FALL 2024 PETEROLEUM ENGINEERING SEMINAR SERIES

Class Venue: EN305 | September 11, 2024 | 4:30 - 5:20 p.m.

Andrew Bunger, Ph.D.

Professor in the University of Pittsburgh's Department of Civil and Environmental Engineering. He joined the University of Pittsburgh in 2013 after spending 10 years in Melbourne, Australia working in the Geomechanics Group within the Commonwealth Scientific and Industrial Research Organization (CSIRO). Prior to that, he received his PhD in Geological Engineering from the University of Minnesota. His research interests include the mechanics of hydraulic fractures, coupled fluid-shale interaction, emplacement dynamics of magma-driven dykes and sills, and the development of novel materials for wellbore cementing and plugging.

Measurement and Modeling of Injection and Flowback for Subsurface Pumped Energy Storage in Horizontal, Fluid-Filled Lenses

Cost-effective energy storage and recovery is essential for the deployment of intermittent renewable energy resources, most notably wind and solar. Traditional pumped hydro storage is typically economically advantageous compared to existing battery technologies, but it is limited in scope due to dependency on terrain with suitable elevation changes. On the other hand, a novel approach of pumped energy storage in the subsurface provides the potential to leverage the ubiquitous difference between the density of water and the density of rock to store and recover energy from manufactured fluid-filled lenses in the subsurface. This presentation will focus on measurement and modeling of lens behavior for a first-of-its-kind demonstration project in the Western Canadian Sedimentary Basin, Alberta, Canada. Detailed comparison between measurements and a model of a horizontal, circular lens in a semi-infinite elastic domain validates the application of this fully-coupled mechanical model. The model is then used to define conditions that maximize the efficiency of the energy storage system. Overall, the study illustrates the feasibility of generating a horizontal lens with simple geometry and direct connection to a vertical wellbore, thereby advancing subsurface efficient pumped energy storage for renewable, but intermittent, energy resources.

SCHOOL OF
CHEMICAL ENGINEERING
College of Engineering, Architecture and Technology