The conceptual model of the Theistareykir high temperature system in N-Iceland

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Abstract

Geothermal energy is a major energy source for both electricity generation and for space heating in Iceland. In other countries it is emerging as alternative energy. A comprehensive geothermal research program in the Theistareykir high temperature area has been ongoing since 1972. Exploration drilling started in the year 2002 and at the end of 2008 six wells had been completed and tested. Our recent magnetotelluric (MT) survey in Theistareykir area has both characterized known geothermal reservoirs and identified new drilling opportunities. MT data confirmed the findings of a previous TEM survey in the Theistareykir field, outlined the boundaries of the geothermal reservoir and for the first time identified and mapped a deeper conductive layer associated with geothermal heat source. The success of these surveys has provided very valuable information for geothermal reservoir characterization around the survey area and will be incorporated into the new drilling program to evaluate the identified geothermal potential.

Interpretation of geological-, geophysical- (TEM and MT), geochemical- and drill-hole data has been integrated in a conceptual model of the system. The size of the geothermal area has been estimated at 45 km^2 based on TEM- and MT resistivity surveying. Until 2009 most of the drilling activity has been concentrated in the eastern part of the area, where the geothermal manifestations are seen and the main up-flow appear to be. The main permeability is associated with the NE- trending tectonic pattern, i.e. fissures, fractures and transform faults, and a high permeability fracture zone divides the area in two parts. Limited testing has revealed productive wells and the geothermal fluid is suitable for generating electricity; low TDS, low gas concentration and high enthalpy. A volumetric reservoir assessment has been carried out using the Monte Carlo method indicating that the electricity generation potential of the area is in the range of 120 – 370 MW_e for 50 years. This is being followed up by numerical model development, which is expected to provide a more accurate estimate of the potential of the field, in particular when more test- and response monitoring data become available. At present a 200 MW_e geothermal power plant is under preparation.

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