Join us July 31st for our live webinar. Registration Link Included Below

View in Web Browser

Join us for this year's Environmental Division Webinar program.

Registration is open to to all by clicking the links below.

Register

JULY 31ST
5:30 - 6:30 PM EST

Geothermal Energy – An Opportunity at Any Temperature

SPEAKER

John McLennan
Professor
University of Utah

Presentation Abstract

Geothermal Energy – An Opportunity at Any Temperature

Natural, high enthalpy, geothermal systems are characterized by a heat source, hydraulically conductive fractures, and water or steam to transfer the heat upward. Although temperatures suitable for electric generation or direct use can be found at relatively shallow depths in the Earth's crust, few sites are characterized by permeability sufficient for significant natural convection to occur. Consequently, extracting heat by creating an artificial heat exchange network in natively unfractured rocks has been suggested for large-scale power production nearer municipalities and transmission lines. This concept of manufacturing an Enhanced Geothermal System (EGS), was first tested at the Los Alamos National Laboratory in the 1970s, under the U.S. Department of Energy's (U.S. DOE) Hot Dry Rock program. In its simplest form, an EGS consists of an injection and a production well interconnected by a network of hydraulic fractures. Developing such an EGS reservoir has proven to be challenging. Despite numerous attempts worldwide over the last four decades, no commercial-scale EGS has been created. However, the untapped potential is exceptional; the U.S. Geological Survey estimates that the electric generating potential from EGS in the western United States alone exceeds 500 GW.

The U.S. DOE recognized that new technologies are required – and likely available - to access this heat. In 2014, the U.S. DOE initiated a multi-year initiative, known as the Frontier Observatory for Research in Geothermal Energy (FORGE) to develop technologies for characterizing, creating, and sustaining an EGS. In 2018, a site was selected near Milford, Utah, for the FORGE laboratory. The location met the criteria of adequate and accessible subsurface temperature with benign seismicity and appropriate environmental attributes in a conductivity-dominated reservoir. Funds have supported the drilling, stimulation, and testing of two 65°inclined wells drilled at the FORGE field laboratory. Since its inception, multiple vertical monitoring wells - for geophone emplacement and reservoir characterization – have also been drilled.

The first inclined well, 16A(78)-32, drilled in late 2020, was hydraulically fractured in three stages near its toe. A second inclined well, 16B(78)-32, has just been drilled to penetrate microseismic clouds from these treatments. Circulation testing between the wells has been carried out.

The FORGE project is described – status, plans, and opportunities. Areas of technology transfer from oil and gas activities – and upcoming challenges - are indicated. These include drilling, cementing, isolation, treatment strategies, conductivity and connectivity development, and challenges related to conformance and immunity to undesirable seismicity. Modeling, simulation, and methods for the evaluation of in situ properties are also highlighted briefly.

But, there is more. Creating heat transfer surfaces with hydraulic fractures interconnecting two or more wells is not the only method of building an engineered heat exchange system. Concepts include single well injection/recovery with down-annulus injection connecting to downward-growing hydraulic fractures and flow up insulated tubing. Another prominent method being implemented is a dual-well system with splayed interconnecting laterals to create a surface area equivalent to multiple hydraulic fractures.

Some of these techniques may be most effective in environments where drilling is easier and where direct heat or heat pumps are the most appropriate investment. Such medium and low enthalpy scenarios are proliferating with new construction and with infrastructure renewal. These applications include repurposing depleted oil and gas wells, cycled subsurface thermal storage, borehole thermal energy systems, and various forms of district heating and cooling.

John McLennan

Speaker Bio

Since October 2009, Professor John McLennan has been a faculty member in the Department of Chemical Engineering at the University of Utah. He has been a Senior Research Scientist at the Energy & Geoscience Institute and an Adjunct Professor in the Department of Civil Engineering at the University of Utah since January 2008. He has a Ph.D. in Civil Engineering from the University of Toronto, awarded in 1980. He has more than thirty-five years of experience with petroleum service and technology companies. He has worked on projects concerned with subsurface energy recovery and storage (hydrocarbon, geothermal) in a variety of reservoir environments throughout the world. He is a co-principal investigator on the DOE FORGE project (Frontier Observatory for Research in Geothermal Energy) and an ARMA Fellow.

Register

FOLLOW US @ChEnected

AIChE® does not rent member email addresses for any purpose.
You may view AIChE's Privacy & Security Policy at any time here.

AIChE 120 Wall Street, 23 Fl New York, NY 10005

Click here to manage your preferences or unsubscribe