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Site Development of Marble Karst Reservoir for Borehole Exchanger Storage, Finkenberg, Zillertal, Austria

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Karst aquifers with increased permeability may improve efficiency of geothermal systems, but their characteristics involve special requirements for investigation and exploration. The marble karst aquifer of the Hochstegen formation was explored and developed for the first time for a middle deep geothermal energy storage at Finkenberg in Zillertal (Tirol, Austria). Due to the lack of data about the destination aquifer substantial studies were conducted and led iterative to a precise prediction about the local hydrogeology and geothermal situation.
In the first step field mapping, hydrochemical sampling and laboratorial determination of thermal conductivity supported first design. Subsequent in 2012 an exploration drilling for in situ testing was completed. The following Enhanced Geothermal Response Test was executed for thermal conductivity profile and stated karst zones of high ground water flow. Geothermal parameters for precise depths allow differentiation between conductive and convective heat flow and correlate with the lithostratigraphic conditioned karst characteristics. Additional studies were focused on geology and hydrology in detail.
The borehole heat exchanger field was developed with nine drillings of 400 m and dual U-shaped tube probes in 2013. It was designed for 1 GWh/a extraction and 400 MWh/a induction adapted in design after the information of the first drilling. Along with construction borehole geophysics confirmed and validated structural geological perception and EGRT results. The comparison between zones of convection and cavity geometries leads to differences in the impact of karst over aquifer depth especial for storing purpose. Supervising of nearby wells shown temporary reaction bound on discrete fissures near surface. Finalizing Geothermal Response Tests proved predicted performance in different boreholes.