Real Time Geosteering in Geothermal

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Geosteering – LWD

Geosteering in Geothermal

1. Introduction – A Paris Basin Case Study

Geothermal District Heating (GeoDH) is the use of geothermal energy (i.e. the energy stored in form of heat below the earth’s surface) to heat individual and commercial buildings, as well as for industry, through a distribution network. The ‘hot’ GeoDH markets in Europe are in France (Paris, and renewed activity in the Aquitaine basin), Germany (Munich) and Hungary, but it is important to always underline that geothermal DH systems can be installed in all European countries. In recent times, there have been new entrants to the market: The Netherlands, Spain (Madrid), UK (Newcastle) etc. By 2020, nearly all states in Europe will have GeoDH

We are not talking about high temperature like for Iceland, Turkey and Italy but temperature below 65C directly used for heating.

Within the aquifer sequence the Dogger (mid-Jurassic) carbonates host a dependable reservoir of regional extent, exploited since the late 1970s with a total of 76 GDH doublets drilled of which 46 (including six triplet recompleted doublets) remain online (June 2018 status). Fig. 1

30 wells were abandoned mainly for technical (corrosion or scaling) or economic reasons (low profitability of geothermal operations compared with fossil energies when the oil barrel fall down to 12US$)

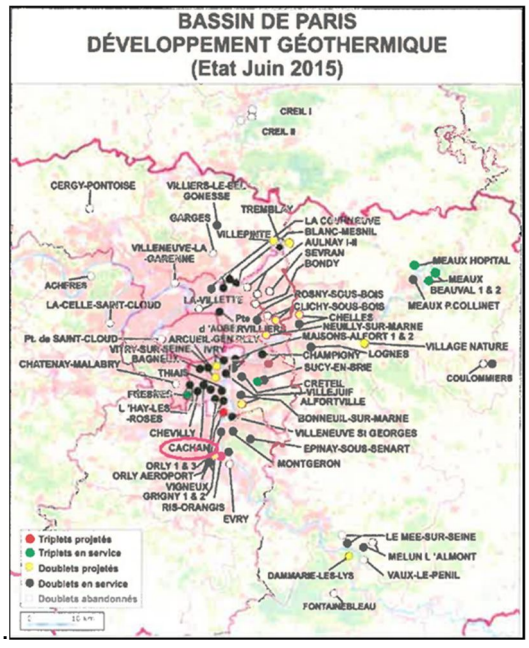

Fig. 1: Paris Basin Geothermal wells

2. What is Geosteering

Geosteering aims at optimal well placement, in real-time, of high angle / horizontal wells targeted at the optimum reservoir location based on the results of downhole LWD, real time information and a multi-disciplinary team approach

Despite the tendency to the automatization People are still the most important component for the geosteering. In this project client decided to have geosteering engineers at rigsite to facilitate decisions within the decision team and directional driller

Well Placement components include Downhole Tools, Advanced Software, People and process, 24/7 on the spot and remote coverage and communication.

The purpose of geosteering is to maximize production, reduce drilling time and therefore cost, avoid drilling ‘unwanted zones’ to drill at faster ROPs and to avoid sidetracks

2.1 Directional Drilling and Rotary Steerable System

Directional drilling pre-well torque and drag analysis for well and BHA optimization and anticollision Point the bit rotary steerable system was used her (other steerable systems are available) to enable smooth well and quick response by means of near bit inclination and downlinking to change RSS parameters on the fly

2.2 Logging While Drilling (LWD)

Azimuthal Denstity tool produces an image. Fig 2. Bright for low density/high porosity and dark for high density/low porosity, center represent bottom of the hole while left and right is the top

Dip picking on Density image tells us relative angle (if layers are dipping down or up relative to borehole inclination) helping to make changes to build or drop the angle and how much.

In this example, a low porosity layer was approaching from bottom so decision was made to build angle to stay in the high porosity layer

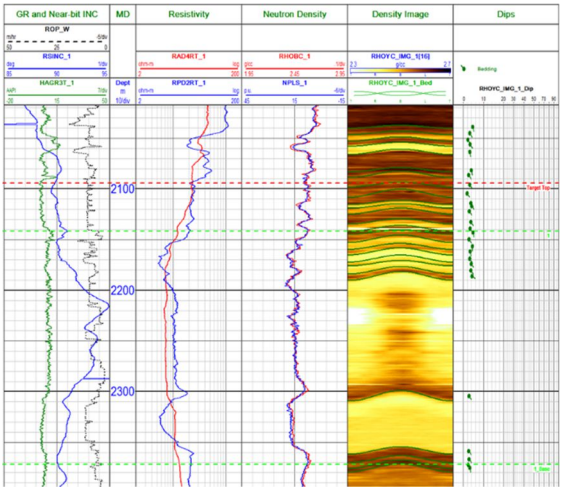

Fig 2. AZD Image

2.3 XRF-XRD and Mud Logging

The integration of X-Ray Fluorescence (XRF), Diffractometry (XRD) with mud logging data, provides detailed chemostratigraphy on drilling cuttings, close to real time in order to support the LWD/deviation activities, to optimize the drilling and to lay down the foundations for the Paris Basin geothermal target refining.

3 Conclusions

With the successful integration of the chemostratigraphic, mud logging, Wireline, Logging While Drilling and production/injection tests the well placement and reservoir characterization was optimized and Transfer modern petroleum technology and know-how to geothermal objectives.

Targeted at 450 (nominal) and 500 m3/h (maximum) productive and injective capacities, the new doublet replaced two existing doublets, ageing (33 years) and rated 180 and 170 m3/h (total 350 m3/h) respectively.

Sources

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