Geothermal Exploration Using the Magnetotelluric Technique

Saibi, Hakim
College of Science, United Arab Emirates University : Professor

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Keynote Speaker

Hakim Saibi
Professor, College of Science
United Arab Emirates University, UAE
Email: hakim.saibi@uaeu.ac.ae

Short Biography

Dr. Hakim SAIBI is a Professor of Geophysics & Geothermics at the United Arab Emirates University in UAE and head of the Earth Energy Resources Laboratory at the same university. He holds a BSc and MSc in Earth Sciences from the University of Science and Technology Houari Boumediene (Algeria), and a PhD in Earth Resources Engineering from Kyushu University, Japan. His research interests mainly focus on geothermal energy using geophysics, remote sensing, numerical modeling, and hydrochemical methods. He has supervised over 15 PhD and Master's students from 11 countries in these fields. He has been awarded funding for seven research projects in the last five years with a total value of 55 Million Yen. Among his accomplishments are the Outstanding Faculty in Science Award (2019) from the Venus International Foundation, the JSPS Post-doctoral Fellowship (2007–2009). He has published 70 journal articles, 60 proceedings, and 4 book chapters, and has been an invited speaker on numerous occasions at academic institutions throughout the world and at both national and international conferences.

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Abstract

Geothermal energy plays an important role, among other renewable energies, in decarbonization and the current global energy transition away from fossil fuels in a range of countries worldwide.

Geothermal reservoirs are generally located between 1 to 5 km depth below the surface and are host to hot water and steam, which are necessary to generate electricity in geothermal power plants. To locate such geothermal reservoirs and understand their geo-structural settings, we apply different geophysical exploration techniques (for example gravity, magnetic, and electromagnetic approaches). Advances in geophysical exploration methods are urgently required to improve cost-effectiveness and enhance solutions to geological and geothermal problems.

The magnetotelluric (MT) geophysical technique is an electromagnetic method and is considered one of the most powerful geophysical methods for geothermal investigation studies. MT has also been widely used in other applications including hydrogeology, tectonics, mining, petroleum, and volcanology. The MT technique helps us to understand the structure of the subsurface environment by studying its electrical resistivity distribution.

MT is particularly important for locating geothermal reservoirs, defining fractured zones, and identifying structural settings in the subsurface; this is of particular help in locating the best sites for geothermal drilling wells in order to increase power plant efficiency.

In this presentation, we will introduce the theory behind the MT geophysical technique, followed by details of the instruments used during field surveys and field procedures. Next, we present the MT data analysis approach (pre-processing), and, finally, we conclude with modeling and inversion of MT data and present 3D electrical resistivity models from geothermal field case studies.

Keywords: Geophysics; Magnetotelluric; Geothermal; Renewable Energy.