STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA) FOR ENERGY SECTOR: CASE STUDY OF OLKARIA GEOTHERMAL EXPANSION PROGRAMME IN NAKURU COUNTY, KENYA.

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ABSTRACT

Strategic Environmental Assessment (SEA) provides an opportunity for integrating environmental management in the energy development process. It serves as a framework against which Environmental and Social Impact Assessments (ESIA) for individual energy projects are carried out thereby ensuring fulfillment of sustainable development goals. Kenya Electricity Generating Company Limited (KenGen) conducted SEA for its geothermal expansion programme at Olkaria in 2014. The objective of the programme was to increase geothermal energy generation by 1,110MWe between 2012 and 2020. This paper discusses key findings of the SEA with respect to biodiversity conservation within Hells' Gate National Park. Documentation of the findings would help to guide development of geothermal energy projects in fragile ecosystems, thereby striking a balance between economic development and biodiversity conservation.

Key words
KenGen, Hell's Gate, Geothermal, Biodiversity, Strategic Environmental Assessment

1. INTRODUCTION

SEA is a strategic framework instrument that helps to create a development context towards sustainability, by integrating environment and sustainability issues in decision-making, assessing strategic development options and issuing guidelines to assist implementation (Partidario, 2012).

SEA, in a strategic thinking approach, has three concrete objectives:

i. Encourage environmental and sustainability integration that would set enabling conditions to nest future development proposals;
ii. Add-value to decision-making, discussing opportunities and risks of development options and turning problems into opportunities and
iii. Change minds and create a strategic culture in decision-making, promoting institutional cooperation and dialogues thus avoiding conflicts.

This paper discusses key findings of SEA for Olkaria geothermal expansion programme with respect to biodiversity conservation.

2. OLKARIA GEOTHERMAL EXPANSION PROGRAMME

KenGen's geothermal expansion programme covers nine (9) year period from 2012 to 2020. The company's installed capacity for geothermal energy is expected to increase from the current

513.8MWe (as at February 2016) to over 1110MWe by the year 2020. The components of the programme include conventional power plants, wellhead power plants, drilling of geothermal wells, direct uses of geothermal energy, an industrial park, staff offices and laboratories.

2.1 Objectives of the Programme

The objectives of the programme are to:

i. Diversify sources of energy in order to minimize the over reliance on hydro and thermal sources of energy.
ii. Mitigate against climate change via reduction of green house gas emissions.
iii. Reduce import bill in the long term by saving on money used to import expensive fossil fuels.
iv. Earn revenue for the company and the government.
v. Create employment opportunities.
vi. Promote direct uses of geothermal heat and
vii. Generate least cost power that will make Kenyan economy competitive.

2.2 Justification of KenGen's Energy Programme

Historically, Kenya's dependence on thermal energy sources and unreliable hydropower has resulted in high electricity costs (Government of Kenya, 2015). The country must, therefore, generate more energy at a lower cost and increase efficiency in energy consumption. Geothermal resource provides a solution to this problem since it is a stable source of base load energy (Government of Kenya, 2007). As a result of commissioning of 140MWe Olkaria IV geothermal power plant, industrial electricity tariffs fell from USD 0.210/kWh in July 2014 to USD 0.146/ kWh in January 2015 and were forecasted to decrease further to less than USD 0.100/ kWh (Government of Kenya, 2015). It is against this background that KenGen's Olkaria Geothermal Expansion Programme was developed.

2.3 Location of Olkaria Geothermal Field

Olkaria geothermal field is located in Naivasha sub-county approximately 120km Northwest of Nairobi, the capital city of Kenya. KenGens' geothermal licensed area measures 204km^2 and is one of the prospects located along the Kenyan Rift Valley as indicated in figure 1. Part of the concession area lies within Hell's Gate National Park (HGNP) which measures approximately 68.25km^2 (KWS,2010). The park is managed by Kenya Wildlife Service (KWS) which is a state corporation.

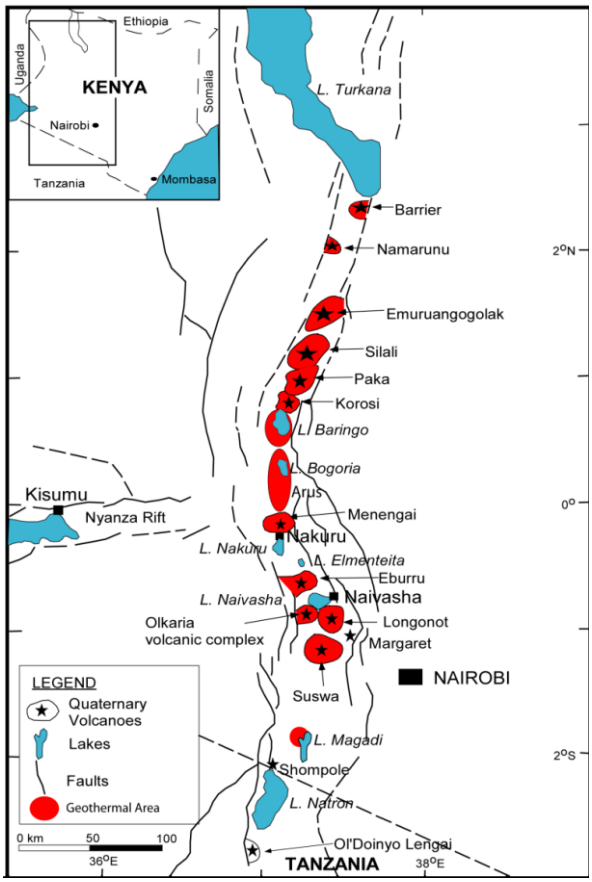

Figure 1: Location of Olkaria Geothermal Field (Ofwona, 2011)

3. LEGAL CONTEXT IN KENYAN SEA PRACTISE

The legal instruments that govern administration of SEA in Kenya are discussed below.

3.1 The Environmental Management and Co-ordination (Amendment) Act, 2015

This is an act of parliament to amend the Environmental Management and Coordination Act (EMCA), 1999. It came into operation on 17th June 2015. Section 42 of the act provides that all policies, plans and programmes (PPPs) for implementation shall be subject to SEA.

3.2 The Environmental (Impact Assessment and Audit) Regulations, 2003

This is a subsidiary legislation to EMCA, 1999 that governs administration of the environmental assessment procedure in Kenya. Clause 42 of these Regulations requires lead agencies, in consultation with NEMA, to subject all proposals for PPPs to SEA in order to determine the ones that are most environmental friendly and cost effective when implemented individually or in combination with others (Government of Kenya, 2002).

3.3 National Guidelines for SEA in Kenya

These guidelines were developed by NEMA in 2012 and are anchored on the Environmental (Impact Assessment and Audit) Regulations, 2003. The guidelines provide direction on how

SEA practice in Kenya should be conducted at national and sectoral levels using best practice approaches (NEMA, 2012).

4. SEA FOR KENGEN'S GEOTHERMAL EXPANSION PROGRAMME

SEA for Olkaria geothermal expansion programme kicked off in January 2014 and was approved by NEMA in August 2015. A total of fifty five (55) stakeholder categories were identified through an intensive stakeholder analysis process (Five Capitals, 2014). These included biodiversity conservation groups such as Nature Kenya and HGNP Management Committee. Stakeholder engagement was achieved through focus group meetings, public meetings with communities, consultative workshops and a validation workshop that approved the final SEA report. The biodiversity groups raised various concerns including loss of biodiversity within HGNP, wildlife disturbance by noise emission, curtailed movement of wild animals by steam pipelines and exposure of hot brine to wild animals.

4.1 SEA Recommendations for Biodiversity Conservation

The following were the key recommendations put forward with regards to biodiversity conservation (Five Capitals, 2014):

4.1.1 Protection of Wildlife Dispersal Areas

SEA report recommended protection of wildlife corridors to enhance habitat connectivity. Two biodiversity corridors were identified: to the west of Lake Naivasha extending north to south and to the south of Olkaria extending east to west. Hell's Gate National Park connects to the east with Mount Longonot National Park. Wild animals use these corridors to disperse in search of food and water.

4.1.2 Protection of Landuse Zones within the Park

Hell's Gate-Mt. Longonot National Park Ecosystem Management Plan 2010-2015 provides a zoning plan for the park. Four zones have been designed i.e. High Use Zone, Low use Zone, Closed Zone and Influence Zone (KWS, 2010). The High Use Zone covers the whole area under geothermal power production and exploration. The zone has two components; the geothermal licensed area and the high use non concession area under direct authority of KWS. Geothermal development activities are only permitted in the licensed area. SEA report recommended protection of the High Use Non Concession, the Closed and the Low Use zones of HGNP.

4.1.3 Restoration of Disturbed Sites

SEA study, revealed that restoration of the areas that had been cleared and/or excavated during construction phase of the 280MWe geothermal projects had not been adequately rehabilitated. The report recommended adequate restoration of disturbed sites both within and outside HGNP in line with international best practice. This involves landscaping and planting of indigenous vegetation.

4.1.4 Minimization of Project Footprint

The report recommended KenGen to consider minimizing the project footprint for all future developments in order to ensure protection of the HGNP.

4.1.5 Minimization of Quantities of Water Abstracted from Lake Naivasha

KenGen uses water abstracted from Lake Naivasha for domestic and industrial purposes. It was noted that drilling of geothermal wells required plenty of water and with the implementation of the proposed industrial park there was need for KenGen to consider alternative sources of water to supplement that of the lake. This would contribute towards protection of the lake which is a Ramsar site.

4.1.6 Sound Management of Effluent

It was observed that Olkaria I power plant, commissioned in 1981, 82 and 85, did not have a reinjection system and thus it was discharging wastewater to the environment. Thermal discharge has a negative impact on tourism and on the wildlife. SEA report recommended installation of a reinjection system to Olkaria I Power Plant which would ensure sound disposal of the waste water.

4.1.7 Noise Emission Minimization

Noise is a significant impact during well discharge tests. The report recommended the need for KenGen to acquire improved silencers that were targeted to reduce the levels of noise during well discharge tests. It also recommended research to be carried out on the possibility of using temporary barriers to reflect the noise away from sensitive receptors during well discharge tests.

4.2 Implementation of SEA Recommendations by KenGen

The table below provides status of implementation of recommended measures by KenGen and KWS.

SEA Recommendation	Status of Implementation by KenGen and KWS
Protection of wildlife dispersal areas.	• KenGen and KWS are undertaking a Joint study to review the Hell's Gate –Mt. Longonot Ecosystem Management Plan 2010-2015. The study will identify and map out all wildlife dispersal areas and sensitive receptors. The study is being financed by the two organizations. • KenGen has purchased land adjoining Hell's Gate and Mt. Longonot National parks. The land will not be enclosed, as is the case for neighbouring flower farms, instead it would be left open to facilitate wildlife dispersal.
Protection of Landuse Zones within the Park.	• Whenever, there is need to carry out geothermal development within the high use geothermal licensed area, KenGen and KWS carry out a joint visit to the site that informs whether the development will proceed or not depending with the sensitivity of the site. In case the development is permitted, Environmental Impact Assessment (EIA) must be conducted and the Environmental Management Plan implemented to the later. • There exists KenGen-KWS memorandum of understanding, 2008 which is undergoing a joint review to incorporate

	emerging issues. • KWS have deployed a Research Scientist at Hell's Gate National Park to work hand in hand with KenGen's environmental scientists. • The land that KenGen has bought will be used for future geothermal development thus facilitating step out from the high use geothermal licensed area.
Restoration of Disturbed Sites.	KenGen has procured the services of a contractor who is currently undertaking landscaping and rehabilitation of disturbed sites and fencing of brine ponds.
Minimization of Project Footprint.	• KenGen is currently drilling multiple wells on the same well pad. Use of directional drilling technology permits drilling of two to six wells on the same well pad thus minimizing the project footprint. • In August, 2015 staff offices were relocated from Hell's Gate National Park to the staff quarters approximately 10km away. This has contributed towards minimization of vehicular and human traffic within the park. About 300 vehicles on average used to enter the park on a daily basis when staff offices were still within the park.
Minimization of Quantities of Water Abstracted from Lake Naivasha.	• KenGen is carrying out drilling of geothermal wells using brine. This has helped to supplement the water abstracted from Lake Naivasha. • Hydrogeological studies have been undertaken to establish feasibility of drilling boreholes at Olkaria geothermal field.
Sound management of effluent.	• KenGen is undertaking rehabilitatation/upgrading of Olkaria I power plant to incorporate a reinjection system thereby minimizing the negative impact on the environment. • Shallow reinjection wells have been incorporated in the design of the wellhead power plants.
Noise emission minimization.	• The company has procured a prototype improved silencer that is currently undergoing test ready for adoption during well discharge tests. • The company has entered into collaboration with research institutions to explore other possible ways of minimizing noise emissions.

Conclusion

SEA for Olkaria geothermal expansion programme provides a framework against which ESIA for individual projects should be carried out. Implementation of the recommendations put forward would go a long way towards ensuring environmentally sustainable development of geothermal resources as is currently being witnessed.

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