainty will impact project timelines and success;
10. The degree to which the project's solution or strategy will maximize subsequent deployment or replication;
11. The degree to which the project supports advancing the technology pathways identified in the *GeoVision* Roadmap and OG's Multi-Year Program Plan; and
12. The degree to which the project promotes increased coordination with nongovernmental entities for field testing of technologies and research applications to facilitate technology transfer.

VII. Selection and Award Notices

Please see the NOFO Part 2, *Selection and Award Notices*, for information on notifications for Letters of Intent, Applications, Award Negotiations, and Post-Selection Information Requests.

VIII. Award Administration Information

A. Post-Award Requirements and Administration

DOE requires all award recipients to follow and accept requirements governed by laws and policies—both federal government-wide and DOE or program specific. These post-award requirements include all National and Administrative Policy Requirements; financial assistance general Certifications and Representations; Fraud, Waste and Abuse requirements; Safety, Security, and Regulatory requirements; and Environmental Review in Accordance with the National Environmental Policy Act requirements.

Post-award requirements and administration applicable to awards funded under this NOFO are identified below. Detailed descriptions of standard funding restrictions are provided in the NOFO Part 2, *Post-Award Requirements and Administration*, section. Detailed descriptions of program specific funding restrictions are provided below the table.

Applicable Post-Award Requirements and Administration	
Title	**Location**
Award Administrative Requirements	NOFO Part 2
Subaward and Executive Reporting	NOFO Part 2
National Policy Requirements	NOFO Part 2
Applicant Representations and Certifications	NOFO Part 2
Statement of Federal Stewardship	NOFO Part 2
Uniform Commercial Code (UCC) Financing Statements	NOFO Part 2
Interim Conflict of Interest Policy for Financial Assistance	NOFO Part 2
Whistleblower Protections	NOFO Part 2
Fraud, Waste, and Abuse	NOFO Part 2
Participants and Collaborating Organizations	NOFO Part 2
Current and Pending Support	NOFO Part 2
Prohibition Related to Malign Foreign Talent Recruitment Programs	NOFO Part 2
Foreign Collaboration Considerations	NOFO Part 2
U.S. Manufacturing Commitments	NOFO Part 2
Subject Invention Utilization Reporting	NOFO Part 2
Intellectual Property Provisions	NOFO Part 2
Go/No-Go Review	NOFO Part 2

Conference Spending	NOFO Part 2
Invoice Review and Approval	NOFO Part 2
Cost-Share Payment	NOFO Part 2
Implementation of Executive Order 13798, Promoting Free Speech and Religious Liberty	NOFO Part 2
Human Subjects Research	NOFO Part 2
Real Property and Equipment	NOFO Part 1
Rights in Technical Data	NOFO Part 1
Energy Data eXCHANGE (EDX)	NOFO Part 1

Real Property and Equipment
Real property and equipment purchased with project funds (federal share and recipient cost share) are subject to the requirements at 2 CFR 200.310, 200.311, 200.313, and 200.316 (non-federal entities, except for-profit entities) and 2 CFR 910.360 (for-profit entities).

For resulting awards under this NOFO, the recipients may (1) take disposition action on the real property and equipment or (2) continue to use the real property and equipment after the conclusion of the award period of performance with Grants Officer approval. The recipient's written request for Continued Use must identify the property and include:

- A summary of how the property will be used (must align with the authorized project purposes)
- A proposed use period, (e.g., perpetuity, until fully depreciated, or a calendar date when the recipient expects to submit disposition instructions)
- Acknowledgement that the recipient must not sell or encumber the property or permit any encumbrance without prior written DOE approval
- The current fair market value of the property
- An estimated useful life or depreciation schedule for equipment

When the property is no longer needed for authorized project purposes, the recipient must request disposition instructions from DOE. For-profit entity disposition requirements are set forth in 2 CFR 910.360. Property disposition requirements for other non-federal entities are set forth in 2 CFR 200.310 – 200.316. In addition, according to the FY23 Consolidated Appropriations Act (Pub. L. No. 117-328), Division D, Title III, Section 309, at the end of the award period the Secretary or a designee of the Secretary, at their discretion, may vest unconditional title or other property interests acquired under this project regardless of the fair market value of the property.

1. Rights in Technical Data

Data rights differ based on whether data is first produced under an award or instead was developed at private expense outside the award.

"Limited Rights Data": The U.S. government will not normally require delivery of confidential or trade-secret-type technical data developed solely at private expense prior to issuance of an award, except as necessary to monitor technical progress and evaluate the potential of proposed technologies to reach specific technical and cost metrics.

Government Rights in Technical Data Produced Under Awards: The U.S. government normally retains unlimited rights in technical data produced under government financial assistance awards, including the right to distribute to the public. However, according to special statutory authority, certain categories of data generated under DOE awards under this NOFO may be protected from public disclosure for up to five years after the data is generated (Protected Data). For awards permitting Protected Data, the protected data must be marked as set forth in the award's intellectual property terms and conditions, and a listing of unlimited rights data (i.e., non-protected data) must be inserted into the data clause in the award. In addition, invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application.

2. Cost Share Payment

DOE requires recipients to contribute the cost share amount incrementally over the life of the award. Specifically, the recipient's cost share for each billing period must always reflect the overall cost share ratio negotiated by the parties (i.e., the total amount of cost sharing on each invoice when considered cumulatively with previous invoices must reflect, at a minimum, the cost sharing percentage negotiated).

B. Helpful Websites

Department of Energy Application Process

C. Questions and Support

1. Questions

Upon the issuance of a NOFO, DOE personnel are prohibited from communicating (in writing or otherwise) with applicants regarding the NOFO except through the established question and answer process described below. Questions regarding this NOFO must be submitted to NextGen_GeoDrilling@ee.doe.gov no later than three (3) business days prior to the application due date and time. Please note, feedback on individual concepts will not be provided through Q&A.

All questions and answers related to this NOFO will be posted on the eXCHANGE site listed on the Opportunity details page of the NOFO. DOE will attempt to respond to a question within three (3) business days unless a similar question and answer has already been posted on the website.

Questions related to the registration process and use of the EERE eXCHANGE website should be submitted to EERE-eXCHANGESupport@hq.doe.gov.

2. Support

Grants.gov

Grants.gov provides 24/7 support. You can call 1-800-518-4726 or email support@grants.gov. Hold on to your ticket number.

SAM.gov

If you need help, call 866-606-8220 or live chat with the Federal Service Desk.

IX. Other Information

Please see the NOFO Part 2, *Other Information*, for additional information and requirements that apply to all DOE NOFOs.