

## Developing EGS in crystalline rock: lessons learned from two 6 km deep holes in Otaniemi, southern Finland

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St1 Deep Heat project drilled two deep boreholes to a depth of 6.1–6.4 km. The aim was to pilot EGS (enhanced geothermal system) in Finland and produce thermal power for the district heating network. The drilling encountered challenges but reached the desired depth where the temperature is over 100 °C. In EGS, the temperature of the fluid is raised by circulating the fluid between the injection and the production well. In Otaniemi, natural hydraulic conductivity at the depth of 6 km is low and had to be enhanced to reach sufficient conductivity. For this, two hydraulic stimulation campaigns were conducted, OTN-3 and OTN-2 in 2018 and 2020, respectively. The stimulations caused seismic activity around the wells with the largest event occurring during the OTN-3 stimulation, having a local magnitude of 1.9. With careful monitoring of seismicity using a traffic light system, larger events were successfully avoided. Despite the stimulation campaigns, sufficient hydraulic conductivity was not reached for commercial production, and the Deep Heat project was cancelled. At present, the scientific use of the deep drill holes is developed by an international team aiming to continue seismic, hydrogeological, microbiological and geothermal studies in the *DEEP EGS* project of the International Continental Scientific Drilling Program (ICDP).