Environmental Management at Olkaria Geothermal Power Project, Kenya

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Introduction

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

- 1974-UNDP/GoK funded exploration Programme for prospects in the Kenyan rift Olkaria inclusive.
Construction of the First 3 X 15MW units power station (Olkaria I) started in 1980 and fully commissioned in 1985.


Hells Gate National Park – Gazetted in 1984-3yrs after the 1st Unit.
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

- Olkaria II power plant
- Olkaria III power plant
- Oserian 1.8 MW power plant
- Oserian Greenhouse heating
- Olkaria Domes
- Kedong ranch
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 & Hobley Volcano
Attraction Features

- Fischers tower and gorge area
- The Plains & part of Ol Njorowa gorge
- Olkaia Hill with a blowing well
- Steaming ground-Hells Kitchen
- Cliff area
- Fischers tower and gorge area
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
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).
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.
Fauna management 3

- Creating awareness in staff on wildlife conservation
- Joint wildlife population studies through quarterly wild animal census.
- Establishment of wildlife watering points.
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 pollution monitoring to ascertain quality around the park - H2S

WHO Occupational Exposure Limit is 10ppm
Air quality & Meteorology Management 2

- Meteorological monitoring

- Precipitation chemistry – flower trial studies

Weather station & data collection

Rain water collection

Vegetation/flower studies
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
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.
Fire Prevention and Control
Management of Excess heat in steam and wastewater

- 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
Water usage

- 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

Water intake in Lake Naivasha

Avifauna of Lake Naivasha
Other Socio-economic benefits of the Project

- 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

Mvuke primary school

Mvuke Health Clinic

Transport

Water facilities

Before rehabilitation

Social afforestation

After rehabilitation
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