

# AT THE CORE

## Word from the PI

As we leave 2021, we can look back with pride at the achievements of the past year. We drilled three new wells. Well 16A(78)-32 is the first highly deviated well drilled specifically for Enhanced Geothermal Systems (EGS) applications.

[Read More](#)

## Technical Discoveries

One of the most significant challenges in realizing commercial enhanced geothermal systems is predicting the complex behavior of creating a geothermal reservoir as the water is injected and the rock is fractured.

[Read More](#)

## Outreach News

There's never a dull moment for the Utah FORGE Outreach and Communication team! We're always busy sharing the project's successes and introducing the concept of geothermal energy and EGS to different people.

[Read More](#)

## Announcements

- Join us for a [guided tour](#) of the Utah FORGE site and its surrounding area!

## Word from the PI

As we leave 2021, we can look back with pride at the achievements of the past year.

We drilled three new wells. Well 16A(78)-32 is the first highly deviated well drilled specifically for Enhanced Geothermal Systems (EGS) applications. Water injected into this well will extract heat from the newly created reservoir before being pumped to the surface through a production well. In addition, the two deep vertical wells, 56-32 and 78B-32, were drilled to support the development of new tools and monitor micro-seismicity during creation of the reservoir. Well 56-32 is the first well at Utah FORGE to reach a depth of 9000 ft and a temperature of 433°F. Well 78B-32 reached a depth of 9500 ft and has an estimated temperature of 440°F-hot enough to cook a turkey. The well set a record for a single bit run in hard, hot granite of 2110 ft in 28 hours.

Expansion of the Utah FORGE underground laboratory will be a priority in 2022. Stimulation testing will be conducted near the toe of well 16A(78)-32 in the early part of the year, and drilling of the production well is planned for the fall. The microseismic network will be completed and seismic data, streamed in near-real time, can be accessed on the Utah FORGE website at <https://utahforge.com/seismic-monitoring/>.

Seventeen research and development projects have been initiated to support Utah FORGE and EGS development. These projects include field and laboratory investigations, tool development, and the work is just beginning.

All of us on the Utah FORGE project want to take this opportunity to wish you a prosperous and healthy 2022. Stay safe.



## Featured Publication

**“Interpretation of hydrothermal conditions, production-injection induced effects, and evidence for enhanced geothermal system- type heat exchange in response to >30 years of production at Roosevelt Hot Springs, Utah, USA.”**

Stuart F. SIMMONS, Rick G. ALLIS, Stefan M. KIRBY, Joseph N. MOORE, Tobias P. FISCHER. (2021)

Find the full publication [here](#).

Check out the [publications page](#) on the Utah FORGE website for more!

# Technical Discoveries

## How high-performance computing helps geothermal research.

One of the most significant challenges in realizing commercial enhanced geothermal systems is predicting the complex behavior of creating a geothermal reservoir as the water is injected and the rock is fractured. A great deal of data is required to ensure that geothermal systems are safe, effective and economically viable. To better understand how large-scale geothermal systems will function, Utah FORGE turned to the modeling and simulation experts at Idaho National Laboratory (INL).

The effort, led by INL’s Robert Podgorney, is using INL-developed software and INL’s high-performance computing resources to provide advanced simulation results. These tools better prepare teams in the field to understand different injection scenarios, and how different operational parameters will impact the results. The many variables involved are ideal for the advanced capabilities of the Multiphysics Object-Oriented Simulation Environment ([MOOSE](#)), a versatile

computer simulation platform developed at INL. Over the last six months, the INL team and FORGE partners at other institutions have used MOOSE-based and other codes to simulate different aspects of rock fracturing and reservoir operation. They have dedicated more than 85 million CPU hours to understanding the challenging physics involved in drilling and operating the geothermal wells.

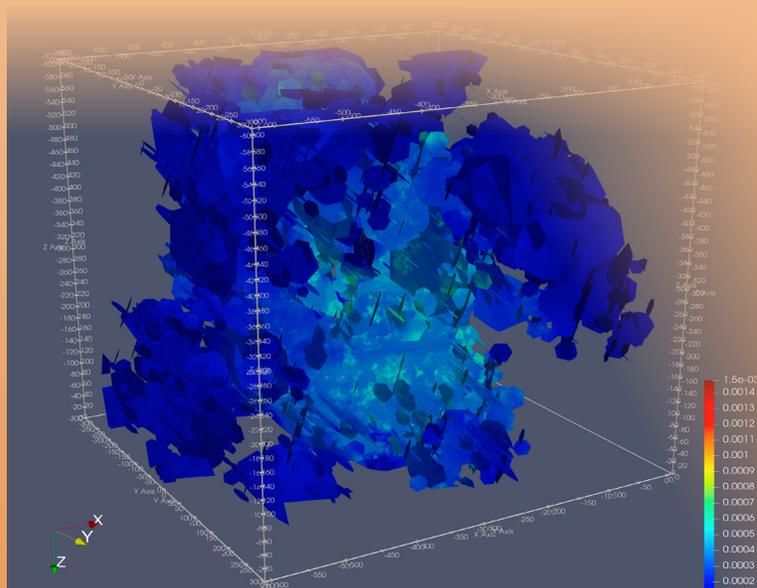
“INL’s high-performance computing resources are accessible to collaborators around the world to help researchers understand complex systems like nuclear reactors,” Podgorney said. “It is a natural fit for the challenging environment of a geothermal system.”

With the foundational site characterization studied thoroughly, the modeling team performed a full simulation of a complex hydraulic stimulation project. They evaluated different scenarios and established operational models based on variations in the rock’s structural properties and existing fractures. The resulting numerical models will then be taken to the field for a full demonstration. The models will enable operators to react quickly based on how the demonstration proceeds, making adjustments in real time with a better understanding of how the materials might behave.

“We’re focused on the science of clean energy,” Podgorney said, “and with tools like MOOSE at our disposal, we can help bring carbon-free power solutions to market more quickly.”

### About Idaho National Laboratory

Battelle Energy Alliance manages INL for the U.S. Department of Energy’s Office of Nuclear Energy. INL is the nation’s center for nuclear energy research and development, and also performs research in each of DOE’s strategic goal areas: energy, national security, science and the environment. For more information, visit [www.inl.gov](http://www.inl.gov). Follow us on social media: [Twitter](#), [Facebook](#), [Instagram](#), and [LinkedIn](#).



Base case simulation results for the stimulation of the open hole section of Well 16A showing only the interconnected fracture network. Colors indicate the predicted post-stimulation fracture aperture.

## Outreach News

Do you know what's great about being a part of the Utah FORGE Outreach and Communication team? There's never a dull moment! We're always busy sharing the project's successes and introducing the concepts of geothermal energy and EGS to different people – from Congressmen to kids.

Road trips are always fun, so we visited Beaver County frequently throughout 2021, meeting with County Commissioners, the Milford City Council, and other officials. Dr. Joseph Moore even provided tours of the site to Lt. Gov. Deidre Henderson and members of Congress! But perhaps the most enjoyable visit came in August when we were invited to host a booth at the Beaver County Fair. We talked with a variety of folks, but our favorite visitors were the kids. They had some really impressive questions - like "How hot is the bottom of the hole?", and "How is granite formed?"

We know that knowledge is power, and we always want to ensure the folks living in Beaver County have the latest information about potential induced seismicity, so we installed computers in the Beaver City, Milford, and Miners-



ville libraries. The computers allow users to see near real-time seismic activity through the [University of Utah Seismograph Stations](#). They can also visit Utah FORGE's [seismic page and website for more information](#).

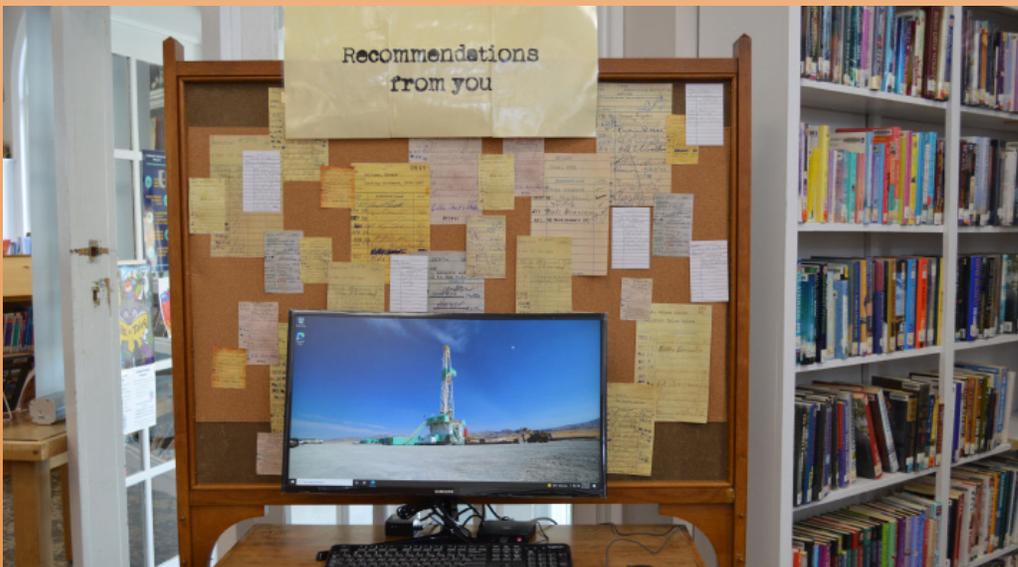
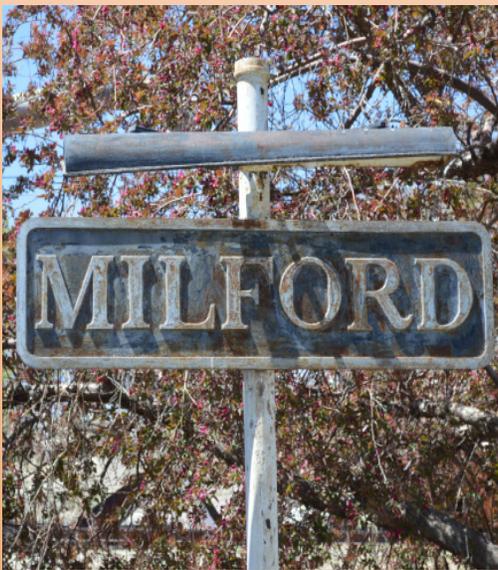
Speaking of gaining knowledge, we gained some important insights from a survey conducted by Dr. Sara Yeo of the U's Department of Communication. She and Dr. Meaghan McKasy of Utah Valley University conducted a survey of 1000 people in 10 western states. Initial results show wide recognition of geothermal energy as a renewable energy source, but – not surprisingly – not many people know about EGS.

Finally, this year we attended Geothermal Rising in San Diego! It was great to be back in person after last year's virtual conference. The event was well-attended and well-run, and it was exciting to engage with so many geothermal enthusiasts who support the work Utah FORGE is doing.

Be sure to follow us on social media and [SUBSCRIBE](#) to stay up to date on all the exciting outreach plans we have in store for 2022!



# Utah FORGE's 2021 in Photos



## Modeling and Simulation Forum

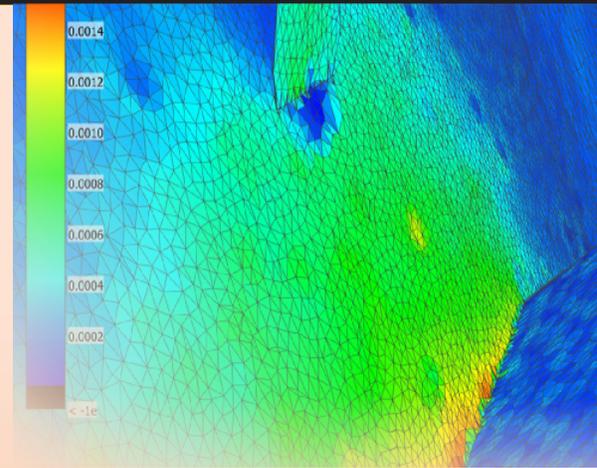
We had a great year for our Modeling and Simulation Forums!

Check out all of the recordings from past forums, [HERE](#).

Registration is [now open](#) for Forum #14 on January 19.

“2021 Utah FORGE modeling summary and 2022 look ahead”

Presenter: Robert Podgorney (INL)



## Upcoming Events



February 7-9, 2022

**STANFORD  
GEOTHERMAL  
WORKSHOP**

[Stanford University](#)



April 19-23, 2022

**SSA  
ANNUAL  
MEETING**

[Bellevue, WA](#)



June 26-29, 2022

**56TH US ROCK  
MECHANICS /  
GEOMECHANICS  
SYMPOSIUM**

[Santa Fe, NM](#)



February 7-9, 2022

**GEOTHERMAL  
RISING  
CONFERENCE**

[Reno, NV](#)

## Down the Pipe at the Site

- Stimulation of the first deep deviated well is scheduled for February
- Installation of permanent internet endpoint equipment on drill pads that will be used for microseismic data acquisition during stimulation
- Installation of shallow seismic boreholes FSB4, 5 and 6
- Electric infrastructure to the 78B-32 wellhead from the power drop on the adjacent 78-32 drill pad

