

# **The Utah Frontier Observatory for Research in Geothermal Energy (FORGE): A Dedicated Laboratory for Enhanced Geothermal System Development**

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## **ABSTRACT**

The U.S. DOE Frontier Observatory for Research in Geothermal Energy (FORGE) is a field laboratory that provides a unique opportunity to develop and test new technologies for characterizing, creating and sustaining Enhanced Geothermal Systems (EGS) in a controlled environment. In 2018, the U.S. DOE selected a site in south-central Utah for the FORGE laboratory. Numerous geoscientific studies have been conducted in the region since the 1970s in support of geothermal development at Roosevelt Hot Springs. A vertical scientific well, 58-32, was drilled and tested to a depth of 2290 m (7515 ft) GL in 2017 on the FORGE site to provide additional characterization of the granitoid that will host the reservoir and overlying alluvium. The well encountered a conductive thermal regime and a bottomhole temperature of 199°C (390°F). More than 2000 natural discontinuities were identified in the Formation MicroImager log run in the granitoid, but measured permeabilities are low, less than 30 microdarcies. Fractures induced during drilling indicate that the maximum horizontal stress trends NNE-SSW, consistent with geologic and well observations from the surrounding area. Approximately 45 m (147 ft) at the base of the well were left uncased. During injection testing in September 2017, a maximum wellhead pressure of 27.6 MPa (4000 psig) was measured at an injection rate of ~1431 L/min (~9 bpm). In 2019, the 2017 openhole injection was repeated with injection rates up to 2385 L/min (15 bpm) and a zone containing critically stressed fractures behind casing was stimulated. Breakdown of this zone occurred at a surface pressure of approximately 29.0 MPa (4200 psig). During the 2019 testing, five seismometers and a nodal array of 150 seismic sensors were deployed on the surface. A Distributed Acoustic Sensing (DAS) cable and a 12-string geophone were deployed in well 78-32. A broadband sensor and a high-temperature geophone were deployed in well 68-32.