GEOTHERMAL ENERGY POTENTIAL OF UGANDA

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ABSTRACT: Uganda is currently facing power shortages with demand exceeding supply by about 130 MW. This is mainly due to climatic fluctuations that have reduced hydropower output from 380 MW, the capacity of hydropower dams at Jinja, to less than 150 MW. This has forced government (GoU) to license Independent Power Producers (IPPs) as a short-term measure to produce electricity from thermal plants to reduce on the shortfall. Despite its considerable hydro resources, the GoU recognizes that it must diversify its energy resources. The present level of uncertainty in climate change and increasing environmental awareness have increased government's need to take a closer look at other renewable energies including geothermal.

1.INTRODUCTION

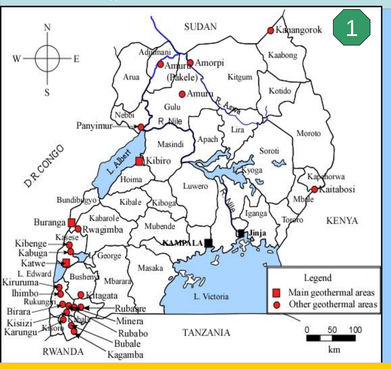
Uganda presently has a total installed capacity of electricity production of 480 MW, 380 MW is hydro power while 100 MW is generated from thermal power plants. Currently, the total production is less than 250 MW while the peak demand is about 380 MW. The country's electricity demand is growing by 8% per annum. With the construction of a 250 MW hydropower plant at Bujagali (Fig. 1) which is underway, it is anticipated that the country's demand will still not be met. The grid electricity access rate is very low 10% with 90% of the population depending on biomass as a source of energy. Geothermal energy could produce base load electricity to complement hydropower if explored and developed. Geothermal exploration has reached advanced stages of surface exploration in Katwe, Buranga and Kibiro and a feasibility study is foreseen.

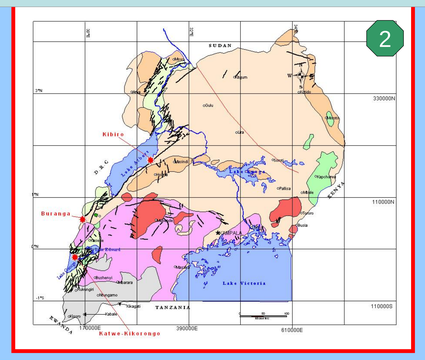
2. GEOTHERMAL POTENTIAL

The country's geothermal resources were estimated at about 450 MW (McNitt, 1982) and no new estimates have been put forward since then. Geothermal energy has a potential role in the energy mix of Uganda because of its location in remote areas far from the single source of hydropower, high transmission energy losses; and uncertainty of continued availability of hydropower arising from climatic fluctuations. Apart from the three major areas Katwe, Buranga & Kibiro, other areas are also being investigated (Fig. 1).

3.GEOLOGICAL POTENTIAL

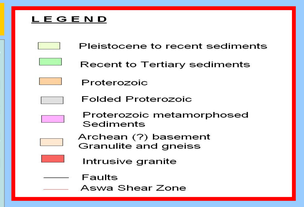
The geology of Uganda consists of an exposed pre-Cambrian basement dissected by the western branch of the East African Rift system in the western part of the country (Fig. 2). The western rift is younger (late Miocene – Recent) than the more mature eastern branch (Morley et al., 1999). The region of the rift has a markedly higher heat flow than the surrounding Pre-Cambrian terrain.

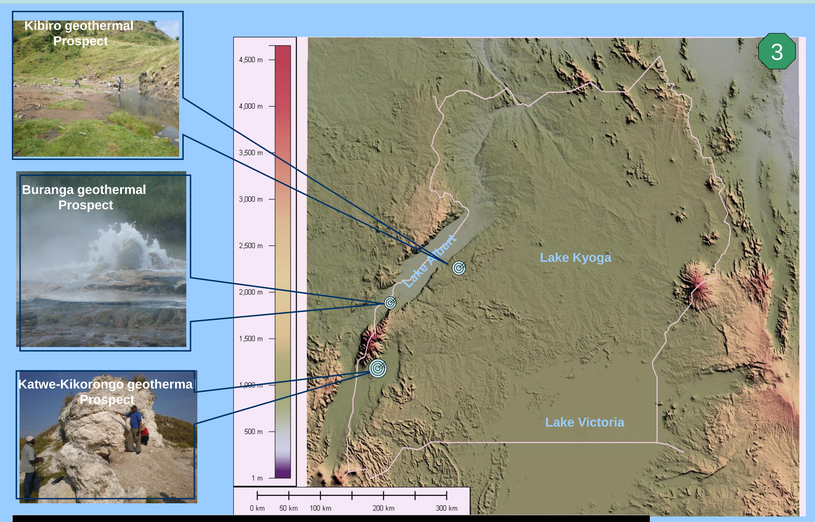




4.GEOTHERMAL SURFACE MANIFESTATIONS

Geothermal manifestations in Uganda are mainly hot springs. In Katwe the hot springs are found in Lakes Katwe and Kitagata with temperatures between 30 and 70˚C and 30-40 ppm H2S. Buranga has the most impressive hot springs some of which are boiling, max. temp. 98˚C, deposits of sulphur. Kibiro hot springs, temperature 86˚C, 10-15 ppm H2S, fumaroles at Kachuru close to Kibiro (figure 3).





DEM and Potential geothermal areas in Uganda

5.EXPLORATION ACTIVITIES AND RESULTS

1993–1994: Geochemical and geological investigation on three areas Katwe, Buranga and Kibiro. GoU and Iceland, UNDP and OPEC. Subsurface temp. of 200+ °C in Kibiro, 140-200°C in Katwe and 120-150°C in Buranga (Armannsson, 1994).

1999 to 2007: Isotope hydrology studies to delineate flow characteristics of geothermal waters and identify their recharge areas. GoU & IAEA. Katwe (Basalt), Kibiro and Buranga (Granitic gneisses); Buranga–subsurface temp; Buranga (200°C), and 140 – 160°C for Katwe and Kibiro. (200°C) Magmatic source of heat for Katwe, Buranga and Kibiro; (Bahati, et. al. 2004).

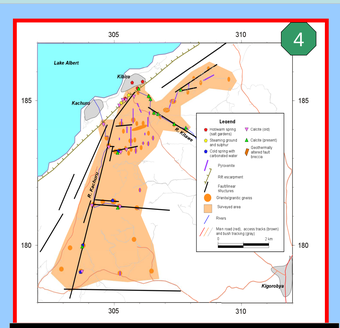
2003-2007: Geological, geochemical and geophysical surveys in Katwe and Kibiro. Large geophysical anomalies in Katwe and Kibiro (Arnason et. al. 2004). Results for Kibiro geology geophysics (Fig. 4 and 5) and Katwe (figure 6) ,

Shallow well drilling for temperature gradient measurements which would also point to the presence of a heat source for a prospect wascarried out at Kibiro (2006-2007) 2006 (figure 7 and 8).

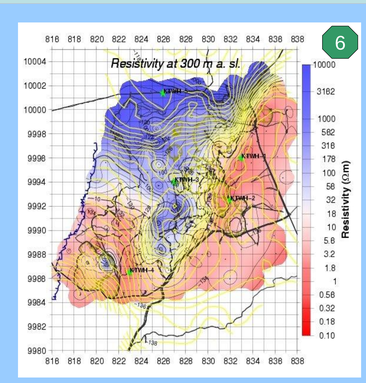
2005-2007: Further detailed geological and geophysical surveys and temperature gradient measurement in Katwe and Kibiro. GoU, WB and ICEIDA.

6.CONCLUSIONS AND RECOMMENDATIONS

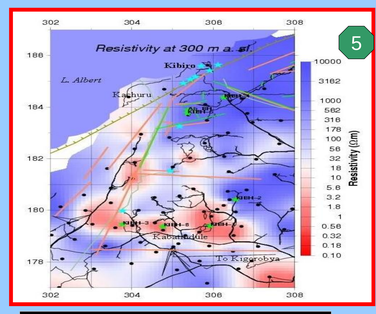
(a) High temp. geothermal reservoirs in Katwe, Buranga & Kibiro (approx. 200°C). (b) Geophysics has mapped anomalous areas that could be potential geothermal reservoirs in Katwe & Kibiro. Temperature gradient measurements suggest absence of a shallow geothermal reservoir. The results further indicate that the system is either deep seated or offset from current suggested positions. (c) Deep exploratory drilling and collection of baseline data for environmental impact assessment are proposed for Katwe, Buranga and Kibiro prospects. (d) The current study has identified other geothermal potential areas which need detailed exploration and development.



Surface geothermal manifestation at Kibrio



•Geophysics at Katwe



Geophysics of Kibiro

Mud drilling at Katwe

7.FUTURE PROGRAMMES

1.Geophysical survey, MagnetoTerrullics MT Measurements, in Katwe at Kibiro to delineate the geothermal anomalous areas and locate drill sites.

2.Detailed geophysical (MT,TEM,Gravity) survey and micro seismic and earthquake measurements of Buranga .

3.Feasibility study: drilling of 2-3 wells to discover a reservoir in the most promising prospect (s), Katwe, Buranga and Kibiro.

4.Detailed surface exploration of other areas.

8.ACKNOWLEDGEMENT

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