Probability-of-success studies for geothermal projects: from subsurface data to geological risk analysis

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In recent years, the development of geothermal plants in Germany has increased significantly due to a favorable political setting and resulting financial incentives. However, most projects are developed by local communities or private investors, which cannot afford a project to fail. To cover the risk of total loss if the geothermal well should not provide the energy output necessary for an economically viable project, investors try to procure insurances for this worst case scenario. In order to issue such insurances, the insurance companies insist on so called probability-of-success studies (POS studies), in which the geological risk for not achieving the necessary temperatures and/or flow rates for an economically successful project is quantified.

Quantifying the probability of reaching a minimum temperature, which has to be defined by the project investors, is relatively straight forward as subsurface temperatures in Germany are comparatively well known due tens of thousands of hydrocarbon wells. Moreover, for the German Molasse Basin a method to characterize the hydraulic potential of a site based on pump test analysis has been developed and refined in recent years. However, to quantify the probability of reaching a given flow rate with a given drawdown is much more challenging in areas where pump test data are generally not available (e.g. the North German Basin). Therefore, a new method based on log and core derived porosity and permeability data was developed to quantify the geological risk of reaching a determined flow rate in such areas.

We present both methods for POS studies and show how subsurface data such as pump tests or log and core measurements can be used to predict the chances of a potential geothermal project from a geological point of view.