

Environmental Management at Olkaria Geothermal Power Project, Kenya

Gabriel Wetang'ula & Benjamin Kubo

Olkaria Geothermal Project

Email: gwetangula@kengen.co.ke

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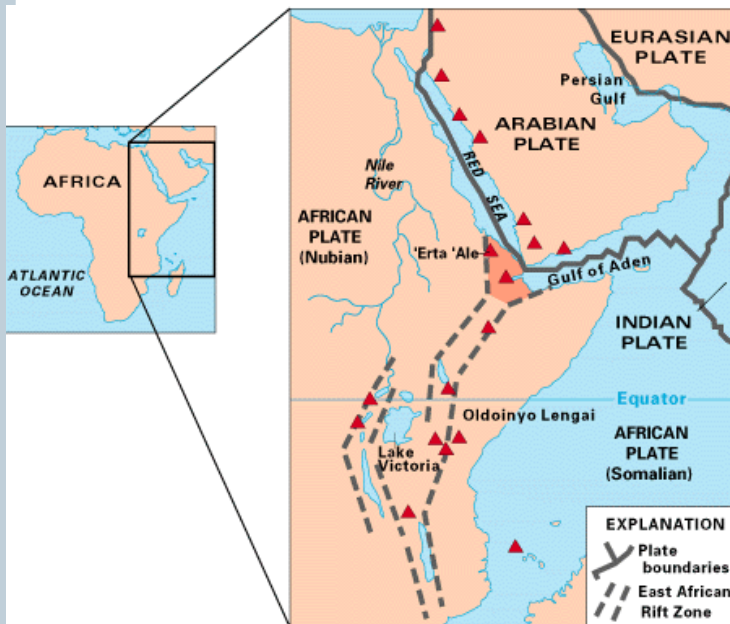
bkubo@kengen.co.ke



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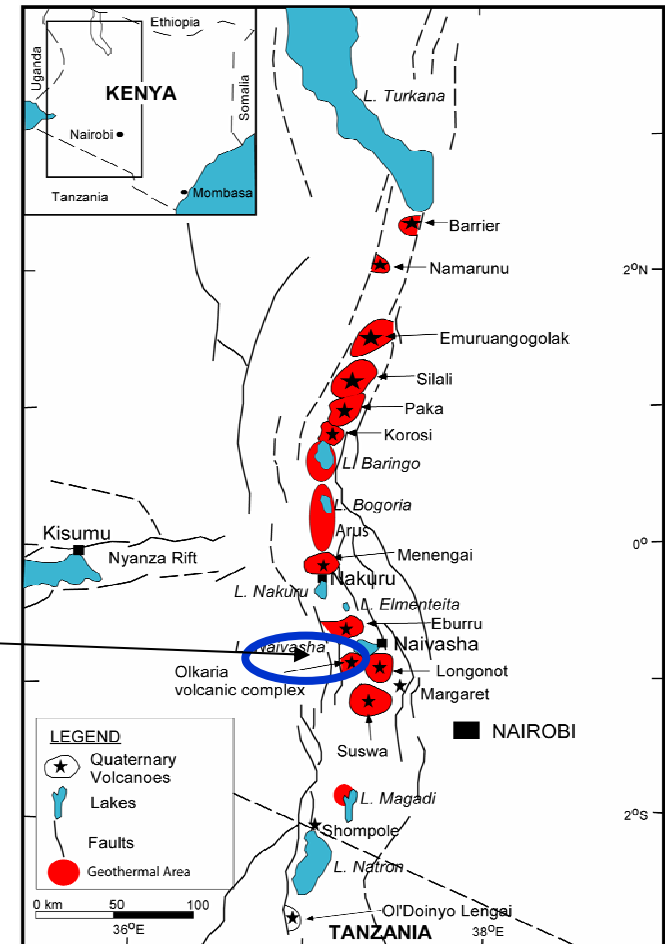
Introduction

- ❖ Kenya has a number of geothermal areas identified in GoK/UNDP scientific surveys.



Geothermal Resource

Olkaria



Olkaria & other geothermal Prospects in Kenya



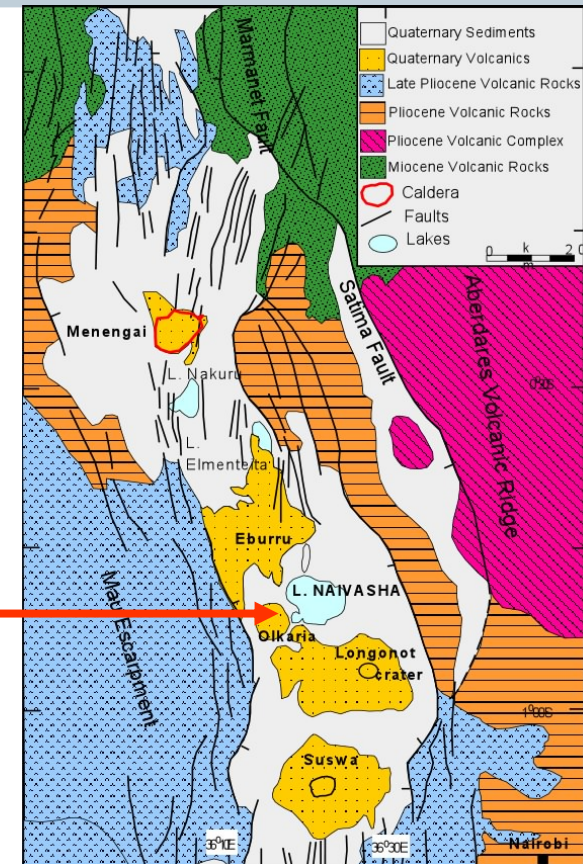
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Olkaria Geothermal Project

- ❖ The Greater Olkaria geothermal is located in the central sector of the Kenya Rift Valley
- ❖ Interest in geothermal development at Olkaria started in the 1950's.
- ❖ Two exploration wells drilled in 1956.

Olkaria

- ❖ 1974-UNDP/GoK funded exploration Programme for prospects in the Kenyan rift Olkaria inclusive.





Olkaria Geothermal Project 2 **KenGen**

- ❖ Construction of the First 3 X 15MW units power station (Olkaria I) started in 1980 and fully commissioned in 1985
- ❖ Commissioning - Unit I (1981), Unit II (1982) and Unit III (1985).
- ❖ Hells Gate National Park –Gazetted in 1984-3yrs after the 1st Unit.



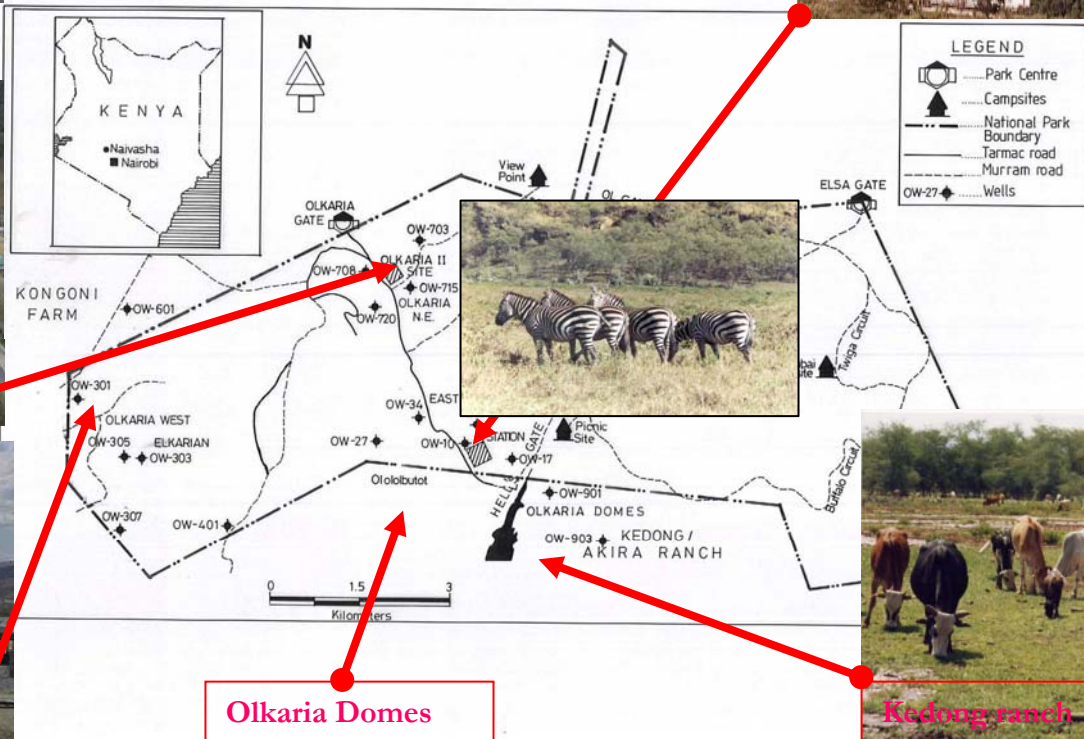
Olkaria I Power Station



Olkaria Geothermal Project 3 *KenGen*

- ❖ Aspect of environmental management in during geothermal development - Wildlife in the area
- ❖ Environmental section was established in 1988
- ❖ Memorandum of Understanding (MoU) signed between the management of KWS and KenGen (then KPC) in 1994
- ❖ MoU harmonizes diverse resource use for mutual benefit
- ❖ Environmental impacts are envisaged and mitigation measures undertaken.
- ❖ Other developments:Olkaria II, Olkaria III-an IPP, Oserian Power station, Olkaria IV, Floriculture & ranching

Activities around Olkaria Geothermal Field and its Environs





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Hells gate National Park

- ❖ It's situated within Olkaria geothermal field located on the southern side of Lake Naivasha
- ❖ Has an area of about 6825.7 ha (68.5 km²)
- ❖ Encloses both the Olkaria I, Olkaria II, Olkaria III (IPP) stations
- ❖ Wildlife species include; Buffalo, Zebra, Gazelle, Hartebeest, Maasai giraffe etc
- ❖ Special sites central and Fischer's towers, cliffs, Hills, Ol Njorowa gorge, Caves, Hells Kitchen & Holey Volcano

Attraction Features

Steaming ground-Hells Kitchen



Cliff area

The Plains & part of Ol Njorowa gorge



Fischers tower and gorge area



Olkaia Hill with a blowing well



Environmental issues and their Management



- ❖ Land acquisition
- ❖ Surface disturbance (flora, fauna, soils)
- ❖ Air emission
- ❖ Noise emission
- ❖ Thermal effluents
- ❖ Chemical discharge
- ❖ Solid waste
- ❖ Water usage
- ❖ Socio-economic benefits

Land Acquisition for geothermal development



❖ Land acquisition is either by:-

- Purchase – Private land
- Government Land
- Negotiation for Access – Trust land/communal land during surface exploration



Negotiation with local communities for free land access rights during surface exploration



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Floral Management

- ❖ Removal of vegetation - kept to minimal
- ❖ Removal invasive plant species
- ❖ Rehabilitation of all areas cleared off vegetation
- ❖ Monitor abundance and diversity of natural vegetation.

Floral Management 2

❖ Rehabilitation of civil works with native plant species



OW during works



Project tree nursery



After



Olkaria II during construction



Olkaria II after construction

Faunal management 1

- ❖ Areas fenced off –those perceived dangerous for animal protection.
- ❖ Pipeline layout- considers animals migration routes or movements (loops).



Wells fenced off



Wildlife migration routes



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Fauna management 2

- ❖ Regulation of vehicle speed limits through bump & road signs to protect wildlife.
- ❖ Night movement of vehicle within the park minimal except for key operations.
- ❖ No introduction of exotic animals by staff e.g. dog, cats.



Wildlife Crossing Road sign



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Fauna management 3

- ❖ Creating awareness in staff on wildlife conservation
- ❖ Joint wildlife population studies through quarterly wild animal census.
- ❖ Establishment of wildlife watering points.



Watering point



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Soil Management

- ❖ Minimize soil disturbance in sloppy area during operations and earthworks.
- ❖ Soil conservation, stabilization, erosion control & monitoring



Minimal soil disturbance & rehabilitation



Soil erosion control



Road surface stabilized

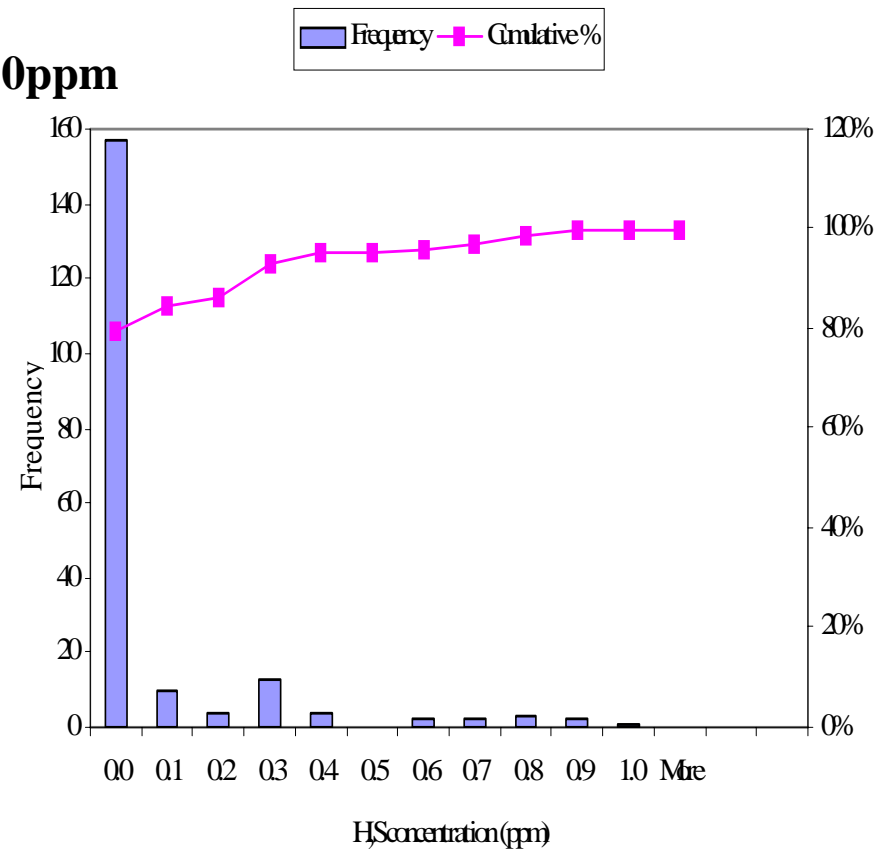
Air quality & Meteorology Management



- ❖ Air pollution monitoring to ascertain quality around the park -H₂S
- ❖ WHO Occupational Exposure Limit is 10ppm



H₂S monitoring around installations



Air quality & Meteorology Management 2



❖ Meteorological monitoring



Weather station & data collection

❖ Precipitation chemistry –flower trial studies



Rain water collection



Vegetation/flower studies



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Noise emission management

- ❖ Noise level monitoring at various vantage points in the park e.g Picnic and Camp sites
- ❖ Use of silencer to reduce noise level during discharge
- ❖ Use of noise protection devices e.g. use of earplugs, ear muffler,
- ❖ Adherence to park regulations - No hooting in the park.



Silencers



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Management of Bush fires

- ❖ Field is in eco-climatic zone V with loose soils and little rainfall.
- ❖ Wildfire hazard is high.
- ❖ Biodiversity loss - Prevention of fire outbreaks.
- ❖ Fire prevention & control awareness- discourage throwing of cigarette filters, lighting of fires; fire danger rating signboard.



Wildfire damage

Fire Prevention and Control



Management of Excess heat in steam and wastewater 1



❖ Cooling tower used to vent heat to atmosphere



Olkaria II – counter flow



Olkaria I – cross flow

Management of Excess heat in steam and wastewater 2



❖ Disposal of hot wastewater - Deep reinjection



Olkaria II - Cold reinjection



Olkaria II – hot reinjection

Aesthetic and Solid waste management



- ❖ Enhancing natural look of the park
- ❖ Steam lines
- ❖ solid waste management



Steamline painted green



Enhancing natural look

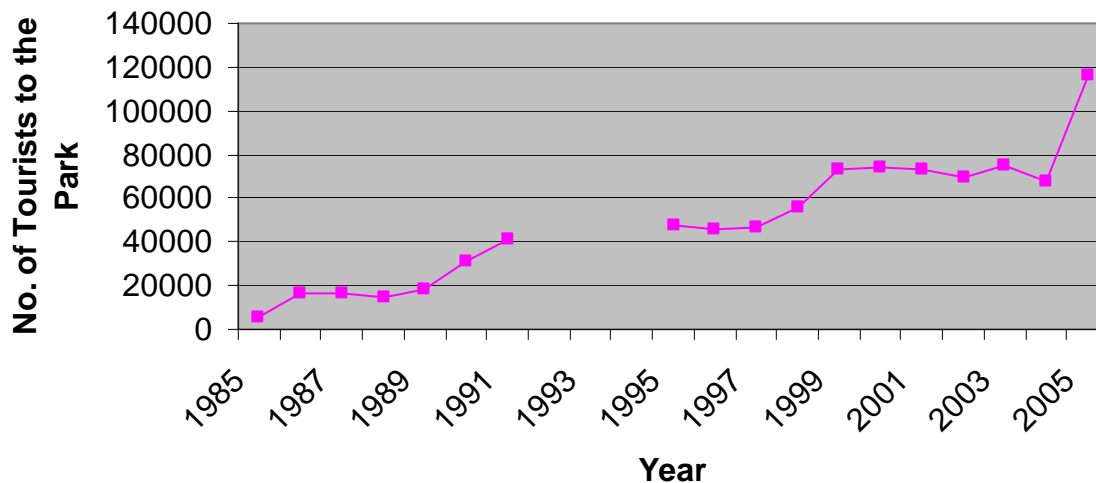


Solid waste management and site audits

Tourism management

- ❖ Geothermal - the key tourist attraction feature
- ❖ Attractions – power generation, steaming grounds, altered grounds, fumaroles & other unique geological features

Figure: Total number of tourists/visitors to the Hells Gate National Park (1985-2005)



Water usage



Water intake in Lake Naivasha

- ❖ Lake Naivasha - freshwater lake in semi-arid area
- ❖ Ramsar site
- ❖ Commercial flower farming
- ❖ Cooling water for - water for startup only
- ❖ Project incorporates eco cycle (recycle & re-use)
- ❖ Lake monitoring programme



Avifauna of Lake Naivasha

Other Socio-economic benefits of the Project

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- ❖ Free clean piped water to local community
- ❖ Educational facilities for locals
- ❖ Use of health facilities by locals
- ❖ Provision of free transport – no public vehicle in the park
- ❖ Improved road network
- ❖ Social afforestation



Environmental Monitoring Programmes



- ❖ Afforestation and Rehabilitation
- ❖ Noise emission
- ❖ H₂S gas
- ❖ Meteorology
- ❖ Precipitation chemistry monitoring
- ❖ Trace elements in wastewater, soil & vegetation
- ❖ Vegetation patterns
- ❖ Wildlife conservation
- ❖ Wildlife population census

Conclusions

- ❖ Geothermal energy is a relatively clean energy source
- ❖ Impacts from its exploitation can be minimized
- ❖ Unforeseen impacts in operational phase checked by initiating monitoring programmes
- ❖ The geothermal project has not led to environmental degradation in Hells Gate National Park
- ❖ KenGen has effective EMS and plan for ISO 14000 certification