

The geothermal resources of the East African Rift

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The uprising mantle plumes lead to a thinned lithosphere, forming of numerous volcanoes, rifting and enhanced heat transfer. Therefore more than 30 geothermal high temperature prospects and 8 volcanoes with known historic eruptions exist in the eastern branch of the rift valley. As an example the Kenyan prospect sites are shown in Figure 10.

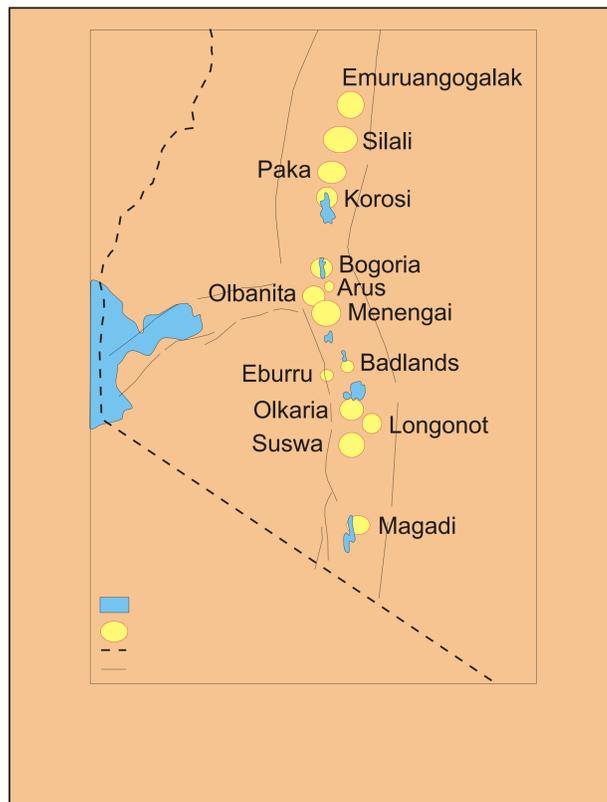


Figure 10 Geothermal prospect sites in Kenya

In contrast the high temperature prospects of the western branch are about 10 times less abundant and there are only three currently active volcanoes.

Numerous hot springs occur in both branches of the rift valley which are suitable for spas and other direct heat applications.

Especially the environment in the Eastern Rift is favourable for the prerequisites which are required for the development of ideal electrical grade geothermal resources (Figure 11):

- 1) high heat flow due to still hot shallow level magma chambers below active volcanoes
- 2) a reservoir of deep seated ground water which is captured by a sealed cap
- 3) permeable rocks mainly due to open fractures allowing fluid flow and recharge of deep ground water by infiltration of rain water
- 4) hot and dry steam without aggressive volcanic gases

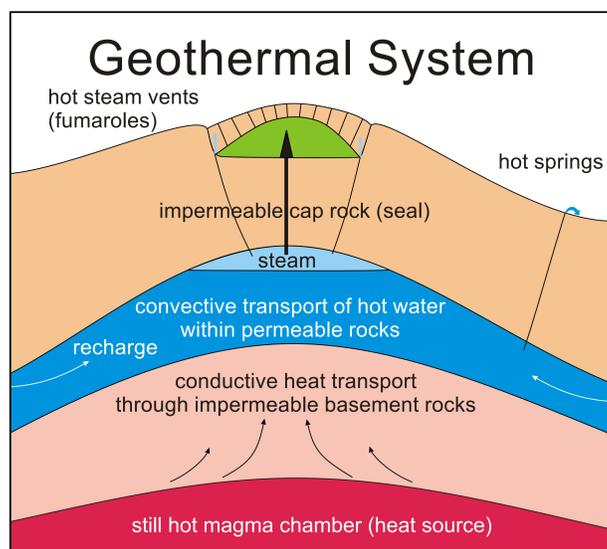


Figure 11 Schematic cross section of a geothermal resource

The combination of these prerequisites is not given within the entire rift. Therefore every prospect site has to be investigated by geologists, geochemists and geophysicists before expensive exploratory drilling is done to avoid financial risks. A potential of at least 2500 MW electrical energy from geothermal resources is assumed for the entire rift (Figure 13).

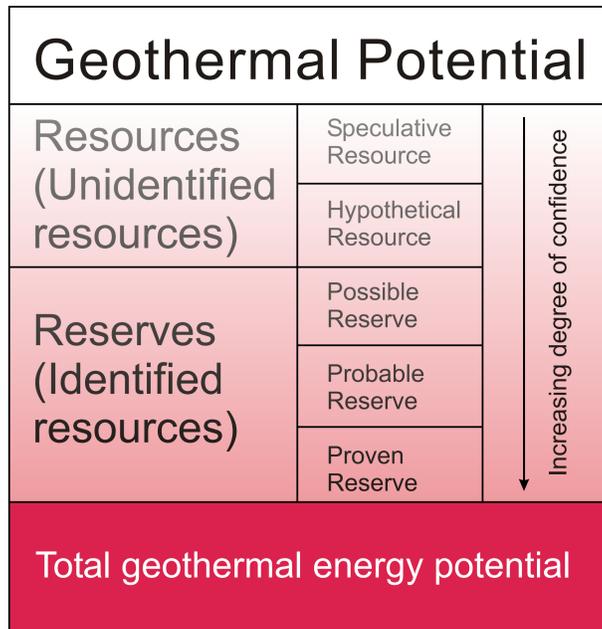


Figure 12 Geothermal potential and its constituents

This MW-number is a matter of continuous change as geo-scientific investigations and drilling proceeds (Figure 12). If e.g. only surface manifestations (hot springs, fumaroles) associated with volcanic activity are known than the assumed MW-number of the potential is a speculative unidentified resource. After geochemical analysis of the geothermal fluids, geological and geophysical investigations the potential is based on possible reserves (identified resources). Finally, after drilling of deep wells, engineering and complete scientific evaluation, the reservoir is well understood (detailed reservoir model) which has than the status of a proven reserve.

1000 MW of electrical capacity are planned to install within the East African Rift System until 2020. So far 121 MW are installed in Kenya (Olkaria) and 8.5 MW in Ethiopia (Aluto-Langano). Important prospect sites for future power plants are (not representative selection sorted from north to south; Figure 13): Alid (Eritrea), Assal (Djibouti), Tendaho (Ethiopia), Eburru (Kenya), Kibiro (Uganda) and Mbeya (Tanzania).

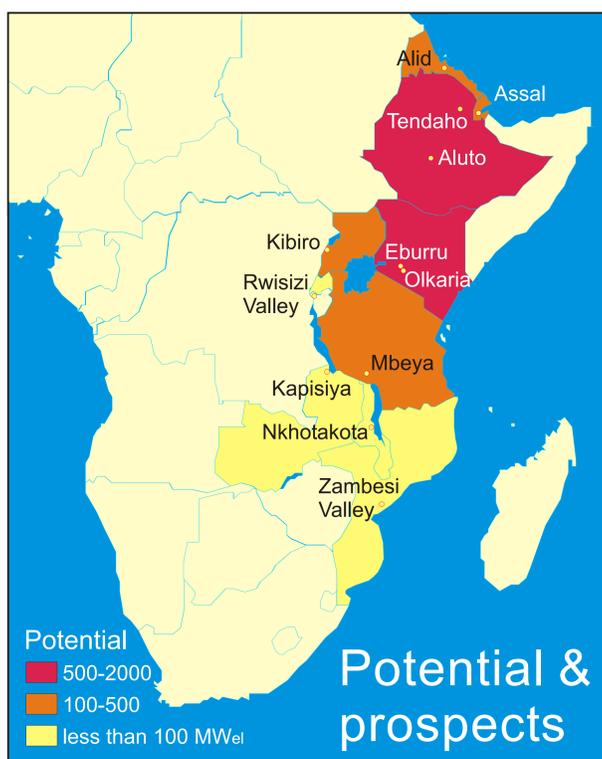


Figure 13 Selected prospects along the East African Rift Valley

Especially at the southern end of the western rift not much is known up to now whether the geothermal prospects offer electrical grade resources. Therefore it would be very useful to gather all available information and evaluate these data by an independent institution applying uniform criteria. This review would result in a ranking list of all prospects which could be the base for planning of necessary geoscientific investigations etc. at the different sites.

The following prospects sites (Figure 14) are suggested for support by GEOTHERM programme:

- 1) Menengai volcano (Kenya)
- 2) Alid volcano (Eritrea)
- 3) Buranga (Uganda)



Figure 14a Menengai volcano in the Kenyan Rift with fumaroles at the crater floor.



Figure 14b Alid volcano in the Danakil Rift, Eritrea with fumaroles at the crater floor.



Figure 14c Buranga prospect in the western rift of Uganda with hot springs.

