**Utilisation of Machine Learning, Data Analytics and Domain Knowledge to design a Prospective Geothermal Project**

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As an alternative energy source, geothermal energy is an appealing form of renewable energy and rapidly gaining mainstream acceptance, not only in Europe but also in parts of the Asia-Pacific as well. As in the case of oil and gas resources, its usefulness lies in its ability to provide heating and for the generation of electricity. However, unlike oil and gas, its use is immediate; in most cases, no conversion or processing is required, and the by-product (cold water) can directly be reinjected in the ground.

As the main energy output is heat, however, it requires careful and efficient planning when it comes to well placement and configuration, since borehole length, pipeline distribution and distance from source to market can directly impact the economics of the project. Particularly in the prospective stage of the project, before placing bit on ground, understanding the well placement and distribution can also allow for modelling of reservoir performance and the impact of the cold-front on the future deliverability of the heated fluids from the subsurface.

This paper will describe the workflow that we have applied to model the efficient well placement and pipeline distribution for a geothermal field, assuming a hypothetical scenario of 2 demand locations, which required 80 MW and 100 MW of thermal output to be delivered. We will demonstrate how static properties were interpreted along with the use of a fairway map to identify sweet spots for optimal well placement. A geothermal simulator (DARTS, a product of TU Delft) was utilized as part of this work, to model the flow rates and doublet performance for the specific well pairs. We will also discuss the use of machine learning via a clustering algorithm to group wells pairs with respect to demand location and finally build a economic model that evaluates the levelized cost of heat. We finally conclude by proposing a generalised machine learning algorithm that allows for rapid evaluation of development scenarios as a first pass tool, which can be utilized to grade other prospect and lead locations as well.

To conclude, through a combination of machine learning, simulation and our domain knowledge/ understanding of static and dynamic properties, we will demonstrate a workflow that allows for geothermal modelling and field development planning.