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Geothermal Energy: The Possible Source to Contribute on Tanzania Energy Mix and Beyond

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ABSTRACT

Tanzania is well endowed in various sources of energy, including geothermal, wind, solar, biomass, natural gas and hydro. Most of these sources are at different stages of development, with the exception of geothermal, which is not yet tapped as it is still undergoing assessment. Hydropower is dominant in the country's electricity mix; and as a result, the country experiences shortfalls in electricity supply in seasons with insufficient rains. By January 1, 2014, hydro power stood at 561.84MW. In an attempt to ensure sufficient electricity supply, Tanzania intends to diversify the country's energy mix by exploring alternative sources of energy. Geothermal energy is considered to be among the most reliable alternatives to contribute in stabilization of Tanzania's energy supply, which will eventually lead to stabilization of energy prices. Tanzania is among the East African countries said to have abundant geothermal resources. Some of the hot springs that prove the presence of geothermal resources in the country are located in areas related to the East African Rift Valley System. Such sites include Northern volcanic provinces of Kilimanjaro, Meru and Ngorongoro; and the Rungwe Volcanic province in southwest Tanzania. Similarly, some coastal areas also show surface manifestations of geothermal resources. It is believed that developing geothermal energy in Tanzania will improve power stability, attract tourism and above all, reduce greenhouse gases, and enhance crop cultivation and animal husbandry as well as increase industrial and commercial activities especially in area with geothermal resources.

1. INTRODUCTION

Recent data show that the current electricity connectivity in Tanzania is 36% of the population. In rural Tanzania, more than 80% of the population rely on traditional biomass energy sources such as wood, charcoal, crop waste and manure for cooking and heating, while kerosene is relied upon for lighting.

With modern energy, Tanzania will be able to step up economic and social development. To improve basic social services such as education and health, modern energy services must be made a priority. This will speed up industries and businesses in Tanzania. Tanzania is endowed with diversified energy resources with enough potential to meet national electricity needs. Only part of this potential has been realized due to financial and technical issues that need to be solved in order to reach a sustainable energy development.

In Tanzania, electricity production for the national grid system has been dominated by hydropower schemes and fossil fuel plants. Hydro power capacity stood at 561.84MW as of January 1, 2014. However, due to insufficient rains and global fuel price fluctuation, other energy sources such as coal, wind, and geothermal energy are being considered to be contributors to reliable electricity supply for the country, and the latter will be a large contributor. Different parts of Tanzania show surface manifestations of geothermal energy.

2. GEOTHERMAL ENERGY

Tanzania is well endowed with geothermal potential, which has not been fully explored for energy development. Geothermal resource exploration performed in Tanzania consists of regional surface mappings that took place in the 1970s. In 1976, the Government of Tanzania in collaboration with the Swedish International Development Agency (Sida) carried out a reconnaissance study to assess geothermal energy resources in Tanzania. Thereafter, Sida contracted SWECO to carry out the referred study from 1976 to 1978, covering almost the entire country (Figure 1). Approximately 50 hot springs, mostly associated with recent block faulting and volcanism, were identified. Most of them are located in areas transacted by the East African Rift Valley System. High temperature hot springs were identified in Lake Manyara, Lake Natron, Ngorongoro Crater and Mbeya region; while lower temperature hot springs were noted around Lake Eyasi, and Maji Moto - Musoma. Following this study, SWECO recommended further studies in the Rungwe Volcanic Province in Mbeya region, Ngorongoro, and Manyara. These sites were selected as first candidates as they appeared to have high subsurface temperatures compared to the other sites.

From June 2006 to July 2007, the Ministry of Energy and Minerals, in collaboration with Geological Survey of Tanzania and Federal Institute for Geosciences and Natural Resources (BGR) of Germany, carried out geological, geophysical, and geochemical studies in the Lake Ngozi - Songwe Geothermal field, Mbeya region. Based on this study, the reservoir temperature was estimated to be greater than 200°C. Further studies to complement the previous studies were carried out in January 2010 by the Government of Tanzania through the Ministry of Energy and Minerals, Geological Survey of Tanzania and Geological Survey of Germany in the Ngozi – Songwe Geothermal Field in Mbeya area.

The aim was to gather more information in order to locate drilling sites for at least 3 temperature gradient wells and to refine the conceptual model with this data. The drilling sites were eventually located near Lake Ngozi in Mbeya region. This was possible because of the level of exploration in this area, which had advanced to the level of demarcating the geothermal reservoir.

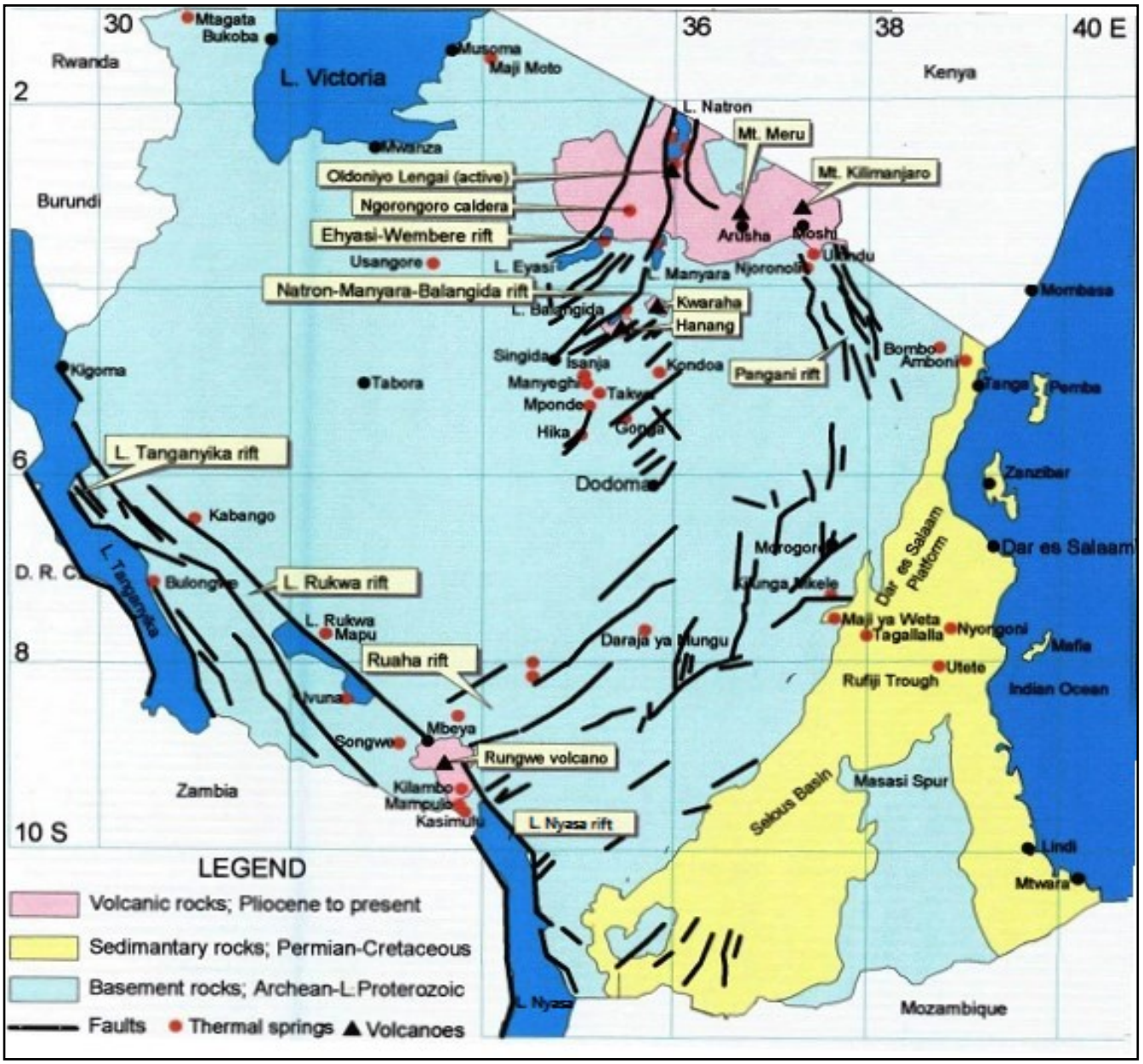

Figure 1: The occurrences of geothermal surface manifestation in the country as, mapped by SWECO in the 1976-1978 study.

2.1 Proposed drilling locations

The three selected sites are located in the north-western part of Lake Ngozi in the Ngozi- Songwe geothermal field, as shown in Figure 2.

The selected area is covered with thick soil on which wheat, maize, potatoes, beans and vegetables are grown, and it is not far from Mbeya City. Ngozi-Songwe geothermal field is found on highly dissected volcanic ridges trending NW to SE with altitudes ranging from 1957 to 2271 meters above sea level. The area is drained by a dense pattern of streams, originating in the Poroto forest and trending in the same direction with the ridges.

2.2 Geothermal Energy for Electricity

Electricity access in Tanzania was about 36% as of March 2014, and the installed capacity is 1583MW (Hydro – 35%, Gas – 34% and thermal 31%). Solar, wind and geothermal energy are all needed to contribute to Tanzania's energy mix, with geothermal energy having the best potential of these renewables. Geothermal energy is an important source to contribute to Tanzania's power mix. It will also play a large role in aquaculture, greenhouse agriculture and other industrial activities.

The promising Lake Ngozi – Songwe Geothermal field is located in the southern part of Tanzania. This is an ideal location, because it is in close proximity to the national grid. This resource has the potential to increase electricity access and stability in Tanzania. A preliminary estimate for the generation capacity of this field is 100 MW.

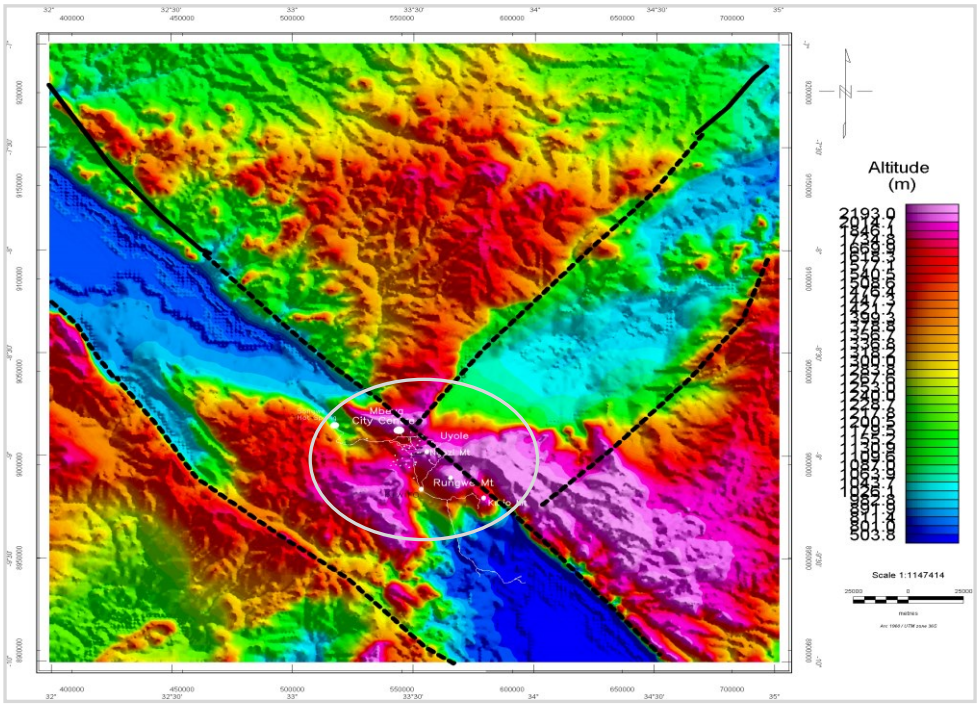

Figure 2: Location of the sites on the Regional Map

The selected sites (MBY105, MBY106, and MBY403) and check point (MBY105) are shown in Figure 3.

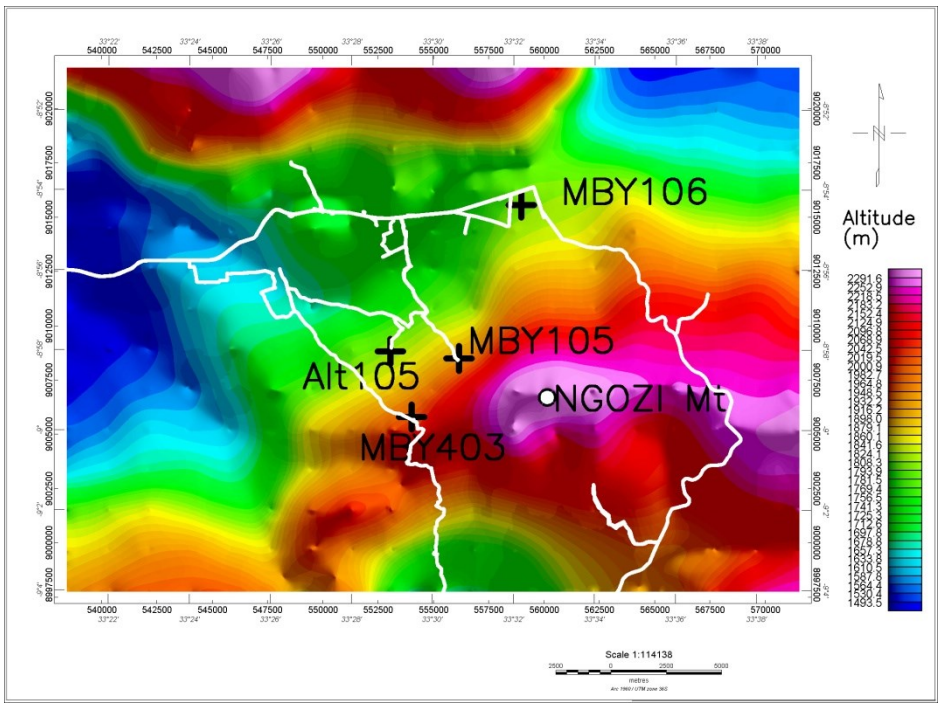

Figure 3: Proposed drilling sites

2.2 Geothermal Energy Beyond Electricity

Geothermal energy will help aquaculture, greenhouse agriculture, and other industrial activities in Tanzania to advance with new technology. This will lead to creation of employment and poverty reduction on both local and national scales. This will facilitate the development of the tourism sector and hotel industry and business will be fostered due to activities that will take place especially in the northern and southern regions of Tanzania, where the most expected geothermal energy development will take place. Songwe and Kilimanjaro international Airports, they are proximal to the geothermal fields that will provide easy access to geothermal economy.

3. CONCLUSION

1. Geothermal energy is a possible source to contribute to Tanzania's electricity mix and beyond.

2. Detailed exploration for geothermal energy in Tanzania is needed

3. Geothermal energy will help fight poverty through people engaging in business after power is connected.

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