

Improving reservoir property prediction and producing a database of Dutch geothermal plays

Publieke samenvatting / Public summary

Aanleiding

Most of the data available for subsurface prediction originates from the hydrocarbon industry, which are not always in the locations most suitable for dense installation of geothermal heat plants, while in so-called “white spots” data completely lack (EBN, 2019). Geothermal projects do not generally generate rich datasets and the industry has seen that this lack of data slows down the increase in number of geothermal doublets. It is often impossible to predict rock properties with sufficient accuracy to evaluate geothermal project performance, due to lack of appropriate data methodologies to convert downhole log data to rock properties. Improper data conversion methodologies and lack of data acquisition also hampers proper well test evaluation, as accurate petrophysical property evaluation is needed as an input. This is mostly the reason for a lack of flow and geothermal power output predictions and uncertainties in quantifying the risks of induced seismicity and drilling.

Doelstelling

The ambition is to significantly enhance the knowledge, mapping, and prediction of the geological character of Dutch geothermal plays, focussing on thermal and geomechanical properties. We aim to improve fundamental understanding of the geological causes behind rock properties, the understanding and quantification of the conversion of downhole log properties into rock properties, the statistical approaches to study these properties, and

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the implementation of rock properties into reservoir models. The study should lead to lower research costs for geothermal operators, lower uncertainties concerning production prediction and risk assessment, and improved production due to more optimal well placement and production strategies. With that, our fully open-access results will be applicable to all geothermal targets in the Netherlands and thereby be able to calibrate reservoir, geomechanical and thermal reservoir models with the ultimate goal to optimise the exploitation of geothermal heat in the Netherlands in a sustainable and safe way.

Korte omschrijving

component, linking rock properties to petrophysical log data by various innovative means, and an implementation component setting the findings into geomodel application. Novel microstructural scanning data enables to link the nano-scale rock composition to dm scale bedding and logs. Focus will be on pore throats, detrital, authigenic and new-grown cements and their types and how these relate to flow, and in particular thermal, and mechanical properties of the rocks. These findings lead to fundamental geological understanding of the impact of the nanometer to decimetre character of rocks on their properties measured in laboratory experiments. Next, petrophysical downhole logging data will be analysed using statistical and machine learning techniques along with existing and new core and rock sample data and interpretations such to produce a much enhanced methodology to relate petrophysical log response to different rock properties. Improved correlations will be produced per play investigated and can be applied to clastic geothermal reservoirs in general.

Resultaat

- Improved geological understanding of the flow, thermal and geomechanical rock properties, based on detailed images and laboratory quantification, for three Dutch geothermal plays.
- Feed of findings into predictive stratigraphic models and enhanced reservoir characterisation validated by geothermal well tests.
- Improved mineralogy scanning

methodology on cores and cuttings fastening workflow and lowering costs allowing to implement the much refined predictive models. • Implementation of statistical techniques, including machine learning, to boost conversion from downhole log properties to rock properties needed for geothermal operation. • Strategic guide for optimal data acquisition in geothermal doublets with low budgets. • Guide for upscaling techniques from core to log to well test to production life focused on thermal and geomechanical properties. • Open access sharing of rock thermal, flow and geomechanical rock and petrophysical properties of Dutch geothermal plays and their interrelations.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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