

Drilling a low temperature groundwater convective system, for heating the school in Glyvrar, Faroe Islands with an open-loop groundwater heating system

Jana Ólavsdóttir, Óluva R. Eidesgaard, Uni Petersen, Barbara B. Hansen
Jarðfeingi, Tórshavn, Faroe Islands

Abstract

The Faroe Islands are a volcanic archipelago in the Nordeast Atlantic Ocean, located in the triangular area between Iceland, Scotland, and Norway.

Fifteen years ago, the government of the Faroe Islands introduced shallow geothermal heat pump systems for heating of private houses around the islands as a greener energy solution instead of oil burners.

The drilling of these shallow geothermal energy systems gave The Faroese Geological Survey (Jarðfeingi) the opportunity to access large amount of information regarding the subsurface. Information that had not been accessible before. The information has been and still is being collected by measuring the depth of the groundwater table, the temperature, and conductivity of the groundwater at five-meter intervals downhole.

Based on the collected data a geothermal gradient map was constructed and areas with geothermal gradients up to 140 °C/km were discovered. The average geothermal gradient of the Faroe Islands is generally around 30 °C/km.

A hypothesis regarding convection of groundwater in fracture zones was put forward in a test project. An area with a geothermal gradient of approximately 60-70 °C/km was chosen close to a school. In addition to the high geothermal gradient the aim was to drill an artesian warm water well.

Geological mapping with specific focus on fractures was done. Three large fractures were mapped, and all turned out to dip 30 - 38 °C in a northern direction. The central fracture zone was interpreted in depth closest to the school.

The test was successful and artesian water was found in one well flowing with 4.5 m²/h of 24.7 °C warm water. The well reached the central fracture at c. 245 m depth. The energy from the water will be used for heating the school through an open-loop shallow geothermal system. After the heat is taken out of the water it is possible to use the water as drinking water.

Paper Proposals