

## Heat Flow Data: Existing Data Shortcomings and Impact on Deep EGS Resource Assessment

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Abstract: The foundation of geothermal resource assessment is heat flow and thermal rock properties to calculate volumetric heat in place and quantify total thermal energy resource. Recent studies (Batir et al., 2018; Batir et al., 2020; Batir and Richards, 2020) presented updated thermal regime and resource assessments throughout the conterminous United States for the purpose of enhanced geothermal system (EGS) exploration. Results of these studies often increased the number of heat flow points, yet usually did not decrease heat flow uncertainty because of limited high-quality data, but these studies often show an increase in resource potential. This is a nonintuitive correlation – more data equals higher resource potential. This generates an important question: is there systematic error within newly calculated heat flow that results in higher resource potential estimates?

Here, we analyze this question by reviewing heat flow inputs for recent projects in the United State including the Basin and Range and the Gulf Coast Basin to assess existing heat flow data shortcomings. Using these data and associated uncertainty, we examine potential impact of end member uncertainty for a ~10 km deep EGS in hypothetical geologic settings including a cratonic setting, a 5 km deep sedimentary basin, and a 15 km deep sedimentary basin.

Results highlight several interesting relationships. First, impact of basement radiogenic heat production is inversely proportional to the thickness of the sedimentary section. The thicker the sedimentary section, the less likely a well is to drill into basement. Second, high sediment radioactivity most negatively impacts temperature estimates in deep basins because more radioactivity is removed compared to low sediment radioactivity. Third, the highest uncertainty is produced in the moderate sedimentary thickness basin because there are unknowns from both the sedimentary and basement section impacting temperature estimates at 10 km depth. These data shortcomings will not be overcome through modeling, but instead require new thermal property measurements to ground truth the current models and assumptions.