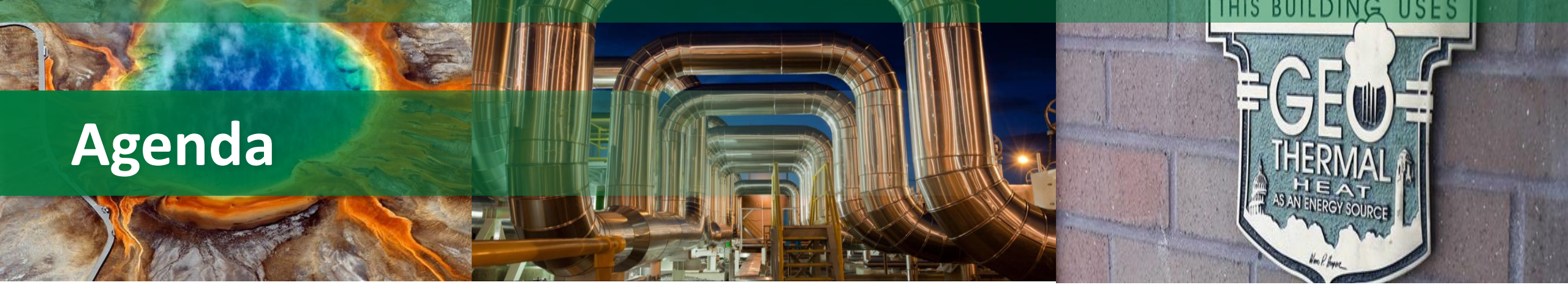
U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Geothermal Technologies Office (GTO): Quarterly Update

June 13, 2024



Agenda

- Department of Energy (DOE) and Office of Energy Efficiency and Renewable Energy (EERE) Updates
- Geothermal Technologies Office (GTO) News and Updates
  - GTO and Geothermal in the News
  - Upcoming and Recent Events
- GTO Program and Project Updates
- Q&A

DOE/EERE News and Updates

Check out what's happening at the U.S. Department of Energy (DOE) and its Office of Energy Efficiency and Renewable Energy (EERE)!

- Meet the Champions Who Used Oil Industry Know-How to Break Ground in Geothermal Energy
- DOE Announces $475 Million for Clean Energy on Mine Lands
- Energy Transitions Initiative Partnership Project (ETIPP) Releases Annual Report
- DOE Announces $100 Million toward Clean Energy Electric Grid
- $5 Million to Support Clean Energy Workforce Development at Minority-Serving Institutions (MSIs)
- $18 Million in Technical Assistance for 30 Communities to Advance Clean Energy Transition

DOE/EERE News and Updates

- EERE Resources
  - Get the latest clean energy news by signing up for the **Weekly Jolt newsletter**: your one-stop-shop for the latest articles, announcements, and upcoming events from EERE
  - Sign up for the **EERE Funding Listserv** to get updates on new funding opportunities across the office

Stay in the Know!

- Follow DOE, Secretary Granholm, and EERE on social media
- Use #GeothermalEverywhere so we can connect with you

U.S. Department of Energy

- X: @ENERGY
- Facebook: @energygov
- LinkedIn: @u-s--department-of-energy
- Instagram: @energy

Secretary of Energy

- X: @SecGranholm
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DOE Office of Energy Efficiency and Renewable Energy

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Upcoming Events

June 17–20 | **International District Energy Association Annual Conference**, Orlando, FL. *Presentation* by Arlene Anderson, GTO Low Temperature Technology Manager

June 23–26, 2024 | **American Rock Mechanics Association (ARMA) 58th U.S. Rock Mechanics / Geomechanics Symposium**, Golden, CO. *Presentation* by Kevin Jones, GTO Acting EGS Program Manager

July 17, 2024| **EUCI Heat Pump Conference**, Online. *Presentation* by Alexis McKittrick, GTO Low Temperature & Coproduced Resources and Hydrothermal Resources Program Manager

Oct. 27–30, 2024| **Geothermal Rising Conference**, Waikoloa, HI.

#GeothermalEverywhere at Recent Events!

- Deputy Secretary David Turk visited DOE's Frontier Observatory for Research in Geothermal Energy
- Secretary Jennifer Granholm announced the Next-Generation Geothermal Liftoff Report at CERAWeek. Lauren Boyd, Sean Porse, and Jason Braden also attended, and Lauren participated in multiple panels and a media roundtable.
- Alexis McKittrick gave a keynote address at the Albany NY-GEO Conference.
- Lauren Boyd participated in a fireside chat at the Bitcoin Policy Summit and gave remarks at Geothermal Rising's Thermal Energy Network Symposium.
- Alex Prisjatschew presented at the National Academies of Science Joint Board on Earth Sciences and Resources /Committee on Earth Resources Spring Meeting.
- The first-place technical team in the Fall 2023 Geothermal Collegiate Competition hosted a community stakeholder event.
- Bill Vandermeer participated in the Colorado Energy Leaders Series event at Colorado School of Mines
- Alexis McKittrick presented at the Michigan Geothermal Energy Association Conference.
- Lauren Boyd presented at the National Renewables Cooperative Organization Board Meeting.
- Mike Weathers presented at the Association of American State Geologists Annual Meeting.

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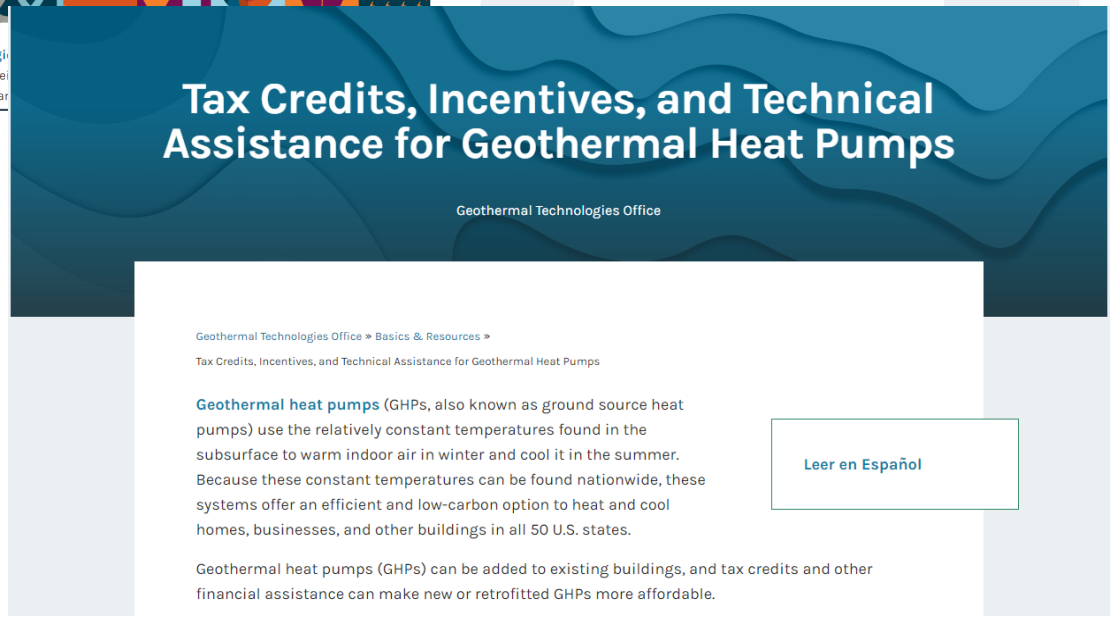
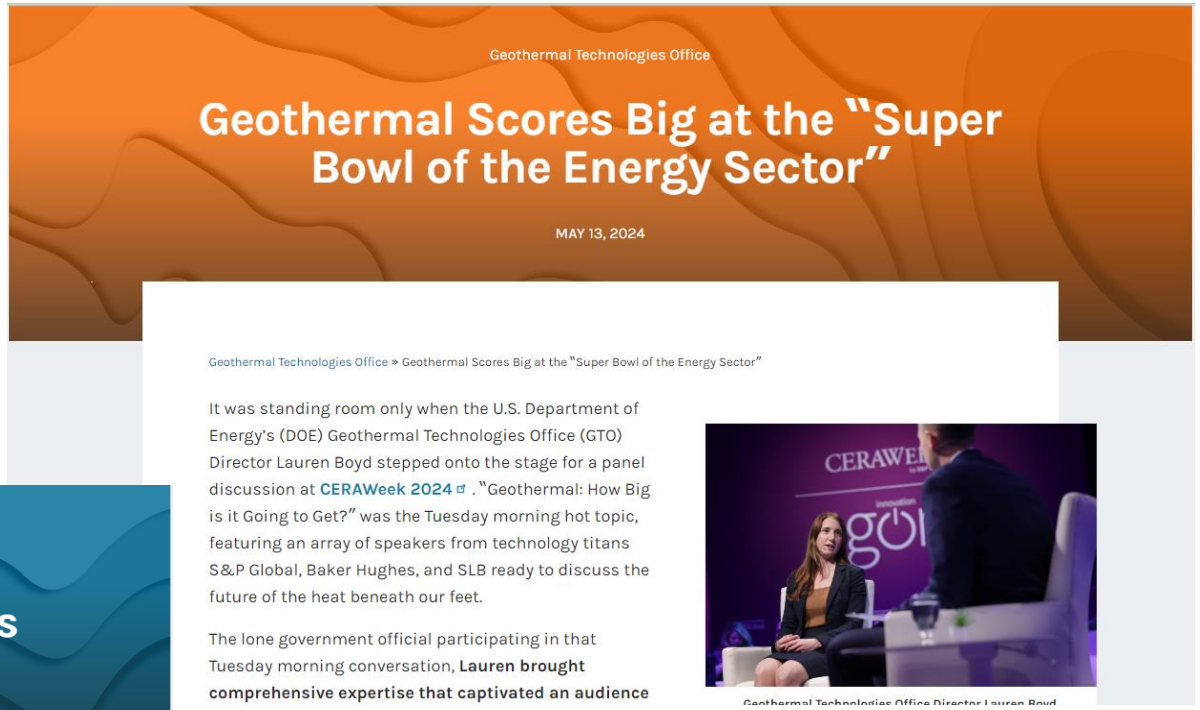
Sharing Geothermal Updates and Resources

Coming Soon
Geothermal Rising
Conference
Big Island





energy.gov/eere/geothermal/

#GeothermalEverywhere: In the News

Get news updates in *The Drill Down*! geothermal.energy.gov

Clean Technica | New Analysis: Geothermal Heat Pumps Key Opportunity in Switch to Clean Energy

Electrify News | The Race to Extract Lithium Around the Salton Sea Area (featuring EERE Principal Deputy Asst Secretary Jeff Marootian)

KXAN Austin | Geothermal Energy Showcased in Austin, Potential Powerhouse for Texas' Grid

Canary Media | New DOE-Backed Projects Tackle Factory Emissions with Heat Pumps and More

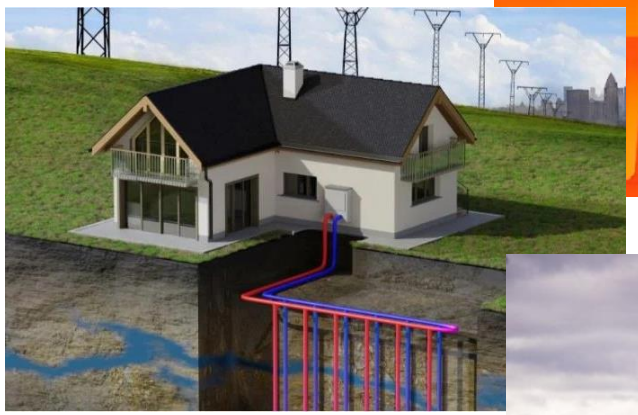
EE Power | Geothermal Heat Pumps Smooth Grid Operations

Utility Dive | Inside the Rise of Groundwater-Based Geothermal Heat Pumps

E&E News by Politico | DOE Eyes 20 Times More Geothermal Power

NPR | Oil Industry Could Help The Biden Administration Tap 'Invisible' Green Energy

Yahoo Finance | U.S. Geothermal Sector Gears Up for Commercial Liftoff



Photos top to bottom: Canary Media, ORNL, Fervo Energy, NPR

Program Updates
Data, Modeling, and Analysis

Sean Porse

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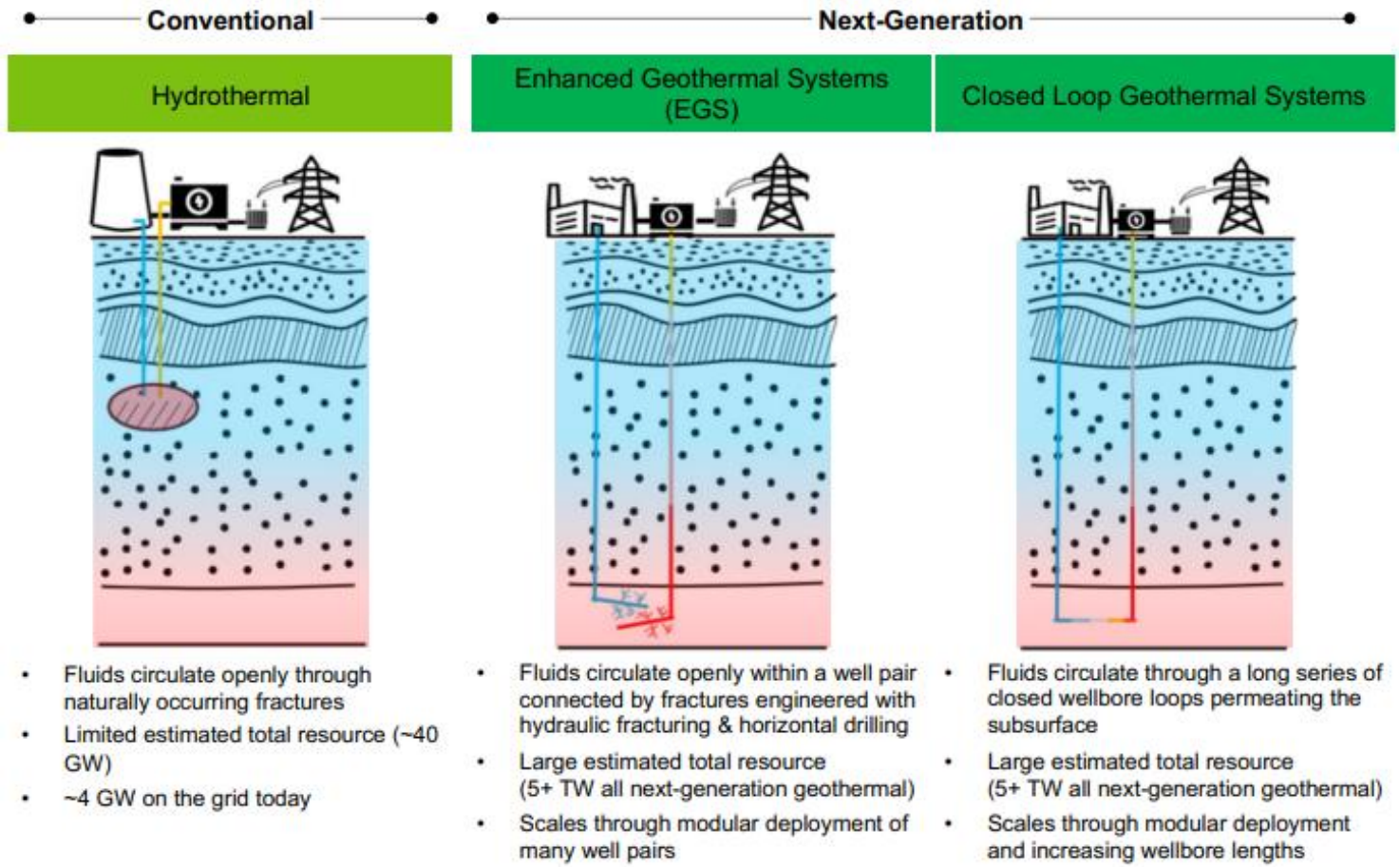
Next-Generation Geothermal Liftoff Report

- Published by DOE's Loan Programs Office; co-authored by GTO and DOE's Office of Electricity and Office of Clean Energy Demonstrations
- Highlights the significant potential for next-generation geothermal in the nation's clean energy future
- Identifies the pathways needed to help realize that full potential
- Catalogues primary challenges to reaching that potential and proposes a suite of solutions to address them



liftoff.energy.gov/next-generation-geothermal-power/

Next-Generation Geothermal Liftoff Report

Reaching Liftoff

2–5 GW ($20–25B)

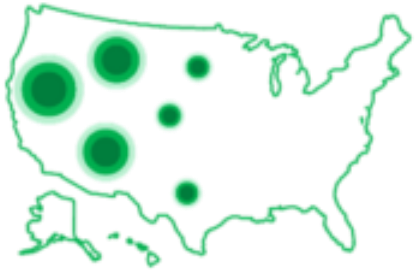
- Prove and document engineering capabilities
- Unlock access to low-risk financing and larger capital pool

Achieving Scale

88–125 GW ($225–250B)

- Mobilize new ecosystem of developers, investors, utilities, and other offtakers
- Rapidly increase inventory of economic resources
- Reduce cost with iterative improvements and implementation of new R&D
- Industrialize repeatable development process, leveraging existing oil & gas workforce and supply chain

Today — 2030 — 2040 — 2050



1. Prove market opportunity

Deployments covering 5–10 different geologic settings

2. Expand viability of geothermal resources in competitive regions

Order and deliver projects, capitalizing on existing workforce and supply chain in competitive regions

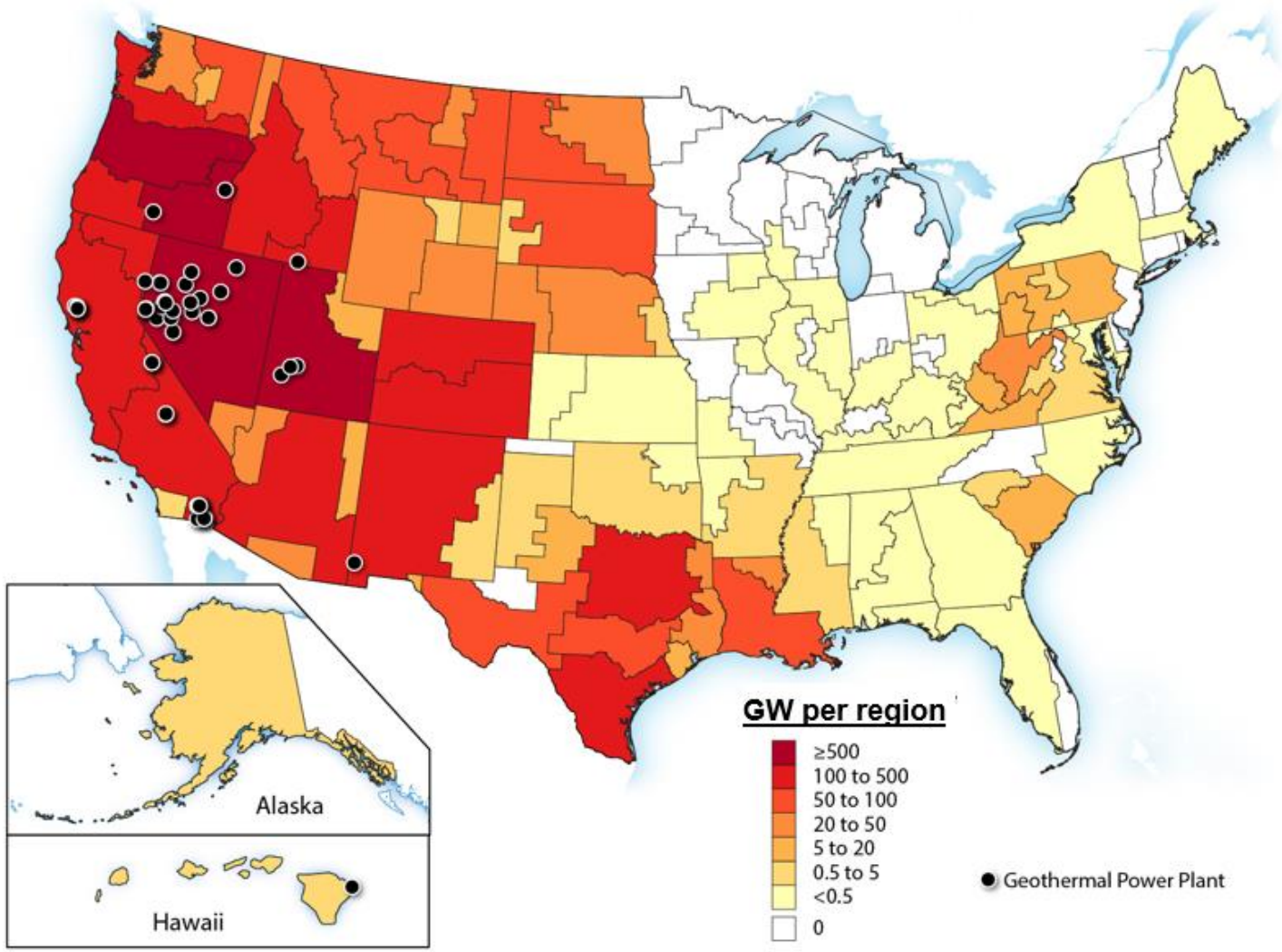
3. Expand geothermal footprint to entire United States

Order and deliver projects across entire United States

Pursue breakthrough R&D *Advances in drilling techniques and resource identification open greater potential development*

liftoff.energy.gov/next-generation-geothermal-power/

Next-Generation Geothermal Liftoff Report



Total next-generation potential, overlain with locations of current conventional geothermal plants.

liftoff.energy.gov/next-generation-geothermal-power/

Geothermal Collegiate Competition

University of Oklahoma (OU) Stakeholder Event
1st Place Winners: Technical Track (Fall 2023)

Geothermal Collegiate Competition
U.S. DEPARTMENT OF ENERGY

- Designed a system of geothermal wells in Pawhuska, OK, to heat and cool the Osage Nation's 40,000-square-foot greenhouse, supporting efforts for native food sovereignty
- Proposed geothermal system would help alleviate the challenge of maintaining a constant year-round growing temperature

Stakeholder event included:

- Networking sessions, presentations by the team and school leadership, and a tour of OU's Mewbourne School of Petroleum and Geological Engineering laboratories.

Students from the OU GCC team answer questions at the community stakeholder event. Photo courtesy OU.

energy.gov/eere/geothermal/geothermal-collegiate-competition

Geothermal Collegiate Competition Fall 2024!

Geothermal Collegiate Competition Fall 2024!

Registration for the 2024 GCC will open in August.

- Teams of three or more collegiate students—undergraduate and/or graduate—and ***all majors*** welcome and encouraged to participate!
- Opportunity to gain real-world geothermal experience and be paired with an industry mentor
- Official competition rules to be released in July.
  - First place: $10,000 and national recognition
  - Second place: $6,000
  - Third place : $2,000
  - Bonus award: $2,000 for an outstanding submission from a Tribal and/or community college.
- Info sessions: July 23 (2 pm ET) and Sept. 12 (4 pm ET)
- Mentors also needed!

Geothermal Collegiate Competition
U.S. DEPARTMENT OF ENERGY

Technical Track: Perform a resource assessment and design a geothermal heating and cooling system for a community; design can also include other renewable energy technologies and/or storage.

Policy Track: Present idea for a geothermal heating and cooling system in a community or campus, focused on analysis of the regulatory environment, economic assessment, and workforce development analysis.

Sign up for GCC updates!

energy.gov/eere/geothermal/geothermal-collegiate-competition
and herox.com/geothermalcollegiatecompetition2024

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State Stakeholder Engagement

GTO-funded engagement efforts, led by National Renewable Energy Laboratory, aim to help communities learn about geothermal energy and empower them in making decisions and choices that support their local needs.

- Currently working with Hawaiian communities
  - Follows on similar work in Alaska
  - Established a Community Council with members from more than a dozen Hawaiian organizations and state agencies
  - Collaborating to host listening sessions in the spring and summer of 2024 on multiple Hawaiian Islands.

energy.gov/eere/geothermal/community-engagement

Geothermal Resources' Value in Implementing Decarbonization (GRID)

- Geothermal power offers unique value proposition to support Administration targets of 100% carbon-pollution-free electricity by 2035 and a net-zero emissions economy by 2050
- Clean, firm resource with high capacity factor, 24/7 availability, and minimal land use footprint
- Flexible geothermal operations and geothermal power coupled with storage could broaden the breadth of services that geothermal power provides to a decarbonizing grid

GRID
Geothermal Resources' Value in Implementing Decarbonization

How can we better understand and quantify this value?

Geothermal Resources' Value in Implementing Decarbonization (GRID)

The GTO GRID funding opportunity aims to catalyze **regional grid modeling studies** that quantify the potential contribution of geothermal power in supporting an equitable transition to a future decarbonized grid and economy.

GRID
Geothermal Resources'
Value in Implementing Decarbonization

- Up to $7 million
- Teaming Partner List available

FOA questions:
Value.of.Geothermal@ee.doe.gov

energy.gov/eere/geothermal/geothermal-technologies-office-open-funding-opportunities

FOA Issue Date:	June 12, 2024
Informational Webinar:	June 26, 2024
Submission Deadline for Letter of Intent (Required):	July 24, 2024 5:00 p.m. ET
Submission Deadline for Full Applications:	September 9, 2024, 5:00 p.m. ET

Program Updates
Enhanced Geothermal Systems

Kevin Jones

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Frontier Observatory for Research in Geothermal Energy

- Commercial-scale stimulation conducted on 16A(78)-32 (injection) and 16B(78)-32 (production) to **develop interwell connectivity**
- **Successfully stimulated** both wells
- 9-hour circulation test following stimulation **proved fluid flow and energy transfer** from an EGS reservoir in hot dry granite
- Resulting sets of **data are being analyzed** to plan additional fieldwork, including a 30-day circulation test scheduled for July 2024.
  - All data are publicly available on the Geothermal Data Repository.

Stimulation activities at Utah FORGE. Photo by Lauren Boyd.

Watch a detailed update of these and FORGE's other activities: utahforge.com/2024/05/09/dr-joseph-moore-webinar-overview-of-latest-activities-at-the-utah-forge-site-egi-spring-series/

Geothermal Geophone Prize

- Selected 5 finalists in March
  - **Avalon Sciences North America**: Chirped Laser Geophone for Geothermal Boreholes
  - **GE Research**: GE MEMS Downhole Geophone
  - **Rice University Geophotonics**: Optical MEMS & Geothermal Seismology
  - **MagiQ Technologies, Inc.**: ThermaView Optical Seismic for Smart Geothermal
  - **Mustang Optics**: Photonic Seismometer for Geothermal Applications
- Each winning team received $250,000 in cash prizes and $100,000 in vouchers to use with an industry expert or national laboratory to advance their seismometer prototypes.

AMERICAN MADE GEOTHERMAL PRIZE
U.S. DEPARTMENT OF ENERGY

GEOTHERMAL GEOPHONE PRIZE

This prize offers a total of $3.65 million in incentives—
$2.55 million in cash prizes, $1.1 million in vouchers.

PHASE 1
Concept & Feasibility Development
Identify and develop initial concept for high temperature, downhole seismic sensor utilizing currently available components

PHASE 2
Design & Proof-of-Concept
Substantially advance seismic sensor concept by demonstrating design's promise in meeting engineering/operational requirements

PHASE 3
Prototype & Test
Fabricate seismic sensor prototypes based on Phase 2 design

Semifinalists receive **$150,000** cash/vouchers

New teams may join during Phase 2 without competing in Phase 1.

Finalists receive **$350,000** cash/vouchers

Winners receive **$350,000** cash prize

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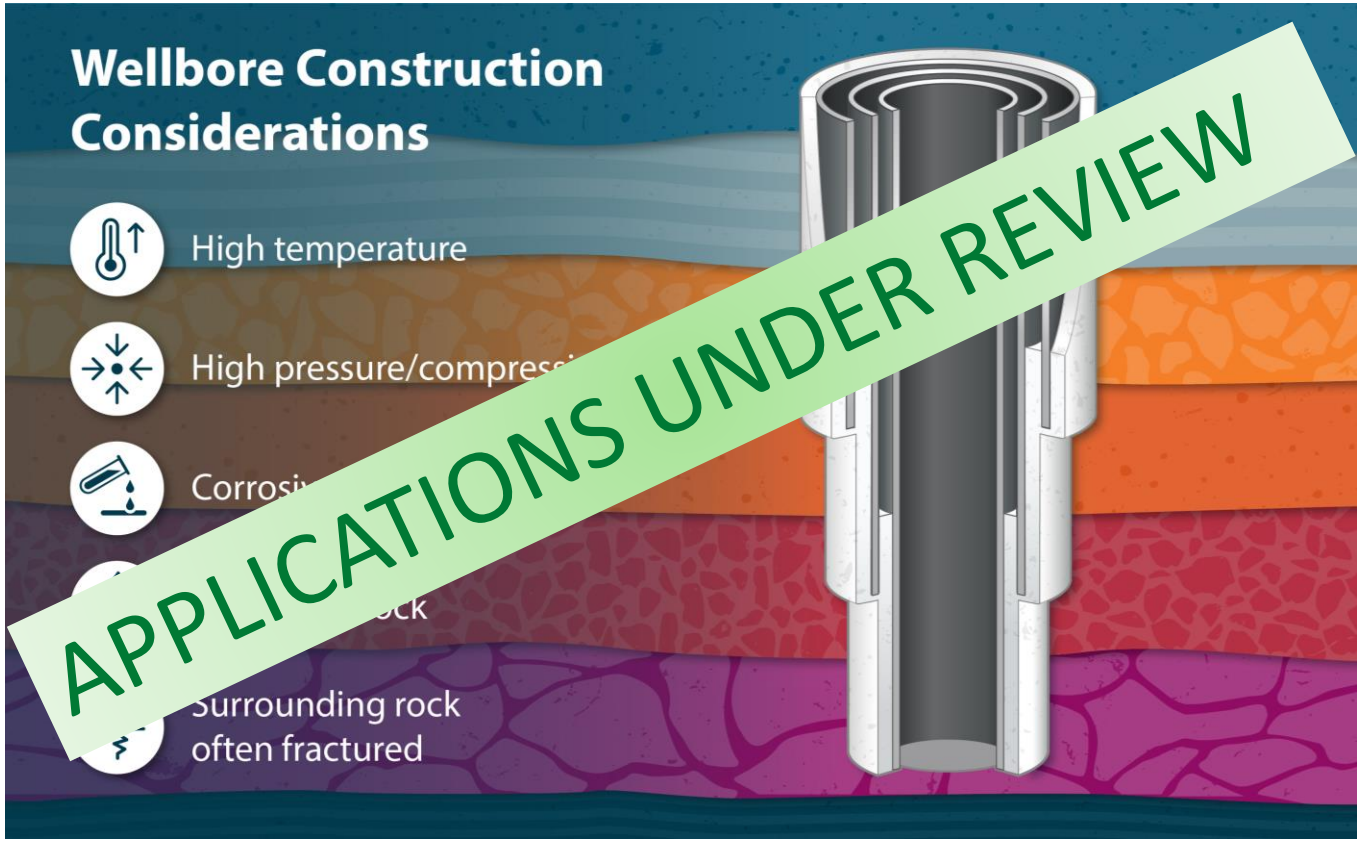
Combined Wellbore Construction and RTES Funding Opportunity

Wellbore Construction: Up to $23.1 million

Targets wellbore tools and technology that:

- Supplement and advance beyond available off-the-shelf solutions for cement and casing evaluation
- Operate in high-temperature geothermal environments
- Operate in a manner not reliant on extraneous wellbore cooling or substantial mitigation of borehole conditions
- Provide high-fidelity data to adequately characterize conditions related to safety and efficacy for long-term operation.



Topic Area 1: High Temperature Tools for Well Integrity Evaluation

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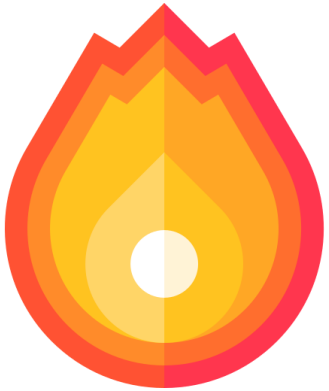

Program Updates
Hydrothermal Program

Sudeep Kanungo

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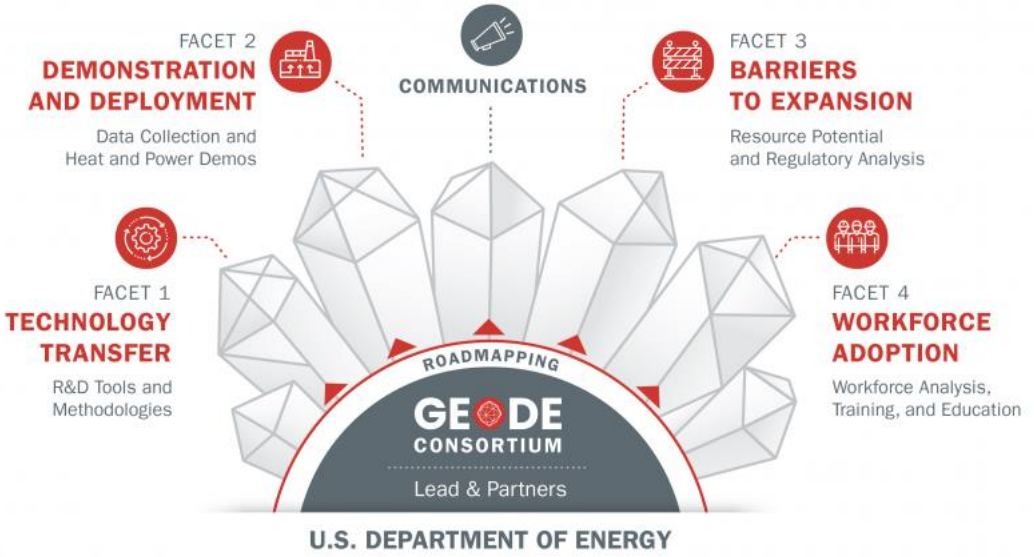
GEODE Kicks Off!

- Administrator team: Project Innerspace, Geothermal Rising, and the Society of Petroleum Engineers
- Receiving $10 million to form a consortium of experts and develop a roadmap to address technology and knowledge gaps in geothermal energy, based on best practices used within the oil and gas industry
- In subsequent years, will issue competitive solicitations to address the gaps and R&D needs identified in the roadmap *(pending appropriations)*
- R&D expected in four facets (graphic)

U.S. DEPARTMENT OF ENERGY

GEODE

Geothermal Energy from Oil + Gas Demonstrated Engineering



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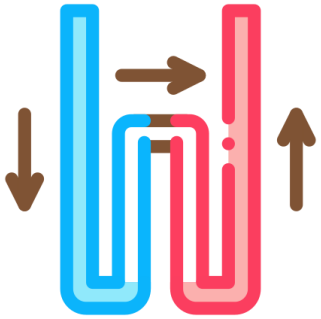
Critical Minerals Lab Call

- Call released in April for DOE national lab R&D to help advance and develop U.S. critical material supply chains
- Topic Areas:
  1. Analysis on rocks from deeper (hotter) and shallower (cooler) in the Salton Sea geothermal area
  2. Evaluation of novel drilling technology improvements to increase access to geothermal reservoirs and stabilize lithium production over time
  3. Characterization of lithium and critical materials in geothermal resource areas beyond Salton Sea region and in oil & gas resources areas
     - *Topic Area 3a: Smackover region and related oil and gas production areas*
     - *Topic Area 3b: Other Known Geothermal Resource Areas that have potential to or are currently producing lithium and other critical minerals in the United States, inc. Alaska and Hawaii.*

Spodumene. Courtesy USGS.



Program Updates
Low Temperature and Coproduced Resources

Sudeep Kanungo

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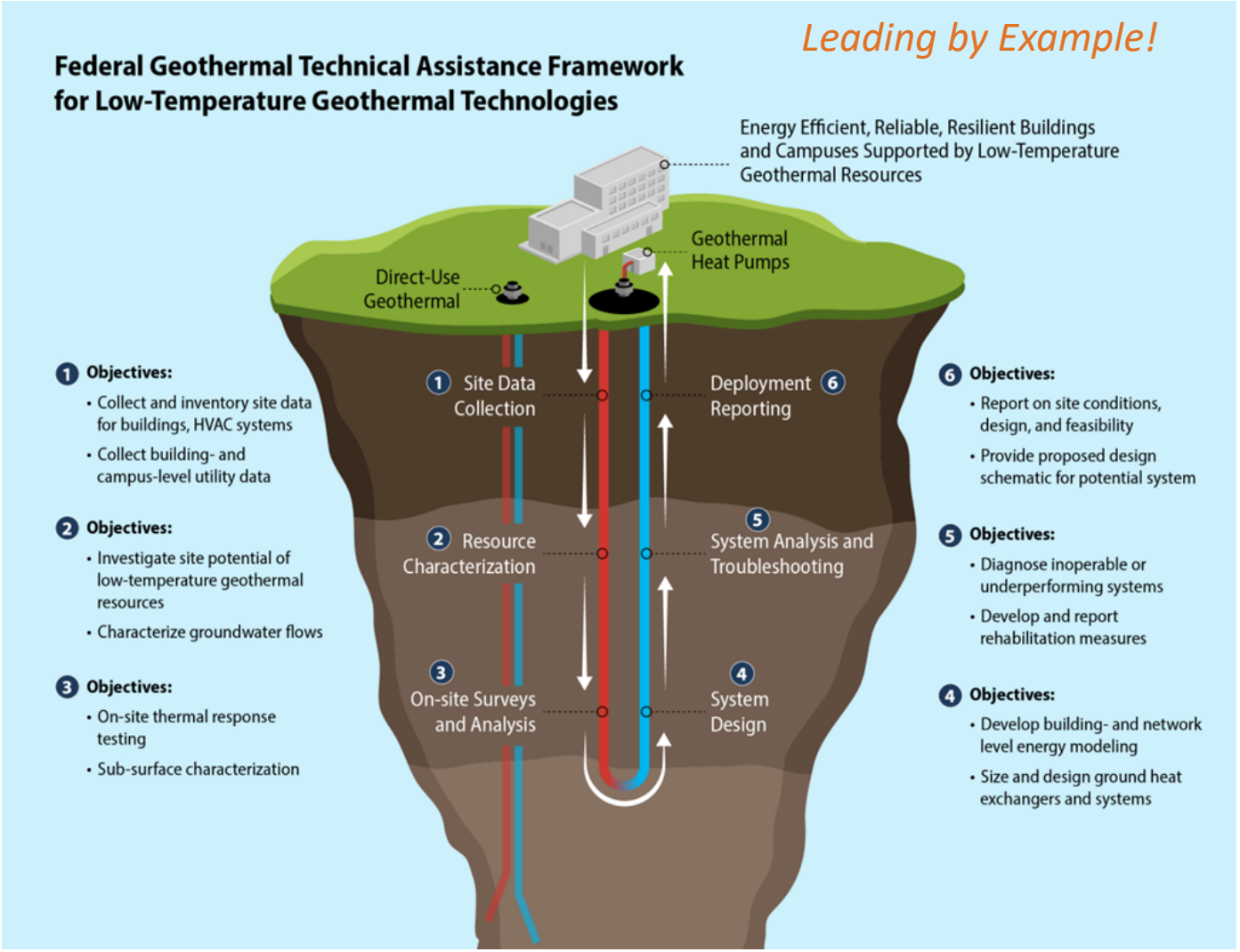
Federal Geothermal Partnerships (FedGeo)

- Partnership between GTO and DOE's Federal Energy Management Program
- Work led by Oak Ridge National Laboratory and its partners
- Effort aims to:
  - Focus on low-temperature geothermal (not power generation)
  - Identify opportunities for low-temp geothermal to meet the needs of federal facilities
  - Enable wider adoption of low-temp geothermal in federal buildings and other buildings in the United States.

Leading by Example!



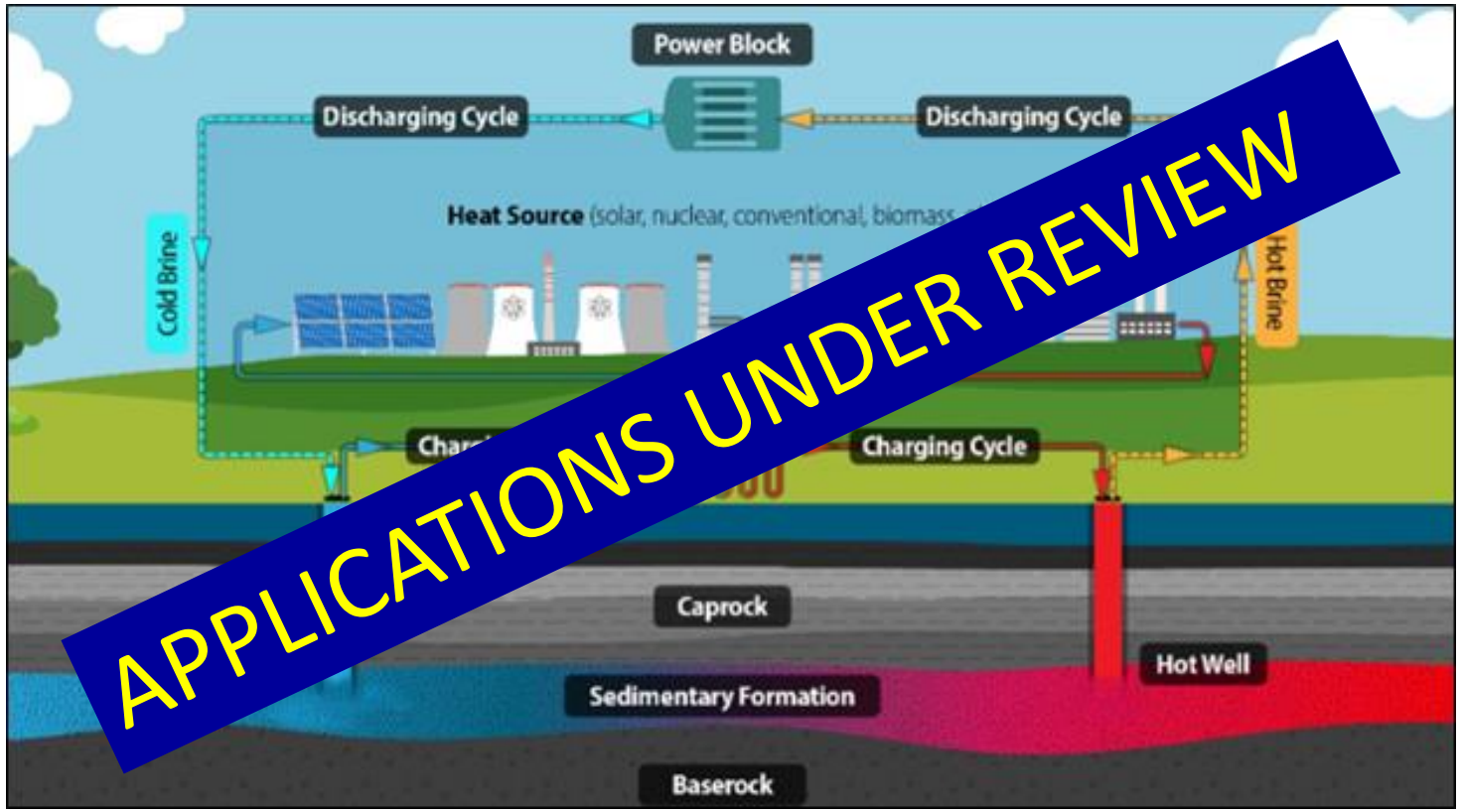
energy.gov/eere/geothermal/federal-geothermal-partnerships

FedGeo Update

- Michigan-based Midwest Geothermal executed a 500-foot mud rotary drilling of the geothermal test well at the U.S. Army's Garrison Detroit Arsenal.
- Fiber optic cables installed during the process will be monitored by the University of Wisconsin over five days to collect site data.
- The data will be integral to creating building models and designs for optimal system performance.
- More information and photos at www.army.mil/article/276775/detroit_arsenal_taps_into_geothermal_power_under_doe_partnership

Info from U.S. Army. Photo courtesy Shannon Bergt.

Combined Wellbore Construction and RTES Funding Opportunity



Topic Area 2: Utilization of Reservoir Thermal Energy Storage Technology and Low-Temperature Geothermal Resources as part of an Industrial Process

Reservoir Thermal Energy Storage (RTES):
Up to $7.9 million

Seeks to demonstrate low-temperature (<130◦ C) RTES technology:

- To reduce emissions from energy-intensive processes using industrial heating, e.g., removing moisture, separating chemicals, treating metals
- With reservoir formations below aquifer systems used for potable water
- Offering a minimum of 10 hours of thermal storage, with preference given to longer-duration storage systems

Learn more on GTO's funding opportunities page: geothermal.energy.gov

Affordable Home Energy Shot™

- Aims to reduce upfront cost of upgrading a home by at least 50% while reducing energy bills by 20% within a decade
- Focus on affordable, scalable solutions that can upgrade buildings of all types
- Intent is to address the persistent burdens faced by low-income households and communities of color
- Centered on building innovations in three pivotal areas:
  - Building upgrades
  - Efficient electrification
  - Smart controls

ENERGY earthshots U.S. DEPARTMENT OF ENERGY | Affordable Home Energy™

50%+ Technology Cost Reduction

20% Lower Cost

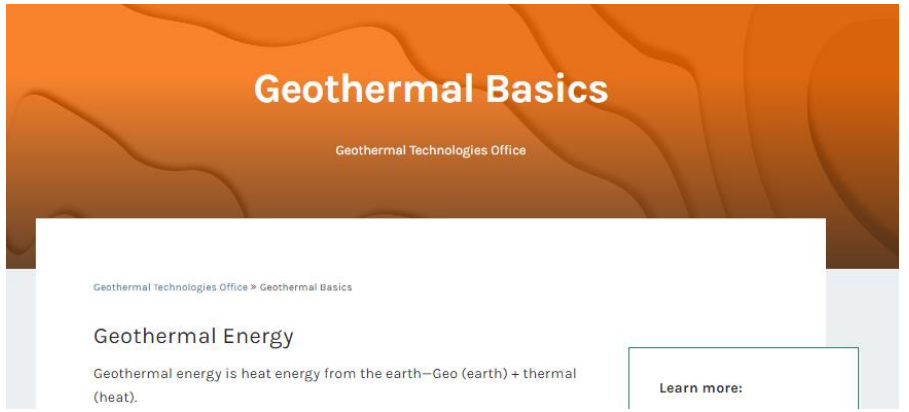
Within the Decade

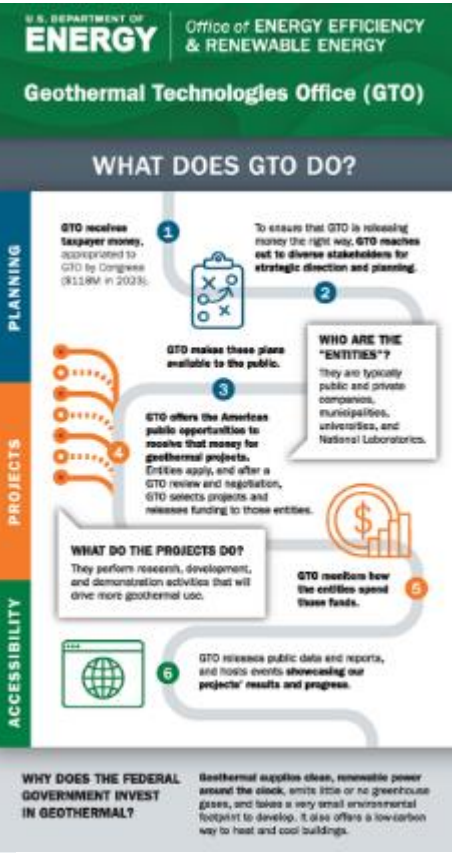
energy.gov/eere/affordable-home-energy-shot

How to Engage with GTO

GTO uses multiple tools and resources to help communicate funding opportunities, provide education about geothermal energy, and engage with stakeholders.

- *The Drill Down* Newsletter
- Funding Opps Webpage
- Funding Opp Quick Guides
- GHP tax credits, incentives, and tech assistance page (in English and Spanish)
- Website (***scan QR code!***)
- Infographics
- Success Stories





geothermal.energy.gov

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Question-and-Answer Session

the drill down

Get the hottest geothermal news from *The Drill Down*, GTO's monthly newsletter!

Sign up today:

geothermal.energy.gov

Interested in serving as a merit reviewer for GTO RD&D projects?

Send us your resume or CV:

doe.geothermal@ee.doe.gov

FORGE photo by Eric Larsen, SLC Flashpoint

Thank you!

The **Geothermal Technologies Office (GTO)** works to reduce the cost and risk associated with geothermal development by supporting innovative technologies that address key exploration and operational challenges.

Visit our website at energy.gov/eere/geothermal or by scanning the QR code.