Geothermal Prospectivity in Turkiye

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Abstract

Turkish oil and gas production at present cannot fulfil demand. The country's average production of 81,000 barrels of oil per day (b/d) and 180 million cubic feet per day of gas (MMcf/d) during October 2023, combined with a consumption of approximately of 964,600 barrel of oil per day (b/d) and approximately 4,575 million cubic feet per day of gas (MMcf/d), results in current production only supplying 8.5% of oil and less than 4% of gas demand. Turkiye needs to import most of its oil and gas, although there are potential new hydrocarbon sources in the Thrace Basin, Mediterranean, and the Black Sea. Natural gas is currently the primary energy source for the country's electricity generation.

Turkiye has more than 400 hydrocarbon fields – over 200 fields located in the Zagros Province in the southwest of the country and over 130 fields in the Thrace basin, towards the northwest of the country. Less than half of the fields are producing, therefore, the remaining fields could possibly be repurposed for geothermal energy, using the infrastructure already in place and the well-developed geological knowledge of the area. Turkiye is one of the top 10 countries in the world for geothermal potential, due to its location, active tectonism, active volcanism, and complex geology. The geothermal potential of Turkiye is estimated to be over 60,000 megawatt thermal (MWt). Geothermal exploration started in the country in 1960 by General Directorate of Mineral Research and Exploration of Turkey (MTA) and as of January 2024, there are more than 1000 natural outflows around the country containing a variety of geothermal resources at various temperatures. There are over 65 geothermal power plants in operation in the country. The energy generated has a variety of uses, including direct heating and cooling, agricultural applications, and on a smaller scale, electricity.

Using an extensive and comprehensive E&P global database, containing more than 231,000 wells with bottom- hole temperatures (BHTs) it is possible to analyze the point data to differentiate regions based on potential geothermal energy usage. These applications range from direct heating and cooling to marginal electric, to being suitable for electricity generation. The workflow produces polygons that define the areas in a particular region that are most prospective for geothermal energy use at increasing depths of 1 km, 2 km, 3 km, 4 km, and 5 km. This paper illustrates the application of this proprietary methodology on Turkiye and its subsurface.