

Geothermal Development in Kenya: The Indigenous, Renewable,
Green Option – **Issues and Lessons Learned**

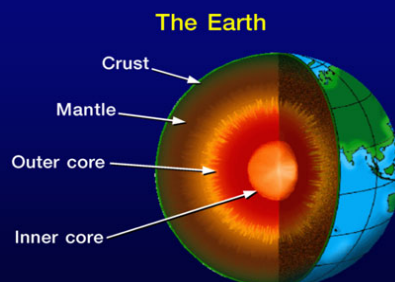
Prof. Imasiku A. Nyambe

IWRM Centre, School of Mines,
University of Zambia & Zambia
Water Partnership

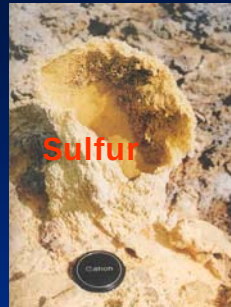
Introduction

What is Geothermal Energy?

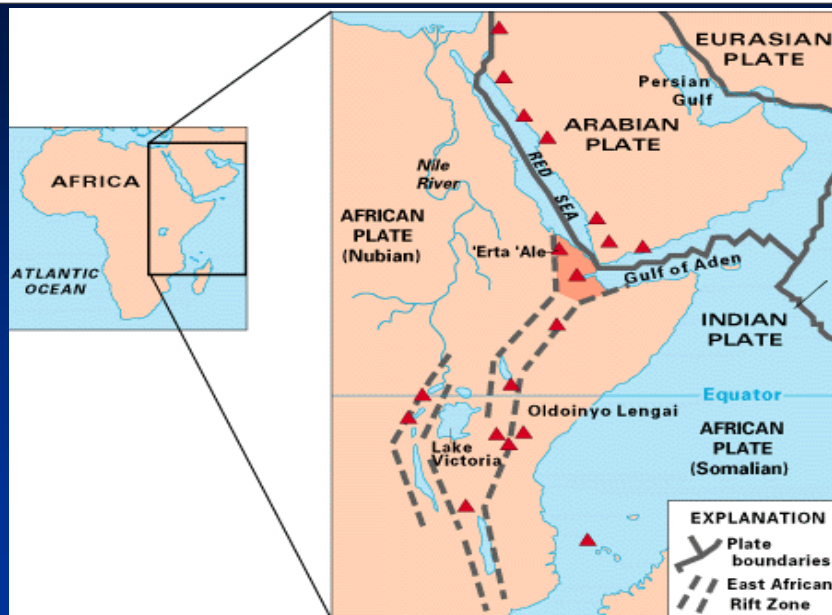
- It is Heat from the earth



How does this Heat show itself up

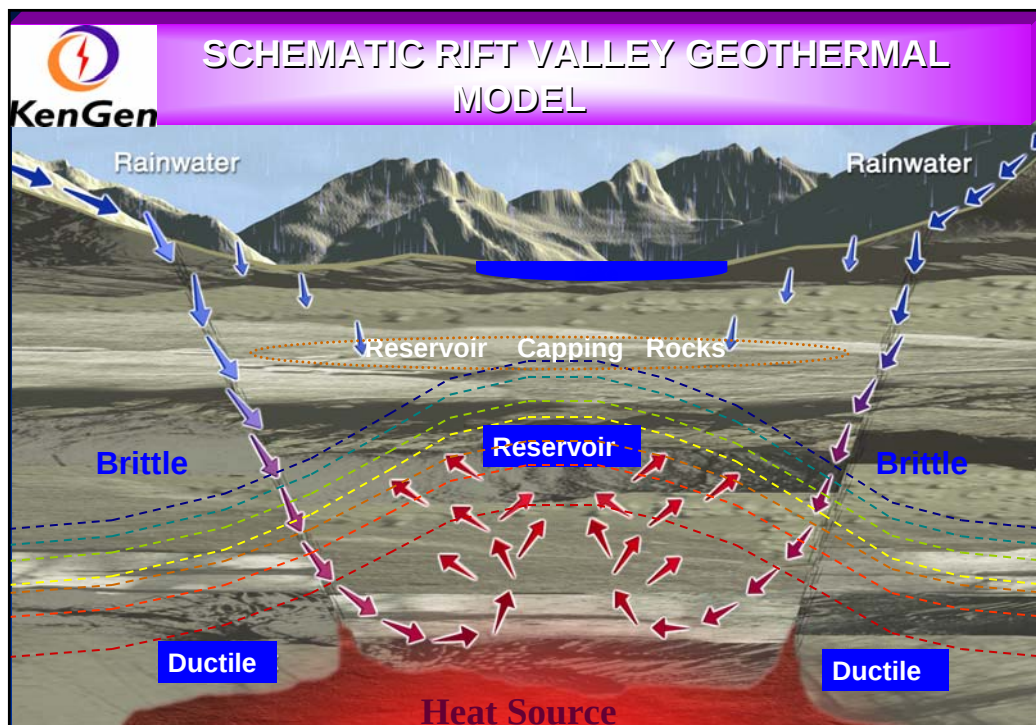


Geothermal Resources in Africa



What does this mean for Kenya

- Kenya relies on three major sources of energy.
 - Biomass -68 %
 - Petroleum - 22 %
 - Electricity -9 %
- In the Electricity sub-sector
 - Hydropower - 57 %
 - Thermal - 32 %
 - Geothermal - 11 %
 - Other forms of renewable energy (wind, solar, biogas, micro hydro etc) - 1 %



Good Example in Kenya



Olkaria II Power Plant 70 MW



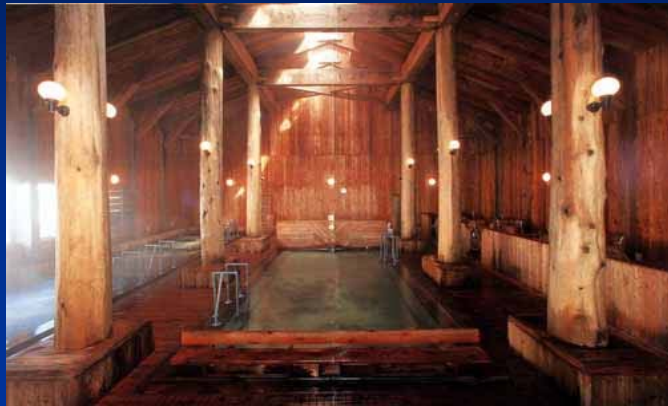
Issues

- Reliance of Kenya on Biomass up to 68% leading to deforestation, erosion and siltation
- Only 15.3% of Kenyans have access to electricity. Therefore there is vast potential for load growth with Kenya's potential at 3,000Mega Watts (requirement currently at 1,000), East Africa at 10,000 Mega Watts
- Exploitation of resource should be done in close collaboration with other users (competitors)
- Maintenance of equilibrium in the existing environmental parameters
- Community acceptance of KenGen's operations particularly on the usage of the water of the lake
- **Investigation into other useful application of Geothermal Energy**

Medical effects of SPRINGS

1. Heat
2. Water pressure
3. Chemical constituents
4. Mental effect

**Bath-tub of
Tamagawa
Hotspring**



Rock-bath for medical treatment



Medical effects of SPRINGS -1

Disease which is susceptible to treatment	Simple hot spring	Chloride spring	Hydrogen carbonate spring	Sulfate spring	Carbon dioxide spring	Iron spring	Sulfur spring	Acid spring	Radioactive spring
Neuralgia	○	○	○	○	○	○	○	○	○
Muscular pain	○	○	○	○	○	○	○	○	○
Joint ache	○	○	○	○	○	○	○	○	○
Frozen shoulder	○	○	○	○	○	○	○	○	○
Movement paralysis	○	○	○	○	○	○	○	○	○
A joint stiffens.	○	○	○	○	○	○	○	○	○
Bruise	○	○	○	○	○	○	○	○	○
Chronic digestive organ disease	○	○	○	○	○	○	○	○	○
hemorrhoids	○	○	○	○	○	○	○	○	○
Cold nature	○	○	○	○	○	○	○	○	○
convalescence	○	○	○	○	○	○	○	○	○
Recovery from fatigue	○	○	○	○	○	○	○	○	○

Medical effects of SPRINGS -2

Disease which is susceptible to treatment	Simple hot spring	Chloride spring	Hydrogencarbonate spring	Sulfate spring	Carbon dioxide spring	Iron spring	Sulfur spring	Acid spring	Radioactive spring
Healthy improvement	○	○	○	○	○	○	○		
Limits crack		○	○	○	○		○		
Burn		○	○	○	○				
A chronic skin disease		○	○	○				○	○
Physically weak child		○							
Chronic women's diseases		○					○		○
Arteriosclerosis				○	○		○		○
Hypertension					○		○		○
Menstrual disorders						○			
Diabetes							○		
Gout									○
Chronic inflammation of the gallbladder									○
Cholelithiasis									○

Lessons Learned

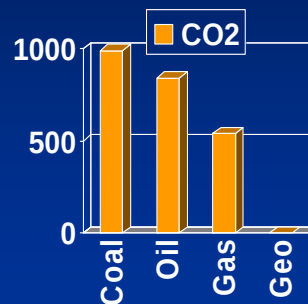
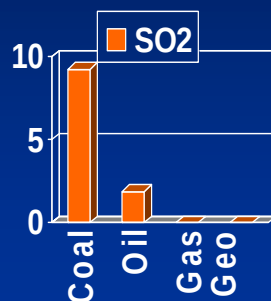
- The older technology at Olkaria 1 is NOT renewable whereas at Olkaria II is
- Exploitation should be done in close collaboration with other stakeholders to avoid depletion of resource e.g. an example in the USA
- Environmental monitoring is the key safety precaution as any changes in the system provides an alert to re-dress
 - Heat outflow and inflow should be balanced and maintained above the equilibrium of silica and bi-carbonate to avoid precipitation of these elements in pipes
 - Geothermal fluids re-injected do Not contaminate GW
 - In a National Park, friendly designs that take of even routes of animals are key to sustainability
- Implementation of wise water use i.e. using existing water at every stage of development e.g. lake water at the beginning and later use the water in the system - re-cycling

Lessons Learned - 2

- At Re-habilitation, use only indigenous plant species
- Steam can be used in Green House Projects with the various outputs from the steam providing an ingredient to plant growth e.g.
 - Heat to maintain the temperature within the Green House
 - Carbon Dioxide for photosynthesis.
 - H_2S for fungi - bacterial growth
- EIA is now done before the beginning of project to avoid spending a lot of finances and have the project stopped later e.g. at Lake Bogoria Prospect, the project could NOT continue after discovering that the community regard the steam from the ground as provided by their Gods
- Regular visits by pupils from Schools and Community leaders in the long run will help KenGen to improve the company image and sensitize the population to counter negative publicity by researchers such as lowering of the lake level.

Lessons Learned - 3

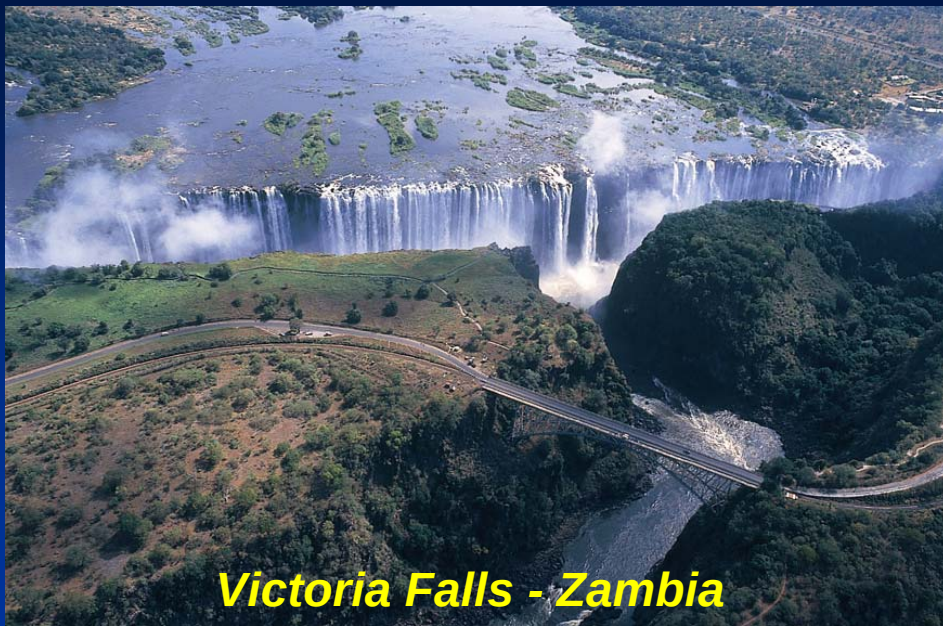
- Though Hydro is cheaper in returns, Geotherm is easier to maintain and is good business because it is not affected on climate change - droughts etc and is non-polluting source of energy



Lessons Learned - 3

- Geotherm can be used for development in remote areas even in arid and semi-arid areas
- Though condensed steam at Olkaria is not used for water supply at Nakuru, the proposed plant there is designed to assist in this area.
- KenGen has a mobile training centre where training is conducted e.g. last November PS where trained
- Potential for regional cooperation through the Geothermal Associations e.g exchange of equipment, maintenance fee and for sourcing of funds and equipment.

Acknowledgement



Victoria Falls - Zambia