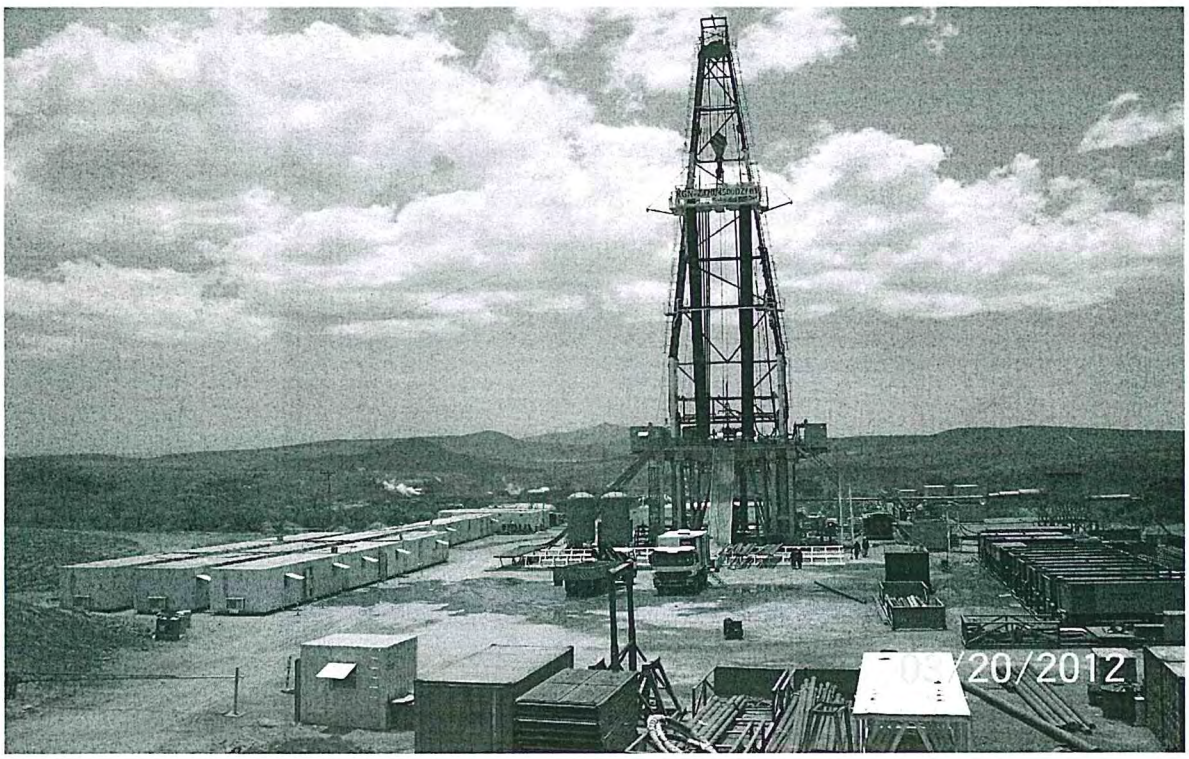
KenGen
Kenya Electricity
Generating Company Ltd.

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT

FOR

THE PROPOSED DRILLING OF EIGHTY (80) GEOTHERMAL STEAM PRODUCTION WELLS FOR EXPANSION OF ELECTRICITY POWER GENERATION AT GREATER OLKARIA GEOTHERMAL FIELD IN NAIVASHA DISTRICT



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ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
CPP	Consultation & Public Participation
dB(A)	Decibel of Noise
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
EA	Environmental Assessment
EMP	Environmental Management Plan
EMCA	Environmental Management and Coordination Act
EMS	Environmental Management System
GoK	Government of Kenya
GIS	Geographical Information Systems
HIV	Human Immunodeficiency Virus
ITCZ	Inter Tropical Convergence Zone
ISO	International Organisation of Standardization
KenGen	Kenya Electricity Generating Company Ltd
KWS	Kenya Wildlife Service
LCPDP	Least Cost Power Development Plan
MWe	Mega Watt of Energy
m.a.s.l	Metres above sea level
NEMA	National Environment Management Authority
OD	Operational Directive
OP	Operational Policy
PRA	Participatory Rural Appraisal
QMS	Quality Management System
RoK	Republic of Kenya
RRA	Rapid Rural Appraisal
UNU-GTP	United Nations University – Geothermal Training Program
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environmental Programme
UV	Ultraviolet

EXECUTIVE SUMMARY

The proponent, Kenya Electricity Generating Company Limited (KenGen), is the leading electricity producer in Kenya with an installed capacity of approximately1200MWfrom hydro, geothermal, oil and wind sources. This Environmental and Social Impact Assessment (ESIA) report is for the proposed drilling of 80 geothermal production wells in Olkaria naivasha district. The current electricity generation from geothermal sources in Kenya is approximately 207 MW, with KenGen accounting for 155MW. Currently KenGen is constructing geothermal power plants to produce a further 280MW. The total potential capacity of the Olkaria geothermal fields is estimated at 1200MW.

Kenya in its' vision 2030 has estimated the national peak demand for electricity in the country to be approximately 3,141MW by the year 2014 and approximately 17,000MW by the year 2030. The government through its least cost power development plan 2010-2030 has identified geothermal power production as its priority with a potential of 5,000MW. KenGen in its good to great strategy intends to meet this demanding by doubling its installed capacity to 3,000MW with a focus on geothermal power generation by the year 2018. The proposed drilling is expected to contribute towards the realization of this goal.

The EIA project report was prepared in line with the legal requirements of the Environmental Management and Coordination Act 1999 and the Environmental (Impact Assessment and Audit) Regulations of 2003. The team carried out the assessment using a combination of methods including; ground surveys, review of existing literature pertinent to the proposed project, focus group meetings with relevant stakeholders and disseminated the findings in public barazas.

The objective of the Environmental and Social Impact Assessment (ESIA) was to identify potential positive and negative environmental impacts associated with the proposed project and make recommendations on how to enhance the positive impacts on one hand and to mitigate the negative environmental impacts on the other. The findings of the EIA indicate that the positive impacts outweigh the negative impacts.

The potential negative social and environmental impacts identified are those associated with the following aspects: removal of vegetation, dust, emissions of hydrogen sulphide (H_2S), noise, elevated and overhead work, indiscriminate disposal of waste, general health and safety aspects, increased traffic, accidental spillage of hazardous materials on the ground surface,

influx of workers at the construction site, fire and exhaust emissions. Mitigation measures for the negative impacts have been provided. Based on the findings of the ESIA, an Environmental Management Plan (EMP) was prepared. It is the opinion of the EIA Experts that implementation of the EMP will ensure environmentally sustainable development throughout the project cycle.

The **project cost** is estimated to be about Kenya shillings forty billion (KES 40,000,000,000) and it is expected to take five years to complete.

Facts on the project:

- The proposed project is located in an area of high geothermal potential and that is licensed to the project proponent for exploration and drilling.
- The proponent has been drilling and producing power from geothermal sources in the proposed project area since the year 1980.
- The proponent has 30 years experience in managing environment and social impacts associated with geothermal exploration, drilling and production of electric power
- The proponent once successful with the drilling will undertake EIA for power plants to utilize the steam generated
- The alternative to this project is the production of electricity from fossil fuels which is expensive and greatly pollutes the environment. The cost of a kilowatt hour for electricity from the various sources is as follows: Geothermal 8.5 US cents; Kerosene 16.5 US cents; Hydro 12.5 US cents; Wind 12 US cents and Coal 9.3 US cents. Hydro as a source of power has been hampered by the frequent drought and thus it is no longer a reliable source of power.
- The proponent has the experience , capacity and technological know how to manage this project sustainably
- The resettlement of communities is not envisioned in this project as land will be acquired through negotiation with already identified large land owners who are

neighboring the existing power plant i.e Oserian Farm, Kamere Farm, Kedong Ranch A and B and Ng'ati farm.

It is the view of the environment impact assessment team that the proposed project poses minimal risk to the environment and we recommend that the project be licensed.

INTRODUCTION

Kenya Electricity Generating Company (KenGen) is the leading electric power producer in Kenya, producing about 75% of electricity consumed in the country. The company uses various sources to generate electricity ranging from hydro, thermal, wind and geothermal. KenGen currently owns and operates two Geothermal Power Stations at Olkaria namely Olkaria I and Olkaria II, located about 120 km Northwest of Nairobi. Olkaria I Power Station has three units namely Unit 1, 2 and 3 which were commissioned in 1981, 1982 and 1985 respectively. Each of these three units produces 15 MWe. Olkaria II Power Station has three units each generating 35 MWe. Unit 1 and Unit 2 of Olkaria II were commissioned in September 2003 whereas Unit 3 was commissioned in June 2010. KenGen has an ambitious strategy to increase its geothermal power generation capacity by 1260 MWe by 2018. Already a project to deliver 280 MWe by the year 2014 at Olkaria I and IV has kicked off.

1.1 Nature of the Proposed Project and its Objective

The proposed project will entail drilling of a total of 80 geothermal production wells in Olkaria area of Naivasha district. The objective of the proposed project is to adequately harness steam that will be used for the generation of 560MWe of geothermal energy in line with vision 2030. The power plants that will make use of the harnessed steam and their due dates are as listed in table 1 below.

Table 1: Proposed Power Plants for the Generation of 560MW

Proposed Power Plant	Capacity, MW	Due Date
OlkariaIV(units3,4&5)	240	2015
OlkariaI(unit6	70	2016
OlkariaV	110	2016
OlkariaIIUnit4&5	140	2017
Total	560	2017

Source: Olkaria Resource Development Department

Separate ESIA studies will be undertaken for each of the proposed power plants.

1.2 Project Justification

The proposed project is geared towards meeting the Vision 2030 Governments' Medium Term target of generating 1,600 MWe of geothermal energy by 2016 and eventually 5,000 MWe by 2030 (GoK, 2011). The Least Cost Power Development Plan (LCPDP) envisions that Kenya's electricity peak demand will increase from 1,302 MWe in 2011 to 15,026 MWe by 2030 in line with the Vision 2030 which envisages energy as a key enabler for economic growth across the country. As a result, the governments' strategy is to change the base load electricity supply from hydro, which is affected by droughts, to geothermal that is reliable and cost effective (GoK, 2011).

The parts of the Olkaria geothermal field being utilized or under development have been subdivided into sectors that include Olkaria East (Olkaria I), Olkaria Northeast (Olkaria II), Olkaria West (Olkaria III) and Olkaria Domes (Olkaria IV). KenGens' current geothermal licensed area within Olkaria measures 204km^2. The studies mentioned above were

undertaken by KenGen at the greater Olkaria field and it was estimated that the geothermal resource size measures 80km^2 and has the potential of yielding approximately 1200MWe of energy. The area under utilization by the year 2014 (after completion of the 280MWe project which is under construction) would be 24 sq km. This implies that only a small fraction of the total estimated geothermal resource potential would have been developed by then hence the need for drilling additional wells for tapping of the resource to generate additional power.

Geological, hydrogeological, geophysical, and geochemical techniques are used to identify and quantify geothermal resources. *Geological and hydrogeological studies* involve mapping any hot springs or other surface thermal features and the identification of favorable geological structures. These studies are used to recommend where production wells can be drilled with the highest probability of tapping into the geothermal resource (Masahi. S and F.Beck, 2003).

1.3 Screening of the Proposed Project

The proposed drilling project falls under category 9 (Electrical Infrastructure including electricity generation stations) of the projects listed under the second schedule to the Environmental Management and Coordination Act (EMCA), 1999. The ESIA project report has been prepared for submission to NEMA, in accordance of the provisions of EMCA, 1999. Considering the fact that KenGen has been undertaking drilling activities at the Greater Olkaria Geothermal Field for decades and by virtue of the support of the proposed project by the stakeholders consulted, it is the opinion of the EIA experts that a full ESIA report is not required for this project.

1.4 Objective of conducting the EIA

National Environment Management Authority (NEMA) currently requires project proponents to carry out Environmental and Social Impact Assessments (ESIA) and prepare related reports for developments that have the potential of resulting to negative social and environmental impacts.

The overall objective of Environmental and Social Impact Assessment (ESIA) is to ensure that environmental concerns are integrated in all development activities in order to contribute to sustainable development. The specific objective of conducting the EIA with respect to the proposed project was to:

- Examine the likely adverse environmental aspects and associated impacts
- Propose appropriate mitigation measures for the significant negative impacts and
- Develop an Environmental Management Plan (EMP) with mechanisms for monitoring and evaluating compliance and environmental performance.

1.5 Scope of the EIA

The EIA was undertaken with respect to the proposed drilling of 80 wells at the Greater Olkaria Geothermal Field in Naivasha District. The EIA report was prepared as per the guidelines provided under the Environmental (Impact Assessment and Audit) Regulations, 2003. The guidelines provide that the ESIA report has to capture the following salient features:

a. Description of baseline environmental conditions of the area
b. Description of the proposed project and associated activities
c. Description of the national environmental legislative and regulatory framework
d. The objectives of the project
e. The products, by-products and waste generated by the project
f. Identification and discussion of any significant impacts to the environment anticipated from the proposed project
g. Description of appropriate mitigation measures proposed for the negative environmental impacts
h. Provision of an environmental management plan
i. Alternative technologies and processes available and reasons for preferring the chosen technology and processes
j. Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies and
k. Public consultation with various stakeholders.

1.6 EIA Methodology

The EIA study process entailed the following steps:

- Meeting with various KenGen staff based at Olkaria Geothermal Project
- Desk top study (literature review) pertinent to the proposed project and its location
- Field survey to collect baseline information through direct observations and photography
- Public barazas
- Stakeholders consultative meetings
- Review of the available secondary materials and
- Compilation of the ESIA report as per the Environmental Impact (Assessment/Audit) Regulations of 2003.

2.0 PROJECT DESCRIPTION

2.1 Components of the proposed project

The proposed project entails drilling of production and reinjection wells as summarized in table 2 below.

Table 2: Total Number of Wells to be Drilled

Type of well	Number of wells to be drilled
Production	80

2.1.1 Production Wells

Production wells are wells drilled with the sole purpose of enabling production of geothermal energy (as hot liquid, two-phase mixture or steam) from a specific target, or a geothermal reservoir. According to (Gudni A and Hjalti F, 2012), production wells are either designed for spontaneous discharge through boiling (high-temperature reservoirs) or for the application of down-hole pumps (lower temperature reservoirs). The proposed production wells are for spontaneous discharge through boiling.

2.1.2 Reinjection Wells

Reinjection wells are used to return energy-depleted fluid back into the geothermal system in question or even to inject water of a different origin as supplemental recharge. The location of reinjection wells is variable as reinjection can either be applied inside a production reservoir, on its periphery, above or below it or outside the main production field, depending on conditions and the purpose of the reinjection (Gudni A and Hjalti F, 2012). Reinjection at Olkaria is applied inside a production reservoir to recharge the reservoir and to prevent release of geothermal fluids onto the earths surface. Fig. 1 below shows the position of directional and production well.

KenGen will contract a company to drill Eighty geothermal wells using five (5) modern drilling rigs.

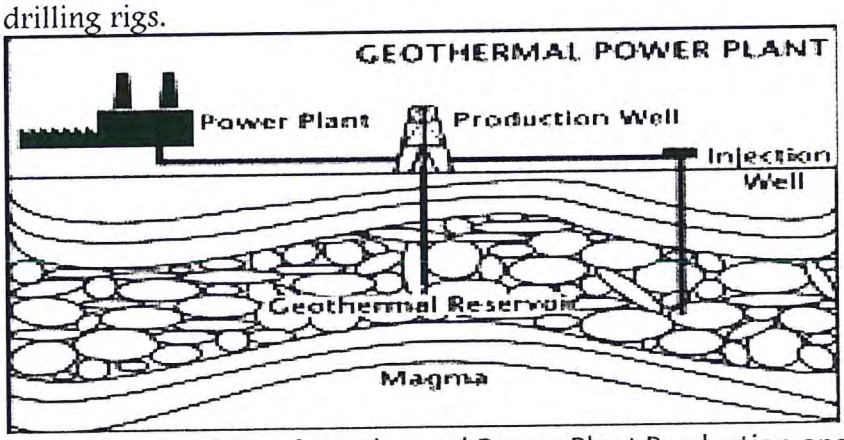


Figure 1: Schematic of Geothermal Power Plant Production and Injection Wells

Source: (Masashi. S & F.Beck, 2003)

2.1.3 Support Infrastructure

Support infrastructure will comprise of roads providing access to the drill pads.

2.2 Materials and Equipment Needed

Table 4 below indicates the materials, tools and equipment that will be used during construction and drilling phase of the proposed project.

Table 3: List of Materials and Equipment Needed

Drilling Materials	Construction/Drilling Tools & Equipment
Drilling bentonite and additives Automotive Diesel fuel Mica flakes Lubricants Drilling detergent Water Cement Nitrogen pressurized hydraulic fluid Dope lubricants Full Gas Cylinders Angle irons Explosives for fishing	Crane Bull dozer Drilling Rigs (8 No.) Hammer Wrenches Jerks Rock bit Casings Sledge hammers Spirit level Welding Machine Grinding Machine Spinning chain Chain tong Slips Bit breaker Elevators Rotary tongs Forklift Tugging ropes Drill pipes D-shakles Trucks Water pump Generators Air compressors Well cementing equipment

Table 4: Quantity of Materials Required to Drill one Well

Type of Material	Quantity Required Per Rig
Bentonite	20 tonnes
Starch	1 tonne
Caustic soda	0.5 tonne
Drilling detergent	12,600 litres
Drill pipe dope (jelly)	5kg
Grease	20kg

Engine oil	1000 litres
Gerabox oil	200 litres
Automotive diesel fuel	300,000 litres
Mica flakes	1 tonne
Water	70,000 cubic metres when brine is not used
	30,000 cubic metres when used together with brine

Source: Olkaria Drilling Section

2.3 Proposed Project Activities

The activities associated with the proposed project have been categorized under four phases of project implementation viz planning, construction of the drill pad, operation (well drilling) and closure/decommissioning as discussed in the following subsection.

2.3.1 Planning Phase Activities

The main activities considered during this phase are: well siting, definition of access routes, production of site layout drawing, cellar drawing, procurement of materials, and hiring of casual labour on need basis. Well siting entails reviewing and discussion of existing geo-scientific data, identification of suitable drill sites, and determination of the required well configuration so as to achieve the desired results (siting the best production wells). This is done by the Olkaria Well Siting Committee. The committee comprises of KenGen environmental scientists, civil engineers, geologists, geochemists, community liaison personnel and drilling engineers. An officer from the Kenya Wildlife Services (KWS) based at Hells Gate National Park is also co-opted in the committee to advice on wildlife related issues.

2.3.2 Construction Phase Activities

Construction phase entails the following activities:

i. Construction and/or adjustment of existing roads using earth moving equipment,
ii. Construction of drill pads using earth moving equipment. The size of the pad measures approximately 180m by 80m for three cellar and 300m by 80m for six cellar pad or 140m by 180m for two sites lying back to back
iii. Digging of the pond measuring 180m by 20m or 300m by 20m
iv. Installation of water supply lines
v. Digging of a cellar measuring 3.5m by 3.5m and 2.4m by 3.5m for big and small rig respectively
vi. Container mobilization and installation of the staff camp
vii. Equipment mobilization (Rig Move)
viii. Equipment installation (Rigging up)
ix. Transportation and delivery of materials to the drill pad and
x. Conducting a pre-spud meeting

Well Pad and Pond Construction

This involves preparation of a stable, well compacted drilling site that will accommodate all drilling equipment and crew and discharge pond enough to accommodate the discharged

fluids as per the approved route map of access roads and well pad layout. The process involves the following: site marking, vegetation clearing, top soil removal, taking spot heights and fixing depth of cut, excavation of the pad area and pond, leveling and compaction, dumping of murrum, final grading, leveling and compaction of the pad using earth moving equipment.

Construction of a Concrete Cellar

This entails construction of a concrete structure that provides working space for casing head equipment for the rig as per the approved detailed cellar drawing. The activities include marking of the cellar area, excavation, bar bending, mixing of concrete, casting of reinforced concrete and laying of drainage casing, curing and site cleaning.

Construction of access roads

This involves construction of new roads providing access to drilling sites/pads as per the approved Route Map of Access Roads. The process entails the following activities: Vegetation clearing, top soil removal, excavation, grading, murrum dumping, final grading and compaction and provision of meter drains using earth moving equipment.

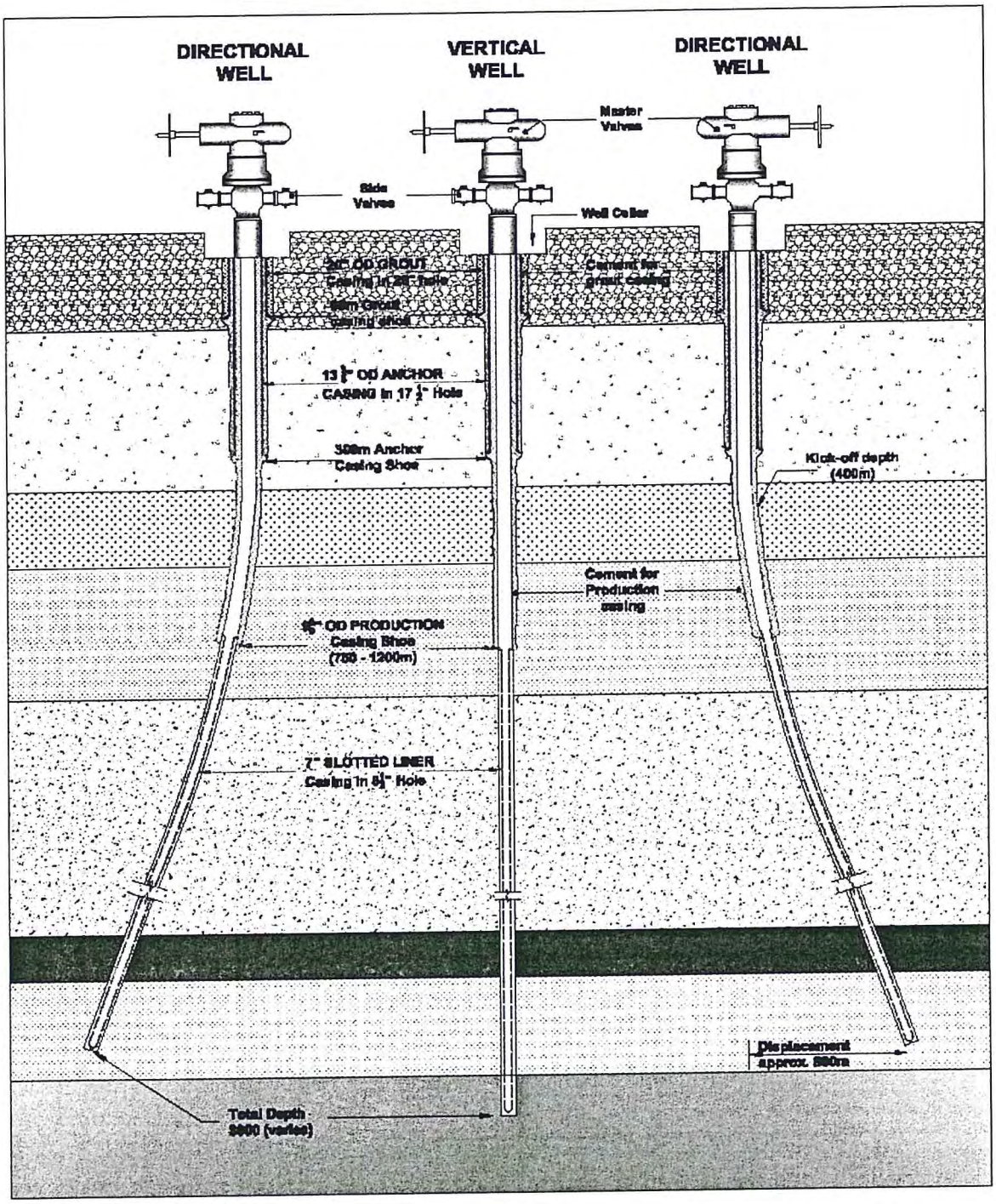
Laying of water lines

The aim of laying the lines is to ensure supply of water for drilling and quenching. The activities involve: survey and approval of pipeline route, pipe transportation, pipe arrangement and coupling, fabrication of bends, fixing of valves, bends and flow meters and leakage testing.

2.3.3 Operation Phase Activities

Typically, geothermal wells are drilled to depths ranging from 200 to 1,500 meters depth for low- and medium-temperature systems, and from 700 to 3,000 meters depth for high-temperature systems. Wells can be drilled vertically or at an angle as shown in fig.....below. The proposed project will entail drilling of 129 directional wells and 43 vertical wells. Wells are drilled in a series of stages, with each stage being of smaller diameter than the previous stage, and each being secured by steel casings, which are cemented in place before drilling the subsequent stage. The final production sections of the well use an uncemented perforated liner which allows the geothermal fluid to pass into the pipe **(Masashi. S & F.Beck, 2003)**.

TYPICAL OLKARIA WELLS PROFILE



The operation or drilling phase at Olkaria Geothermal Project entails spud-in (commencement of drilling), well drilling to total depth using a rig, casing, cementing, undertaking completion tests, well capping and rigging down. This takes approximately two to three months. The target is to drill a well measuring 3000 metres in depth.

Drilling of the Well

This entails drilling of the following holes using a rig:

i. A surface hole measuring 26" to target depth
ii. An intermediate hole measuring 17½" to target depth
iii. A production hole measuring 12¼" to target depth and
iv. A main hole measuring 8½"to target depth

Each rig is equipped with 4 generators and 12 air receivers.

Installation of the Well Casing

It entails setting up the following Run in Hole (RIH) casings:

i. RIH 20 casing to protect the wellbore from collapse and isolate intrusion of formation fluids
ii. RIH 13⅜" casing to protect the wellbore from collapse and allow for adaptation of wellhead equipment upon completion of drilling of intermediate hole to target depth as per work instruction
iii. RIH 9⅝" casing to protect the wellbore from caving in and channel formation fluid (steam) to the surface upon completion of drilling of intermediate hole to target depth as per work instruction and
iv. RIH 7 " slotted casing to protect the wellbore from collapse and direct flow of steam to the wellhead upon drilling of the main hole

Well Cementing

It involves pumping of cement through the casing to provide competent bond on casing-casing and casing-formation annuli (the space between the casing-casing or casing-wellbore) with the help of well cementing equipment

Well Capping (Master Valve Installation)

This entails all activities from the time the well is drilled to Total Depth. The master valve is installed and closed after the drilled well is quenched and 13.625" Blow Out Preventer (BOP) is laid down. This is done to facilitate shutting or turning on steam. Quenching is undertaken by pumping cold water in the well to subdue (control) formation pressure.

Fishing

This entails recovering of an object that is left in the well bore during drilling or workover operations without which further drilling cannot proceed. Such objects include tubulus, drill tools or stuck pipe. They are normally recovered by the use of fishing tools and explosives in some special cases.

Rigging Down

Rigging down entails dismantling of the rig components, loading on trucks and moving them from the completed well to a new drill pad well for installation. Rigging down will be effected under the following circumstances:

i. Upon successfully drilling the target depth (a well measuring approximately 3000m in depth)
ii. When tubulus, drill tools or pipes stuck in the well bore during the drilling process fail to be recovered and
iii. Upon successfully undertaking completion of tests

Once the rig has been moved, the site is cleaned and the rehabilitated. The aim is to restore disturbed surface terrain on a well site by planting the area with indigenous grass, shrubs and trees after well drilling and testing has been done.

Well Completion tests

This entails taking measurements in a well immediately upon completion of drilling to determine the physical properties and the potential of the well.

Well Discharge Tests

This involves determining geothermal well output and its reservoir characteristics by opening the bleed valve and shutting-in the well upon completion of monitoring (i.e after two months). The parameters measured include flow rate, enthalpy, critical pressure and well head pressure.

Well Shut-in Tests

It covers all the measurements done in a well immediately upon completion of discharge testing to determine hydraulic properties of the well.

Reservoir Monitoring

This entails assessing the reservoir condition of boreholes through down hole logging of shut-in wells, pressure monitoring at feedzone depths and mechanical physical logging of the boreholes.

2.3.4 Decommissioning Phase Activities

Decommissioning of the drilled wells will become necessary when the wells attain their end of life i.e when they no longer become productive. Once this occurs, the affected wells will be deactivated according to the well closure procedure. The steam lines will then be dismantled and connected to new wells for reuse. Non-reusable pipes will be sold to licensed scrap metal dealers. The closure of the well will involve removing the well head, sealing the well with cement and backfilling of the depression left behind by the well head as necessary. The affected well pads will be back filled, landscaped and replanted with suitable indigenous grass and trees.

2.4 Types of Waste to be Generated

Table 5 below indicates the types of waste to be generated during project implementation and proposed options for their management.

Table 5: Types and quantities of waste to be generated

Type of Waste	Approximate Quantity Generated Per Rig/Service	Proposed Waste Management Option
Used oil filters	8 filters for the 4 generators/rig after every	Accumulate safely and dispose of through licensed

	240hours, 500 hours and 1000 hours of operation of the drive engine	hazardous waste handler
Used fuel filters		Accumulate safely and dispose of through licensed hazardous waste handler
Used oil	420 litres per service conducted s	Accumulate safely and sell to licensed used oil recycler
Worn out casing shoes	600 pieces	Accumulate safely and sell to licensed scrap metal dealers
Empty plastic & metal containers		• Issue out to staff for reuse • Issue out to the local community as part of Corporate Social Responsibility (CSR) contribution • Reuse within Olkaria e.g for fabricating solid waste containers • Return to the supplier
Empty gunny bags	•	• Issue out to the local community as part of CSR contribution • Reuse within Olkaria • Return to supplier
Geothermal fluid		• Provide well fenced ponds for temporary holding • Reuse for drilling of the geothermal wells
Polythene papers		Accumulate safely and sell to licensed recyclers of polythene papers
Scrap metals		Accumulate at OW3 designated site for selling to licensed scrap metal dealers
Oily rags	1/4kg per servicing of generator	Accumulate in suitable closed containers and contract a NEMA licensed hazardous waste handler to collect for appropriate disposal
Raw sewage		• Use of soakage pits • Contract licensed sewage Exhausters

2.5 Project Cost

The total cost of the proposed project is 40 billion Kenya shillings hence the EIA license fee to be paid to NEMA is one million Kenya shillings (Ksh. 1,000,000).

2.6 Project Implementation Time Frame

Drilling of a single well takes approximately 55 days hence the total time for drilling 80 wells is approximated to take 3 years.

2.7 Labor Requirements

The project is expected to employ 114 people working in 5 shifts for the duration of the drilling; the well pads will be guarded after completion.

3.0 BASELINE INFORMATION

3.1 Project Site and Ownership

3.1.1 Location

The proposed drilling project will be located at the Greater Olkaria Geothermal Project, Naivasha District in Rift Valley Province.

3.1.2 Site Details

The drilling sites will majorly comprise the land within geothermal licensed area as shown in the appended Geothermal Resource Map. This comprise of existing land owned by KenGen and the one leased from KWS. KenGen has also identified suitable sites listed in the table 6 below which will be acquired for further expansion once negotiations with the land owners has been formalized.

Table 6: Details of Additional Land Proposed for Acquisition

ITEM NO.	Land Label on Map	LAND OWNER	LR. No.	REQUIRED LAND SIZE		ESTIMATED ENERGY POTENTIAL (MW)
				(Acres)	(KM^2)	
1	1a	Kedong	8396/7	4487	18.9	280.5
2	1b	Kedong	8396/7	1959	7.9	118
	Subtotal	***Kedong***	***8396/7***	***7446***	***26.9***	***398.5***
4	Maela Ngati farm	Ngati Farmers Cooperative Society.	8398/2	3071	12.4	186
	Subtotal	*Ngati Farmers*	*8398/2*	*3071*	*12.4*	*186*
5	Oserian Option 1	Colvile Ltd	10999	391	1.6	82.5
	Oserian option2	Colvile	10999	1358	5.5	82.5
	Subtotal	Colvile Ltd	10999	1358	5.5	82.5
6	Land '4'	Kamere Estates	9005/4	412	1.7	25.5

	Subtotal	*Kamere Estates*	*9005/4*	*412*	*1.7*	*25.5*
	Grand Total	***All***	***All***	***12287***	***46.5***	***692.5***

3.2 Land use

The Olkaria area and its environs support multiple land use systems consisting of ranching, flower and horticultural farming, tourism, wildlife conservation, human settlement, infrastructure and other uses. To the south and southeast of the Olkaria Geothermal Project, are situated large tracts of land covering mainly the Kedong and Longonot Ranches, which primarily rear cattle. These ranches form important dispersal areas for wildlife from the Hell's Gate and Longonot National Parks. Other important ranches around the project area include Oserian, Kongoni and Ndabibi farms.

3.3 Water Resources

Lake Naivasha which is approximately 150 km^2 in total area was declared Kenya's second Ramsar Site in 1995. The lake is located right south of the alkaline Lakes of Elementeita and Nakuru. The alkaline lakes are often in volcanic areas with hot springs and in a terminal position. Naivasha's wetlands receive inflow from two perennial and several ephemeral streams. The main Rivers are the Gilgil, Karati and Malewa. The rainfall in the highlands maintains the perennial flow of the rivers.

The Malewa and Gilgil rivers drain from the northern part of the catchment while Karati River drains from the northeastern part. Flow in the Karati river and other streams are seasonal and often don't reach the lake as surface water. The Malewa river accounts for about 90% of the river discharge into the lake. The lake serves as the source of water for the local residents, Olkaria Geothermal Project and the surrounding flower farms. According to the lake level data collected by KenGens' Geographic Information Systems (GIS) section in 2011 and 2012 as shown in fig. 2 and 3, there has been a drastic increase in the lake level from September 2011 to May 2012.

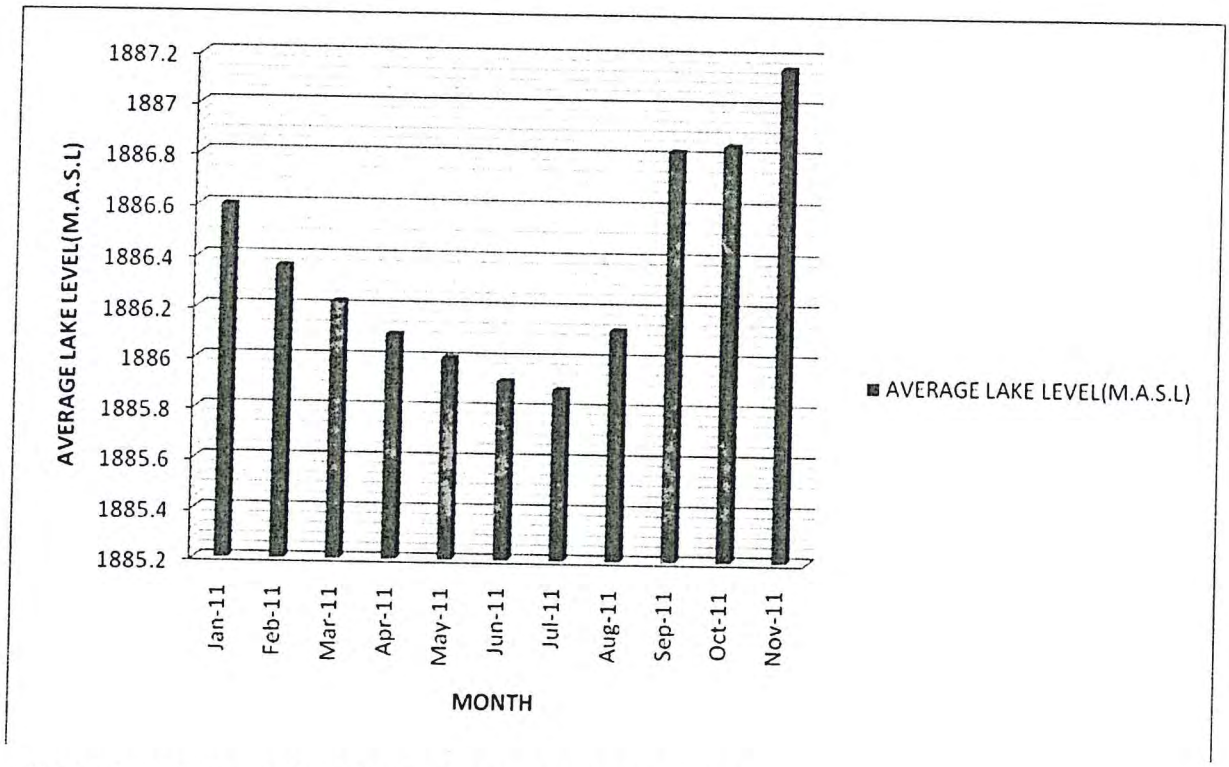


Figure 2: Lake Level for Lake Naivasha recorded in 2011

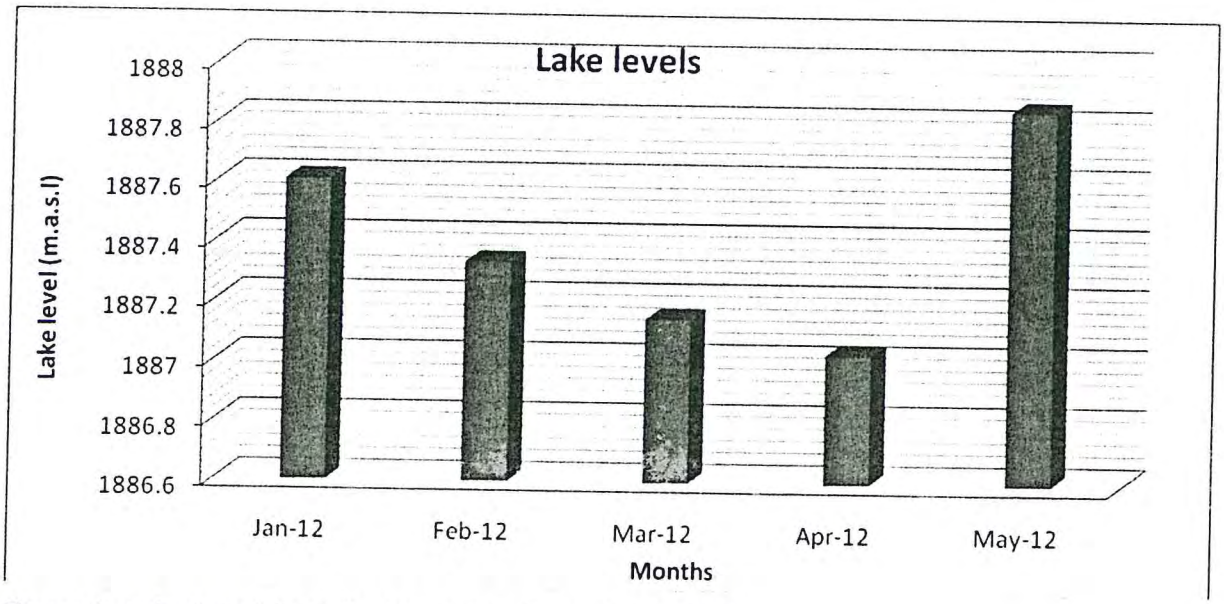


Figure 3: Lake Level for Lake Naivasha Recorded in 2012

3.4 Tourism

Tourism is an important activity around Lake Naivasha, as well as at the Olkaria Geothermal Project. Conditions that favour tourism in the project area include proximity to Nairobi, uniqueness of geothermal power generation and the presence of Hell's Gate and Longonot

National Parks. In Hell's Gate National Park, visitors can view game while in Lake Naivasha, bird watching, hippo viewing and water sports are popular tourist activities.

3.5 Population and Demographic Characteristics

According to the 2009 census, the populations of Naivasha area and its environs is illustrated in table 7 shown below:

Table 7: Population Distribution by Some Administrative Units in Naivasha, August 2010

Sub-location	Male	Female	Total population 2009	Households	A/square	Density
Hells Gate	32,565	32,081	64646	22,147	436.7	148
Olkaria	13011	12,426	25,437	9,194	345.5	74
Malewa	4432	4267	8699	2845	152.9	57
Kongoni	2054	2050	4104	1209	86.3	48
Maiela	4416	4804	9220	2124	41.9	220
Moi ndabi	2936	2840	5776	1564	167.9	34
Ndabibi	4527	3871	8398	2361	131.7	64

Source: Republic of Kenya 2009 Kenya Population and Housing Census

The neighbourhood of the Olkaria Geothermal Project is scarcely populated. The population currently comprise of the Maasai community, residents of Kamere and employees from KenGen, neighbouring flower farms, KWS and contractors.

3.6 Climate

The Lake Naivasha and its environs fall under Eco-climatic Zone IV which is described as environmentally fragile and prone to land degradation. The mean monthly temperature in the project area has been recorded to range from 15.9 - 17.8°C with a mean of 16.8°C. The mean monthly maximum temperatures range from 24.6-28.3°C. July is the coldest month while the hottest month is February.

The monthly distribution of rainfall is governed by the movement of Inter-tropical Convergence Zone (ITCZ). This results in a bimodal pattern of rainfall distribution with long rains in March, April and May while the short rains are received in the months of October and November. Generally the floor of the Rift Valley has lower rainfall than the flanking highlands. This area experiences a double rain shadow effect from the west and east flanking escarpments (Mau and Aberdare Range / Kinangop respectively). Rainfall in the project area and its environs is generally low, recording an average of 634 mm annually. Evaporation exceeds precipitation almost throughout the year. It ranges from approximately 1,700 mm per year in areas around the lake to approximately 1,000 mm per year on higher ground, with variations from year to year.

3.7 Geology of Olkaria Geothermal Field

The surface geology of Olkaria geothermal field is dominated by pyroclastic type of volcanic rocks that comprises of volcanic ashes, volcaniclastic sediments, pumiceous clasts, lithic fragment and lava such as the Olol butot comenditic lavas. These volcanic materials have undergone hydrothermal alteration, oxidation and weathering to yield superficial deposits products such as clays that are enriched with silica and Fe-oxides gives that give the clays reddish brown colorations. They are generally loose and unconsolidated hence easily eroded by action of water or wind, hence the presence of numerous gulleys and erosional surfaces in the area.

The sub- surface geology of Olkaria has been well established as a result of the sub-surface data that is obtained from geothermal well drilling that has been ongoing since 1950's. During drilling, the rock cuttings that are brought to the surface are daily logged as a function of depth by the Rig site geologist. The Rig geologist then analyses the rock types to identify the lithology with depth among other important parameters that assist to understand the characteristic of the geothermal system.

The lithostratigraphy of Olkaria has therefore found to be comprised of six main groups namely; Protezoic 'basement' formations, Pre-Mau Volcanic, Mau tuffs, Plateau trachytes, Olkaria Basalts and Upper Olkaria Volcanics (Omenda, 2000, Lagat 2004). The table 8 below shows the generalised stratigraphic sequence with depth from the surface to the basement.

Table 8: Generalised Stratigraphic Sequence with Depth from the Subsurface to the Basement

Formation Name	Lithology	Thickness (M)	Characteristic
Upper Olkaria	Comendite Lavas and their pyroclastic equivalents, ashes , minor basalts Thomsonet al.,1963, Clarke et al.,1990, Omenda, 1998a)	0-500 m	Superficial
Olkaria Basalt	Basalt flow, minor pyroclastics and trachytes(Haukwa, 1986, Ambusso and Ouma, 1991, Omenda 1998a)	100-500	Cap-rock
Plateau	Trachytes with minor basalts, tuffs and rhyolites (Odongo 1986 ,Omenda 1994,1998a)	1000-2600	Reservoir
Mau Tuffs	Consolidated ignimbrites (Omenda 1994,1998a)	>2600	Reservoir
Pre Mau	Trachytes, basalts, ignimbrites	unknown	Reservoir

Proterozoic	Gneisses, schists, marbles and quartzites(Shackleton,1986,Mosley,1993, Smith and Mosley, 1993, Simiyu et al., 1995, 1996)	5000-6000	Basement

3.8 Geothermal Resources at Olkaria

Geothermal resources in Kenya are located within the Rift Valley with an estimated potential of between 7,000 MWe to 10,000 MWe spread over 14 prospective sites as indicated in Fig. 4 below.

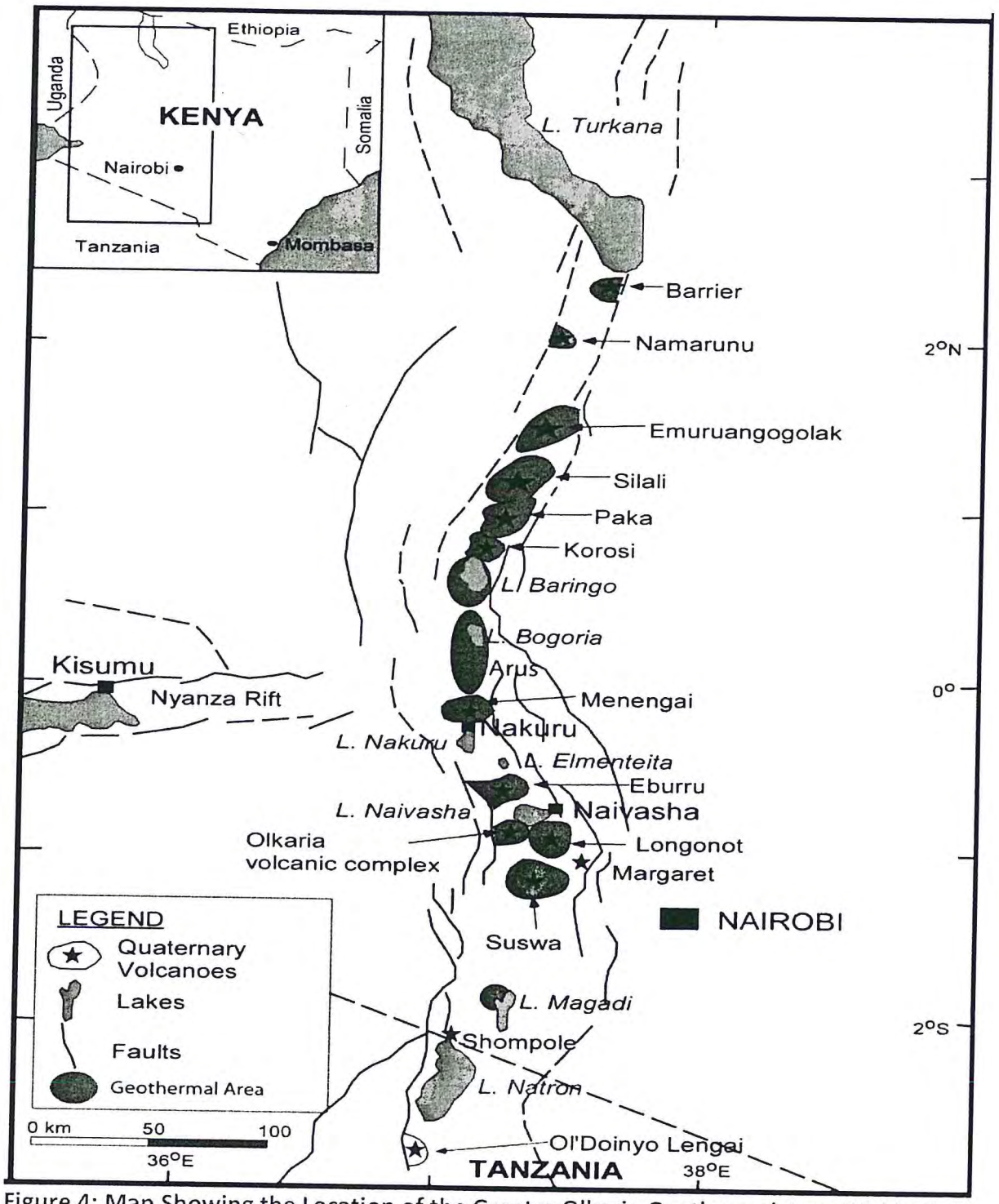


Figure 4: Map Showing the Location of the Greater Olkaria Geothermal Area Within the Great Rift Valley of Kenya.

The parts of the Olkaria geothermal field being utilized or under development have been subdivided into sectors that include Olkaria East (Olkaria I), Olkaria Northeast (Olkaria II), Olkaria West (Olkaria III) and Olkaria Domes (Olkaria IV) as shown in fig.5 below. KenGens'

current geothermal licensed area within Olkaria measures 204km^2. According to studies undertaken by KenGen at the greater Olkaria field, it was estimated that the geothermal resource size measures 80km^2 and has the potential of yielding approximately 1200Mw of energy.

Greater Olkaria Geothermal Wells Map

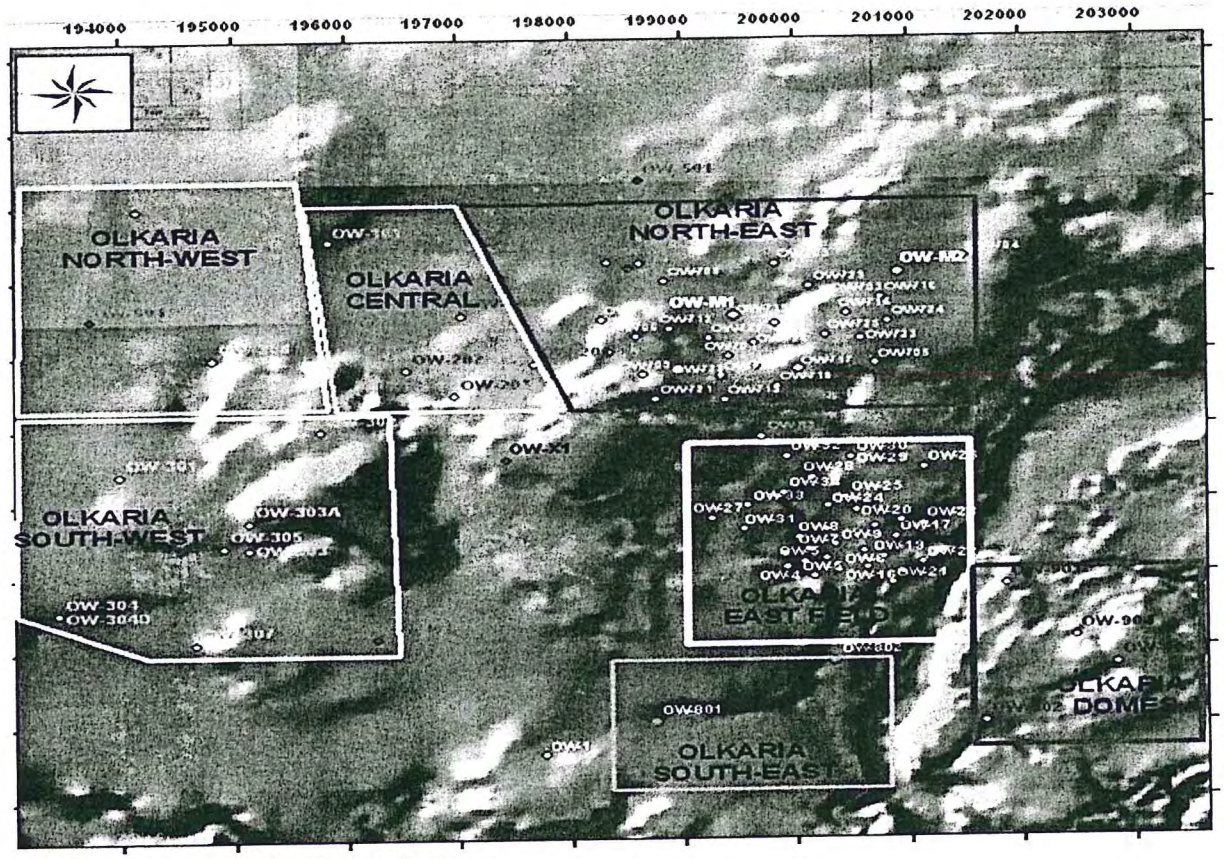


Figure 5: Greater Olkaria Wells Map

3.8.1 Current Installed Generation Capacity at Olkaria

The current installed generation capacity at the Greater Olkaria field is as indicated in table 9 below.

Table 9: Installed Geothermal Generating Capacities at Olkaria

Company	Power Plant	Installed Generation Capacity (MWe)
KenGen	Olkaria I units 1,2 & 3	45
KenGen	Olkaria II units 1,2 & 3	105
Orpower 4 Inc.	Olkaria III	48

Oserian Development Company		4
TOTAL		202

KenGen is currently constructing, a well head generator, Olkaria IV and Olkaria I units 4 and 5 Power Plants which will generate a total of an additional 280MWe of geothermal energy. Additionally Independent Power Producers (IPP□s) have been licensed to develop Suswa and Longonot geothermal prospects.

3.9 Topography

The Olkaria area where the Geothermal Project is located comprises volcanic features that consist of steep sided domes formed from pyroclastic rock and lava flows. Olkaria Domes enclose an approximately circular depression that has been cut by the Ol Njorowa Gorge, which was formed by out-flowing water from Lake Naivasha. The Olkaria I and II Power Stations are located in the centre of the depression. To the north of Olkaria, the topographical features are dominated by depressions of four water bodies including the Crescent Island, the main Lake, Lake Oloidien and Crater Lake.

3.10 Soils

The intricate soil structure and striking differences in physical properties including its colour is a by-product of the interaction of climate, geology, geomorphology and altitude. The soils are of volcanic origin, mainly of mixed assemblage of acid and basic lavas. Superficial soils occur in the fault troughs of the grid-faulted area. The soils in Lake Naivasha are very porous resulting in the aridity of the land. Sombroek et al. (1982) on basing his classification on soil texture has divided these soils into osols, cambisols, planosols and phaezeoms.

Where pyroclastics are of very recent volcanic activity the soils present are very deep, dark reddish-brown to dark brown well drained andosols. They are very friable and smeary with a texture of clay loam to clay, with thick acid humic topsoil. The planosols and phaezeoms soils are found on the plateaus of 8 per cent average slope on a high level flat to gently undulating structural plain. These soils are developed on volcanic ashes and pyroclastics of recent volcanoes.

The poorly drained planosols are mottled clay under silty loam layer. The well drained phaezeoms are a complex of deep of 80-120 cm thick soils to very deep of 120-180 cm of very dark grayish brown to black that are firm and moderately calcareous cracking clays. Cambisols are found on the minor hill scarps. They are mainly clay loam in texture and well drained with a few outcrops.

3.11 Biodiversity

The prominent vegetation types around the Olkaria Geothermal Project are: woodland, bush-land and wetlands with vegetation dominated by *Tarchonanthus camphorates* and *Acacia drepanolobium.* The grass species comprise of star and couch grass. Fauna include buffalos, giraffes, warthogs, zebras, grants gazelle, baboons, monkeys, snakes, waterbuck and more than 80 species of birds.

4.0 RELEVANT POLICY, LEGISLATIVE AND ADMINISTRATIVE FRAMEWORK

4.1 General Overview

The current legal provisions for natural resource management in Kenya are contained in over seventy seven (77) sector-specific statutes. For a long time, the country lacked an umbrella legislative guide for harmonious and holistic environmental management. As such resources were managed sectorally in accordance with the statutes that were in place. However, sometimes these statutes were contradictory. In 1999, the government enacted the Environmental Management and Co-ordination Act (EMCA) which is an umbrella legal framework under which the environment is being managed. The Act establishes the institutional framework under which environmental management is to be coordinated. EMCA prevails over all other sectoral laws relating to the environment, in cases of conflict or contradictions. It also grants the public a *locus standi* in matters of the environment. Kenya is also a signatory to various international environmental laws including the Ramsar Convention, the Vienna Convention, United Nations Framework Convention on Climate Change, the Montreal protocol and the Kyoto Protocol.

4.2 The Constitution of Kenya, 2010

According to article 42 of the Kenyan Constitution, every person has the right to a clean and healthy environment, which includes the right:
(*a*) to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and
(*b*) to have obligations relating to the environment fulfilled under Article 70.

The obligations contemplated under article 69 of the constitution and which the Kenyan Government shall endeavour to fulfill through participation of the citizens and organizations includes: achieving and maintaining a tree cover of at least ten per cent of the land area of Kenya; encouraging public participation in the management, protection and conservation of the environment and eliminating processes and activities that are likely to endanger the environment;

Article 70(1) provides a locus standi to a person who alleges that a right to a clean and healthy environment recognised and protected under Article 42 has been, is being or is likely to be, denied, violated, infringed or threatened. Such a person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter.

4.3 Environmental Management and Coordination Act (EMCA), 1999

Section 3 of the act provides that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. The entitlement to a clean and healthy environment includes the access by any person in Kenya to the various public elements or segments of the environment for recreational, educational, health, spiritual and cultural purposes. In case the right to a clean and healthy environment is infringed, the act empowers such a person to apply to the High court for redress.

Section 58 (1) requires a project proponent to carry out Environmental Impact Assessment (EIA) for projects listed under the second schedule to the act and submit to NEMA a project report for review and approval. Pursuant to section 63, the Authority may, after being

satisfied as to the adequacy of an EIA study, evaluation or review report, issue an EIA licence on such terms and conditions as may be appropriate and necessary to facilitate sustainable development and sound environmental management. According to section 68 the owner of the premises or the operator of a project for which an environmental impact assessment study report has been made shall keep accurate records and make annual reports to the Authority describing how far the project conforms in operation with the statements made in the environmental impact assessment study report submitted under section 58. The proposed 560MW drilling project falls under category 9 (Electrical Infrastructure including electricity generation stations) of the projects listed under the second schedule to the Act hence the need for an EIA. Upon issuance of EIA license, KenGen shall be required to submit to NEMA, annual environmental audit reports incorporating all the necessary documents to prove compliance.

4.4 The Energy Act, 2006

Section 27 (1) of this act requires KenGen to have a licence for generation of electrical energy. According to section 38 (1), a person shall not carry out any electrical installation work unless the person is licensed by the Energy Regulatory Commission as an electrician or an electrical contractor. Section 103 (1) provides that the Minister shall promote the development and use of renewable energy technologies, including but not limited to biomass, biodiesel, bioethanol, charcoal, fuelwood, solar, wind, tidal waves, hydropower, biogas and municipal waste. Under subsection 2, the Minister may perform such functions and exercise such powers as may be necessary under this Act to promote the development and use of renewable energy, including but not limited to:

(a) formulating a national strategy for coordinating research in renewable energy;
(b) providing an enabling framework for the efficient and sustainable production, distribution and marketing of biomass, solar, wind, small hydros, municipal waste, geothermal and charcoal;
(c) promoting the use of fast maturing trees for energy production including biofuels and the establishment of commercial woodlots including peri-urban plantations;
(d) promoting the use of municipal waste for energy production,
(e) promoting the development of appropriate local capacity for the manufacture, installation, maintenance and operation of basic, renewable technologies such as bio-digesters, solar systems and hydro turbines;
(f) promoting international co-operation on programmes focusing on renewable energy sources;
(g) harnessing opportunities offered under clean development mechanism and other mechanisms including, but not limited to, carbon credit trading to promote the development and exploitation of renewable energy sources;
(h) promoting the utilization of renewable energy sources for either power generation or transportation;
(i) promoting co-generation of electric power by sugar millers and sale of such electric power through the national grid directly to the consumers;
(j) promoting the production and use of gasohol and biodiesel.

Geothermal Power generation embraces renewable energy technology. KenGen will harness opportunities offered under Clean Development Mechanism upon commissioning of the 560MWe power plants.

4.5 The Land Act No.6 of 2012

According to section 38(1) No suit shall be brought upon a contract for the disposition of an interest in land unless—

(a) the contract upon which the suit is founded-
(i) is in writing;
(ii) is signed by all the parties thereto; and
(b) the signature of each party signing has been attested to by a witness who was present when the contract was signed by such party.

(2) Subsection (1) shall not apply to a contract made in the course of a public auction nor shall anything in that subsection affect the creation or operation of a resulting, implied or a constructive trust.

KenGen will be required to enter into a written contract with the land owners of any additional land that will be bought for the purposes of geothermal power generation. Any disputes that might arise will be referred to the Environment and Land Court, established in the Environment and Land Court Act, which is vested with exclusive jurisdiction to hear and determine disputes, actions and proceedings concerning land as provided for by Section 150 of the Act.

4.6 Geothermal Resources Act (Cap 12)

Section 7 (1) of this act requires KenGen to be in possession of a geothermal resources licence over part of the entire geothermal resources area and to comply with the terms and conditions of the license. Section 14 provides that the holder of such a licence may for the purposes of generating, transmitting or supplying electrical power-
(a) extract, take, use and apply geothermal resources on or under any land which is the subject of licence;
(b) erect, construct, provide and use such works and appliances as may be necessary for the purpose of generating electricity, and in connection with the transmission, use, supply and sale of electricity
Subject to section 8 (1) of the act, the licence confers upon KenGen the right-
(a) to enter upon the land being the subject of the licence to bore and to extract geothermal resources and to do all such things as are reasonably necessary for the conduct of those operations;
(b) in so far as it may be necessary for and in connection with the operations referred to in paragraph (a)-
(i) to drill and construct all necessary boreholes;
(ii) to erect, construct and maintain houses and buildings for his own use and for use by his employees;
(iii) to erect, construct and maintain plant, machinery, buildings and other erections as may be necessary;
(iv) to utilize the geothermal resources;
(v) subject to the Water Act, to reclaim and utilize any water; and
(vi) to construct and maintain roads and other means of communications and conveniences;
(c) to take and use or apply the geothermal resources for any purpose specified in the licence.

According to section 16, the holder of a license shall be liable for any loss, damage or injury to any person or property resulting from his works or operations, whether as a result of negligence or otherwise. This implies that KenGen should implement adequate measures to ensure safety of staff, visitors and neighbours to the geothermal licensed area.

4.7 The Geothermal Resources Regulation, 1990

Regulation 13 of Geothermal Resources Regulation, 1990 stipulates as follows:

Pursuant to regulation 13, all geothermal operations shall be conducted in a workman-like manner and comply with the following requirements -
(a) as far as reasonably practicable -

i. prevent the unnecessary waste of or damage to geothermal or other energy and mineral resources;
ii. protect the quality of surface waters, air, and other natural resources, including wildlife, soil, vegetation and natural history;
iii. protect the quality of cultural resources, including archaeological, historical, scenic and recreational resources;
iv. accommodate other land users;
v. protect human and wildlife resources from unacceptable levels of noise;
vi. prevent injury to life; and
vii. prevent damage to property;

(b) sites selected for the construction of drilling sites, roads, sumps, steam transmission lines and other construction attendant to geothermal operations shall be evaluated for stability and in unstable earth conditions shall be avoided where they could affect the integrity of the facility;
(c) operations shall be conducted in a manner which minimizes erosion and disturbances to natural drainage;
(d) the licensee shall conduct all operations in such manner as to afford reasonable protection of fish, wildlife, and natural habitat.

Regulation 18 (1) provides that all licensees, which includes KenGen, shall maintain, at the site of works, and present on demand by any person authorized by the Minister -

a. a register of the progress of operations specifying all important matters relating to operations and, in particular, the characteristics of casing, the cementation effected, production tests and like matters as well as all occurrences and accidents,
b. geological and geophysical records and logs of all past and current bores;
c. a record of the physical and chemical characteristics of fluids emitted from past and current bores;
d. a register giving the names of all persons employed; and
e. such other matters as may be prescribed.

KenGen will be required to comply with the above mentioned regulations throughout the construction and operation phase of the proposed drilling project.

4.8 Explosives Act (Cap 115)

According to section 9(1), No person shall purchase or otherwise acquire blasting materials except under the authority of, and to the extent authorized in, a written permit issued by an inspector. Section 7(i) stipulates that No person shall keep, store or be in possession of any authorized explosive in or on any premises (d) unless the explosive is kept in quantities not exceeding five hundred kilograms in weight, and is stored in an isolated place approved by an inspector and under conditions specified in writing by an inspector

KenGen has already complied to the above provisions. The company has a permit issued by an approved Government Inspector and the existing explosives are stored safely in an isolated place.

4.9 The Local Government Act (Cap 265) Revised Edition 2010

According to section 163 (e), Every Municipal Council shall subject to any other written law relating thereto, have power to control or prohibit all businesses, factories and workshops which, by reason of smoke, fumes, chemicals, gases, dust, smell, noise, vibration or other cause, may be or become a source of danger, discomfort or annoyance to the neighbourhood, and to prescribe the conditions subject to which such businesses, factories and workshops shall be carried on. KenGen will be required to put in place adequate mitigation measures to ensure compliance with the above requirement throughout the project cycle.

4.10 Occupiers Liability Act (Cap 34)

Section 1(4) stipulates that in determining whether the occupier of premises has discharged the common duty of care to a visitor, regard is to be had to all the circumstances, so that (for example) -

(a) where damage is caused to a visitor by a danger of which he had been warned by the occupier, the warning is not to be treated without more as absolving the occupier from liability, unless in all the circumstances it was enough to enable the visitor to be reasonably safe; and

(b) where damage is caused to a visitor by a danger due to the faulty execution of any work of construction, maintenance or repair by an independent contractor employed by the occupier, the occupier is not to be treated without more as answerable for the danger if in all the circumstances he had acted reasonably in entrusting the work to an independent contractor and had taken such steps (if any) as he reasonably ought in order to satisfy himself that the contractor was competent and that the work had been properly done. KenGen will be required to contract a competent drilling contractor and to sensitize visitors on safety measures to be observed while accessing all work areas.

4.11 Wildlife (conservation and Management) Act (Cap 376)

Section 13 prohibits the following:

1. unlawful persons from hunting any animal in a National Park

2. conveying into a National Park, or being within the area thereof, while in possession of, any weapon, ammunition, explosive, trap or poison without authorization
3. (b) Cutting, injuring or setting fire to any vegetation in a National Park, or allowing any fire lighted by a person or his servants to enter a National park

   (i) Clearing, cultivating or breaking up for cultivation any land in a National Park

There exists a memorandum of understanding (MoU) between KenGen and KWS. The MoU provides guidelines for compliance with the provisions of the above act. KenGen adheres to the MoU when carrying out activities within Hells Gate National Park.

4.12 The Wildlife (Conservation and Management) (National Parks) Regulations- (Regulation under section 16 of the act)

According to Regulation 5 the following are prohibited acts.
(1) Except with the special permission of the Director or an officer of the Service duly authorized, no person shall -

(a) enter or leave any National Park elsewhere than at a place approved by the Director as an entrance or exit; or
(b) be within any National Park unless he is in a stopping place, or unless he is in a motor vehicle designed to travel on not less than four wheels; or
(c) be within any National Park or any portion thereof between the hours of 7.15 p.m. and 6 a.m.; or
(d) drive, or cause to be driven, a motor vehicle at a speed greater than 40 km an hour; or
(e) cause a vehicle to be stopped on any road in such a manner as to obstruct or impede the passage of any other vehicles; or
(f) drive or cause to be driven, a motor vehicle than on open and maintained roads; or
(g) alight from or get out of, or stand up in/on a motor vehicle, except in a stopping place; or
(h) display any notice or advertisement within a National Park, or on any boundary of a National Park; or
(i) collect any money from members of the public, or sell any goods, or offer any goods for sale, or purchase any goods or carry on any trade, within a National Park.

Regulation 6 prohibits Nuisances. Except with the special permission of the Director or an officer of the Service, or of a duly authorized agent of the Director, no person, while within any National Park shall -

(a) discard any refuse or litter; or
(b) in any other way disfigure the National Park or part thereof; or
(c) unnecessary cause or make any noise or do any act which is likely to disturb or annoy any other person.

4.13 The Work Injury Benefits Act, 2007

According to section 7 (1) of the act, every employer is required to obtain and maintain an insurance policy, with an insurer approved by the Minister in respect of any liability that the employer may incur under the act to any of his employees. In addition, every employer carrying on business in Kenya shall within the prescribed period and in the prescribed manner register with the Director - section 8 (1). Pursuant to section 10 (2) of the act, it is the duty of every employee to ensure his/her safety at the place of work and hence where an accident, not resulting in serious disablement or death, is caused by the deliberate and willful misconduct of the employee, such an employee is not entitled to compensation. However, according to section 12 if an employee is injured in an occupational accident or contracts an occupational disease while the employee, with the consent of the employer, is engaged in any organized first aid, ambulance or rescue work, fire-fighting or other emergency service, the accident or disease is for the purposes of this Act, deemed to have arisen out of and in the course of the employee's employment. In a circumstance where an accident occurs in the course of employment, section 21 makes it a requirement for a written or verbal notice of such an accident to be given by or on behalf of the employee concerned to the employer who shall send a copy of the notice to the Director within twenty four hours of its occurrence in the case of a fatal accident. In line with section 22 (1), an accident that has occurred should be reported to the Director by the employer in the prescribed manner within seven days from the date of receiving a notice of the accident or having learned that an employee has been injured in an accident. Similarly, it is the responsibility of the employee to report to his/her employer the occurrence of an accident not later than 12 months from the date of such an accident or else the right to benefits, in accordance with section 27 (1), shall lapse if the accident is not reported within such a period of time (12 months). According to section 46 (1), the employer shall be responsible for availing necessary means of transport where an employee is injured in an accident, which necessitates his conveyance to a hospital medical facility and from a hospital or medical facility to his residence. KenGen will be required to record and investigate all accidents reported. In addition, the company will be required to ensure safety of all staff and to provide a standby ambulance especially when carrying out critical activities like rigging up, rigging down and rig move. Risk Management Meetings will provide an opportunity for staff sensitization on all safety aspects.

4.14 The Occupational Safety and Health Act, 2007

Under section 6 of this act, every occupier is obliged to ensure safety, health and welfare of all persons working in his workplace. The occupier shall achieve this objective by preparing and as often as may be appropriate, revising a written statement of his general policy with respect to the safety and health at work of his employees and the organization and arrangements for the time being in force for carrying out that policy (Section 7). He is also required to establish a safety and health committee at the workplace in a situation where the number of employees exceeds twenty (section 9) and to cause a thorough safety and health audit of his workplace to be carried out at least once in every period of twelve months by a registered safety and health Advisor (Section 11). In addition, any accident, dangerous occurrence, or occupational poisoning which has occurred at the workplace needs to be reported to the occupational safety and health officer of the respective area by an employer or self-employed person (section 21).

According to section 44, potential occupiers are required to obtain a registration certificate from the Director for all premises intended for use as workplaces. Such places shall be maintained in a clean state during the operation phase (section 47).

To ensure machinery safety, every hoist or lift – section 63 and/or all chains, ropes and lifting tackles – section 64 (1d), shall be thoroughly examined at least once in every period of six months by a person approved by the Director of Occupational Health and Safety Services. Similarly, every steam boiler - section 67 (8) and/or steam receiver - section 68 (4) and all their fittings and/or attachments shall be thoroughly examined by an approved person at least once in every period of twelve months whereas every air receiver shall be thoroughly cleaned and examined at least once in every period of twenty four months or after any extensive repairs - section 69 (5). According to section 71 (3), every refrigeration plant capable of being entered by an employee also needs to be examined, tested and certified at least once in every period of twelve months by an approved person.

In relation to fire safety, section 78 (3) requires spillage or leaks of any flammable liquid to be contained or immediately drained off to a suitable container or to a safe place, or otherwise treated to make it safe. Furthermore, a clear and bold notice indicating that smoking is prohibited should be conspicuously displayed in any place in which explosive, highly flammable or highly combustible substances, are manufactured, used, handled or stored- section 78 (5). In addition, necessary precautions for dealing with fire incidents should be implemented including provision of means for extinguishing fire and means for escape, in case of fire, for the persons employed in any workplace or workroom – section 81. As far as disaster preparedness and emergency response program is concerned, section 82 (1) makes it a mandatory requirement for every occupier of a workplace to design evacuation procedures to be used during any emergency situation and to have them tested at regular intervals.

To promote health and safety of employees who are at risk of being exposed to chemical substances, section 84 (3) and 85 (4) requires every employer to maintain at the workplace material safety data sheets and chemical safety data sheets respectively for all chemicals and other hazardous substances in use and ensure that they are easily available to the employees.

The employers' positive contribution towards the welfare of the employees include provision and maintenance of adequate supply of wholesome drinking water - section 91 and a first aid box or cupboard of the prescribed standard – section 95 at suitable point (s) conveniently accessible to all employees.

Other precautionary measures include: issuance of a permit to work to any employee, likely to be exposed to hazardous work processes or hazardous working environment, including such work processes as the maintenance and repair of boilers, dock work, confined spaces, and the maintenance of machinery and equipment, electrical energy installations, indicating the necessary precautions to be taken – section 96 (1); provision and maintenance for the use of employees, adequate, effective and suitable protective clothing including suitable gloves, footwear, goggle and head coverings in any workplace where employees are likely to be exposed to wet, injurious or offensive substance – section 101 (1).

KenGen and the appointed drilling contractor will be required to adhere to all the above mentioned safety measures throughout the project cycle.

4.15 The Environmental Management and Co-ordination (Water Quality) Regulations, 2006

It is an offence under Regulation No. 4 (2), for any person to throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution.

Regulation No. 11 further makes it an offence for any person to discharge or apply any poison, toxic, noxious or obstructing matter, radio active waste or other pollutants or permit the dumping or discharge of such matter into the aquatic environment unless such discharge,

poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards for effluent discharge into the environment.

Regulation No. 14 (1) requires every licensed person generating and discharging effluent into the environment to carry out daily effluent discharge quality and quantity monitoring and to submit quarterly records of such monitoring to the Authority or its designated representatives.

4.16 The Environmental Management and Co-ordination (Waste Management) Regulations, 2006.

Regulation No. 4 (1) makes it an offence for any person to dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.
Regulation 5 (1) provides categories of cleaner production methods that should be adopted by waste generators in order to minimize the amount of waste generated and they include:

I. Improvement of production process through-
   - Conserving raw materials and energy
   - Eliminating the use of toxic raw materials and wastes
   - Reducing toxic emissions and wastes

II. Monitoring the product cycle from beginning to end by-
   - Identifying and eliminating potential negative impacts of the product
   - Enabling the recovery and re-use of the product where possible, and
   - Reclamation and recycling and

III. Incorporating environmental concerns in the design and disposal of a product

Regulation 6 requires waste generators to segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal.
Regulation 15 prohibits any industry from discharging or disposing of any untreated waste in any state into the environment.
Regulation 17 (1) makes it an offence for any person to engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by NEMA. Regulation 18 requires all generators of hazardous waste to ensure that every container or package for storing such waste is properly labeled.
KenGen and the appointed drilling contractor will be required to comply with the above mentioned requirements throughout the project cycle.

4.17 The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

According to regulation 3 (1), no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. Regulation 4 prohibits any person to *(a)* make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or *(b)* cause to

be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source.

Regulation 5 further makes it an offence for any person to make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property.

First (1st) Schedule: Table showing Maximum Permissible Noise Levels

Zone		Sound Level Limits dB(A) (Leq, 14h)		Noise Rating Level (NR) (Leq,14h)	
		Day	Night	Day	Night
A	Silent Zone	40	35	30	25
B.	Places of worship	40	35	30	25
C.	Residential: Indoor	45	35	35	25
	Outdoor	50	35	40	25
D.	Mixed residential (with some commercial and places of entertainment)	55	35	50	25
E.	Commercial	60	35	55	25

Time Frame:

Day: 6.01 a.m - 8.00 p.m (Leq, 14 h)
Night: 8.01 p.m – 6.00 a.m (Leq, 10 h)
Regulation 12 (1) makes it an offence for any person to operate a motor vehicle which- *(a)* produces any loud and unusual sound; and *(b)* exceeds 84 dB(A) when accelerating. According to subregulation 2 of this regulation, No person shall at any time sound the horn or other warning device of a vehicle except when necessary to prevent an accident or an incident.
Regulation 13 (1) provides that except for the purposes specified in sub-Regulation (2) thereunder, no person shall operate construction equipment (including but not limited to any

pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform any outside construction or repair work so as to emit noise in excess of the permissible levels as set out in the Second Schedule to these Regulations.

Second Schedule: Table showing Maximum Permissible Noise Levels for Construction Sites

(Measurement taken within the facility)

Facility		*Maximum Noise Level Permitted (Leq) in dB(A)*	
		Day	Night
i.	Health facilities, educational institutions, homes for disabled etc.	60	35
ii.	Residential	60	35
iii.	Areas other than those prescribed in (i) and (ii)	75	65

Time Frame:

Day: 6.01 a.m. – 6.00 p.m. (Leq, 14 h)
Night: 6.01 p.m. – 6.00 a.m. (Leq, 14 h)
Regulation 16 (1) stipulates that where a sound source is planned, installed or intended to be installed or modified by any person in such a manner that such source shall create or is likely to emit noise or excessive vibrations, or otherwise fail to comply with the provisions of these Regulations, such person shall apply for a licence to the Authority. According to regulation 18 (6) this license shall be valid for a period not exceeding seven (7) days.

Regulation 19 (1) prohibits any person to carry out activities relating to fireworks, demolitions, firing ranges or specific heavy industry without a valid permit issued by the Authority. According to sub-regulation 4, such permit shall be valid for a period not exceeding three months.

4.18 The Public Health Act (Cap. 242)

Section 115 prohibits causing nuisance or other condition liable to be injurious or dangerous to health. Section 118 provides a list of nuisances which includes any noxious matter, or waste water, flowing or discharged from any premises, wherever situated, into any public street, or into the gutter or side channel of any watercourse, irrigation channel or bed thereof not approved for the reception of such discharge.

4.19 The Public Health (Drainage and Latrine) Rules

Rule 85 provides that every owner or occupier of every workshop, workplace or other premises where persons are employed shall provide proper and sufficient latrines for use by employees. Rule 87 requires every contractor, builder or other person employing workmen

for the demolition, construction, reconstruction or alteration of any building or other work in any way connected with building to provide in an approved position sufficient and convenient temporary latrines for use by such workmen. Rule 91 provides that no person shall construct a latrine in connection with a building other than a water closet or a urinal, where any part of the site of such building is within 200 feet of a sewer belonging to the local authority which is at a suitable level, and where there is sufficient water supply. *KenGen and the appointed drilling contractor will be required to construct suitable pit latrines or soakage pits for use by workers and visitors when undertaking drilling at the well pads.*

4.20 The Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005 –Legal Notice N0.25

According to Rule 5, where noise in a workplace exceeds the continuous equivalent of eighty five dB (A) the occupier must develop and implement an effective noise control and hearing conservation programme which must be in writing and should address:

a) Noise measurement
b) Education & training
c) Engineering noise control
d) Hearing protection
e) Posting of notices in noisy areas
f) Annual programme review

Rule 8 provides that all noise measuring equipment should be regularly calibrated, maintained, inspected and operated according to manufacturer's instructions. Rule 10(2) requires occupiers to carry out regular inspection and maintenance of machines and installations to ensure that noise emission is prevented or controlled.
Rule 13 provides that where the noise level is above ninety (90) dB(A), the employer shall:
-Post a sign at the entrance to and in every room or conspicuous place, clearly and prominent marked "DANGER HEARING PROTECTION MUST BE WORN"
-Supply hearing protection to all persons required to enter such an area
-Ensure that all workers and any other person entering this area wear hearing protectors

4.21 The Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007

Rule 6(1) requires occupiers to ensure that highly flammable substances are stored:
a) In suitable fixed storage tanks in safe positions, or
b) In suitable closed vessels kept in a safe position in the open air, and where necessary, protected against direct sunlight; or
c) In suitable closed vessel kept in a storeroom which is either in a safe position or in a fire resisting structure;

Rule 23(1) requires fire drills to be conducted at least once in a year and records kept available for inspection. According to Rule 24, KenGen will be required to identify a location in the workplace (rig site) where every worker shall assemble in the event of fire. Rule 29 obligates KenGen to Provide means of extinguishing fire at the workplace (rig sites).

4.22 The Water Act 2002

Section 18 of this Act provides for national monitoring and information systems on water resources. Following on this, sub-Section 3 mandates the Water Resources Management Authority to demand from any person or institution, specified information, documents, samples or materials on water resources. KenGen will be required to maintain proper records on water abstraction and consumption.

According to section 94 of the Act, it is an offence to throw or convey or cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive or unwholesome matter or thing into or near to water resource in such a manner as to cause, or be likely to cause, pollution of the water resource or side channel of any watercourse, irrigation channel or bed thereof not approved for the reception of such discharge.

Appropriate measures to prevent potential of contaminating surface water will need to be put in place by KenGen.

4.23 Water Resources Management Rules, 2007, Legislative Supplement No.52.

Rule 23 (1) stipulates that any person whose works or water use activity falls within Category A is required to notify the Authority, prior to construction or installation of works. Abstraction of surface water from lake Naivasha by KenGen falls under this category. However, KenGen has already applied for and obtained an abstraction permit from WRMA. Rule 81 prohibits pollution of water by discharging or applying any poisonous, toxic, noxious or obstructing matter, radioactive waste or other pollutants into any water resource unless such discharge meets the permissible water quality standards recommended by Water Resources Management Authority (WRMA). Rule 88 provides that No person shall willfully and deliberately allow any substance to spill out into any water resource or onto land where such spillage may or is likely to contaminate any body of surface or groundwater. KenGen shall be required to put in place necessary measures to prevent the potential of polluting Lake Naivasha.

4.24 The Factories and Other Places of Work (Hazardous Substances) Rules 2007

Rule 12 (3) provides that every employer who uses any hazardous substances at work shall be in possession of a copy of material safety data sheet for each type of substance in use at his premises. Rule 13 (1) stipulates that every employer shall ensure that the quantity of waste from hazardous substances in his use are kept at reasonable minimum levels and that such waste is disposed of in a manner less harmful to human and the environment.

Rule 15 (1) provides that every employer shall facilitate the training of his worker on safety by a) instructing the workers how to obtain and use the information provided on labels and chemical safety data sheets and b) using the chemical data sheets along with information specific to the workplace, as a basis for the preparation of instructions to workers, which should be written if appropriate. KenGen will be required to implement the above measures in order to ensure safety of staff and to prevent environmental pollution.

4.25 The Factories (Building Operations and Works of Engineering Construction) Rules, 1984.

Rule 7 requires every contractor who employs more than twenty persons to appoint a safety supervisor who should be experienced in the works being carried out at the site. Rule 48 (1) prohibits any timber or material with projecting nails to be placed or be allowed to remain in any place at a site where they are a source of danger to persons employed. Rule 55 (C) provides that properly maintained scaffolds or; where appropriate, ladders or other means of support which shall be sufficient and suitable for the purpose shall be provided, placed and kept in position for use where work cannot be safely done on or from the ground or from part of a building or other permanent structure.

Rule 109 (1) prohibits any crane, crab or winch to be used unless it has been tested and thoroughly examined by a competent person within the previous four years and no pulley block, gin wheel or sheer legs shall be used in the raising or lowering of a load weighing one tone or more unless it has been tested and thoroughly examined by a competent person.

Rule 132 provides that where a contractor has more than five persons in his employment on a site, he shall provide and keep clean and in good repair a sufficient number of suitable first aid boxes, which shall, while work is going on, be reasonably accessible to all positions on the site where persons in his employment are working. KenGen and the appointed drilling contractor will need to comply with the above mentioned measures throughout the construction and operation phase of the proposed drilling project.

4.26 The 1971 Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat.

The purpose of the 1971 Ramsar Convention is to stop the loss of wetlands and to promote their conservation and wise use as a means of achieving sustainable development. Each state party shall designate at least one wetland for inclusion in a List of Wetlands of International Importance ("Ramsar List") and ensure the maintenance of the ecological character of each Ramsar site {article 2 (1)}.

KenGen will be required to continue supporting the conservation of Lake Naivasha throughout the project cycle.

4.3 KenGens' Capacity to Ensure Compliance with Legal and Regulatory Requirements

KenGen is fully committed to long-term environmentally sustainable development that is consistent with National and International standards. In line with this commitment, the company maintains and continually improves a Quality Management System and Environmental Management System based on ISO 9001:2008 and ISO 14001:2004 standards respectively. The company has documented manuals, procedures and work instructions which are available on the companys' intranet and in hard copies at the points of use.

Olkaria Geothermal Power Project has a well functioning Environment, Quality, Safety and Liaison Section. The section will coordinate and supervise implementation of the Environmental Management Plan throughout the project cycle. This will be achieved by ensuring that the appointed drilling contractor and KenGens drilling team adhere to the

requirements of the relevant legal provisions, documented procedures, work instructions and EMS and QMS manuals.

5.0 POTENTIAL SOCIAL AND ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES ANTICIPATED ENVIRONMENT IMPACTS AND MITIGATION

5.1 Potential Negative Environment Impacts

5.1.1 Impacts on flora and fauna

Vegetation shall be cleared during preparation of drill pads and access roads using earth moving equipment. This has the potential of reducing the habitant available to the wild animals. There is also the potential of wildlife to be displaced when the animals avoid the area due to its changed ecology from increased human activity and noise. Disturbance of the plant community may induce changes in species composition. During drilling and well tests, noise emissions may result to disturbance of animal behaviours. The hot geothermal fluids discharged during drilling and well testing will impact negatively on the growth of the vegetation.

The following measures for mitigating against adverse impacts on flora and fauna re recommended to the proponent for implementation;

- Access roads and drill sites will be sited to minimize direct impact on sensitive ecosystems
- Noise control measures including use of silencers and reducing the duration of the vertical discharge test shall be put in place to minimize the impacts of noise on wild animals
- All degraded lands shall be rehabilitated with appropriate indigenous plant species and maintained until the time it can naturally sustain itself
- Geothermal fluids from the drilling of the wells shall be used for drilling of the wells as is currently being done.
- Drill pads will have multiple wells (3 Or 6 wells/pad) in order to increase the output of the production wells. This will be achieved by complementing vertical drilling by directional drilling.
- the ponds for containing the geothermal fluids will be enclosed with a chain link fence and the site guarded to prevent access to the pond by wild animals
- KenGen will Co-opt a representative from Kenya Wildlife Service in the well siting committee
- KenGen will continue collaborating with KWS to carry out studies on biodiversity within Hells Gate National Park

5.1.2 Hydrogeology and Water Consumption

Drilling requires water to soften the earth, for cementing of the casings and mixing of concrete for the cellar construction. The source of this water is Lake Naivasha. In order to reduce pressure on the lake, KenGen supplements the water abstracted for drilling by the

geothermal fluid. Drilling of one well requires approximately 70,000 cubic metres of water. However, when geothermal fluid is used for drilling, the water required reduces to 30,000 cubic metres hence saving 40,000 cubic metres of water. Since previous studies have shown that the Greater Olkaria Geothermal Field does not have underground water, the proposed drilling of geothermal wells is envisaged not to impact negatively on underground water resources. There is the risk of storm water surface runoff to be contaminated by the geothermal fluids which might finally find its way to the lake. This can contribute to contamination of the lake water due to cumulative impact.

To mitigate on the possible impacts to water resources, KenGen proposes to implement the following mitigation measures:

- Supplementing the water required for drilling by the geothermal fluids in order to minimize the impact on Lake Naivasha
- Containment of the geothermal fluids in protected ponds and monitor the level to avoid mixing with storm water runoff
- Any need to increase the volume of water abstracted from the lake shall be communicated to the Water Resource Management Authority for consideration
- Monitoring of the quality of the geothermal fluids should continue as per the requirements of Environmental Management and Coordination (Water Quality) Regulations, 2006
- Proper house keeping within and around the rig will be observed before, during and after drilling, while proper clean up procedures will be undertaken in case of drilling fluid and oil spills.

5.1.3 Noise Generation

Noise levels will increase during the actual drilling of the geothermal wells due to the diesel generators and during the well testing process. Noise has the potential of causing nuisance to neighbours and staff, disturbance to wild animals and to some worst scenarios, hearing impairment especially for staff working within the noise hazardous areas.

To mitigate against noise pollution the proponent shall put in place the following mitigation measures to protect workers, visitors to the site and wild animals;

- All wells under test will be fitted with silencers to minimize the noise generated
- Employees and visitors to drilling sites and wells being tested shall be provided with ear protectors to protect their health
- The drilling rig and its components including the generators shall be serviced and maintained in optimal working conditions to minimize the noise that will be generated

- Warning signs shall be placed at all noise hazardous areas
- Noise measurement shall be undertaken periodic and appropriate mitigation measures recommended based on the results
- The duration for the vertical discharge (well testing) should be restricted to two months

5.1.4 Impacts on Air quality

Impact on air quality will occur especially during well pad preparation and equipment mobilization as a result of traffic movement and well drilling due to generator operation. The exhaust emissions have the potential of contributing to green house effect whereas dust has the potential of causing nuisance and adverse health impact to wild animals, neighbours, visitors and staff. Release of hydrogen sulphide during drilling and upon completion of drilling has the potential of poisoning wild animals, neighbours, staff and visitors to the site incase the recommended levels are exceeded. The egg like smell of hydrogen sulphide gas will cause nuisance. However, this occurs naturaly in areas with natural geothermal manifestations such as fumaroles in the Olkaria area of Naivasha.

The following mitigation measures shall be put in place to mitigate against adverse effects on air quality;

- Areas where vegetation has been cleared such as the drilling pad and access roads will be sprinkled with water throughout the project lifecycle to control dust emission
- All fuel powered equipment including the generator will serviced and maintained in optimal working conditions to mitigate against exhaust emissions.
- Traffic movement shall be limited to 40KM/Hr along the project access roads to reduce the risk of dust emission
- Employees likely to be exposed to dust emission will be provided with dust masks
- Monitoring of hydrogen sulphide emission throughout the drilling process and upon completion of drilling
- Use of permit to work by all employees carrying out operations at the rigs and during well testing

5.1.5 Soil erosion

The removal of vegetation during well pad preparation and construction of the access roads exposes the area to soil erosion by wind and storm water runoff water. The topography of the area which is generally uneven with gulleys and the loose volcanic soils exacerbates the risk.

The following mitigation measures shall be implemented to minimize soil erosion during the implementation of the project:

- Clearing of vegetation for the well pad and the access roads shall be restricted to the demarcated area
- The area where vegetation has been removed shall be compacted and gravelled
- Appropriate soil erosion control measures including construction of gabions and replanting of vegetation in degraded areas shall be carried out
- All rehabilitated areas shall be monitored from time to time and appropriate measures implemented
- All loose soil shall be properly stored to avoid being washed away by storm water runoff or being carried away by wind

5.1.6 Impacts on the aesthetic value of the area

The area is expected to lose its natural attractiveness as a result of the human activity and interference with the natural vegetation. How, this may not necessarily lead to the reduction in the number of tourist visiting the area as most tourists visiting the area are attracted by the geothermal operations at Olkaria.

To minimize the impact on aesthetic value, all areas degraded during drilling shall be rehabilitated to near their original state.

5.1.7 Geological risks

Geothermal areas are associated with geothermal risks such as volcanic eruptions, micro seismic risks (earthquake) activities, mass movements/ landslides and subsidence. it is said that the last volcanic eruptions in the Kenyan Rift valley occurred approximately 1400 years ago. Ground-based seismic data collected in these area indicate that there is no risk of a large earthquake or a volcanic eruption anticipated in the area. The risks to the project and local communities posed by volcanic activities is hence very low.

5.1.8 Soil Excavation

The construction of the drill pad and excavation of the ponds for containing geothermal fluids has the potential of generating excess soil as waste. This can be a source of nuisance to staff and neighbours when piled in frequently accessed areas.

The project proponent is proposing to reserve the top soil in a safe place for reuse during rehabilitation of the affected drill pads and ponds.

5.1.9 Socio-Economic Impacts

Large projects usually result to an influx of population due to the opportunities presented by the activities and the proposed drilling project is no exception. the KenGen Olkaria licensed geothermal area is spatially settled and the Maasai's who live there are in the process of being resettled as a result of an ongoing project, therefore the area will not have any settlements. the influx of project staff from other areas may cause short term social concerns in the area that may need to be addressed. Such concerns include spread of HIV/AIDS and Sexually Transmitted Diseases.

KenGen will implement the following mitigation measures in order to address social concerns:

i. Provision of condoms in all sanitary facilities

ii. Sensitization of staff and the local community as well as creating awareness on HIV/AIDs

iii. Organizing Mobile Voluntary Counseling Tests

The projects will have major socio-economic benefits as it will offer job opportunities for communities living around Naivasha area and provide some business opportunities as well. A total of 282 temporary staff will be employed during the operation phase of the proposed project. The anxiety to get employment, has the potential of causing community unrest. In this regard KenGen will be required to establish a committee that will look into the issue of emloyment of temporary staff. The proposed project has also the potential of generating revenue through Clean Development Mechanism (CDM) since geothermal energy is clean. The Community Development Carbon Fund (CDCF), which is a component of CDM will be used to finance community projects around Olkaria Geothermal area hence contributing to development of the area. For the case of Olkaria II 3rd unit, the CDCF component was used to construct domestic water line in Maiella location, construction of classrooms in two schools and digging of a community water pan.

5.1.10 Population Growth

In the short term there may be an increase in population as the project will draw staff for the projects from diverse areas. The population increase is expected to be short term and will be back to normal after the completion of the project. Naivasha district has generally had a boom in population due to the presence of job and business opportunities as a result of the large flower farms and the various geothermal power plants in the area.

KenGen and the drilling contractor will address this issue by implementing the following measures:

- Accommodating additional staff in the existing camp sites located away from the drilling areas
- Picking and dropping staff to and from Naivasha town and
- Operating in shifts (5 shifts for KenGen and 4 for drilling contractor). Upon working for two weeks, staff will break for two weeks offduty

5.1.11Waste Generation

The types of waste to be generated and their approximate quantities are provided under table 5 of this report. Such waste include used oil, gunny bags, empty plastic containers, used oil filters, worn out casing shoes and scrape metals. The table provides waste management strategy for each type of waste that will be generated in order to prevent potential for environmental pollution.

5.1.12 Land Access rights and Compensation

KenGen proposes to acquire more land for drilling of wells from its neighbors' namely; Maiela Ng'ati farm, Kedong Ranch A and B, Oserian Farm and Kamere farm). There is the potential of creating unrest to the land owners due to anxiety to have the piece of land sold to KenGen.

In order to address this issue, the company will engage the landowners in discussions and follow the due process to acquire the earmarked land. The rights of access shall be obtained in a legally acceptable manner.

5.1.13 Health and Safety Concerns

Health and safety concerns include noise, hydrogen sulphide emissions, falling objects, fire, spillage of hazardous materials, falling in ponds containing hot discharges and use of air receivers. This can cause injury, hearing impairment and death in the worst case.

The mitigation measures proposed by KenGen include the following:

- Statutory inspection of lifting equipment and air receivers
- Monitoring of noise and hydrogen sulphide emissions
- Develop emergency response plan and procedures for hydrogen sulphide emission
- Proper servicing of the generators
- Provision standard first aid kits
- Provision of spill response kits
- Provision of fire fighting equipment
- Training of staff in first aid and fire fighting
- Fencing and guarding of ponds
- Induction of new staff on safety aspects pertaining to their job description

- Holding of safety meetings and implementing recommendations
- Recording of injuries, carrying out investigation and implementing preventive actions
- Provision and use of personal protective equipment
- Use of permit to work
- Use of no smoking signs at the diesel storage area
- Sensitizing the local community and visitors on safety aspects associated with geothermal operations

6.0 PROJECT ALTERNATIVES

This section identifies potential alternatives to the proposed project. Alternatives with respect to site and design have been compared and based on the analysis, the best alternative has been arrived at. 'The No action' alternative has also been considered.

6.1 Alternative Geothermal Field

KenGen did not consider any other alternative geothermal field outside Olkaria for drilling of the proposed wells since the existing geothermal potential at Olkaria has not been fully harnessed. Assuming that this potential was fully exploited, then the alternative field could have been the other identified geothermal prospects e.g Menengai and Lake Bogoria. The Greater Olkaria Geothermal Field was the preferred alternative for drilling of the proposed wells for the following reasons:

KenGen is already undertaking drilling at the site hence it would not require to transport drilling equipment and staff away from Olkaria. This implies that the cost of drilling wells at the site will be far much lower than that of drilling the same number of wells at the alternative geothermal field. The time taken to drill the desired number of wells at the present site would be shorter than if drilling of the same number of wells was to be undertaken at an alternative site due to transport and other logistics.

6.2 Alternative location of drill pads

Bearing in mind that, adequate location of drill pad and their access routes can prevent and/or reduce many of the envisaged environmental impacts during well drilling, various alternatives for pad location will be carried out according to the following criteria:
a) **Ecological importance and landscape**: lesser effects on the natural and landscape resources present in the area e.g on wildlife.
b) **Terrain suitability**: enough capacity to withstand drilling equipment and lesser susceptibility of the terrain to natural risks.
c) **Incidence in the socio-economic environment**: the drill pads will be located away from areas inhabited by human beings to avoid involuntary resettlement.

6.3 Alternative Sources of Energy

Apart from geothermal energy source, KenGen considered other energy sources including fuel, coal and hydro systems. Geothermal energy source was considered the best option for the following reasons:

- It is clean and renewable
- It emits less green house gases compared to thermal energy hence it can generate additional revenue through CDM
- It is indigenous, abundant and readily available in Kenya hence reducing the cost of power plant operation as opposed to thermal energy that relies on imported fuel.
- It generates continuous and reliable base load electricity in the country
- Has very low planned and unplanned outage rates (time when power is in demand but is unavailable due to forced outage)
- Geothermal power plants are available for generation 95% of any given time unlike hydropower plants which are prone to vagaries of weather

6.4 The No action Alternative

The No action alternative is a situation where the proposed wells are not drilled. This alternative was not considered since by doing so, a big fraction of the identified geothermal potential will remain untapped hence making the target for vision 2030 (Medium Term target of generating 1,600 MWe by 2016 and eventually 5,000 MWe by 2030) unrealized. The No action alternative will also deny the government an opportunity for generating revenue. The local community and the drilling contractor will also be denied the foreseen job opportunities.

6.5 Well Drilling Design

The well drilling design considered both vertical and directional drilling. In the past geothermal wells were mostly vertical and the same usually also applies to the first wells (exploration wells) in fields where development is just starting. Recently directional wells have become dominant in many geothermal fields in the world including the Greater Olkaria Field. The principal benefits are that fewer drill-pads and less surface piping are needed. This translates into reduced environmental impacts and costs associated with well pad construction and piping. Directional drilling also enables reaching drilling targets that are not easily accessible by vertical wells. KenGen will use both designs in the proposed project. However, more emphasis will be on directional drilling. The number of directional wells will be 129 whereas vertical would be 43.

6.6 Well Pad Construction Design

The design of the well pads will put into consideration the environmental impacts associated with well pad construction. Hence each pad will have multiple cellars to minimize on the number of well pads constructed. We shall have three categories of well pads as follows:

i. Well pad measuring 180m by 80m for three cellars
ii. 300m by 80m for six cellars and
iii. 140m by 180m for two sites lying back to back

The above will go along way to minimize the number of vegetation to be cleared and amount of dust generated.

7.0 PUBLIC CONSULTATIONS

7.1 The need for public consultation

EIA process is largely determined by effective Consultation and Public Participation (CPP) which basically provides the cornerstone for project planning and successful implementation. Consultation and Public participation helps to:

i) Facilitate involvement and participation of affected persons throughout the project cycle.

ii) Ensures a sense of responsibility and commitment towards implementing the Environmental Management Plan (EMP).

CPP should be undertaken mainly during project planning, in implementation and decommissioning phases. It should involve the affected persons, lead agencies, private sector, among others. The methodology for CPP may include: meetings and technical workshops with affected communities; interpersonal contacts; Dialogue with user groups and local leaders; Questionnaire/survey/interview; and Participatory Rural Appraisal or Rapid Rural Appraisal (PRA/RRA) techniques. It is the responsibility of the project proponent to adequately ensure effective distribution of the information to the affected persons to mitigate against unnecessary delays in decision making and project implementation.

7.2 Objectives of Public Participation

Public participation is essential for good governance and may empower local communities. Impact assessment is multi-purposive, aiming specifically to:

- Invite the affected and interested public into the decision-making process to foster justice, equity and collaboration
- Inform and educate the stakeholders (who include; the proponent, public, decision-maker(s) and the regulator) on the planned intervention and its consequences;
- Gather data and information from the public about their human (including cultural, social economic and political dimensions) and biophysical environment, as well as about the relations (Including those related to traditional and local knowledge) they have with their environment

- Seek input from the public on the planned intervention, including its scale, timing and ways to reduce its negative impacts, to increase its positive outcomes or to compensate impacts, which may not be mitigated
- Contribute to better analysis of proposals leading to more creative development, more sustainable interventions and consequently greater public acceptance and support than would otherwise be the case
- Contribute to the mutual learning of stakeholders and to improvement of the public participation and impact assessment practice for a proposal.

7.3 Public Consultation with Respect to the Proposed Project

Public consultations entailed two public barazas (at the Maasai Cultural Centre and Kamere) and a stakeholders consultative meeting with key stakeholders at the KenGen Social Hall as shown in the photos below.



Plate 1: The Chief Hells Gate Location Addressing the Participants at the Maasai Cultural Centre



Plate 2: The Lead EIA expert explaining the Impacts of the Proposed project during the baraza held at the Maasai Cultural Centre

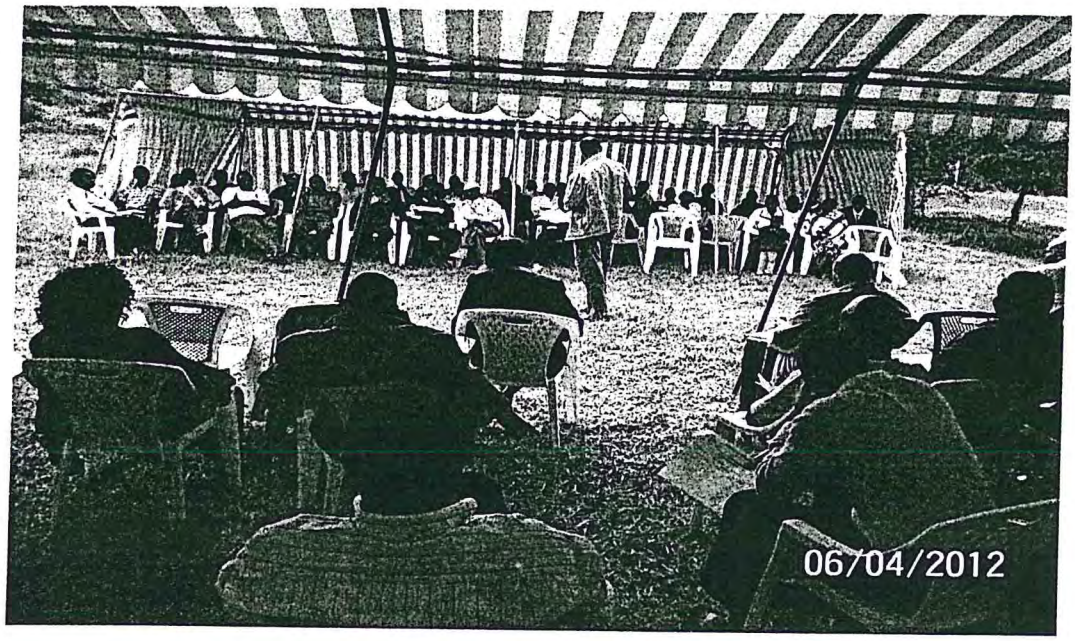


Plate 3: The Chief Addressing the Public Baraza at Kamere

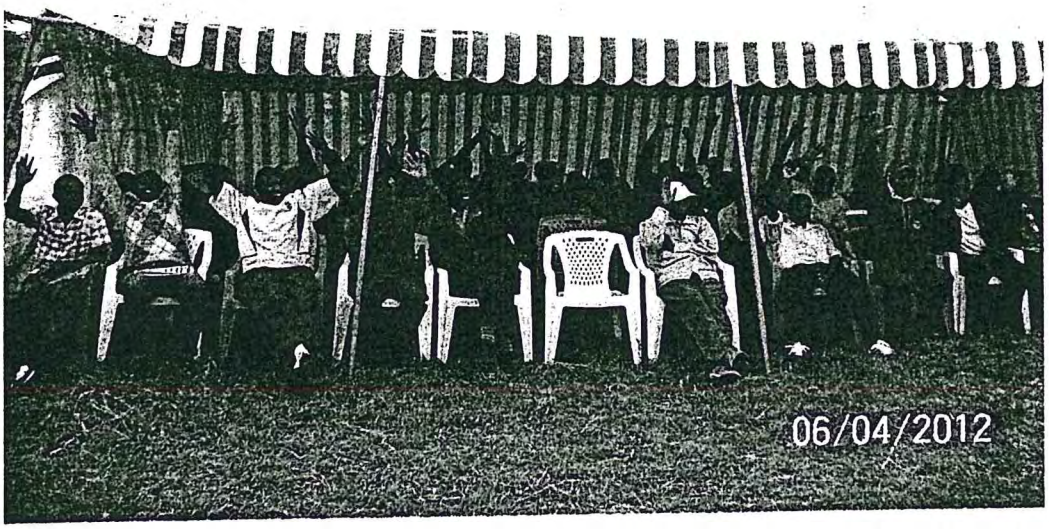


Plate 4: The Participants Raising Hands in Support of the Proposed Project during the Public Baraza held at Kamere

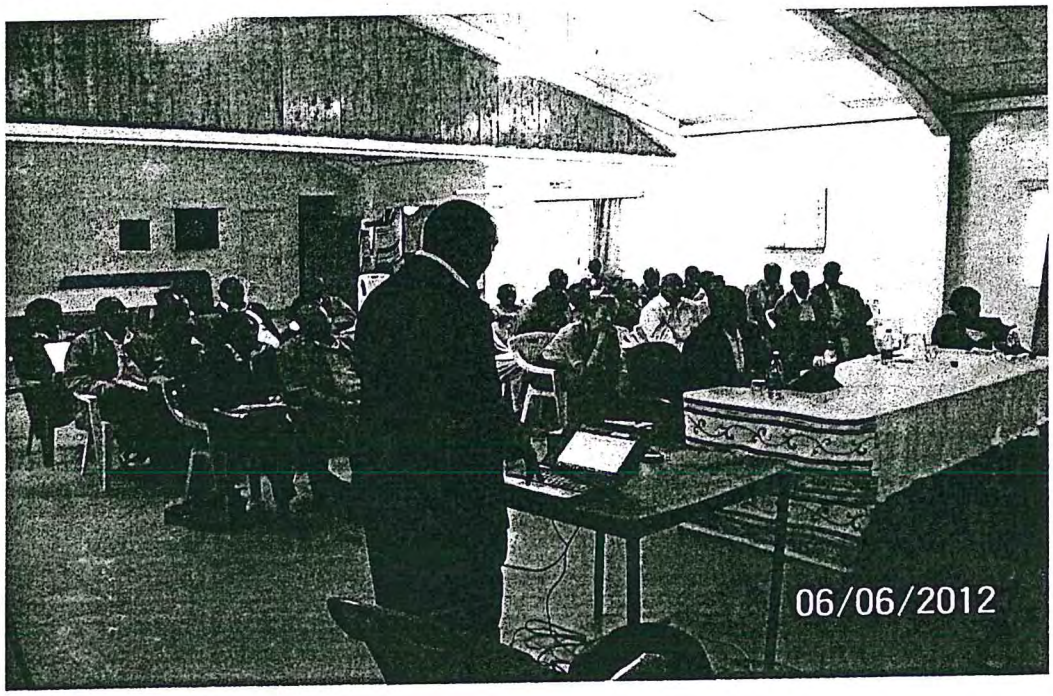


Plate 5: The Lead EIA Expert Presenting ESIA findings during Stakeholders Meeting at Social Hall

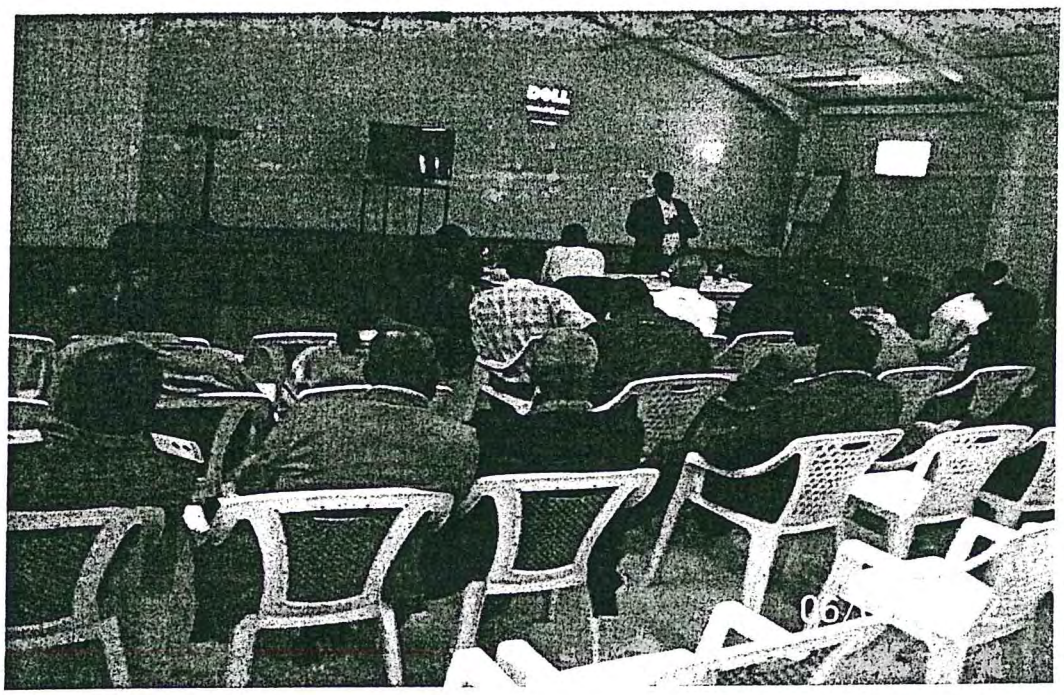


Plate 6: The Geothermal Development Manager Responding to Issues during Stakeholders Meeting at Social Hall

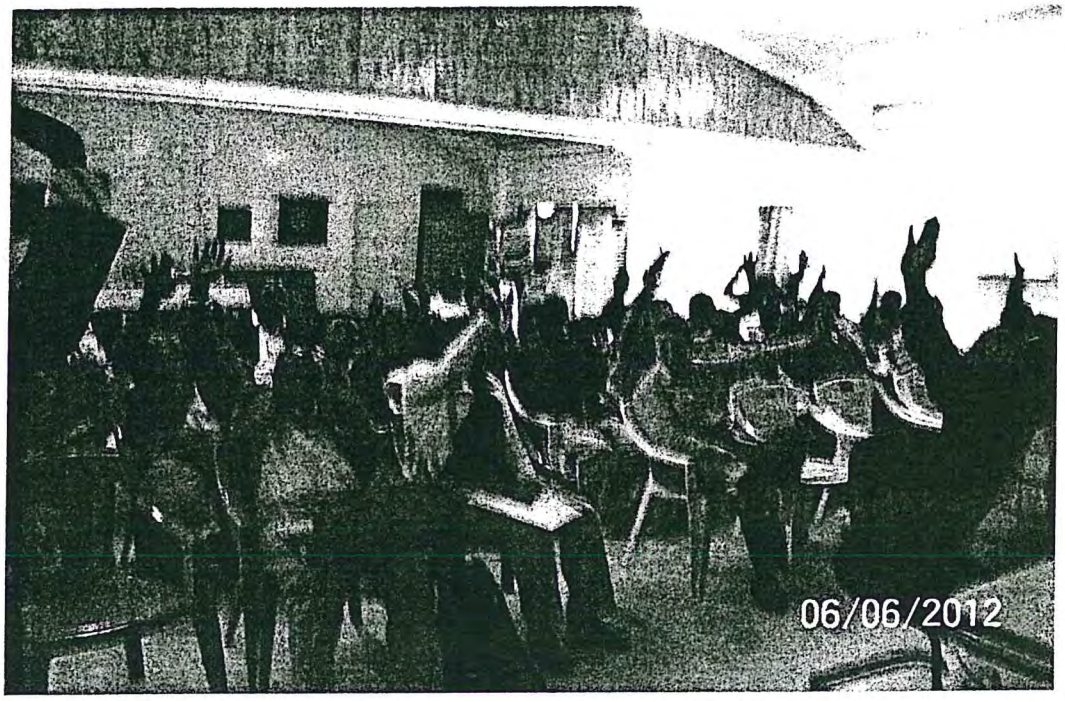


Plate 7: Stakeholders Raising Hands During Stakeholders Meeting at Social Hall

7.4 Results of the public consultation process

The summary of the stakeholders meetings held is provided in table 10 below.

Table 10: Summary of Public Consultation Meetings

STAKEHOLDER	UNDERLYING NEEDS	UNDERLYING FEARS	CURRENT STATUS
Hells gate villages (Olomayani, Olongonot, Cultural Centre and Narasha Community	-Building of access roads an d other amenities -Employment of locals -Freedom of passage for grazing land - preservation of their culture -HIV/AIDS awareness to the community members prior to project commencement -Priority to community members for any business opportunities	-Relocation of those who will be affected - Shrinking land for large stock of livestock - Preservation of their culture -Alternative sources of livelihoods for the community - Preservation of their culture and livelihoods -Employment opportunities due to low levels of education	- KenGen has established a committee to look into employment issues and will continue with this in the coming project - Community members will not be relocated or resettled as it is the case now. - A cultural centre will be built to preserve the local culture - Employment opportunities created by current project has given community alternative livelihood. -Water, health issues, access, transport provision for locals being provided by Kengen through CSR
Kamere, Maasai village communities	-Employment opportunities for the youth in Kamere -Security concerns due to increased population - Need for soil protection support due to current soil	-Effects of H2S on buildings and plants - Effects of drilling on stability of buildings -Increased insecurity - Job security and protection of workers -Health and safety issues for the those who will be	- Employment opportunities has been fairly distributed with Naivasha area given 20% of all casual employment opportunies.

	erosion in Kamere	employed, handling of compensation incase of injuries -Job opportunities for the unskilled people -Effects of H2S on residents of Kamere -Gender considerations in employment -Access to Kengen offices due to KWS rules -Inclusion in committees and methods of appointing the committee members	-Some of the participants were members of ACC and aware of how the opportunities are being shared out. - Kengen is constructing a an Office block near housing estate and can easily be accessed.
Government Ministries, representatives of organization near the lake, land owners, KWS, Riparian,	-Fair and transparent land acquisition - Protection against the effects of H2S - Protection of public land and utilities -employment opportunities and fair distribution with gender considerations - Security for people and property - repair of the road from Naivasha. Support in soil conservation efforts in Naivasha. - Controlled development to reduce development of slums due to increase of temporary employees - HIV/AIDS awareness to the community - Proper rehabilitation of land after drilling - friendly esthetics to animals	- Land acquisition and procedures - Effect of drilling on water aquifers - Impact of H2S on roofing material, and plants - Impact of H2S on flowers - Impact of drilling on the flower business due to abstraction of a lot of water from the lake -Land being sold to other owners before acquires it. - Fate of public utilities when KenGen acquires land. -Employment opportunities and how they will be distributed fairly. -Mushrooming slums due to increased temporary workforce -Soil erosion around Kamere. Security concerns due to increased population -Damage of road due to movement of heavy equipment -Disturbance of soil during drilling which affect wildlife that inhabit the soil - Loss of migration corridors for the animals due expansive drilling	-KenGen will meet, discuss and negotiate with land owners. -Public utilities will be protected during acquisition as it has always been the case - EMPS being monitored in the other field which have been drilled and this will continue for the new field. - KenGen will have a separate consultative meeting KWS to address all the concerns raised about wildlife protection. MOU between Kengen and KWS exists and will be honored. - KenGen constructed the Moi South lake road and will continue to

		-Fires that occur during drilling -Increased traffic and over-speeding which can kill animals -fear of animal poisoning by effluence discharged - Creation of gulley which can pose danger to animals	maintain it with support from all stakeholders - Provicial Administration will look into issues of security and address the concerns raised. - Current research has shown that H2S is good for flowers and therefore a positive impact. Oserian flowers already using the technology

8.0 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

ENVIRONMENT MANAGEMENT AND MONITORING PLAN

The environmental management is a tool used in environment and social impact assessment to manage the anticipated environmental impacts and it is also used by companies as a contract condition in awarding of contracts. This environmental management plan will be part of the contract for the drilling of eighty (80) production wells to provide a portion of steam required for the proposed 560MW.

Table: Environmental Management and Monitoring Plan for drilling of appraisal and production wells for the proposed 560MW project in Olkaria geothermal area

Anticipated Impacts	Proposed Mitigation Measure	Responsibility for Implementation & Monitoring (Construction)	Responsibility for Implementation & (after Construction)	Means of Verification	Frequency of Monitoring	Cost
Land acquisition	- Negotiate and purchase land from the affected land owners	Proponent	Proponent	Land purchase agreements and Title deeds	Once off	Internal cost
Soils erosion	- 3 wells are drilled on one pad to minimize area required - Compact cleared areas to avoid wind erosion - Rehabilitate all degraded areas -Build gabions where gulley's	Contractor and KenGen & civil environment section	KenGen environment section	- Inspection and observation reports - Rehabilitation reports	Continuously for the life time of the project	-Construction cost -Operations cost after completion of drilling works
Impact on Water Resource -Increase in water abstraction from Lake Naivasha	- Geothermal fluids will be used for drilling -Containment of geothermal fluids to control surface runoff getting into water ways -Reinjection geothermal fluids into the wells	-Proponent -Contractor	Proponent	-Monitoring of water used by the project	Continuously during drilling works	Internal cost

Table: Environmental Management and Monitoring Plan for drilling of appraisal and production wells for the proposed 560MW project in Olkaria geothermal area						
Anticipated Impacts	Proposed Mitigation Measure	Responsibility for Implementation & Monitoring (During Construction)	Responsibility for Implementation & (after Construction)	Means of Verification	Frequency of Monitoring	Cost
Air quality • Dust from cleared areas • Emissions form equipment and vehicles • Emissions of hydrogen sulphide	- Monitor H_2S and dust levels and sprinkle exposed earth surfaces - Maintain drilling machinery, equipment and vehicles used at optimal working conditions - Monitor precipitation chemistry - Speed limits of 40Km/hr to be imposed and drivers sensitized	Contractor and project proponent	Proponent	- Monitoring reports - Servicing schedule and status reports - Water sprinkling programs	Continuously	Internal cost
Noise • Noise from diesel generators • Noise during testing of wells	- Maintain drilling machinery, equipment and vehicles used at optimal working conditions - Monitor noise levels -Sensitize staff working in areas of high noise levels -Erect warning signs in areas with high noise levels - Provide staff working in excessive noise (above 45dba) and visitors with appropriate PPES	Contractor and proponent	Proponent	- Noise levels monitoring records -Maintenance schedules and status -Warning signs	Continuously	Internal cost

Table: Environmental Management and Monitoring Plan for drilling of appraisal and production wells for the proposed 560MW project in Olkaria geothermal area						
Anticipated Impacts	Proposed Mitigation Measure	Responsibility for Implementation & Monitoring (Construction)	Responsibility for Implementation & (after Construction)	Means of Verification	Frequency of Monitoring	Cost
Waste effluent • Geothermal fluids that remains after use in drilling	-Monitor waste brine and other discharges quality -Re-inject all brine discharges -Contain effluents and waste brine sumps to allow see page	- Contractor and Proponent	Proponent	- Observation and inspection reports	Continuously during drilling	Internal cost
Accidental oil spills	- Prepare plans and procedures for proper storage and handling of oil products - Plants and equipment should be maintained in optimal working conditions to avoid leakages - Bund oil and lubricants storage area and Cover outdoor storage sites -Deploy drip trays while servicing machines and equipment -Line oil store floors with appropriate material and any drains should go to an oil interceptor	- Contractor and project proponent	Proponent	- Inspection and observation reports -Record of oil waste	-During mobilization of machinery and during servicing of equipment	Part of project cost

Table: Environmental Management and Monitoring Plan for drilling of appraisal and production wells for the proposed 560MW project in Olkaria geothermal area						
Anticipated Impacts	Proposed Mitigation Measure	Responsibility for Implementation & Monitoring (Construction)	Responsibility for Implementation & (after Construction)	Means of Verification	Frequency of Monitoring	Cost
Drilling chemicals	- Provide and enforce strict use of procedures and material safety data sheets for handling process chemicals - Formulate emergency response plans and procedures just in case of a chemical spill -Chemicals should be stored in appropriate stores and with cover	Proponents safety section	Proponents safety section	- Inspection at point of use for emergency response plans and procedures	Continuously	Internal cost
Source of Construction Materials can degrade environment in other areas	-Specify required standard for all materials and appliances -Verify source of all construction materials -Quarries for raw materials for access roads should be NEMA licensed -Raw materials that can be supplied by locals should be contracted to locals in the area	Contractor and project proponent	- Project proponent	- Inspections and observation reports	- Continuously	Internal cost

Table: Environmental Management and Monitoring Plan for drilling of appraisal and production wells for the proposed 560MW project in Olkaria geothermal area						
Anticipated Impacts	Proposed Mitigation Measure	Responsibility for Implementation & Monitoring (Construction)	Responsibility for Implementation & (after Construction)	Means of Verification	Frequency of Monitoring	Cost
Solid waste generation from the construction and workers	- All waste generated by the project should be disposed off as per EMCA 1999 (waste management regulations) - Waste should be segregated, transported in permitted vehicles and disposed off in NEMA licensed sites -Construction waste that can be re-used for landscaping and gabions making	- Contractor and project proponent	-Project proponent	- Inspections and observation reports	-Continuously	Internal cost
Biological and physical environment • Destruction of vegetation through charcoal burning and logging • Threat of poaching of wild animals by workers • Introduction of alien species	- Ensure only the minimal required areas are cleared of vegetation - Only vegetation indigenous to the area should be used for rehabilitation works - Rehabilitate all the degraded areas - Sensitize workers against destruction of vegetation, cutting of trees and poaching	- Contractor and project proponent	Project Proponent	- Rehabilitation reports -Inspections and observations reports	- Continuously	Part of project cost

Table: Environmental Management and Monitoring Plan for drilling of appraisal and production wells for the proposed 560MW project in Olkaria geothermal area

Anticipated Impacts	Proposed Mitigation Measure	Responsibility for Implementation & Monitoring (Construction)	Responsibility for Implementation & (after Construction)	Means of Verification	Frequency of Monitoring	Cost
Employment opportunities	- During construction first priority should be given to local communities - Women and vulnerable groups should be given high priority - Job opportunities should be distributed equitable among the local population	- Contractor and project proponent	Project proponent	- Employment reports for the project	- Continuously	Part of project cost
Material storage and workshop yards	- Material storage and workshop should be located away from sensitive ecosystems -Provide bins for solid waste storage, color coded and type of waste specified -Provide eateries sanitation facilities for the workers	-Contractor and project proponent	Project proponent	-Inspection and observation reports	- Continuously	Internal cost
Visual intrusion and aesthetics	- Use colors that blend with the local environment for equipment and pipelines -Re-vegetate areas that had been cleared of vegetation	-Contractor and project proponent	Project proponent	-Inspection and observation reports	- Continuously	Internal cost

Table: Environmental Management and Monitoring Plan for drilling of appraisal and production wells for the proposed 560MW project in Olkaria geothermal area						
Anticipated Impacts	Proposed Mitigation Measure	Responsibility for Implementation & Monitoring (Construction)	Responsibility for Implementation & (after Construction)	Means of Verification	Frequency of Monitoring	Cost
Public nuisance	-Minimize air pollution with measures earlier proposed -Notify the public through local community leaders of possible disturbance during construction -Erect warning signs -Create a complaints register	- Contractor and project proponent	Project proponent	-inspections and observations -Record of complaints registers and action taken	-Continuously	Internal cost
Public Health and Safety	-Reduce dust emission levels through regular watering of cleared areas -Conduct awareness on sexually transmitted diseases such as HIV/AIDS -Provide standard facilities for solid waste and sanitation -Provide workforce with wholesome drinking water -Monitor quality of water, air and noise levels	- Contractor and project proponent	Project proponent	-Inspection reports -Records of measurement	-Continuously	Internal cost

Table: Environmental Management and Monitoring Plan for drilling of appraisal and production wells for the proposed 560MW project in Olkaria geothermal area						
Anticipated Impacts	Proposed Mitigation Measure	Responsibility for Implementation & Monitoring (Construction)	Responsibility for Implementation & (after Construction)	Means of Verification	Frequency of Monitoring	Cost
Occupational health and safety	-Prepare safety and emergency plans and procedures -Test safety and emergency plans regularly -Ensure compliance with codes of practice, ordinances, laws, regulations and union agreements -Provide appropriate PPE'S and enforce use by workers	- Contractor and project proponent	Project proponent	-Inspection of plans and procedures -Reports of tests of plans and procedures -Inspections and observation of activities	-Continuously	Internal cost
Hazardous wastes i.e oil filters,	-Store and dispose off hazardous waste as per EMCA (Waste regulations 2006)	-Contractor and project proponent	Project proponent	-Records of hazardous waste generated -Contract with a NEMA hazardous waste handler	-Continuously	Internal cost

NB: Environmental Management and Monitoring plan for the operational and decommissioning phase will form part of EIA for the construction and operation of power plants

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

The findings of the EIA for the proposed drilling of geothermal wells at KenGens' greater Olkaria geothermal field indicate that the project has the potential for both positive and negative environmental impacts. However, the positive impacts outweigh the negative impacts. The positive impacts envisaged include: provision of reliable green energy to power the country to vision 2030 approximately the wells are expected to produce steam to generate 560MW, creation of job opportunities during the drilling phase and during construction and operation of power plants and business opportunities for local entrepreneurs'.

The potential negative social and environmental impacts identified are those associated with the following aspects: Removal of vegetation, dust, noise, emission to air, elevated and overhead work, indiscriminate disposal of waste, fire, general health and safety aspects, increased traffic, and accidental spillage of hazardous materials on the ground surface.

The EIA team has proposed an environmental management and monitoring plan that is adequate to mitigate against the negative environment and social impacts associated with the proposed drilling project.

9.2 Recommendations

Appropriate mitigation measures for the negative impacts associated with the aspects mentioned above have been provided by the EIA team in the environmental management and monitoring plan. It is the opinion of the EIA team that implementation of the Environmental Management Plan by KenGen will ensure environmentally sustainable development throughout the project cycle.

We recommend the project report to be licensed as the project site is situated in an area where geothermal power production has been going on for the last 30 years. The proponent had adequate capacity and over 30 years experience in managing the environment and social impacts associated with the project.

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APPENDIX 1: MINUTES OF THE PUBLIC BARAZA HELD AT THE MAASAI CULTURAL CENTRE

MINUTES OF PUBLIC CONSULTATION MEETING ON THE ESIA FOR THE PROPOSED DRILLING OF 172 GEOTHERMAL WELLS AT OLKARIA, NAIVASHA DISTRICT

AREA: HELLS GATE LOCATION

DATE: 4.06.2012

VENUE: MAASI CULTURAL CENTRE

TIME: 11.00 A.M

PRESENT

List of attendance sheet is attached

APOLOGIES
Mr Muchemi – Geothermal Development Manager
Mr Adan Isaac - District Officer, Kongoni

MIN 1/6/2012 OPENING REMARKS

The Chief called the meeting to order at 11.15 A.M. The meeting was opened with a word of prayer by Mr Parsampula.

The Chief welcomed all the participants to the meeting and elaborated that the objective of the meeting was to create awareness to the community on the upcoming drilling of wells for 560 MW plant as an expansion of the current projects. He said that the law requires that all the stakeholders be involved, informed and consulted on any project before commencement in order to harness their views on the understanding of the positive and negative socio-economic and environmental impacts of the project. He urged the community members to be attentive and participate in all the sessions.

He reiterated that the community had benefited a lot from the KenGen projects which have brought services like water, roads, health facilities education and employment closer to the community which are now enjoying the benefits. The livelihood of the community members has changed and they can now easily access services which could not be there if it was not for the project. He urged the community to continue to support all government development because they are aimed at addressing challenges and improving their living conditions.

MIN 2 /6/2012 KENGEN REPRESENTATIVES ADDRESS

The Ag. Geothermal Development Manager welcomed all to the meeting and requested the community to actively participate in the discussions and deliberation on the issues which they

were going to be informed. He informed them that the project which is being planned is not very different from the one that is ongoing. The land to be utilized has been identified and may not involve resettlement of people.

The EIA Lead Expert, Mr Baraza thanked the Provisional Administration for organizing and mobilizing the community to attend the meeting. He said that Kenya developed Vision 2030 as a blue print for development. Among the projects which were identified as key in realization of this vision is the development of affordable energy which can spur other development to enable the country to attain middle level economy state by 2030.

KenGen has taken up this challenge and in line with current climate change strategies, has prioritized clean energy as the appropriate way of generating power through geothermal development. It is out of this desire that there has been a lot of expansion in geothermal development lately including the planned 280 MW which was ongoing.

He informed the community that KenGen intends to drill 172 wells which if successful will be used to produce 560MW. He informed them that surface exploration studies which were done at Hells Gate, Olkaria and surrounding environs confirmed an availability of geothermal resource, which was estimated to support an installed capacity of 1200 MW and so far 207MW has been developed. As a legal requirement an EIA has to be carried out before the wells are drilled. Stakeholders are involved and informed of any impacts of the projects on them and the environment and that was the purpose of the meeting.

Mr Hussein, EIA team leader, outlined to the community the anticipated environment and social impacts which have been identified and proposed mitigation measures which KenGen is committed to putting in place and complying. He said that in every project there are positive and negative impacts but the important thing is to make sure that the negative impacts are mitigated in order to reduce the effects on the environment. These issues include:

i) Creation of employment opportunities. The project activities will require both skilled and unskilled labour and KenGen is committed to giving priority to the local community when these opportunities arise. Gender issues will be taken into consideration and as required by law, a third will be given to women.
ii) Creation of entrepreneurial activities – The project will attract a high population which will require goods and services. This will create opportunities for business which the local community may benefit.
iii) HIV/AIDS awareness will be carried to educate the community on the health risks which they can be exposed to with entrants of outsiders and interactions with them. This is to mitigate against any health issues relating to HIV AIDS pandemic. This will be done prior to commencement of the project.
iv) Storage and disposal of waste. Any waste generated out of project activities will be disposed off in a proper manner in a way that will not cause and negative impact on environment or people. All the contracted firms to dispose waste shall adhere the legal requirements of disposal of waste.

v) Healthy and safety – This will be emphasized in every project activity that requires human labour. The right protective gear shall be provided and awareness on health and safety shall be created.

vi) Effects on Flora and fauna; Care will be taken to ensure that risks are addressed and any area which is affected is carefully rehabilitated with the indigenous plants. No harmful external plants shall be introduced to the area.

vii) Noise levels shall be minimized by ensuring that the machines used are properly serviced. Where noise levels will be high ear Muffs and ear plugs shall be provided.

viii) Protection against dust. This will be minimized through watering of the dust areas.

ix) Water abstraction; Care will taken in use of the water especially from Lake Naivasha to reduce abstraction through use of brine in drilling activities.

x) Preservation of indigenous culture and tradition. The traditions of the local people will be respected and the project does not in any way try to change the culture of the people.

xi) Disposal of geothermal fluids-the participants were informed that the fluids will be re-injected into the reinjection wells

After the presentation by the EIA Team leader, the meeting was opened to the community to air their views and concerns.

QUESTIONS/ VIEW RAISED

1. Mr Randoine : He supported the project and says that it will be of great benefit to the community.
   Question: Will the project require that people to be resettled and if this is the case where do we expect them to be taken to.
   Answer: No, the area identified for drilling of the 172 wells will not cause any resettlement of people.
2. Mr Koskos. He appreciated the infrastructural development which has been brought by the other drilling projects and wondered if the project will lead to more benefit in terms of opening up the area and development of roads, and other amenities
   Answer: This will be considered at the time of project but definitely the project will develop access roads which the community can use.
3. Daniel Shaa: He expressed his gratitude to KenGen for the support they have given the community.
   Question: Can the community be given more time to digest and understand the issues that have been raised and give a feedback later.
   Answer: The community will be continuously involved and consulted on these issues and more meetings will be convened for them to air their fears and concerns. Since the project under discussion is not significantly different from others which currently being done the community should not have any fear since they have witnessed that they are no adverse effects on them and actually there are many positive impacts as opposed to negatives ones.

4. Simon : How will KenGen ensure that the livelihoods of the local community who are pastoralist is safeguarded and not affected by shrinking land which can cause overstocking and overgrazing which can also be destructive to the environment.
   Question ; How will the culture be preserved?
   The land which will utilized is currently used a grazing grounds for the large herds of the community.
   Answer: The area which will be fenced will only around the well pad leaving out the rest of which can be used for grazing. The project will create alternative livelihood opportunities such jobs creation and businesses.
   Concerning preservation culture, they were involved that a new cultural centre will be constructed by funds from the 280 MW plant. This will ensure that their culture is preserved.
5. Siloma Confirmed that community were happy to hear that KenGen is expanding as it means more benefits will come to the community
   Question; There is need for Kengen to plan early and prepare if incase people will be resettled to avoid past mistakes. He also wanted to know how the community will be involved, will be through committees like SCC as it is being done now?
   Answer: Yes, several committees will be formed to address different issues.
6. Stephen: We have written proposals to KenGen to support us in creating awareness on the HIV/AIDS pandemic and no response has been given. Can this request be considered before the commencement of the project?
   Answer: Yes, the proposals will be handled by the Health safety committee of the SCC who give direction on the issues at the time.

The Ag. Geothermal development Manager once again assured the community that they will not be relocated from their land. The Chief thanked all those who participated in the discussions. He urged the women to be more active next time in such discussion as many opportunities have been created for them.

There being no other business the meeting was closed at 1.20 PM with a word of prayer by Mrs Tatiye Parkire.

Signed: Beatrice Kipng'ok
Sociologist

KENYA ELECTRICITY GENERATING COMPANY LTD

KenGen

PUBLIC BARAZA FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS AT OLKARIA

VENUE: CULTURAL CENTRE **DATE: 4TH** JUNE, 2012 **TIME:** 1030 HOURS

ATTENDANCE SHEET

NO.	NAME	DESIGNATION	INSTITUTION/ ORGANIZATION	SIGNATURE
1.	Daniel shau	Cultural Centre		[signature]
2.	Havon Kiraison	Liaison Offizer	KenGen	[signature]
3.	Philip Sekento	Liaison Offize	KenGen	[signature]
4.	Philip Baraza	Env' Officer	KenGen	[signature]
5.	Kelly Tarvakaro	Liaison Offizer	KenGen	[signature]
6.	Orkos Parsampula	Cultural Centre		[signature]
7.	Kak's Parteyie	Liaison Offize	KenGen	[signature]
8.	Simon Sencho	Cultural Centre		[signature]

9.	Richard Nicamasiai	Oloonongot		
10.	Laban Karani	Olomayiana		
11.	Joseph Lesanchu	Cultural Centre		
12.	Dan	Kimamenki		
13.	Kasen Parsampula	Cultural Centre		
14.	Mical Nkuruna	Cultural Centre		
15.	James Ekiru	Cultural Centre		
16.	Patrick Michule	Olomayiana		
17.	Abdi Shama	Cultural		
18.	Joseph Sancale	Oloosingat		
19.	John Meppukori			
20.	Miriam Mbaru	Cultural Centre		
21.	Hannah Marumbe	Cultural Centre		
22.	Racheal Nduta	Olomayiana		
23.	Miriam Parsampula	Cultural Centre		
24.	Sabina Lore	Cultural Centre		
25.	Sijmoi Kiraisen	Naracha		
26.	Nasieku Pensampuk	Naracha		
27.	Nalotu Esha	Oloonongot		
28.	Kateri Nguyia	Olomayiana		
29.	Manwen Sentero	Cultural Centre		
30.	Maria Seget	Cultural Centre		
31.	Elisha Shaa	Naracha		
32.	Moses Sindingia	Cultural Centre		
33.	John Songuyia	Susua		

34.	Abdiaye Nasieku	Cultural Centre		[illegible]
35.	Karriau Kimamadi	Narasha		[illegible]
36.	Joel Siriai	Narasha		[illegible]
37.	Pemba Karani	Cultural Centre		[illegible]
38.	Tatiyie Parkire	Oloosinyat		[illegible]
39.	Hussein J. Guyo	Chief Hells Gate	OOP	[illegible]
40.	Collins Kishoyian	Cultural Centre		[illegible]
41.	Sentero Noosaron	Cultural Centre		[illegible]
42.	Simon S. Serrito	Cultural Centre		[illegible]
43.	Joseph Ludena	Cultural Center		[illegible]
44.	Elikana Sangurungoi	Cultural Centre		[illegible]
45.	Jackson Sankaro	Cultural Centre		[illegible]
46.	Nameyor Teeka	Cultural Centre		[illegible]
47.	Leyielan Lentirankoi	Olomayiana		[illegible]
48.	Joseph Seret	Cultural Centre		[illegible]
49.	Jack Sereu	Cultural Centre		[illegible]
50.	Paul Mosiro	Narasha		[illegible]
51.	Shunguya Karani	Narasha		[illegible]
52.	John Mokola	Narasha		[illegible]
53.	Radoine Nkamaciai	Oloonongot		[illegible]
54.	Stephen Mankuyio	Oloosinyat		[illegible]
55.	Lemeen Nairenyo	Olomayiana		[illegible]
56.	Lemaidua Karani	Oloosinyat		[illegible]
57.	Cyrus Keringithi	Kenhen AMPD	Kenhen	[illegible]
58.	Rose Mathenge	Kenhen - Olkaria		[illegible]

59.	James Hassan	Cultural Centre		[illegible]
60.	Benson Kisotu	Narasha		[illegible]
61.	George Naikuni	Suswa		[illegible]
62.	Sipoi Noosaron	Cultural Centre		[illegible]
63.	Nasile Hassan	Cultural Centre		[illegible]
64.	Fatuma Shaa	Cultural Centre		[illegible]
65.	Maria Kirotie	Cultural Centre		[illegible]
66.	Moses Kisotu	Olomayiana		[illegible]
67.	Samuel Lorgeeti	Cultural Centre		[illegible]
68.	Daudi Lenguyia	Cultural Centre		[illegible]
69.	Charles Kamania	Cultural Centre		[illegible]
70.	Joseph Lenguyia	Cultural Centre		[illegible]
71.	Sempeyuan Seret	Cultural Centre		[illegible]
72.	Beatrice Kipngok	SHRO	Kengen	[illegible]
73.	Santai Nanenyu	Oloosinyat		[illegible]
74.	Natimama Mankuyio	Olomunyak		[illegible]
75.	Muntungei Parsampula	Narasha		[illegible]
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APPENDIX II: MINUTES OF THE PUBLIC BARAZA HELD AT KAMERE

MINUTES OF STAKEHOLDERS CONSUTLATION MEETING ON THE ESIA FOR THE PROPOSED DRILLING OF 172 GEOTHERMAL WELLS IN OLKARIA, NAIVASHA DISTRICT

AREA: HELLS GATE LOCATION

DATE: 4.06.2012

VENUE: KAMERE COMMUNITY

TIME: 3.00 PM

PRESENT

Attendance sheet is attached

APOLOGIES
Mr Muchemi – Geothermal Development Manager
Mr Adan Isaac- District Officer, Kongoni

MIN 1/6/2012 OPENING REMARKS
The Chief called the meeting to order at 3.15 pm. Opening prayers were offered by Silas Ekisa. The chief informed the community that the purpose of the meeting was to seek their views and concerns on the development of well pads to support the generation of 560 MW. This he said is a legal requirement that an EIA be carried out before commencement of any project.

MIN 2/6/2012 KENGEN REPRESENTATIVE ADDRESS
The Ag. Geothermal Development Manager informed the participants that the intended project was not any new from the current ones being developed. He told them that they were aware of the job opportunities which have been created by the current projects and urged them to support the upcoming project. It is a government requirement that stakeholders are involved and informed about the project and given the opportunity to share their opinions and concerns before a project is done. This was the purpose of the meeting. He thanked all the participants for responding to the invitation.

Mr Somow, the Lead EIA expert informed the community that Kenya has developed vision 2030 as a blueprint for development and among the key issues is development of affordable power to the nation. In response to this demand and in an effort combat the climate changes impacts; KenGen is focusing on geothermal energy as clean energy source and in the long run affordable source to the nation.

He informed them that surface exploration studies which were done at Hells Gate, Olkaria and surrounding environs confirmed an availability of geothermal resource, which was estimated to support an installed capacity of 1200 MW and so far 207MW has been developed. As a legal requirement an EIA has to be carried out before the wells are drilled. Stakeholders are

involved and informed of any impacts of the projects on them and the environment and that was the purpose of the meeting.

Mr Baraza took the community through the environmental management plan for mitigating adverse social and environmental impacts during and after the implementation of the 560 MWe geothermal drilling project. He outlined the benefits of the projects as

i. Creation of employment opportunities- the community will be given priority when employment opportunities occur. A committee will be constituted which will specifically look into this to ensure equity fairness and gender considerations. Casuals and temporary employment will be available for both skilled and unskilled labor requirements
ii. Enhancement of entrepreneurial activities. He noted that Kamere residents were business people who will benefit from the opportunities of offering goods and services to the people undertaking project activities.
iii. Increase of power to the country will spur other development including infrastructural development and bring services closer to the people.

As expected in any project, there are some aspects which may have negative impacts. Kengen has put in place a management plan to mitigate against them. Some of these aspects are;

i) Soil erosion during preparation of well-pads- this will be mitigated by rehabilitating the area and planting indigenous grass and trees.
ii) Strain to lake Naivasha due to water abstraction: Use of brine will reduce the utilization of the water from the lake to very low levels
iii) Noise, Health and safety of employees- protective gear will be provided and engines will be serviced regularly as required.
iv) Hazardous waste disposal; will be addressed proper disposal and in strict compliance to legal requirements
v) HIV /AIDS awareness to reduce health risks due to entrants of outsiders. Awareness on this issue will be carried out.
vi) Geothermal fluids from the wells will be used for drilling other wells and the balance reinjected back to the geothermal reservoir

The meeting was then opened to the participant to ask questions or give their comments in regards to the proposed 560 MW geothermal drilling project.

Jason Ongeri

Question: How will KenGen ensure job security for the people who will be employed?

Answer: The applicable employment laws will be followed and the contractors will also comply with the law. However KenGen will not take responsibility for individual loss of job due to misconduct.

Incase of any injury at work, how will the employee be compensated?

Work Injury Act and OSHA Act will be applicable and employers are aware of this. The right protective gear will also be provided and contractors will be required to strictly adhere to the laws. Insurance covers will be given to all KenGen employees.

Justin Nyangeri
Question: What is the effect of H2S on building and the environment and how will mitigate these effects?

Answer: H2S does not have any effects on Iron sheets. The iron sheets are affected by other emissions from vehicles etc. data on this is continuously being collected and monitored by the company.

Question: KenGen staff are provided with milk to prevent effects of H2S gas, how will Kamere people be also assisted?

Answer: The milk that KenGen buys is for staff tea and not to mitigate against H2S. There is no scientific proof that milk helps to ease the effects of H2S

Question: How will KenGen ensure that those with no skills access employment opportunities particularly those from Kamere?

Answer: Employment will be coordinated by a committee which will ensure all inclusiveness, equity and gender issues. There will be employment opportunities for both skilled and non-skilled labour.

Purity
Question: Does H2S affect pregnant women?
Answer: H2S has no negative effect on pregnant women. There are many women employees in the Company who have gotten children with no complications

When the projected is expected to start?
Answer: The project will start in 6 to 12 months time depending on many factors including licenses funding etc.

Question: Will the drilling of wells affects the stability of houses which have been constructed by plot owners in Kamere?
Answer: The wells being drilled will not destabilize the area in any way. There are staff house and camps which have been constructed near well site but have not suffered any destabilization.

Question: How will Kengen ensure gender consideration is done during the nomination of the ACC committees? How will the youth be involved?

Answer: The Committee is normally constituted by the District Commissioners and gender issues and distribution is taken into consideration. Youth are also represented in the committees. The one which was constituted for the 280 MWe was done through nominations. It may be necessary to adopt election method.

Question: The project will bring in many people who may a cause for insecurity, how Kengen will ensure that security issues are addressed. She proposed a police post at Kamere as one of the solutions to the insecurity.
Answer: The Provincial Administration will handle this matter and the proposal should be given to them for consideration.

Dominic Ndungu
Suggestion: He proposed that an office be opened in Kamere to deal with employment issues.
Answer: Kengen administrative offices will be moving to the site of the Baraza which is next to Kamere

Vincent Otana
Question: Currently access to KenGen for youth who are looking for jobs is denied by KWS. How will this addressed so that KenGen can be accessed by those who are in need of jobs?
Answer: KenGen is planning to put up an office building near Lakeview estate which will now be accessible to all people away from KWS restrictions.

Samuel Kinyanjui
Conditions of getting a job in KenGen for non skilled is acquisition of certificate of good conduct and PIN certificate. The amount required in order for the one to get a certificate of good conduct is over Ksh 1000 which is too high for those who do not have any source of income. How will KenGen assist the youth in this aspect?

Answer: KenGen will continue to ask for these certificates since there are necessary. Youth are encouraged to sacrifice and get them if they require employment.

Closing remarks
The Ag. Geothermal Manager thanked all for turning up and participating in the meeting. He said Kengen is committed to ensuring all the measures given in the management plan will be implemented. The benefits for the project were many and he urged the community to support the project.

Chief Hussein
The chief enquired from the people if they were convinced that the proposed project should be done by KenGen. The people responded in the affirmative on condition that all the issues raised will be addressed by KenGen. The Chief thanked the people for their support and assured them that the government was committed to developing affordable power which every Kenyan should benefit from.

The meeting was closed at 5.30 with a word of prayer.

Signed: Beatrice Kipng'ok
Sociologists

Hussein A Somow
Lead Expert EIA

KENYA ELECTRICITY GENERATING COMPANY LTD

KenGen

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS AT OLKARIA

VENUE: KAMERE **DATE: 04TH** JUNE, 2012 **TIME:** 1430 HOURS

ATTENDANCE SHEET

NO.	NAME	DESIGNATION	INSTITUTION/ ORGANIZATION	SIGNATURE
1.	Elizabeth Nyeri Nwiangi	Kamere		
2.	Julius Njeri	Kamere		
3.	Ruth Wambui	Kamere		
4.	Salome Khisa	Kamere		
5.	Catherine Nambuire	Kamere		
6.	Mical Nanyanyi	Kamere		
7.	Samuel Kamba	Kamere		
8.	Josiah Ndungah	Kamere		
9.	Silas ELRSA	Kamere		
10.	George Mburua	Kamere		
11.	Eliphas Kisia	Kamere		
12.	Clinton Wanjala	Kamere		

13.	HESBON MONARI	Kamere		[illegible]
14.	Simon Kimani Kamau	KAMERE		[illegible]
15.	DISMAS ONYAPIDI	KAMERE		[illegible]
16.	MOSES K. NAIBA E	KAMERE		[illegible]
17.	Moses Simiyu	Kamere		[illegible]
18.	RICHARD WEKESA	KAMERE		[illegible]
19.	JASON MI ONGERI	KAMERE		[illegible]
20.	RUTH WAIRIMU	KAMERE		[illegible]
21.	VINCENT OTANA	KAMERE		[illegible]
22.	MICHAEL KERAMA	KAMERE		[illegible]
23.	Justine Nyaneti	KAMERE		[illegible]
24.	Dauci Wengombe	KAMERE		[illegible]
25.	DAVID MOTINA	KAMERE		[illegible]
26.	MAKETRIC ANGWEYA	KAMERE		[illegible]
27.	JOHN MATEBEI	KAMERE		[illegible]
28.	LENDAU KASIKWA	KAMERE		[illegible]
29.	Godfrey N. Chege	Karakita	Ass. Chief	[illegible]
30.	Purity Wangira	Kamere	Coordinator NDWF.	[illegible]
31.	Samuel Mwaniki	Kamere	Youth Leader	[illegible]
32.	Benjamin Odeki	Kamere		[illegible]
33.	Dominic Gitau	Kamere		[illegible]
34.	Martin Mukono	Karakita		[illegible]
35.	John Kabue	Kamere		[illegible]
36.	David Chege	Kamere		[illegible]
37.	Moses Kinyanga	Kamere		[illegible]

38.	Nduko N George	Kamere		[illegible]
39.	NICKSON OTWORI	Kamere		[illegible]
40.	Goerge Gichuki	Kamere		[illegible]
41.	Arap Sato	Civil Adm	Kengen	[illegible]
42.	Kelly D Tamakaro	Clo – KenGen	KenGen	[illegible]
43.	Peter Wanwe Palanga	Ulr. Olkaria Ward.	Naivasha M. Council	[illegible]
44.	Philip Sekento	Liaison Office	KenGen	[illegible]
45.	Philip Baraza	Env' Offizer	KenGen	[illegible]
46.	Hussein J. Guyo	CHIEF HELLS GATE	Prov. Admin	[illegible]
47.	Haron Kiraison	CLO	KenGen	[illegible]
48.	Hussein Ali Sanwo	Lead Expert EIA	KenGen	[illegible]
49.	Eyme W'Karingithi	AMRO	KenGen	[illegible]
50.	Beatrice Kipngok	CHRO	Kengen	[illegible]
51.	Lydia Kakenia	Liaison Office	KenGen	[illegible]
52.	Tom Wechuni	Kamere		[illegible]
53.	Sarah Wangela	Kamere		[illegible]
54.	Asha Wera	Kamere		[illegible]
55.	JOHN WAITAR	Kamere		[illegible]
56.	Peter Kamande	Kamere		[illegible]
57.	Samuel [illegible]	Kamere		[illegible]
58.	Caroline Mayimba	Kamere		[illegible]
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APPENDIX III: MINUTES OF THE STAKEHOLDERS MEETING HELD AT THE SOIAL HALL

MINUTES OF STAKEHOLDERS MEETING ON ENVIRONMENT AND SOCIAL IMPACT ASSESMENT FOR THE PROPOSED DRILLING OF 172 GEOTHERMASL WELLS IN OLKARIA, NAIVASHA DISTRICT

DATE: 6th June 2012

Venue: Lakeview Social Hall

Time: 11.20 a.m

Present:

The attendance sheet is attached

The meeting was called to order at 11.20 and was opened by a word of prayer by Beatrice Kipng'ok followed by self introduction.

The Ag. DC welcomed all the participants to the meeting. She informed the members that the purpose of the meeting was to inform the stakeholders of the proposed expansion of geothermal to drill wells to support generation of 560MWe. He requested all to actively participate in the deliberations.

MIN 1/6/2012 OVERVIEW OF GEOTHERMAL DEVELOPMENT: GEOTHERMAL DEVELOPMENT MANAGER

Geothermal exploration in Kenya started in 1950s and drilling of wells started in 1970 by East Africa Power and lighting company. With time technology and equipments have improved and with that the drilling has also been accelerated. Since that time KenGen has continued to drill wells which have supported the existing Olkaria I and II Power Stations and the upcoming Olkaria IV and Olkaria I units 4 & 5 Power Stations expected to generate a total of 280MWe. Geothermal surface exploration done over the years has confirmed an availability of geothermal resource, which was estimated to support an installed capacity of 1200 MW and so far 220MW has been developed within the Greater Olkaria Geothermal Field by KenGen and Independent Power Producers.

The government is committed to development of geothermal energy since it is clean, abundant and cheap to generate as opposed to other alternative sources of power generations which are expensive and unreliable for instance Hydro stations. Emergency power generated from diesel is more expensive and puts extra burden on the consumer. The governments' focus of late has been on geothermal and to accelerate exploitation of the geothermal resource, Geothermal Development Company (GDC) was created in 2009.

Studies have revealed that due to climate change, there has been a rise in the earths' temperature causing resulting to evaporation. This makes Hydro generation unreliable due to fluctuation of the water levels in the rivers.

In compliance with the legal requirement, an EIA has to be carried out before the wells are drilled. Stakeholders are involved and informed of any potential social and environmental impacts associated with the proposed project in order to provide comments that will help in decision making. The purpose of the meeting was therefore to fulfill this requirement.

MIN 2/6/2012 PRESENTATION ON DRILLING TECHNOLOGY

Mr Barasa the EIA lead Expert gave a presentation on the process of drilling, requirements (material, land, labor and machines) and drilling technology.

MIN 3/6/2012 ENVIRONMENTAL MANAGEMENT PLAN PRESENTATION

Mr Hussein, the EIA Lead Expert and Team Leader took the participants through an elaborate Environmental Management Plan for minimizing or mitigating against environmental impacts during and after implementation of the 560MWe drilling project.

Min 4/6/2012 Issues/ questions/ proposals at the plenary

Questions

1) Hussein Nguyo, Chief Naivasha, wanted clarification over a number of issues namely; first, what procedures KenGen followed to acquire the geothermal licensed area. second, whether negotiations with land owners within the proposed area has kicked off and three whether drilling of geothermal wells extend beyond the water table and whether drilling activities are likely to impact on ground water resources.

Response

The GDM informed the members that under the Geothermal Act, geothermal resources belong to the government and an organization can acquire a licence despite not owning the land. However, prior to project implementation, KenGen negotiates with the individual land owners whose land fall within the licensed area in did to acquire the target land. In order to acquire the additional land that will be required for drilling of the proposed geothermal wells KenGen is planning to approach individual land owners at a later date. Regarding contamination of ground water during drilling, the GDM informed the group that the geothermal area is fractured and thus there is no ground water over geothermal water since all water percolates to geothermal reservoir. Nonetheless, during drilling casing is done up to the target depth.

2) Venkatish Rao of Karuturi wanted to know what measures will be taken to contain H_2S and also the impacts on flower farmers due to the expected increased water abstraction from Lake Naivasha for the purpose of geothermal expansion.

Response

The GDM informed members that H_2S emission will be limited because well discharge testing will be undertaken for only two months. With regard to expected increased water abstraction from the lake, GDM informed the meeting that currently KenGen has put in measures to

reduce the amount of water abstracted from the lake by using brine for drilling. Further, a research is ongoing on suitability of brine for cementing purposes and this if successful is expected to reduce the amount of water abstracted from the lake.

3) Mr. Joseph Ngaruiya commented that emissions from geothermal activity has affected plants, corroded houses and increased respiratory diseases in Moi Ndabi area.

Response

The GDM informed the stakeholders that a pilot study undertaken jointly by KenGen and Oserian Development Company Ltd in 2003, on effects of geothermal emissions on flowers showed that flowers close to geothermal power stations were healthier than those in farms located far away. This study prompted the current practice of use of geothermal emissions for flower farming at Oserian Development Company. With regard to corrosion of houses and respiratory diseases, the GDM commented that geothermal energy has the least emission compared to other modes of generations like coal and fuel. According to precipitation chemistry conducted by KenGen, the results indicate that the geothermal activities does not contribute to acid rain formation.

4) Silas Wanjala wanted to know if geothermal fluids would pollute Lake Naivasha.

Response

The GDM informed the meeting that no drilling would be undertaken within Lake Naivasha catchments. Some studies commissioned in 1980s using water borehole drilling technologies did not yield positive results hence it was concluded that the Olkaria Geothermal Field does not have underground water resources.

5) The Chief, Maella location wanted to know what was going to happen since members of Maiella Ng'ati Farmers Association are in the process of subdividing their land and applying for land titles. He also informed the meeting that there are some public amenities in the said area.

Response

The GDM informed the meeting that KenGen cannot halt land transactions and when times come for negotiation for land, KenGen shall enter into negotiation with individual registered land owners. All public amenities will be identified and compensated accordingly.

6) The issues of employment opportunities arising from the project implementation was raised by several participants.

Response

The GDM informed the meeting that KenGen is largely a government body and thus job vacancies will be advertised on papers, however for non skilled jobs recruitment will be done

through project Stakeholders Coordination Committee which will be formed from identified stakeholders.

7) Linda Munyao of Oserian Development Company wanted to know what KenGen would do to arrest mushrooming of slums expected due to increased temporary workforce whilst Purity Wanjira wanted to know what measures KenGen would put in place to arrest insecurity issues that would be associated with increased population.

Response

The GDM agreed that the growth of slums and increased insecurity is real concern but the responsibility lies with other government institutions like provincial administration and KenGen can only support initiatives on the same as its mandate is power generation.

8) G.N.Chege wanted to know what measures are being taken to arrest soil erosion around Kamere beach

Response

GDM informed the participants that this can only be done through Corporate Social Responsibility (CSR).

9) S.N.Njoroge commented that it is unlikely for KenGen to utilize all its licenced area and thus was seeking to know if KenGen has established the area required for the proposed drilling of geothermal wells for 560MWe project. He further raised the issue that sinking of the ground is likely to occur if in practise many unproductive well are abandoned.

Response

GDM informed the participants that a study has already been undertaken to determine approximately land requirement for the 560 MW project. On the abandonment of unproductive wells, the GDM clarified ordinarily unproductive wells are converted to reinjection wells and as required by EMCA, the decommissioning of abandoned wells will become necessary upon closure of the power stations which is not anticipated to occur soon.

10) Hussein Guyo sought to know on AIDS awareness whether KenGen will undertake awareness for neighbouring communities

Response:

GDM informed the meeting that the HIV/AIDS awareness campaigns will include even the neighbouring communities

11) Evelyn Silali from KWS sought clarification on a number of issues as summarised below.

- Disturbance of soil during drilling which can lead to death of small insects and small animal which live in the soil

- Temporary employees and migrants who do poaching which is illegal
- Charcoal burning at the park by the workers
- Rehabilitation of land after drilling- some parches are left bare
- Licenced geothermal area is large and may lead to loss of migratory corridors for animals
- Fires during drilling activities
- Increased Traffic and over speeding of vehicles
- Soil erosion forming deep gulleys which pose as danger to wildlife
- Poisoning of animals due to effluence from discharge
- Aesthetic of the area, many pipes with different colours scare the wild life
- Landscaping on steep terrain.

Response

The GDM responded as follows:

Soil erosion control measures including gabion construction and revegetating of disturbed sites is being undertaken by KenGen and the company will liaise with experts from KWS in order to come up with the best approach to the problem.

KenGen will continue sensitizing staff on park rules including poaching, charcoal burning and over speeding. Offenders should be reported and stiff measures taken against them. He urged the local administration to assist in ensuring compliance with the park rules.

KenGen in collaboration with KWS has carried out mapping of animal routes and the steam lines are being designed to allow for animal migration i.e use of loops.

The pipes will be painted with camouflaging colours in order to prevent visual intrusion

In order to prevent adverse impact on wild animals all geother fluid ponds will be fenced off and guarded.

Min 5/6/2012: Fate of the Proposed Project

The participants were asked whether KenGen should go ahead with the proposed project and all the participants affirmed it by show of hands. Ms Sarah Higgins proposed and was seconded by councillor Palang.

Min 6/6/2012: Closing Remarks

Mr Hussein, the EIA lead Expert, assured the participants that the EMPs will be put in place since it was a condition by NEMA for KenGen to comply. There are also other bodies which monitor this implementation including the Donors, CDM verifiers, ERC and ISO EMS audits.

The ag. DC thanked all for the participants and informed them that they were free to seek further clarification from KenGen in case they observed anything of concern with the project.

Signed: Beatrice kipng'ok

Sociologist

Hussein .A. Somow

Lead Expert EIA/EA

KENYA ELECTRICITY GENERATING COMPANY LTD

KenGen

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS FOR THE 560MW PROJECT AT OLKARIA

STAKEHOLDERS CONSULTATIVE MEETING HELD AT THE SOCIAL HALL ON 6TH JUNE 2012.

ATTENDANCE SHEET

NO.	NAME	DESIGNATION	ORGANIZATION	MOBILE NO.	ID NO.	SIGNATURE
1.	Philip Barasa	Lead EIA/Expert	KenGen	0724455061	21192463	[illegible]
2.	Hussein A. Sarwar	Lead EIA Expert	KenGen	0721514071	22408924	[illegible]
3.	G. G. MUCHEMI	GDON	KenGen	0720730921	4831527	[illegible]
4.	Rose Mathenge	Lead EIA Expert	KenGen	0721400016	23540304	[illegible]
5.	SILAS WANJALA	LNRA MONITORING OFFICER	LNRA	0736887691	24276375	[illegible]
6.	EVERLYN SILALI	RESEARCH SCIENTIST	KWS	0723885890	11574703	[illegible]
7.	Yoshihiko Sawabe	Research	KWS	0703596509	MB3556097	[illegible]
8.	Sarah Higgins	Hon Sec/Manage Team	LNRA/KWS	0723786007	23576007	[illegible]
9.	John Kimani	Secretary NGATI	Secretary	0716542243	0477554	[illegible]
10.	GITHU MUCHIRI	Tresure	Tresure	0734650[illegible]	3340[illegible]	[illegible]
11.	Peter NGAHU	Committee member	Committee	0712117503	4265369	[illegible]
12.	Njugunna Kangethe	Vice chairman	Vice Chairman	0700272235	0841395	[illegible]
13.	JULIUS MWANGI	ASST/CHIEF MAELA	COP	0720292624	0875259	[illegible]

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS FOR THE 560MW PROJECT AT OLKARIA

STAKEHOLDERS CONSULTATIVE MEETING HELD AT THE SOCIAL HALL ON 6TH JUNE 2012.

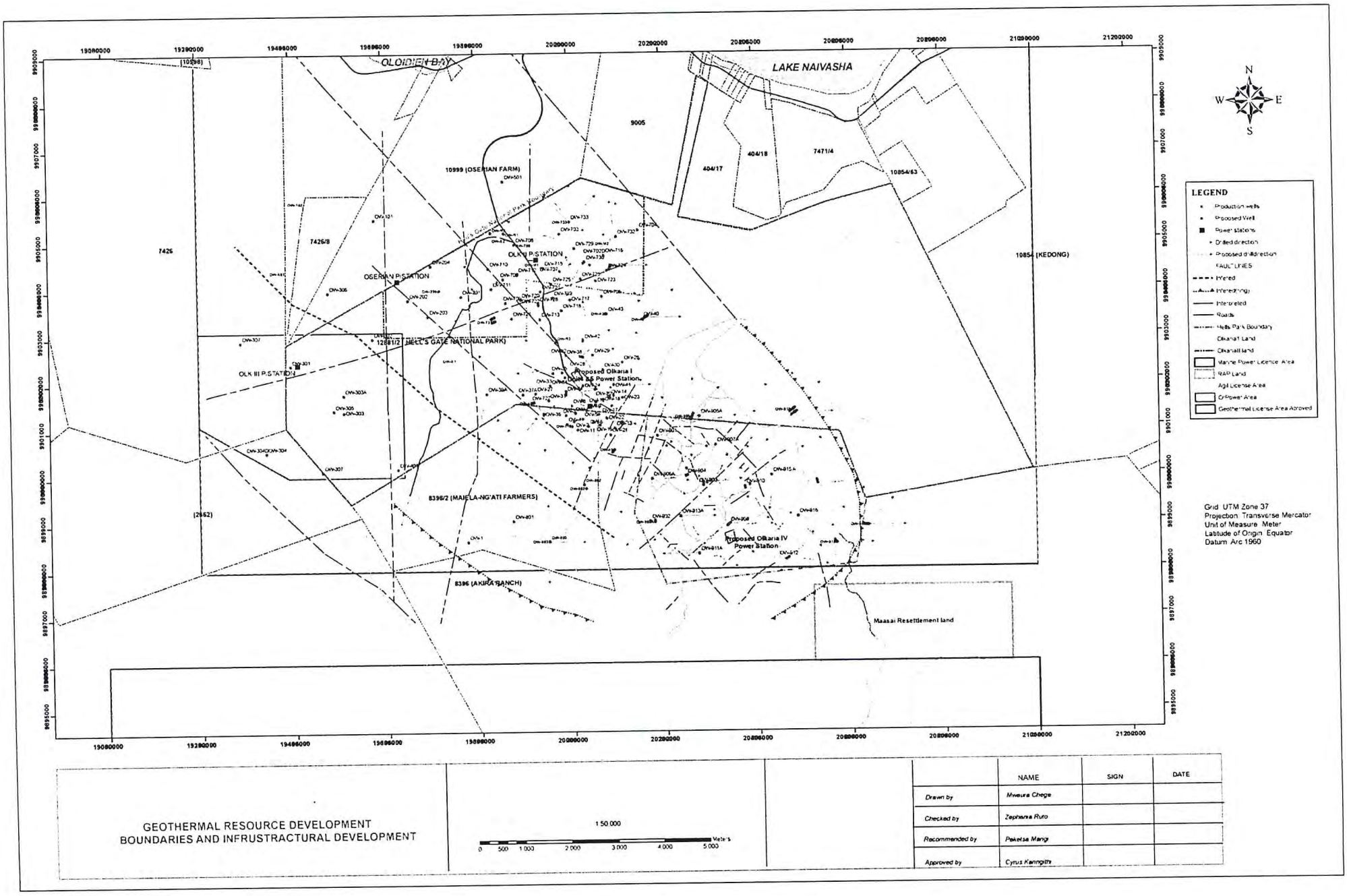
NO.	NAME	DESIGNATION	ORGANIZATION	MOBILE NO.	ID NO.	SIGNATURE
14.	PATRICK KARANJA	Ngati Chairman	CHAIRMAN	0725863193	6883357	[illegible]
15.	FRANCIS KURIA	CHIEF MAIELLA	O.O.P	0722472658	11046636	[illegible]
16.	LINDA MUNYAO	ENVIRONMENT Manager OSERIAN	OSERIAN	0719869719	20655452	[illegible]
17.	VENKATESH RAO	DGM	KARUTURI LTD	0726337266	253091	[illegible]
18.	PETER PALANGA	CLLR OLKARIA	M C NAIVASHA	0729783285	20792827	[illegible]
19.	HUSSEIN J GUYO	CHIEF HELLSGATE	PROV ADMIN	0725826952	16155767	[illegible]
20.	RAJU N.B	G.M.	KARUTURI	0729085267	22242490	[illegible]
21.	G.N. CHEGE	ASST CHIEF OLK	NAIVASHA	0720280937	2321544	[illegible]
22.	C.W. KARINGITHI	Asst MGR RD	[illegible]	0722598434	7038314	[illegible]
23.	EVA WANJA	CMO	WRMA	0713665078	24056012	[illegible]
24.	ANGELA WANYAMA	D.O. NAIVASHA	O O P	0721466131	12745256	[illegible]
25.	ELIJAH WEFUTAH	D.F.O / NAIVASHA	K.F.S.	0733921313	10871856	[illegible]
26.	ADAN ISSACK	D.O KONGONI	O.O.P	0721671894	22685145	[illegible]
27.	JOHN KIMILU	DDO, OFFICE NAIVASHA	MPND & Vision 2030	0721-221273	21754261	[illegible]

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS FOR THE 560MW PROJECT AT OLKARIA

STAKEHOLDERS CONSULTATIVE MEETING HELD AT THE SOCIAL HALL ON 6TH JUNE 2012.

28.	S N NJOROGE	DISTRICT WORKS OFFICER NVS	PUBLIC WORKS	0720709300	9124632	[illegible]
29.	BEATRICE KIPNGOK	SOCIOLOGIST	KENGEN	0720547198	10745908	[illegible]
30.	PURITY WANSIRA	Coordinator WILDE PEACE	Women 4 Peace	0727248184	7669424	[illegible]
31.	ALBERT KIMUTAI	AP INSPECTOR	ADMINISTRATION	0725650206	2742259	[illegible]
32.	T N NJIMU	DRIVER	O.O.P.	0721535980	21[illegible]	[illegible]
33.	JOSEPH NGARUTA	Community Leader	CP Kenyon	0720709550	4553256	[illegible]
34.	CORNELIUS NDETEI	Sr Environment Scientist	Kengen	0721389945	21719941	[illegible]
35.	MARTIN OCHIENG	DRIVER	KARUTURI	0720565061	4439353	[illegible]
36.						
37.						
38.						
39.						
40.						
41.						
42.						
43.						
44.						

APPENDIX IV: GEOTHERMAL RESOURCE MAP SHOWING THE LICENSED AREA



GEOTHERMAL RESOURCE DEVELOPMENT
BOUNDARIES AND INFRUSTRACTURAL DEVELOPMENT

1:50,000

0 500 1,000 2,000 3,000 4,000 5,000 Meters

	NAME	SIGN	DATE
Drawn by	Mweura Chege		
Checked by	Zephania Ruto		
Recommended by	Pakelsa Mang'a		
Approved by	Cyrus Kenngiths		