Elucidating Critical Controls on Fracture and Stratigraphic Permeability in Hydrothermal and EGS Domains of the Greater Salton Sea Geothermal Field and Vicinity

PROJECT SUMMARY

Title: Elucidating Critical Controls on Fracture and Stratigraphic Permeability in Hydrothermal and EGS Domains of the Greater Salton Sea Geothermal Field and Vicinity

Principal Investigator **–** Jeffrey B. Hulen, Energy & Geoscience Institute (EGI), Univ. of Utah

Collaborating Investigators **–** Joseph N. Moore and Michal Nemčok (EGI); Joel Renner, K. Kit Bloomfield, and G. Michael Shook, Idaho National Engineering and Environmental Laboratory (INEEL; separately funded)

Nearly doubling the nation's viable geothermal electrical-generation resource to 40,000 megawatts (MWe) within the foreseeable future (ref: *this solicitation*) is an unquestionably ambitious goal. Realization of this vision will require (**1**) major advances in technology and fundamental understanding of the complex variables controlling the accumulation and transport of fluid, solutes, and heat in the crust; and (**2**) routine application of *Engineered Geothermal Systems (EGS)* technology, that is, the artificial augmentation of hydrothermal systems (and ultimately hot, impermeable rock volumes) that are currently subcommercial. We propose to address both of these requirements by investigating critical controls on fracture and stratigraphic permeability in a dynamic, 600 km^2 thermal anomaly centered on the Salton Sea geothermal field (SSGF) in California's Imperial Valley.

The anomaly in question encompasses what we will call the greater Salton Sea geothermal cluster (GSSC), which includes the SSGF as well as the smaller and lower-temperature Brawley, Westmoreland, and Niland fields. The GSSC is characterized by unusually high temperatures (>240^{o}C to nearly *400^{o}C*) at readily drill-accessible depths (<3 km). It represents an enormous reservoir of heat, much of which still remains to be tapped. Less than 20% of the SSGF's 2300 MWe resource potential has been developed, and although the other three fields are inactive, they are poised for rejuvenation under a more favorable economic climate (e.g., the enactment of a Federal Production Tax Credit for geothermal power). The region will continue to supply an inordinately large proportion of the country's natural geothermal power, and the corresponding potential for EGS commercialization can be considered essentially limitless.

Our project seeks to advance basic knowledge of the GSSC's hydrothermal and affiliated EGS regimes by focused investigation of the interlinked tectonic, sedimentary, diagenetic, and hydrothermal controls on permeability creation and renewal proximal to the region's known and well-drilled hydrothermal systems. The work (**1**) will be centered on the >80-well SSGF, which boasts the most comprehensive regional reservoir database and borehole sample suite; and (**2**) will utilize a balanced array of traditional and novel observational, analytical, and interpretive techniques (e.g., conceptual modeling; *in situ* stress analysis and computational stress-field inversion; geologic logging and analysis; fluid-inclusion microthermometry; hydrothermal-history reconstruction) to identify and characterize the highest-quality natural and enhanceable hydrothermal targets in what is demonstrably the premier EGS candidate region in the western United States. This project's research yield stands to benefit *all* geothermal operators, explorationists, and lessees pursuing EGS and hydrothermal opportunities throughout the Salton Trough now and for decades if not centuries to come.