U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Geothermal Technologies Office: Quarterly Update

November 30, 2023

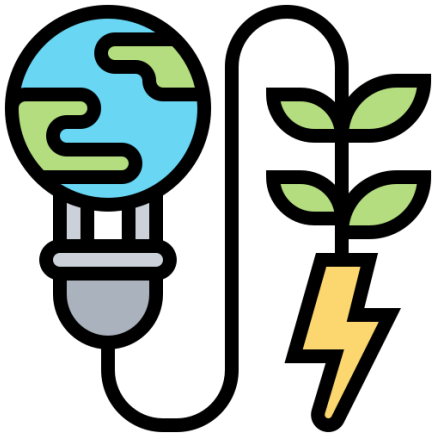
Agenda

- Department of Energy / Office of Energy Efficiency and Renewable Energy Updates
- GTO #GeothermalEverywhere
  - Recent Events
  - Upcoming Events
  - In the News
- Sharing Geothermal Updates
- GTO Program Area Updates
  - **Spotlight: Frontier Observatory for Research in Geothermal Energy New R&D Selections, Scott Beautz (National Energy Technology Laboratory)**
- Q&A

Enter your questions into the Q&A tab anytime during the webinar!

DOE/EERE News & Updates

- Department of Energy (DOE)
  - $169 Million to Accelerate Electric Heat Pump Manufacturing
  - $3.5 Billion to Strengthen Domestic Battery Manufacturing
  - EnergyTech University Prize Opens
  - $18 Million for Clean Energy-Related Economic Development in Low-Income, Energy-Burdened Communities



- Office of Energy Efficiency and Renewable Energy (EERE)
  - John Palo Wants a Geothermal Heat Pump in Every U.S. Home and Building
  - Up to $7.5 Million to Support Clean Energy Innovation in Underserved Communities

- Office of Science
  - DOE Announces $264 Million for Basic Research in Support of Energy Earthshots
  - Small Business Innovation Research and Small Business Technology Transfer (STTR) Program Releases New Topics

- Office of Fossil Energy and Carbon Management
  - $3.5 Million to Provide Workforce Development Opportunities in Energy Communities

DOE/EERE News & Updates

Jolt Newsletter

- Get the latest clean energy news by signing up for the Weekly Jolt: your one-stop-shop for the latest articles, announcements, funding opportunities, and upcoming events from EERE!

Get Real-Time Updates!

- Follow DOE, Secretary Granholm, and EERE on social media
- Use #GeothermalEverywhere

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Secretary of Energy

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

- Twitter: @eeregov
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- LinkedIn: @eeregov

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#GeothermalEverywhere: Recent Events

- 2023 **Geothermal Rising Conference**
- Deputy Secretary David Turk spoke about geothermal and other clean energy topics at The Atlantic Festival.
- Lauren Boyd presented in Geothermal Rising's Full Steam Ahead webcast series and to the Chicago and Colorado 350 chapters.
- Alexis McKittrick presented at an International Ground Source Heat Pump Association Town Hall and at DOE's Justice40 week.
- Alex Prisjatschew presented at the Clean Energy States Alliance domestic lithium webinar.
- Angel Nieto, George Stutz, and Jennifer Livermore presented at the Society of Petroleum Engineers and Geothermal Rising's Geothermal and Oil & Gas Workshop.
- Jeff Bowman presented at DOE's Industrial Heat Shot™ Summit.

SPE International

GEOTHERMAL RISING
POWERING OUR RENEWABLE FUTURE

ENERGY earthshots
U.S. DEPARTMENT OF ENERGY

Industrial Heat™

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Upcoming Events

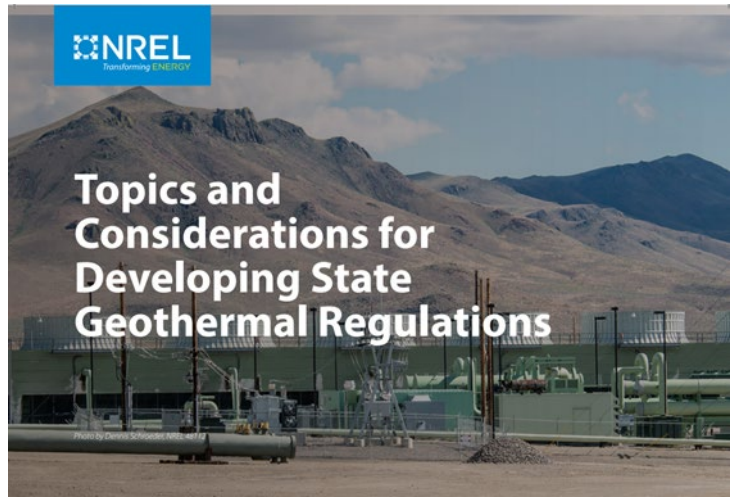
2023

- Dec. 6–8 | International Ground Source Heat Pump Association (IGSHPA) Annual Conference, Las Vegas, NV. *Keynote* by Alejandro Moreno.
- Dec. 19 | National Renewable Energy Laboratory, Topics and Considerations for Developing State Geothermal Regulations Webinar, virtual.

2024

- Jan. 26 | IGSHPA Dig Deeper Webinar, virtual.
- Feb. 12–14 | Stanford Geothermal Workshop, Stanford, CA. Early bird reg. ends Jan. 8.

International Ground Source Heat Pump Association



Stanford | Doerr School of Sustainability

#GeothermalEverywhere: In the News

Gulf Oil & Gas | NSF-DOE Geothermal INTERN Opportunity Supports Growth of Geothermal Energy Workforce

KUER 90.1 | How rural southwest Utah is proving the potential of renewable geothermal energy

Los Angeles Times | The Salton Sea has even more lithium than previously thought (Alex Prisjatschew featured!)

PBS EnergySwitch (TV) | Energy Switch | What's New in Geothermal? (Lauren Boyd featured!)

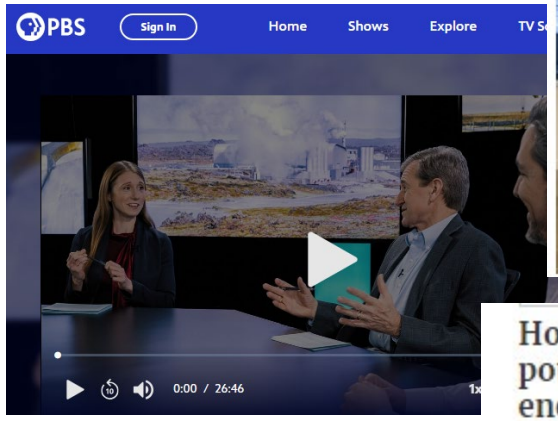
PBS NewsHour | Governors, Biden administration push to quadruple efficient heat pumps by 2030

TechXplore | New approach may help extract more heat from geothermal reservoirs

Telemundo Utah | Estudiante mexicano se destaca en doctorado en Geofísica en la Universidad de Utah

ThinkGeoEnergy | Fervo Energy Breaks Ground on Next-gen Geothermal Project in Cape Station, Utah

Wall Street Journal: Future of Everything Podcast | Going Electric? Why Future Power Could Come From Hot Rocks (Lauren Boyd featured!)

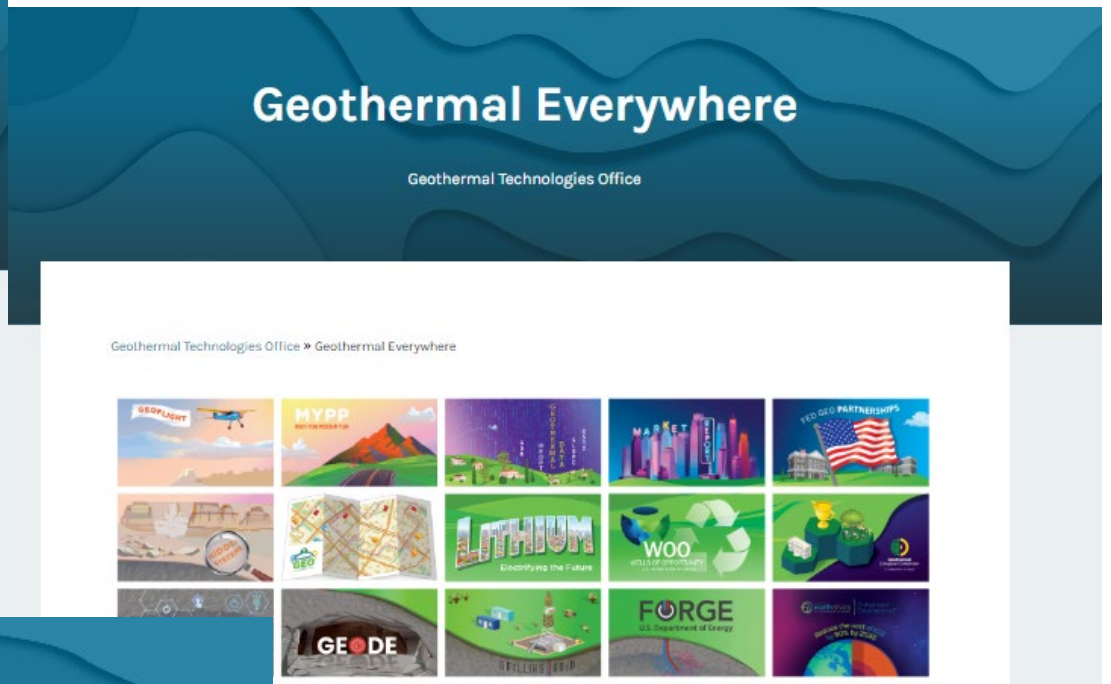



How rural southwest Utah is proving the potential of renewable geothermal energy

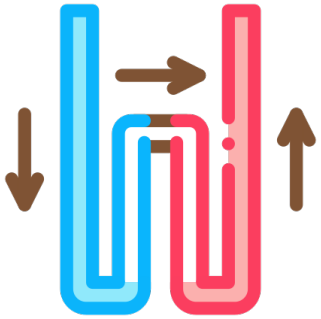

SEPTEMBER 20, 2023
New approach may help extract more heat from geothermal reservoirs
by Matthew Carroll, Pennsylvania State University
To produce more efficient geothermal systems, researchers have proposed a process calle...

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

Sharing Geothermal Updates and Resources



energy.gov/eere/geothermal/



Program Updates
Low-Temperature and Coproduced Resources Program

Alexis McKittrick

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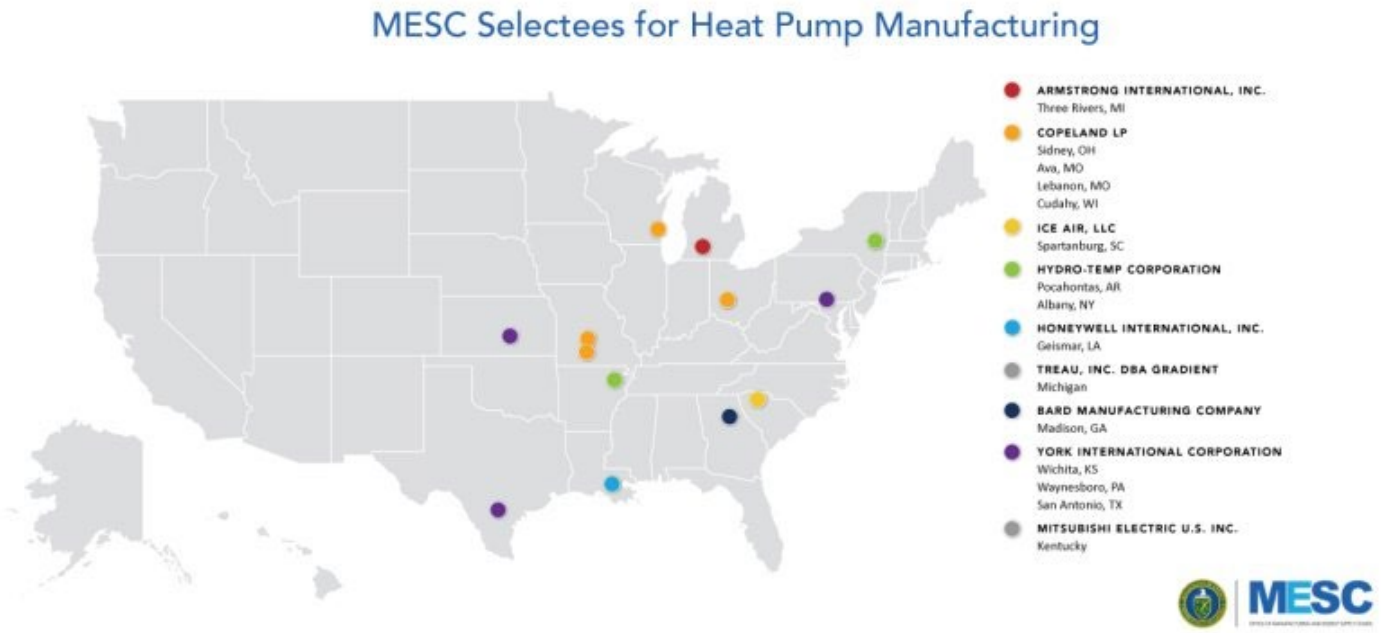
Heat Pump Manufacturing

- Nine projects selected to receive up to $169 million to accelerate electric heat pump manufacturing at 15 sites in 13 states

- First awards from DOE's authorization to use the Defense Production Act to increas domestic production of five key clean energy technologies, including ground-source (geothermal) and air-source electri heat pumps.

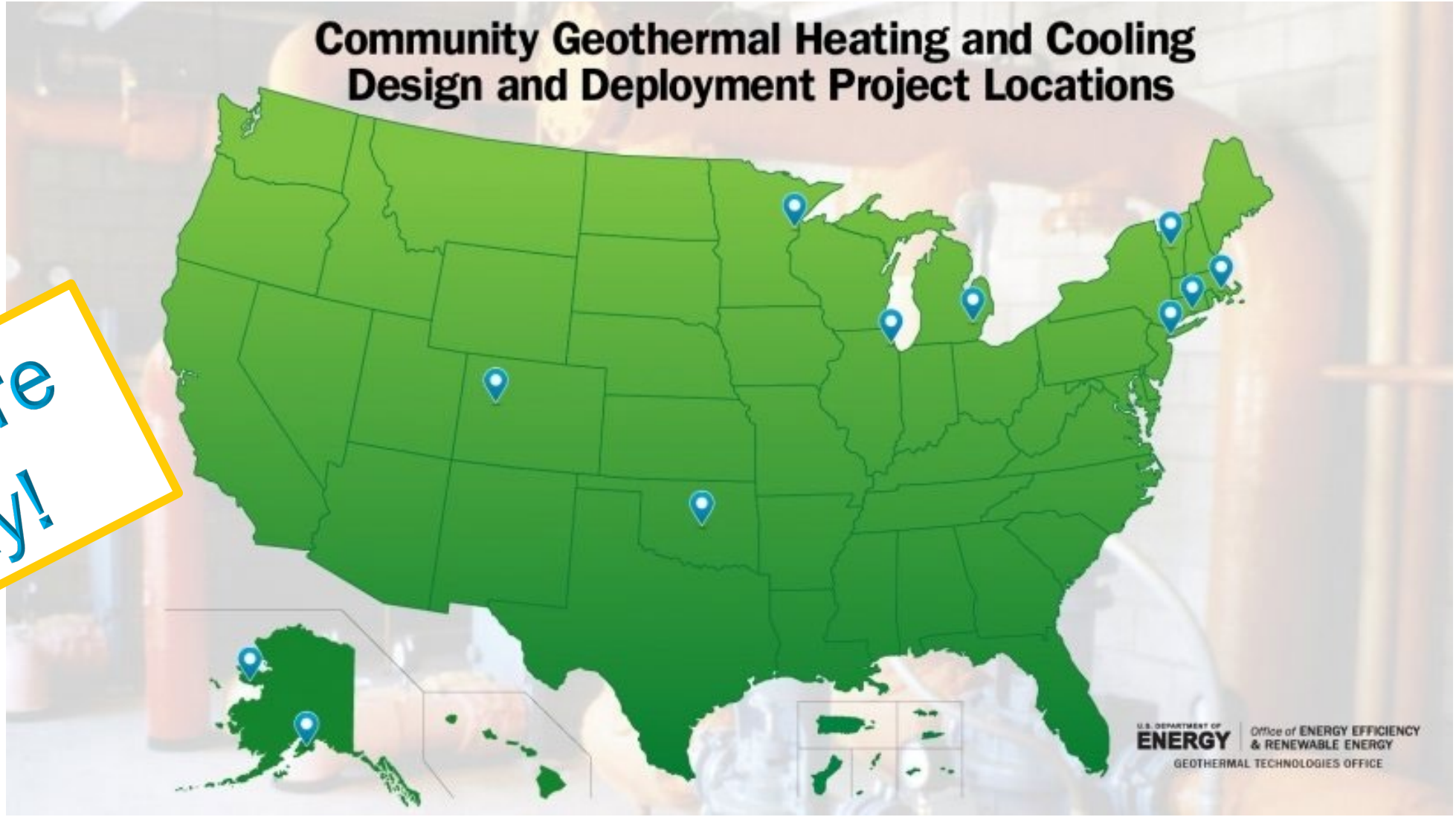
- Two projects that include geothermal heat pumps:
  - Ice Air, LLC, Spartanburg, SC
  - Hydro Temp Corporation, Pocahontas, AR and Albany, NY



Community Geothermal Projects

COMMUNITY GEO
U.S. Department of Energy

Projects are underway!



Program Updates
Hydrothermal Program

Alexis McKittrick

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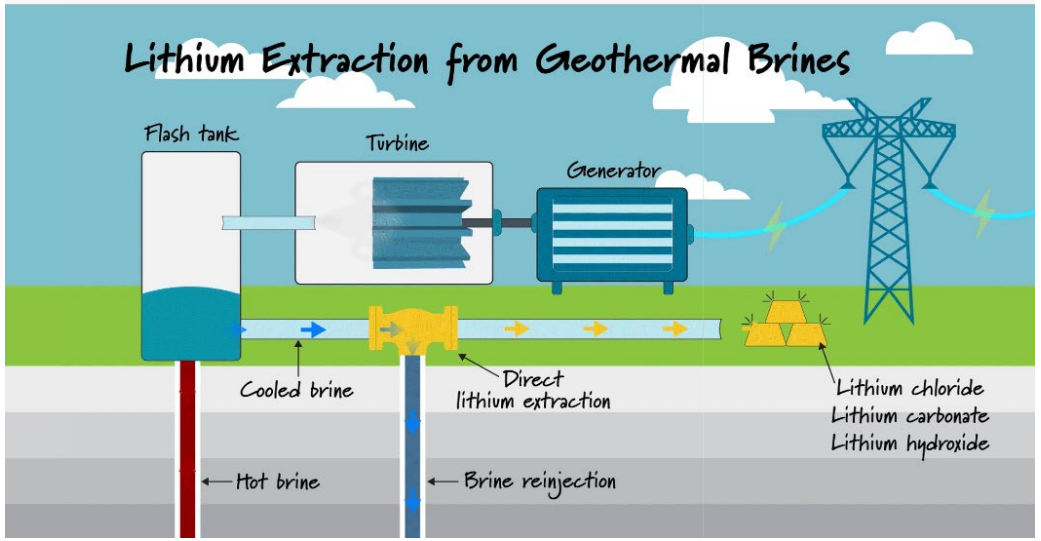
Lithium Extraction Prize

- Over two years, competitors advanced through three phases—concept to design to prototype—for innovations to directly extract lithium from the hot water used to produce geothermal energy

- Three teams split a total of $2 million:
  - **Winning Team ($1 million)**: University of Illinois Urbana-Champaign; Team SelectPureLi, *A Redox Membrane for Lithium Hydroxide Extraction*
  - **Runner-Up ($500,000)**: University of Virginia; Team TELEPORT, *Targeted Extraction of Lithium with Electroactive Particles for Recovery Technology (TELEPORT)*
  - **Runner-Up ($500,000)**: George Washington University; Team Ellexco, *Chemical-Free Extraction of Lithium from Brines*



Visit our Lithium Storymap to learn more about this critical material! energy.gov/eere/geothermal/lithium-storymap

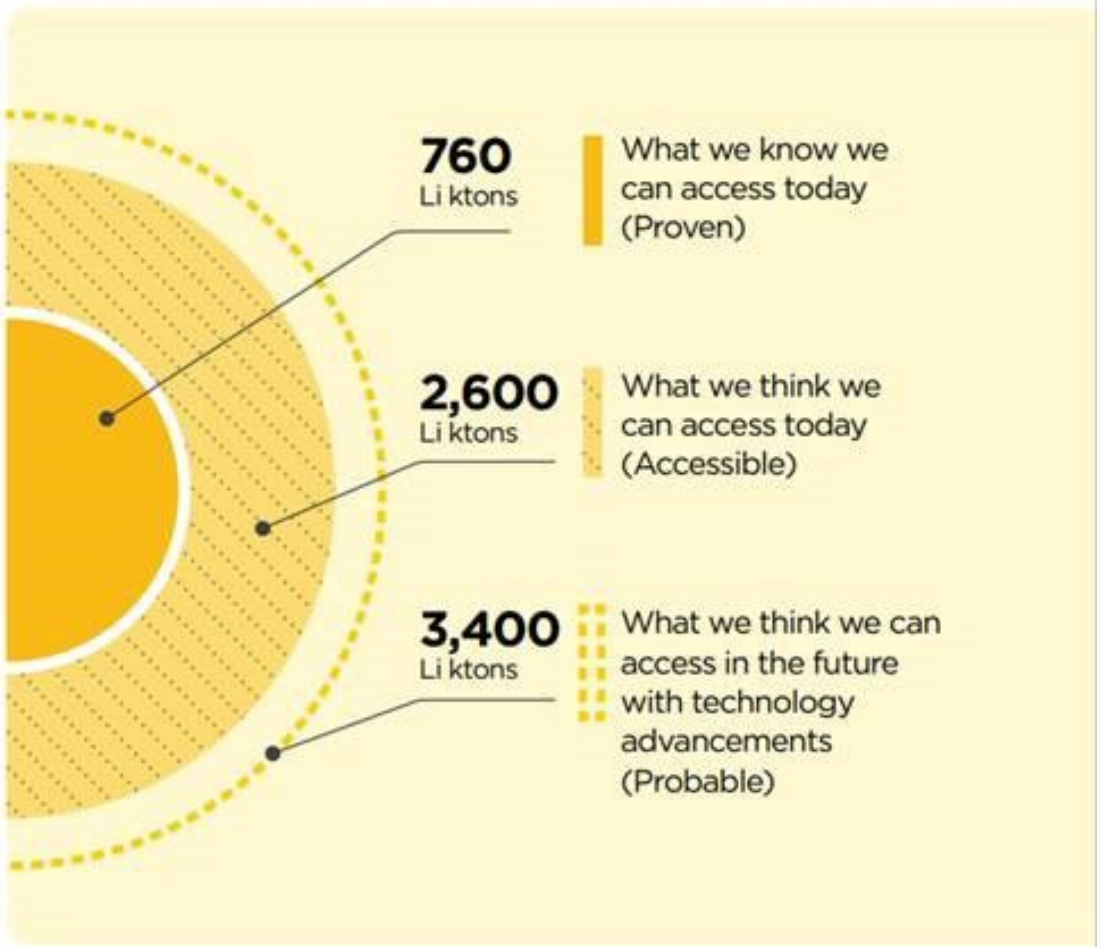
Lithium in the Salton Sea Geothermal Area

Analysis and report by Lawrence Berkeley National Laboratory just released!

- Lithium resource in Salton Sea Known Geothermal Area could provide the country with enough secure, domestic lithium to support **more than 375 million electric-vehicle batteries—exceeding all the vehicles currently on U.S. roads.**

- Accessing this resource would enable the United States to **meet or exceed global lithium demand for decades.**

Extracting lithium from geothermal brines offers the country its only opportunity to pair clean, renewable electricity generation with the retrieval of a domestic source of a critical mineral essential to overcoming the climate crisis.



energy.gov/eere/geothermal/lithium

Program Updates
Data, Modeling, and Analysis

Jeff Bowman

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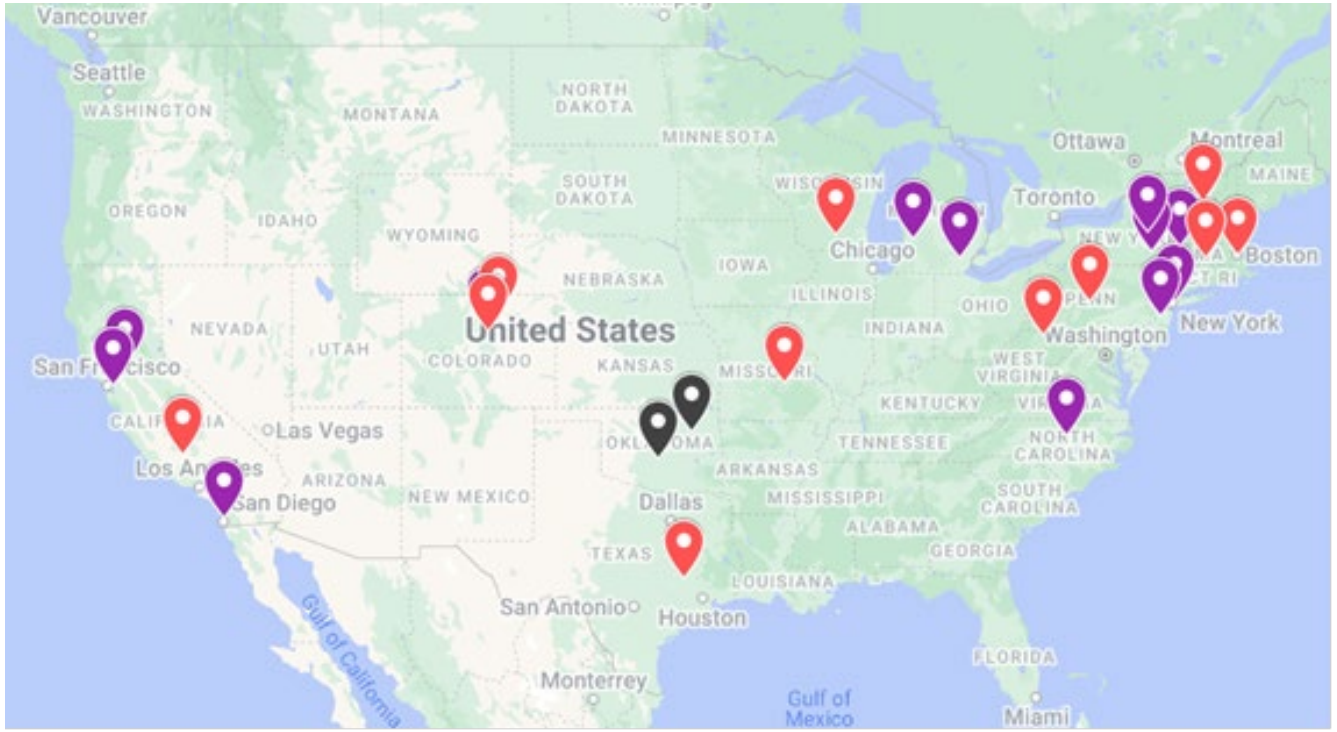
Geothermal Collegiate Competition

Fall 2023 competition is underway!

A total of 33 from 25 U.S. collegiate institutions have registered!

- 21 teams registered for Technical Track
- 12 teams registered for Policy Track (new for 2023)
- 19 teams also took advantage of option to be paired with a mentor



Participating teams; colors denote tracks: Policy (purple), Technical (pink), both (black)

Submissions are due Dec. 20th!

Want to be part of next year's competition as a team or a mentor? Sign up for updates through the GCC website.

Considerations for Geothermal Regulations

Analysis and report from National Renewable Energy Laboratory

- Synthesizes existing state and federal geothermal regulations, best practices from geothermal and other extractive industries, and review/advice from a Geothermal Regulatory Stakeholder Working Group to detail information states might find valuable when developing geothermal regulations

- Provides considerations in five key areas:
  - Geothermal resource ownership and definition
  - Leasing process
  - Exploration approval process
  - Drilling/wellfield development approval process
  - Underground injection control process

Webinar Dec. 19, 2023, 1:00 pm ET

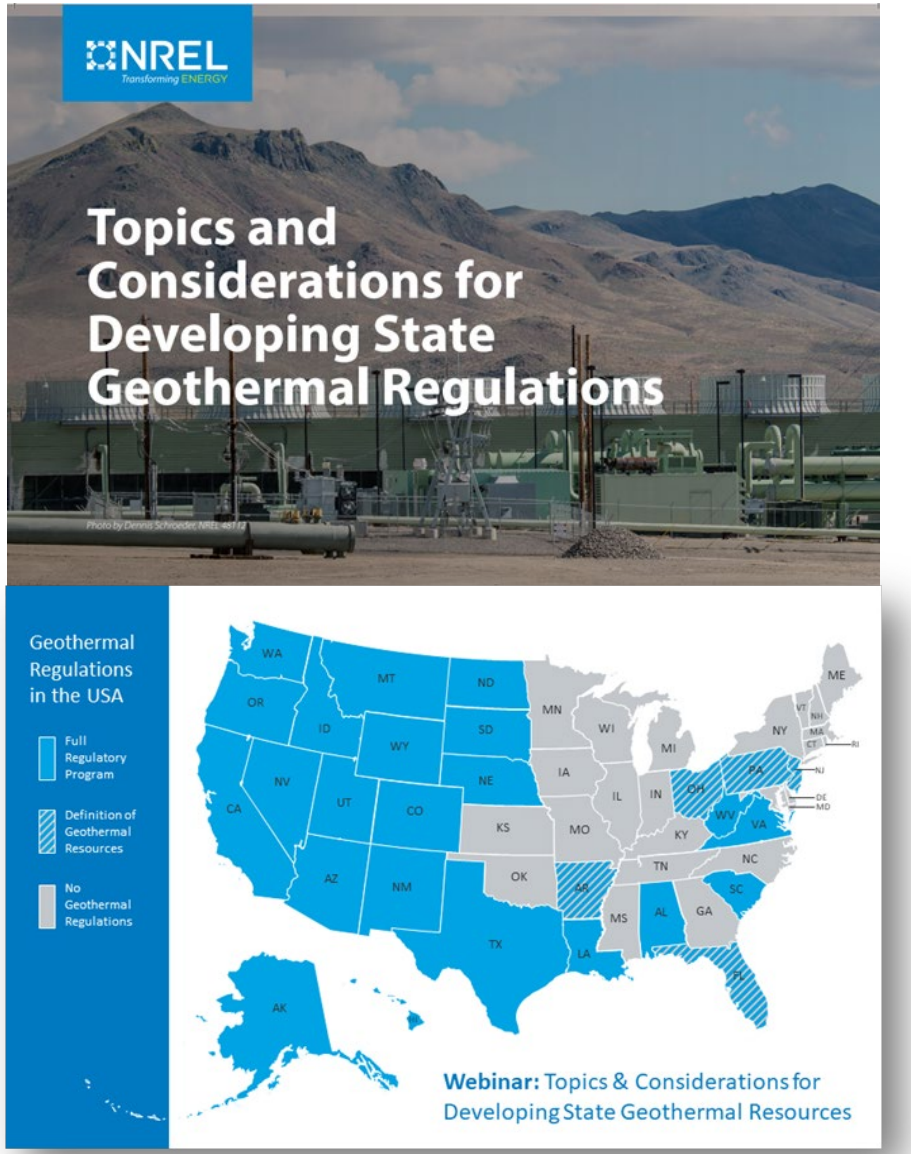


Photo and graphic by NREL

Geothermal Analysis Tools

New feature in NREL's **REopt** web tool allows users to compare GHP and hybrid geothermal heat exchange systems using information like system size, intended use, and current energy costs to identify optimally sized heating and cooling solutions

https://reopt.nrel.gov/

GeoCLUSTER

Geothermal Closed-Loop USer Tool in Energy Research

https://geocluster.labworks.org/

GeoCLUSTER allows users to evaluate thermal and economic performance of closed-loop geothermal systems, and to optimize economic competitiveness using levelized cost of heat and levelized cost of electricity.

NREL wants your thoughts on data and analytical tools that work for you!

Help shape the future of geothermal analysis in the NREL Geothermal Energy Atlas User Insights Questionnaire.

Program Updates
Enhanced Geothermal Systems

Kevin Jones

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Geothermal INTERN

energy.gov/eere/geothermal/nsf-intern-program

GTO and the National Science Foundation selected first cohort in August

- Fourteen students representing 11 colleges and universities nationwide, including two Hispanic-Serving Institutions, as well as an array of ethnic or cultural backgrounds and academic disciplines
- Applications on a rolling basis
- Program expected to support up to 20 students in FY 2024.

Frontier Observatory for Research in Geothermal Energy (FORGE) Updates

Scott Beautz, Engineer and Project Manager

National Energy Technology Laboratory

NATIONAL ENERGY TECHNOLOGY LABORATORY

UTAH FORGE

U.S. Department of Energy

energy.gov/eere/geothermal/forge

utahforge.com

FORGE newsletter: utahforge.com/latest-news/#research-news

FORGE R&D Solicitations

- FORGE R&D solicitations aim to facilitate and spur transformative enhanced geothermal systems (EGS) research across the geothermal community, culminating in rigorous and reproducible EGS technical solutions and a pathway to commercial EGS development.
- Five primary desired outcomes:
  - Gain fundamental understanding of key mechanisms controlling fracture generation, fluid flow, heat transfer, and sustainability of EGS reservoirs
  - Allow the research community to develop, test, and improve EGS technologies
  - Enable rapid dissemination of technical data to the research community, developers, and other stakeholders
  - Enable a pathway towards a rigorous and reproducible EGS development approach
  - Reduce uncertainty and risk for commercial development.

FORGE Solicitation 2020-1

- FORGE Solicitation 2020-1 awarded $49 million to 17 projects to advance EGS.
- Five topic areas:
  - Devices Suitable for Sectional (Zonal) Isolation Along Both Cased- and Open-Hole Wellbores Under Geothermal Conditions
  - Estimation of Stress Parameters
  - Field-Scale Characterization of Reservoir Stimulation and Evolution Over Time, Including Thermal, Hydrological, Mechanical, and Chemical Effects
  - Stimulation and Configuration of the Wells at Utah FORGE
  - Integrated Laboratory and Modeling Studies of the Interactions Among Thermal, Hydrological, Mechanical, and Chemical Processes

Awardees (Solicitation 2020-1)

Battelle Memorial Institute
Clemson University
Colorado School of Mines
Fervo Energy Company
Lawrence Berkeley National Laboratory
Lawrence Livermore National Laboratory
Pennsylvania State University
PetroQuip Energy Services
Purdue University
Rice University
Stanford University
U.S. Geological Survey
University of Oklahoma
University of Texas at Austin
Welltec

Data from FORGE R&D projects are available in the Geothermal Data Repository (https://gdr.openei.org/

FORGE Solicitation 2022-2

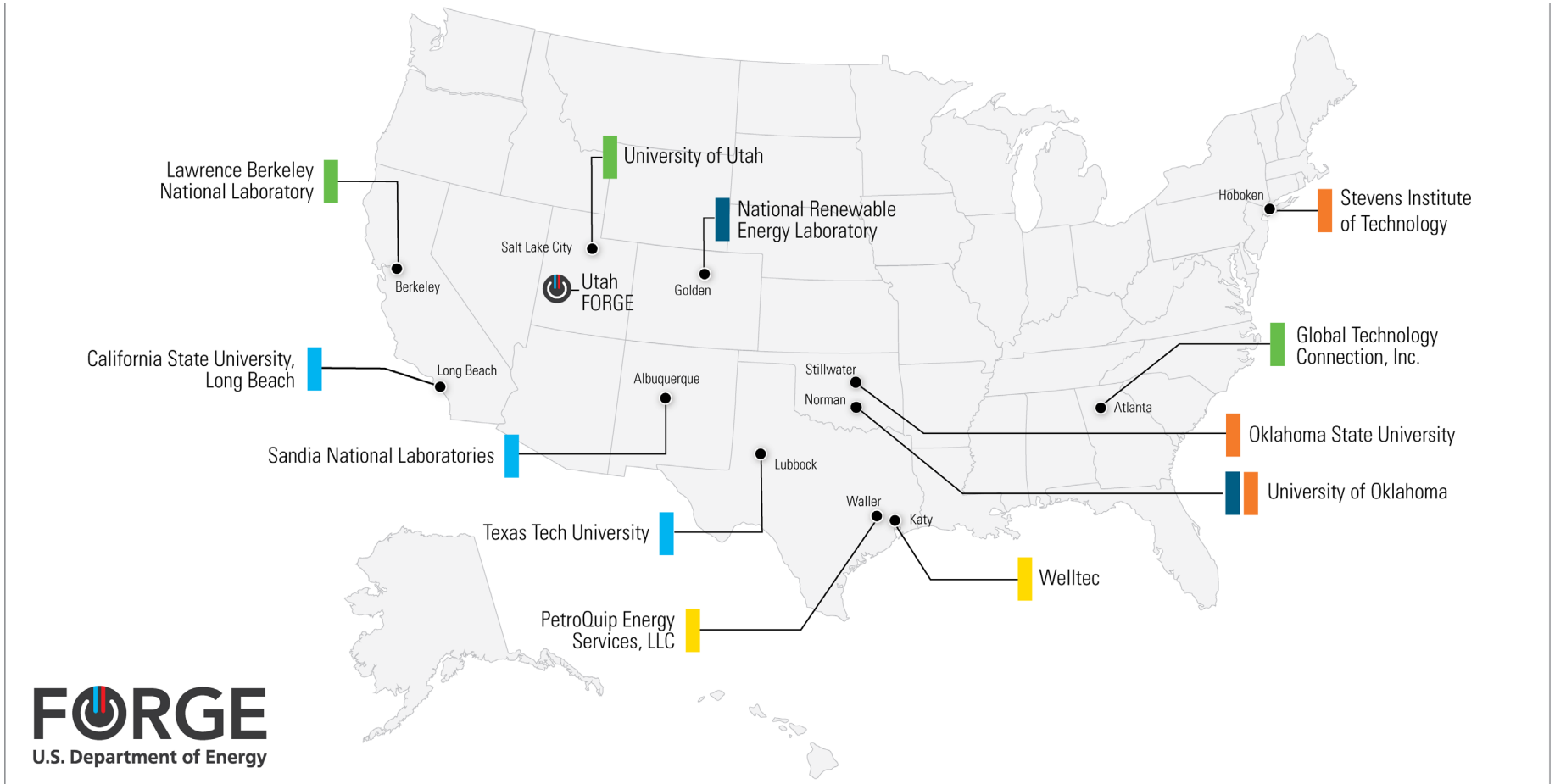
FORGE Solicitation 2022-2 was released in August 2022, providing up to $44 million for projects to develop and test technology to foster innovation in EGS.

Five topic areas:

- Adaptive Induced Seismicity Monitoring Protocols
- Alternative Stimulation Schemes
- Field Scale Experiments to Measure Heat-Sweep Efficiency
- High Temperature Proppants
- Multiset Straddle Packers for Open Hole Operations

Eric Larsen, Flashpoint SLC

FORGE Solicitation 2022-2 Prime Selectees



Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
Adaptive Induced Seismicity Monitoring Protocols	Alternative Stimulation Schemes	Field Scale Experiments to Measure Heat-Sweep Efficiency	High Temperature Proppants	Multiset Straddle Packers for Open Hole Operations

energy.gov/eere/articles/us-department-energy-announces-13-projects-receive-44-million-innovations-enhanced

FORGE Solicitation 2022-2 Selected Projects (Prime Selectees)

Topic 1: Adaptive Induced Seismicity Monitoring Protocols

- Global Technology Connection, Inc. | Atlanta, GA
- Lawrence Berkeley National Laboratory | Berkeley, CA
- University of Utah | Salt Lake City, UT

Scott Beautz, National Energy Technology Laboratory

FORGE Solicitation 2022-2 Selected Projects (Prime Selectees)

Topic 2: Alternative Stimulation Schemes

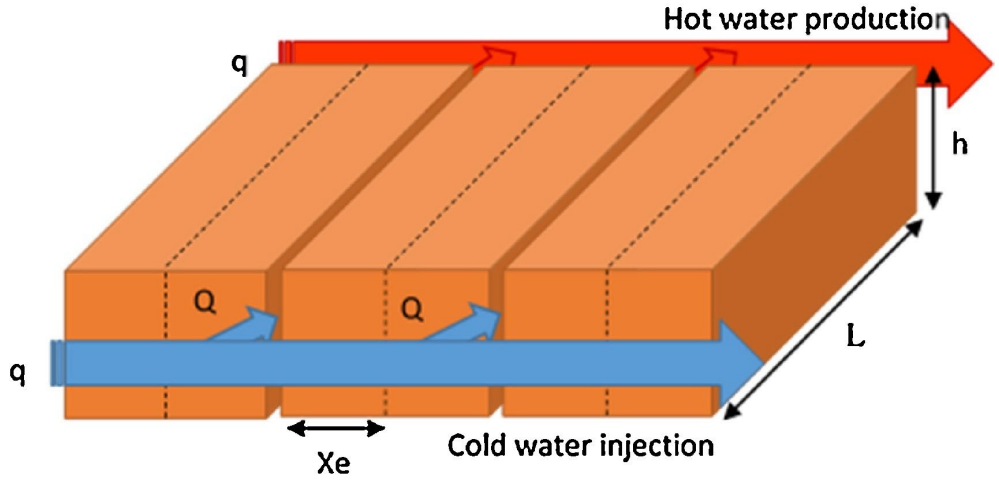
- National Renewable Energy Laboratory | Golden, CO
- University of Oklahoma | Norman, OK

Scott Beautz, National Energy Technology Laboratory

FORGE Solicitation 2022-2 Selected Projects (Prime Selectees)

Topic 3: Field Scale Experiments to Measure Heat-Sweep Efficiency

- California State University, Long Beach | Long Beach, CA
- Sandia National Laboratories | Albuquerque, NM
- Texas Tech University | Lubbock, TX



Schematic of the Gringarten et al. (1975) analytical solution.

FORGE Solicitation 2022-2 Selected Projects (Prime Selectees)

Topic 4: High Temperature Proppants

Source: Hexion

- Oklahoma State University | Stillwater, OK
- Stevens Institute of Technology | Hoboken, NJ
- University of Oklahoma | Norman, OK

FORGE Solicitation 2022-2 Selected Projects (Prime Selectees)

Topic 5: Multiset Straddle Packers for Open Hole Operations

- PetroQuip | Waller, TX
- Welltec | Katy, TX

Source: TAM international

Thank You!

the drill down

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Questions?

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.

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