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An Integrated Approach in 3D/4D Modelling in Geothermal Development

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Through all stages of development, a geothermal project is exposed to a range of challenges. These manifest in resource existence, size, suitability, sustainability and utilization challenges. As well as being highly susceptible to market, financing and commercial risks. The most important element used to overcome the challenges and in de-risking of geothermal well targets or assessing geothermal resource capacity is the use of a conceptual model with the available information.

Stages of a geothermal development are divided into exploration, feasibility, development and operations. The conceptual model changes throughout these stages as more data, understanding and management needs change. During exploration a geothermal conceptual model will often consist of a geological, structural, geochemical, geophysical and most importantly a thermodynamic component derived from geoscientific data. Without detailed subsurface data, surface geochemical and resistivity often indicate temperature anomalies within the subsurface while structure and geological setting gives good indication of permeable and non permeable zones for reservoir delineation and well targeting. During the feasibility and development stages time dependent data such as temperature and chemistry will be incorporated into the conceptual model that forms a base for the numeric model, used for key decision such as well targeting, output forecasts and communication with local community and financiers.

Types of data collected during the first three stages of development vary slightly between each project. Once a geothermal project moves into the operational phase the behaviour of well performance as well as reservoir understanding, dictates the type of data collected and incorporated into the model. This in many cases includes time dependent data such as tracer testing, well flow rates and chemistry.

It is well known integrated software and workflows enables geoscientists, engineers and managers to collaborate for greater efficiency, productivity and understanding. Combining the right technology, data, knowledge, systems and people will lead to measurable gains and productivity. New technologies and software solutions are tackling this challenge in solving needs for integrated workflows. The use of Leapfrog Geothermal software has been instrumental in moving the conceptual model into a 3D and 4D space. While associated products are changing the way projects operate. We will look at the use of modelling in a geothermal context and look at global case studies where this solution is providing a platform for all disciplines to communicate, collaborate and form the basis for key decisions.

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