



## Reservoir modelling of deep geothermal systems: the examples of Guardia Lombardi

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In the framework of the VIGOR project, a characterization of medium enthalpy geothermal resources was carried out in the Campania region (southern Italy), with a focus on the “Guardia dei Lombardi” area (Avellino). The VIGOR project started on the basis of an agreement between the Ministry of Economic Development and the Italian National Research Council, and it deals with the exploitation of innovative uses of geothermal energy in the so-called “regions of convergence” (Campania, Calabria, Puglia and Sicily).

One of the main results of this research is the development of an integrated 3D geological model, which provides the base for a detailed assessment of possible geothermal exploitation of the carbonate reservoir. The preliminary results of our study suggest that “Guardia dei Lombardi” can be indicated as an interesting area for medium enthalpy geothermal exploitation, although the presence of a CO<sub>2</sub> gas cap and the scaling capability of the deep fluids need to be carefully evaluated.

The aim of this work is to give an estimation of a geothermal well productivity, in the case of a geothermal exploitation. The geothermal well that is thought to be more suitable in the Guardia dei Lombardi Area is named Bonito 1 Dir, a well with a measured temperature of 118 °C at 3,107m depth, which gives a corrected temperature of 138 °C with an error of 8 °C. The pressure was found to be nearly hydrostatic, with 266.9 bar at 2992.4 m depth, and the potential reservoir is hosted in the Mesozoic carbonate formation.

According to hydraulic tests, we found that the permeability porosity product gives nearly 100 mD for the carbonatic formation. Since the matrix porosity is nearly 1% with 0.65 mD from core drilled tests, the result of the hydraulic test is to be related to a fractured system; in this case, there is no a clear relation among porosity and permeability, thus we had a sensitivity check on the possible porosity-permeability values of the system, keeping as a constrain the value obtained from the hydraulic test.

From the 3D geological model we obtained the boundary of the carbonate formation hosting the geothermal reservoir, and we modelled the cases of both a single producing well and a geothermal doublet in order to give an estimation of the geothermal potential.

Deposition of calcite in a formation may significantly reduce the inflow performance of geothermal wells producing brine with CO<sub>2</sub>-rich content. The key operational and reservoir parameters influencing the magnitude of impairment by calcite deposition were identified through the numerical modelling of the rate of calcite deposition and its effect on flow rate assuming idealized flow conditions. This is an important constrain for a well lifetime, especially in the case of a 138 °C well, because the power production requires a large fluid flow, and an encrustating fluid may severely affect the geothermal well performance.

The results of the model, in terms of fluid flow at wellhead and scaling potential, will be available for an economic evaluation of the feasibility of geothermal exploitation of the Bonito 1 Dir well, in the Guardia dei Lombardi area.