National Geothermal Academy 2018

Module 1: Geothermal Resource Decision Workshop

Date: 18 – 22 June 2018

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Location: University of Nevada, Reno: Redfield campus (south Reno)

National Geothermal Academy
University of Nevada, Reno

Description:

This course is directed at teaching geoscience and engineering students and professionals how geothermal conceptual models are constructed and how they are used to support a resource decision assessment process. Best practice publications in the geothermal industry emphasize the integration of geoscience data to build geothermal resource conceptual models that are the basis for well targeting and resource capacity assessment at all stages of geothermal exploration and development.

Following a presentation on decision-making under the uncertainty characteristic of subsurface exploration, lectures will introduce the components of geothermal conceptual models for two types of systems: 1) magmatically-heated, volcano-hosted geothermal reservoirs; and 2) deep-circulation heated, fault- and sediment-hosted reservoirs, with examples from the USA and internationally. Students will participate in teams to complete exercises using real data from both types of systems, to simulate the experience of professionals advising a geothermal developer in making high-value resource decisions.

Lectures on geothermal geochemistry, geology, geophysics, and basic concepts of thermodynamics of water flow in rock will be interspersed with the exercises that provide participants opportunities to:

- design a conceptually-effective and financially-efficient exploration survey;
- interpret and integrate real geoscience data using a conceptual model approach;
- build an initial range of resource conceptual models;
- complete probabilistic well target and resource capacity risk assessments;
- interpret drilling results, update conceptual models and reassess targets and capacity;
- based on well results, recommend constructing a power plant at the minimum economic capacity or terminating the investment; and
- rank a suite of <180°C deep circulation geothermal prospects, bid against other teams for prospects, and assess outcomes relative to known results.

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Research on how experts make predictions and decisions in conditions of uncertainty comparable to the geothermal subsurface indicates that the most important prerequisite for sustained success is realistic experience making decisions and analyzing their outcomes. In a typical geothermal career, it may take decades to accumulate sufficient experience. This type of workshop is directed at accelerating this process, by simulating realistic experience in making geothermal resource decisions and responding to consequences. The exercises are also designed to give participants experience in identifying and seeking the type of information that junior professionals more effectively acquire from more experienced experts and mentors, particularly information needed to assess uncertainty. Simple MS Excel decision risk analysis tools will be provided to support the exercise, so participants should bring a laptop.

At the completion of this workshop, participants should expect to understand the basic components and construction of geothermal resource conceptual models, the role of the most commonly used geoscience data in constraining geothermal conceptual models, the rationale for the use of conceptual models in well targeting and capacity assessment, and simple strategies used to address decision uncertainty. More generally, students should better appreciate the strengths and weakness of basing decisions directly on data (anomaly hunting) versus basing decisions on an integration of data in a conceptual model.

Participant expectations:

The course is intended to simulate the experience of professionals who are in a team at a geothermal resource consultancy that is providing resource advice to a geothermal developer. Students should be aware that the course grade will be partly based on participation in a team that compiles real data, actively solicits expert advice, builds conceptual models, assesses model uncertainty, justifies probabilistic decision recommendations and adjusts both models and recommendations based on new information.

Course participants should also be prepared to practice efficiently and effectively soliciting the advice of mentors and consultants who will be involved in running this course: this is an important skill for junior professionals conducting resource assessments. The presenters will act as outside expert consultants subject to real-world proprietary constraints on what advice they can give. Experts can answer technical questions about data analysis and, based on their case history experience elsewhere, they can describe likely ranges of outcomes that might be associated with the data. Providing that they effectively solicit expert advice on uncertainty in their conceptual models, participants with a wide variety of background can complete a realistic geothermal resource capacity and well targeting assessment based on the simplified but real data provided.