Ethiopia
Geoscientific Exploration for Development of the Tendaho Geothermal System

Energy sector
Although more than 90% of the electrical energy produced in Ethiopia is generated by hydropower plants, the government of Ethiopia supports the development of geothermal energy. Geothermal energy as an indigenous energy resource is particularly promising as it is independent from rainfall fluctuations, time, and provides a stable power supply. Its use assists in diversifying the energy mix.

The installed electrical generating capacity of about 800 MW (mainly hydropower plants) reaches approximately 14% of the population, who are mainly located in Addis Ababa and other large towns. In general rural areas are not connected to the main electrical grid. Often they are connected to small local grids which are fed by local diesel plants and small hydro units.

Due to the growth of the agricultural and industrial sectors and an increasing power demand in the whole country, decentralisation of power generation and an increased supply are necessary. Additional geothermal energy production could support all these fields.
The government of Ethiopia supported the rehabilitation of the only geothermal power plant (Aluto Langano, 8 MW), which has been recently reconnected to the national grid. To extend the production from the field work is conducted with Japanese collaboration partners. Other plans exist which aim to improve and extend the nationwide grid, including an extension to Sudan and Djibouti for future power export.

Still, plans exist to install new hydropower plants for the mid term. The aim is to double the installed capacity. Therefore, the government also supports the exploration and investment in geothermal power production in order to establish a well balanced energy mix.

Geothermal potential
Geothermal exploration work in Ethiopia started in 1969 and continues up to now. Possible resource areas have been defined within the Ethiopian sector of the East African Rift system and the Afar triangle. About 120 localities are believed to have independent heating circulation systems, about 24 of them are judged to have high enthalpy potential, making generation of 1000 MWel a realistic vision. The priority areas to be developed are the Tendaho prospect in the Afar triangle, Aluto Langano, Abaya and Corbetti in the main Ethiopian Rift.
The Tendaho prospect is located in the Afar triangle in the Dubti plantation close to the state capital Semera, approximately 400 km north-east of Addis Ababa. Several surface manifestations like fumaroles, mud pools, and geysers are present. Extensive exploration was completed in the late 1970s to 1990s by the Ethiopian Government together with the Italian Aquater company (ENI Group). Several exploration wells were drilled, two of them reaching a horizon with temperatures exceeding 260°C. This reservoir horizon is located at approx. 300 m of depth and supply is estimated to be provided by a large source reservoir at greater depth (> 1 km).

Project description
The project ‘Geo-scientific Exploration for Development of the Tendaho Geothermal System’ started at the end of 2006 and its 1st phase was finalised in summer 2009. The objective of phase 1 was to find and delineate the assumed deep seated source reservoir by extending the existing geo-scientific basis aiming at identifying the drilling location. The new project phase 2 started in April 2010 and will terminate in September 2012. Its objective is to enable the Ministry of Mines and Energy to submit a funding application to financing partners. The project is carried out by the Geological Survey of Ethiopia (GSE), a governmental institution under the Ministry of Mines and Energy and BGR. The GSE has high expertise in geothermal exploration reaching back to 1969. At present, a geothermal working group of about ten members is involved in geothermal exploration work. The BGR supports exploration at Tendaho by applying Magnetotellurics (MT), a geophysical method delineating the electrical resistivity structure down to approximately 5 km. Magnetotellurics can also be applied in most of the remaining high enthalpy geothermal prospects for the benefit of a successful exploration of a deep reservoir.
Other components within the joint project were training in the Magnetotelluric and Transient Electromagnetic (TEM) methods, advisory support and training in special geochemical analyses such as soil gas sampling.

The acquired MT data demonstrates clearly the shallow reservoir and the deep source area. Two counterparts were trained on the job in MT and are now part of an MT expert group which has been established together with the University of Addis Ababa. A MT-equipment has been handed over to the GSE. One counterpart was sent to the UNU-GTP for training on environmental impact studies. The 1st ARGeo conference [http://www.bgr.de/geotherm/ArGeoC1/index.html], held in Addis Ababa in November 2006, was supported by the BGR. The participation of Ethiopian counterparts at the 2nd ARGeo conference [http://www.argeoc2.org] in Uganda (Entebbe, 2008) was financed by BGR.

Recent developments
In phase 2 of the GEOTHERM Programme project activities focus on further geoscientific support of the Tendaho geothermal field as well as advisory on regulatory issues and capacity building.

Cooperation partners:
Ministry of Mines and Energy [http://www.mome.gov.et/] (MME) and its subordinate institutions:
2. Ethiopia Electric Power Cooperation (EEPCO) [http://www.eepco.gov.et] and
3. Ethiopian Electricity Agency (EEA) [http://www.ethioelectricagency.org/]

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