GeoPower Africa Project

Investigations on potential small scale use of geothermal resources in remote regions along the East African Rift

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GEOLOGICAL SURVEY OF TANZANIA

Abstract

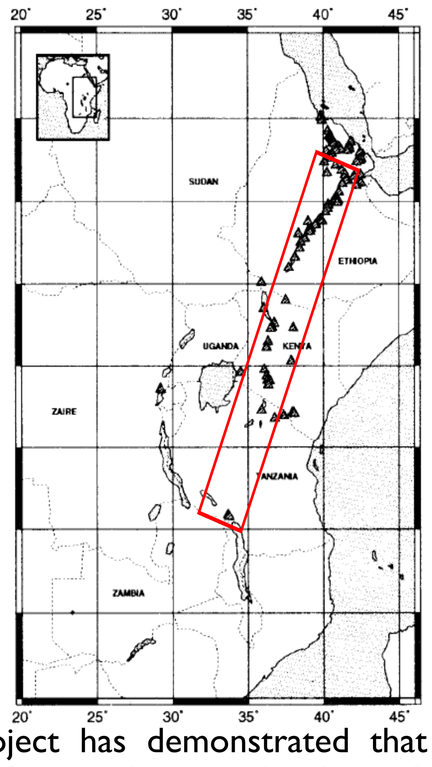
Satellite and ground-based systematic mapping along the East African rift system (EAR) reveal active magmatic and/or aqueous fluid movement beneath 40% of the volcanoes, and similar results are emerging from the Ethiopian and Tanzanian rift sectors (e.g., Ferguson et al., 2010; Mariita, 2002; Mburu and Kinyanjui, 2011; Biggs et al., 2009; Omenda et al. ,1993; Varet 1978, 2012). These geothermal fluids can be utilised for small-scale energy generation units to support local communities in green-houses, food drying, thermal bathing and green tourism.

The GeoPower Africa project has mapped small local geothermal areas in the Ethiopian, Kenyan and Tanzanian sectors and identified new forms of geothermal exploitation along the EAR. Some of these sites have been recommended for utilisation for development of small size units combining power, heat applications from medium to low enthalpy resources (70-150°C) and their application for powering groundwater pumping in areas not connected to the electric grid. These efforts required an inter-disciplinary approach including geology, volcanology, hydrogeology and fluid geochemistry. A systematic socio-economic approach was included in order to serve the needs and maximize the benefit for the local communities around the sites where geothermal resources exist.

In parallel, our training and research exchange program engaged researchers who have implemented similar applications in Africa, USA and Europe, with the aim of determining the necessary conditions and local training for such applications to be deployed in test sites in the three countries. In so doing, we have built a strong regional framework for scientific and technological exchange, while at the same time empowering and educating local communities, particularly in pastoralist regions where resources are sparse.

Project Scope and Objectives

The scope of the project was to identify remote sites within the East African rift system for local geothermal energy development that would provide power for social economic development in these off-grid zones.



Volcanic activity on the EAR system, controlling the hydrothermal activity of geothermal resources (red rectangle indicates area of investigation in GeoPower Africa project)

Our project has demonstrated that similar initiatives can succeed and be replicated on a large scale along the EAR system, as there are numerous suitable sites that have the required conditions. The project has:

1.Demonstrated that several such geothermal sites exist in the EAR, by providing a systematic mapping and inventory of these natural occurrences;

2.Proved that several of these sites are suitable for immediate developments considering the social factors, notably the presence on site of communities deprived of energy and water sources;

3.Shown that production of geothermal fluids by shallow drilling can allow a technically and economically feasible development to occur at a later stage (this was a research project and neither the time nor the budget allocated allowed for project implementation);

4.Provide guidelines for developments (pre-feasibility and feasibility studies, site development and operation) that can be used by various stakeholders: local communities, enterprises, NGO's, public authorities, financial institutions, etc);

5.Build capacity of the involved institutions;

6.Disseminate information using appropriate communication tools and channels to various stake-holders.

Example of a site (Alutu, Ethiopia and Eburru, Kenya) to be equipped as a consequence of GeoPower Africa project; a geothermal occurrence is used by local poor population for water production, by condensation of natural steam.

Crop-drying at Eburru, Kenya, using geothermal steam. GeoPower Africa has made recommendations on better and efficient ways of utilisation

Methodology

Our plan was two-pronged: Part 1) conduct a systematic rift zone assessment and Part 2) share best-practice in methodologies implemented in EAR and elsewhere. Stakeholders were educated through training efforts by the collaborating institutions of Dedan Kimathi University of Technology, Addis Ababa University and Geological Survey of Tanzania in their respective countries. Part 1, regional surveys, required compilation of both geological and hydro-geological descriptions and understanding of geothermal characteristics at each site, as well as socio-economic considerations, including present and future needs of the local populations and potential for eco-tourism.

Part 2 involved exchange of researchers and geothermal experts for training and assessment, and development of communication strategies with pastoralist and rural communities in the three countries. Successful completion of Parts 1 and 2 required regular meetings of the Principal Investigators to fully integrate regional survey data sets, and to develop implementation strategies. From data collected in the region and previous experiences of medium and low applications elsewhere, application proposals matching both resource and demand were made for a few relevant demonstration sites.

Our Findings

1. *Numerous geothermal sites* exist, many in the low enthalpy range
2. A good number of sites are harnessed by the local population for their *domestic use*
3. A good number of sites give indications of potential for small scale direct applications

Our Recommendations

Applications in:

> Tourism (bathing, balneology)
> Agriculture (food drying/preservation/processing)
> Aquiculture (fish farming)
> Meat (abattoirs and hides and skin processing)
> Water harvesting

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