UTAH FORGE
NEWSLETTER

OCTOBER 2021

AT THE CORE

Word from the PI

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Technical Discoveries

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Outreach News

The Utah FORGE Outreach and Communication team had a busy summer meeting with Congressmen, presenting at public meetings, and even attending a county fair!

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Announcements

- Dr. Joseph Moore (PI) and Dr. John McLennan (Co-PI) present the success story of drilling the first deep deviated well in winter of 2021 at the Utah FORGE site. Check out the story here.
- The registration for the Modeling and Simulation forum #11 on October 20th is now open.

Word from the PI

The past few months have seen significant drilling activity at the Utah FORGE site.

Since completing well 16A(78)-32, which will be used to inject water into the reservoir, we drilled two additional deep vertical wells. Well 56-32 was drilled on the north side of Mag Lee Wash to a depth of 9070 ft. The well reached a temperature of 435°F at total depth. In July, we completed well 78B-32 to a depth of 9500 ft. This is the deepest and hottest well at the Utah FORGE site. The temperature at the bottom of this well is estimated to be close to 460°F.

Lessons learned from drilling the previous wells were applied to 78B-32. Using bits with modified designs and closely monitoring drilling parameters reduced the time to drill this well compared to the first wells by nearly 50%. In fact, a new drilling record in hard hot granite was set: 1208 ft in 53 hours on a single bit run. We will use these lessons to further improve drilling performance when we begin work on the production well late next year. Since drilling accounts for nearly 50% of the cost of a geothermal development project, reducing those costs will have a major impact on geothermal development worldwide.

We are currently making plans for stimulating three zones near the toe of well 16A(78)-32. A new temperature survey indicates the well reached a temperature of 427°F. The first zone will be in the 200 ft of uncased rock at the toe of the well. The second and third stimulations will be in the cased portion of the well. This will be the first time we conduct large-scale stimulations in one of the Utah FORGE wells. The stimulations will be monitored for microseismicity using 12 level geophone strings in three deep wells, as well as shallow and surface seismometers. The microseismic data will tell us how high and wide the fractures grow.

These are exciting times at Utah FORGE! And you can always keep apprised of all our activities by following us on Facebook, Twitter, and LinkedIn.

Featured Publication

"Flowback Test Analyses at the Utah Frontier Observatory for Research in Geothermal Energy (FORGE) Site"

Pengju XING, Branko DAMJANAC, Joseph MOORE, John MCLENNAN. (2021)

Find the full publication here.

Check out the publications page on the Utah FORGE website for more!

Technical Discoveries

In a new paper to be published in Geosphere (an open-access journal published by the Geological Society of America), Stuart Simmons and co-authors provide an up-to-date characterization and interpretation of the Roosevelt Hot Springs hydrothermal system based on chemical and physical production data extending >30 years. This is one of the hottest hydrothermal systems in the Basin and Range province, and it is entirely hosted in fractured granitoid of Oligocene-Miocene age. It is also located close to Utah FORGE, being about 4 km east of the project site, and it shares the same geological setting.

A key finding of the new paper is the evidence of sustained EGS-type heat transfer. Such heat transfer involves the mining of heat from hot fractured rocks as injected cool water percolates into the production zone. This process is also known as heat sweep, and in 2015-2016 it accounted for ~10-20 MW of produced thermal power in two wells supplying the Blundell plant (38 MWe gross). Time series data suggest that this sort of heat sweep has been a steady on-going process going back to at least the early 1990s.

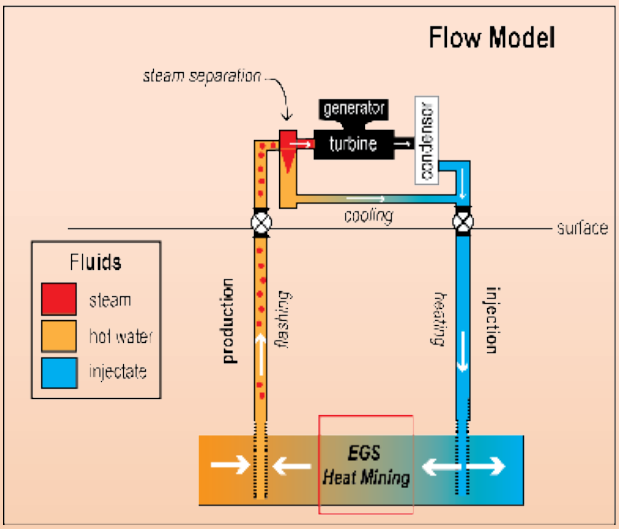
To be clear, evidence of injectate in produced fluids from operating fields is not new or even particularly exciting. At Roosevelt Hot Springs, however, the location of a single injector relative to the four production wells, and the small number of wells simplifies data processing. This includes quantifying the effects of injection breakthrough and heat transfer, based on gradual increases in the chloride compositions and the oxygen and hydrogen isotope ratios of the produced fluids.

Heat mining has been a longstanding goal of EGS research since the start of hot dry rock geothermal power investigations in the 1970s. In nearly all the recent field experiments, however, injectivity, tracer return, and/or pressure support rather than rock to fluid heat transfer is all that has been attained or proven. This contrasts with

Sampling sites for geothermal production fluids at Roosevelt Hot Springs. In the top photo, a mini-separator is attached to a two-phase line to collect water and gas samples. In the bottom photo, produced water is sampled from a tank that is filled by a continuous stream of conductively cooled liquid via a stainless-steel capillary tube that extends downstream of the separator (tall cylindrical vessel).

Technical Discoveries (continued)

success at the Fenton Hill hot dry rock site where relatively short period outputs of 3 to 10 MWth were achieved. One well-known constraint is that fracture-controlled networks are prone to confined fluid flows and short-circuiting, which minimize effective rock to fluid heat exchange and sustained geothermal energy production. This is precisely the sort of problem that Utah FORGE is designed to overcome. In this light, more details of how fractures control fluid flow at Roosevelt Hot Springs are desirable, and until they can be resolved, what is clear is that optimal conditions for EGS-type heat exchange appear to have formed naturally. Roosevelt Hot Springs thus appears to provide an analogue to the type of heat transfer being tested, making it relevant for future EGS investigations.



Production-injection flow model showing the main processes (italicized labels) influencing the evolution of fluid compositions. EGS-type heat mining occurs in the reservoir as cool injectate percolates back to the production well mixing with reservoir water.

Modeling and Simulation Forum

The October 20th M&S forum #11 registration is now open. Read more about it and register here.

Topic: Ground acceleration modeling from potential induced seismicity

Presenter: Chandrakanth Bolisetti (Idaho National Laboratory)

If you would like to see past M&S recordings, check out the Modeling and Simulation Forum page on our website.

Lectures and Podcasts

Don't forget to check out the latest update to the Utah FORGE Geoscientific Overview webinar.

The geoscience of Utah FORGE sets the geological scene to DOE's flagship geothermal field laboratory that has been established to make significant advances in EGS technologies.

This webinar covers the basin architecture, rock types, fault/fracture patterns, thermal structure, fluid flow, geochemistry, and the datasets and resources that are available from the Utah FORGE website.

Outreach News

The Utah FORGE Outreach and Communication team had a busy summer with conferences, Congressmen, presenting at public meetings, and even attending a county fair!

The team recently returned from 2021 Geothermal Rising where we staffed a booth visited and participated in several FORGE-related presentations. Visitors to the booth learned about the advancements in the project and saw the debut of our latest video!

U.S. Representatives Chris Stewart (UT) and Ed Case (HI) visited the Energy & Geoscience Institute at the University of Utah as part of the American Congressional Exchange, a bipartisan policy group. They learned more about geothermal energy and the great research being conducted by Utah FORGE.

In our ongoing efforts to apprise the local community of our activities, Dr. Joseph Moore presented at the August 17 Beaver County Commission and Milford City Council meetings. He

discussed the project's achievements over the past several months, upcoming stimulation, and induced seismicity. For their part, both the County Commissioners and the City Council members expressed their unwavering support for the Utah FORGE project.

The Outreach and Communication team also hosted a booth at the Beaver County Fair the last weekend of August. Nearly 350 people stopped by to visit with us, learn more about the project, and ask questions. The team used a thermal camera to draw folks to the booth, which led to a seamless discussion about heat transfer. Visitors could also look at core samples and a sample drill bit. And for the kids, there was a small packet with an information card, a piece of granite, and magnifying glass to check out all the cool minerals!

It was incredibly satisfying to hear how excited people of all ages are about the research being conducted in their own backyard. We're extremely grateful to have such amazing community support!

Partner Spotlight

The Utah Geological Survey (UGS) is a state agency and division of the Utah Department of Natural Resources. The UGS provides timely scientific information about Utah's geologic environment, resources, and hazards. The UGS has been involved with the Utah FORGE project since its inception in 2014.

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Upcoming Events

October 24, 2021
WORLD GEOTHERMAL CONFERENCE
Reykjavik, Iceland

December 13-17, 2021
AGU FALL MEETING
New Orleans, LA

February 7-9, 2022
STANFORD GEOTHERMAL WORKSHOP
Stanford University

Down the Pipe at the Site

- In the fall of 2021 temperature survey and a cement bond log (CBL) will be run in well 78B-32.
- A 150 Mbps internet connection to site has been provided by the Utah Education and Telehealth Network via a radio link from Milford High School approximately 10 miles away. The signal will then broadcast from a 30 ft tall communications mast on the 78-32 drill pad. The internet connection will be used to support various research teams and allow continuous monitoring by researchers across the globe.
- The seismic network currently in place at the site consists of one borehole geophone/accelerometer, three shallow borehole broadband/accelerometers, three surface broadbands, three surface accelerometers, and one surface geophone. In preparation for the upcoming stimulation, the UUSS will add three shallow borehole broadband/accelerometers, three surface broadbands, and at least 200 nodal three-component geophones. The nodal instruments will be arranged in a cluster pattern to detect earthquakes with very small magnitudes.
- Stimulation of well 16A(78)-32 is planned for early 2022 which will involve stimulating three zones at the toe of the well; one in open section (uncased) and two in cased portion of the well.