

**ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED  
MALINDI SOLAR POWER PLANT (40MW) PROJECT IN WERU GROUP RANCH  
NO. 19 IN LANGO BAYA LOCATION, MALINDI DISTRICT IN KILIFI COUNTY**



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**NOVEMBER, 2015**

**SUBMISSION OF DOCUMENTATION**

I, **Bii Kenneth Ng'eny** submit this Environmental Impact Assessment Study report, for the **Proposed Malindi Solar Power Plant (40MW), Located at Weru Group Ranch – No. 19 in Lango Baya Location, Malindi District in Kilifi County.** To my knowledge all information contained in this report is accurate and a truthful representation of all findings as relating to the project.

**Signed at WOTE on 29<sup>th</sup> day of November, 2015**

Signature: .....

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**Signature:**

I, **Jared Keburi** on behalf of **MALINDI SOLAR GROUP LIMITED**, receive this **Environmental Impact Assessment Study Report, for the Proposed Malindi Solar Power Plant (40MW), Located at Located at Weru Group Ranch – No. 19 in Lango Baya Location, Malindi District in Kilifi County.** To my knowledge all information contained in this study report is accurate and a truthful representation of all findings as relating to the project.

**Signed at Nairobi on this 01 day of December, 2015.**

Signature: .....

**Designation:** Director

## ACRONYMS

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<b>PPA</b>	Power Purchase Agreement
<b>KPLC</b>	Kenya Power and Lighting Company
<b>EIA</b>	Environmental Impact Assessment
<b>EMCA</b>	Environmental Management Coordination Act
<b>EMP</b>	Environmental Management Plan
<b>EMF</b>	Electro Magnetic Field Emissions
<b>GHG</b>	Green House Gases
<b>IMCE</b>	Inter-Ministerial Committee on Environment
<b>KM<sup>2</sup></b>	Kilometres square
<b>KV</b>	Kilo Volts
<b>KWS</b>	Kenya Wildlife Services
<b>NEC</b>	National Environment Council
<b>NEAP</b>	National Environment Action Plan
<b>NEMA</b>	National Environment Management Authority
<b>NGOs</b>	Non Governmental Organizations
<b>NPEP</b>	National Poverty Eradication Plan
<b>PAPs</b>	Project affected persons
<b>PPE</b>	Personal Protective Equipment
<b>TOR</b>	Terms of Reference
<b>NRPB</b>	National Radiological Protection Board
<b>KENGEN</b>	Kenya Electricity Generating Company
<b>MW</b>	Mega Watts
<b>IPPS</b>	Independent power producers
<b>GOK</b>	Government Of Kenya
<b>WARMA</b>	Water Resource Management Authority
<b>PV</b>	Photovoltaic's
<b>CSP</b>	Concentrating Solar Power
<b>DC</b>	Direct Current
<b>AC</b>	Alternating Current
<b>PIC</b>	Prior Informed Consent

<b>CPP</b>	Consultation and Public Participation
<b>OSHA</b>	Occupational Safety and Health Act

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## EXECUTIVE SUMMARY

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Nowadays it is widely accepted that the active Solar Energy Systems (photovoltaics, solar thermal, solar power) provide significant environmental benefits in comparison to the conventional energy sources, contributing to the sustainability of the human activities. Electricity production in Kenya today highly depends on imported energy, namely natural gas and fuel oil, while as the country operates below 1350MW instead of the required 15,000MW as at today. In the period of (2008-2020) annual electricity demand growth is expected to be (5.5%). This will further increase the burden on Kenya's economy as well as the dependency on international fuel prices.

In order to decrease the dependency of the Kenya's on international fuel prices, to enhance security of supply and to shift patterns of energy supply and demand into a more sustainable direction, the Government of Kenya, initiated an Energy Strategy, it set ambitious goals for the development of renewable energies. By the year 2030 as per our vision, the share of renewable energies in primary energy supply is to increase from the current 5% to 25% basing on the proposed energy Act 2010. A number of single targets have been set, such as for wind power 1500MW (Geothermal about 5000 MW), solar power (600 MW) and solar water heaters (share of 30% by 2030), in addition to waste/energy (80-120MW) apart from Hydro.

Due to this need, Malindi Solar Group Limited intends to develop a renewable energy project of 40MW to be based at Weru group ranch No. 19 which is located 125 km northeast of the city of Mombasa and 40 km west of the centre of Malindi town along Malindi – Kakoneni – Lango Bara road (C103) in Kilifi County. The project proponent wishes to develop the Malindi project under the Feed-In-Tariff policy. Under this policy the maximum installed capacity for a grid connected PV plant is capped at 40MW. The estimated project cost **for the 40MW Solar Plant is One Billion Five million Eight Hundred and Twenty Four Thousand Five Hundred and Twenty Kenya Shillings (Kshs 1,005,824,520).**

The major objective of the project is to utilize the ample solar energy resource in Kenya to generate clean electricity and feed it to the national grid in order to meet the country's electricity

energy requirements while displacing electricity produced by burning fossil fuels that contribute to production of Green House Gases (GHG) that cause global warming.

The Kenya government policy on all new projects requires that an Environmental Impact Assessment (EIA) be carried out at the project planning phase in order to ensure that significant impacts on the environment are considered as a component of the preliminary stage of the Project Cycle. This report presents in broad terms the key environmental and social issues that are anticipated to arise from the proposed project.

Environmental Impact Assessment is a tool for environmental Planning and has been identified as a key component in new project implementation. The EIA conducted conformed to the requirements of the National Environment Management Authority (NEMA) as stated in The Environmental Management and Coordination Act (EMCA) 1999 and stipulated in the Environmental (Impact Assessment and Audit) Regulations 2003 Legal Notice No. 101.

### **Scope Objective and Criteria of the Environmental Impact Assessment (EIA)**

Kenplan Kenya Limited a NEMA registered and licensed firm of Experts in Environmental Impact Assessment and Auditing was appointed as a Consultant to conduct the Environmental Impact Assessment of the proposed Malindi Solar Power Plant (40MW), Located at Weru Group Ranch in Lango Baya Area in Malindi District, Kilifi County, lead by **Faith Moses** an Associate Expert and **Kenneth Bii Ng'eny** as the Lead Expert. The scope of the assessment covered construction works of the proposed solar project which included Clearing of the project area, ground preparation, masonry, and installation of solar panels as well as the utilities required. The output of this work was an Environmental Impact Assessment Study report for the purposes of applying for an EIA license.

### **Objective**

The Environmental Impact Assessment (EIA) Study Report is to achieve the following objectives:

1. To identify and assess potential environmental and social impacts of the proposed project
2. To identify all potential significant adverse environmental and social impacts of the proposed project and recommend measures for mitigation measures
3. To verify compliance with the environmental regulation and industry standards

4. To generate baseline data for monitoring and evaluation of how well the mitigation measures will be implemented during the cycle
5. To recommend cost effective measures to be implemented to mitigate against the expected impacts.
6. To prepare an EIA report compliant to the Environmental Management and Coordination Act (1999) and detailing findings and recommendations.
7. To provide guidelines to stakeholders participating in the mitigation of adverse social impacts of the project

The consultant on behalf of the proponent conducted the EIA exercise by incorporating but not limited to the following Terms Of Reference (TOR):

- i. The proposed location of the project
- ii. A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project.
- iii. The objectives of the project.
- iv. The technology, procedures and processes to be used, in the implementation of the project.
- v. The materials to be used in the construction and implementation of the project.
- vi. The products, by-products and waste to be generated by the project.
- vii. A description of the potentially affected environment.
- viii. The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- ix. To recommend a specific environmentally sound and affordable waste management system.
- x. Provide alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- xi. Analysis of alternatives including project site and technologies.
- xii. An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- xiii. Provide an action plan for the prevention and management of the foreseeable accidents and hazardous activities in the cause of carrying out development activities.
- xiv. Propose measures to prevent health hazards and to ensure security in the working environment for the employees, residents and for the management in case of emergencies.

- xv. An identification of gaps in knowledge and uncertainties which were encountered in compiling the information.
- xvi. Such other matters as the Authority may require.

### **Methodology outline**

Since the proposed site is located within an area with no rich natural resources whose total effect to the surroundings could not be adverse and noting that the intended development and use of the facility will be in line with what exists in the surrounding areas, an environmental Study report would be seen to be adequate. The general steps followed during the assessment were as follows:

- Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule 2 of EMCA, 1999
- Environmental scoping that provided the key environmental issues
- Desktop studies and interviews
- Physical inspection of the site and surrounding areas
- EIA Public participation by the use of questionnaires
- Reporting.

### **Environmental screening**

This step was applied to determine whether an environmental impact assessment was required and what level of assessment was necessary. This was done in reference to requirements of the EMCA, 1999, and specifically the second schedule. Issues considered included the physical location, sensitive issues, and nature of anticipated impacts.

### **Environmental scoping**

The scoping process helped narrow down onto the most critical issues requiring attention during the assessment. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects.

### **Desktop study**

The consultant reviewed the necessary documents relating to the project have an understanding and background information regarding the project. In line with the review the relevant policies, regulations and relevant legal documents were analyzed.

### **Site assessment and public participation**

The consultant carried out field visit on 19<sup>th</sup> – 21<sup>st</sup> November, 2015. The consultant carried out public consultation in order to disseminate and inform the stakeholders about the project with special reference to its key components and location, Gather comments, suggestions and concerns of the interested and affected parties. This process enabled the establishment of a communication channel between the general public and the team of consultants, the project proponents and the Government and the concerns of the stakeholders be known to the decision-making bodies at an early phase of project development

### **Reporting**

In addition to constant briefing of the client, this Environmental Impact Assessment study report was prepared. The contents were presented for submission to NEMA as required by law.

### **Project Impacts and Mitigation Measures**

#### **Construction phase**

The construction phase will involve broad activities with notable impacts such as to include:

#### **Positive Impacts**

- i. Job Opportunities to skilled and unskilled Labourers
- ii. Gains in the Local and National Economy
- iii. Spin off benefits
- iv. Market supply for structural materials

#### **Negative Impacts**

- i. Construction waste generation
- ii. Soil erosion and sedimentation
- iii. Dust emission from the site preparation activities as well as well as construction vehicles
- iv. Potential for hazardous material and oil spills

### **Operation and Maintenance**

The following potential impacts have been identified during operations and maintenance:

#### **Positive impacts**

- i. A source of Clean Energy
- ii. Employment and income generation
- iii. Improve on the country's grid

## Negative Impacts

- i. Occupation health and safety issues

**Table 1: Impacts and Mitigation Measures**

Possible Impacts	Mitigation measures
Impacts on Flora, Fauna, Avifauna, Habitat Loss Destruction, disturbance and Displacement	<ul style="list-style-type: none"> <li>• Clearing vegetation only in construction areas and demarcating areas where no clearing will happen</li> <li>• Rehabilitation or ecological restoration during and after the construction phase will be undertaken with locally indigenous plants</li> <li>• Maintaining of re-vegetated areas after rehabilitation has taken place</li> <li>• Ensure that all human movement and activities are contained within designated construction areas in order to prevent peripheral impacts on surrounding natural habitat.</li> <li>• Vehicles coming into the site must use designated roads.</li> <li>• The wet area next to the panels will be fenced to prevent any disturbance on the fauna within the shallow water pan.</li> <li>• Educate all contractors as to the importance of the avifauna on the site and the importance of avoiding disturbance to it as far as possible</li> <li>• Implement tree planting program within the farm to offset any loss of trees.</li> </ul>
Noise impact	<ul style="list-style-type: none"> <li>• Using mechanical equipment with noise suppressing technologies in order to reduce the noise-rating as much as possible.</li> <li>• Install portable barriers to shield compressors and other small stationary equipment where necessary</li> <li>• Providing workers with PPEs against noise e</li> <li>• Control earthworks</li> <li>• Install drainage structures properly e.g ear plugs</li> <li>• Placing signs around the site to notify people about the noisy conditions</li> <li>• Regular maintenance of equipment to ensure they remain efficient and effective.</li> <li>• Construction and decommissioning should be carried out only during the specified time which is usually from 0800hrs to 1700 hrs, where permissible levels of noise are high and acceptable.</li> <li>• There should not be unnecessary honking of the involved machinery.</li> <li>• Drivers to adhere to speed limits within the project site access roads and vicinity.</li> <li>• Construction of sound proof walls round the sub-station to reduce on the impacts of noise to the surrounding environment, through a plastic fence or phonic barrier if necessary.</li> </ul>
Loss of top soil,	<ul style="list-style-type: none"> <li>• Restricting of vegetation soil cover to those areas necessary for the project</li> </ul>

soil compaction and soil erosion	<p>development.</p> <ul style="list-style-type: none"> <li>• Sprinkling water on the soil to prevent dust from rising.</li> <li>• Creating specific paths for the trucks</li> <li>• Ensuring there is enough space for normal percolation of water</li> <li>• Landscaping</li> <li>• The disturbed areas should be rehabilitated with indigenous vegetation as soon as possible to prevent soil erosion if it was necessary.</li> <li>• Proper installation and configuration of drainage structures to ensure their efficiency</li> </ul>
Impact on surface and ground water	<ul style="list-style-type: none"> <li>• During construction, the design (of the drainage systems) should ensure that surface flow is drained suitably in to the public drains provided to control flooding within the site.</li> <li>• The channels should be designed with regard to the peak volumes such as periods or seasons when there is high intensity of rainfall in case such an event occurs.</li> <li>• They should never at any time be full due to the resulting heavy down pours.</li> <li>• The drainage channels should ensure the safe final disposal of runoff/surface water and should be self cleaning which means it should have suitable gradient.</li> <li>• Soil stockpiles should be protected from wind or water erosion through placement, vegetation or appropriate covering if it was necessary.</li> <li>• Proper drainage control such as culverts, cut off trenches should be used to ensure proper management of surface water runoff to prevent soil erosion.</li> <li>• Cleared or disturbed areas should be rehabilitated with indigenous vegetation as soon as possible to prevent erosion and loss of biodiversity if it was necessary.</li> <li>• Fuel, oil and used oil storage areas should have appropriate secondary containment (ie bunds) to prevent underground water contamination.</li> <li>• Vehicles and machine will be properly surfaced and well maintained to reduce risk of potential oil and fuel spills and leakages.</li> </ul>
Air quality (dust and vehicle emission)	<ul style="list-style-type: none"> <li>• Sprinkling water on soil before an excavation and periodically when operations are under way to prevent raising of dust.</li> <li>• Spray stock piles of earth with water</li> <li>• Avoid pouring dust materials from elevated areas to ground</li> <li>• Cover all trucks hauling soil, sand and other loose materials</li> <li>• Sensitize construction workers</li> <li>• Provide dust masks for the personnel in dust generation areas</li> <li>• Regular maintenance and services of machines and engines.</li> <li>• Controlling the speed and operation of construction vehicles.</li> <li>• Use clean fuels eg. Unleaded and de-sulphurized fuels if clean fuel is available.</li> <li>• Vehicle idling time shall be minimized</li> <li>• Alternatively fuelled construction equipment shall be used where feasible</li> </ul>
Traffic impact	<ul style="list-style-type: none"> <li>• Placing signs around the site notifying other vehicles about the other traffic and to set the speed limit around the site.</li> <li>• Ensuring all drivers for the project comply to speed regulations.</li> </ul>



	<ul style="list-style-type: none"> <li>• Making sure the construction doesn't occupy the road reserves and complying to traffic and land demarcation obligation.</li> <li>• A grievance procedure will be established where by any complaints by the project's neighbors are recorded and responded to.</li> </ul>
Generation of waste	<ul style="list-style-type: none"> <li>• Development of waste management plan (WMP) following the principals of waste minimization at source, segregation for re-use, recycle as well as treatment and disposal of waste.</li> <li>• Following EMCA regulation on waste management, legal notice 121.</li> <li>• Using waste minimization techniques such as buying in bulk and creating opportunities for regulation. Reducing, Re-using, Recycling, Recovering, rethinking and Renovation.</li> <li>• Creating waste collection areas with clearly marked facilities such as color coded bins and providing equipment for handling the waste. The bins should be coded for plastics, rubber, organics, glass, timber, metals.</li> <li>• Allocating responsibilities of waste management and identifying all sources of wastes and ensuring wastes are handled personnel licenced to do so especially for hazardous waste.</li> <li>• Making available suitable facilities for the collection, segregation and safe disposal of the waste</li> <li>• Effluent and storm water runoff will be discharged away from water courses (drainage channel)</li> <li>• Steel off-cuts will be reused or recycled , as far as possible</li> <li>• Any used oil stored on site must be stored in impervious container</li> <li>• Special attention shall be paid to the sanitary facilities on site</li> <li>• Garbage shall be disposed off periodically</li> </ul>
Health and safety impacts	<ul style="list-style-type: none"> <li>• Employing an OSH plan that will outline or OSH risks and provide a strategy for their management.</li> <li>• Ensuring all potential hazards such as movable machine parts are labeled</li> <li>• Raising awareness and educating workers on risks from equipment and ensuring they receive adequate training on the use of the equipment.</li> <li>• Providing the workers with adequate PPEs and monitoring regulatory to ensure they are replaced on time when they wear out.</li> <li>• Placing visible and readable signs around where there are risks.</li> <li>• Providing fire fighting equipments and creating safe and adequate fire and emergency assembly points and making sure that they are well labeled</li> <li>• Providing fire fighting equipments and in easily accessible areas as well as ensuring site personnel are well trained to use them as well as maintaining them regularly</li> <li>• Labeling chemicals and material according to the risks they possess.</li> <li>• Creating safe and adequate fire and emergency assembly points and making sure they are well labeled.</li> <li>• Ensure dustbin cubicles are protected from animals, rains and are well covered</li> </ul>

	<ul style="list-style-type: none"> <li>• Proper treatment of waste water</li> <li>• The proponent should ensure that the project site is properly fenced as well as employ guards to prevent children from tampering with the heavy machinery.</li> </ul>
Water sources	<ul style="list-style-type: none"> <li>• Management of water usage. Avoid unnecessary wastage of water</li> <li>• Avail storage tanks.</li> <li>• Harvesting of rain water</li> </ul>

## Conclusion

It is quite evident from this study that the development of the solar plant and operation of the proposed Malindi Solar Power Plant (40MW) project, Located at Weru ranch No. 19 in Lango Baya Area in Malindi, Kilifi County, will bring positive socio-economic and environmental effects in the study area including enhancing attractive financial, economic and social returns to the local community, county government and the investor, creation of employment, availability of social amenities, improved infrastructure, increase in power to the national grid and increase in revenue among others.

Solar Energy Technologies (SETs) provide significant socio-economic benefits. It is proposed that the environmental impact of the facility will be minimal and greatly outweighed by the environmental benefits of less diesel burnt to produce electricity and the corresponding reduction of CO<sub>2</sub> emissions and other greenhouse gases associated with burning diesel. On the other hand, it must be realized that no man-made project can completely avoid some impact on the environment, neither can SET installations. Potential environmental burdens are associated with loss of amenity, depend on the size and nature of the project and are often site specific. However, adverse effects are generally small and can be minimized by appropriate mitigation measures, technologies or techniques that may involve the use of air emission or odor control equipment, design tools for optimal design and siting of the installations, best practice guidelines, improved pieces of equipment (such as gearless or lubricant-free motors), or, completely innovative design (e.g., closed-cycle plants, submerged plants, etc.). It is up to the involved factors (investors, developers, and permitting authorities) to make the appropriate decisions by taking environmental issues into serious consideration.

However, although the project will come with various positive impacts, negative impacts will also be experienced hence the need to also look at them. The negative impacts of this project include: Increased population without commensurate services and facilities; increased pressure on infrastructure; air pollution; water pollution; social crime and generation wastes among others.

The consultant wishes to document the following based on the above conclusion:-

- i. The negative impacts that will arise during the project cycle will be mitigated
- ii. The impacts that will be adverse will be temporary during the construction phase and can be managed to acceptable levels with the implementation of the recommendation of the mitigation measures for the project

### **Recommendations**

It is therefore our recommendation that the project be allowed to go on provided the following recommendation have been made:-

- i. Mitigation measures outlined in this report should be adhered to and the Environmental Management Plan (EMP) implemented to the letter. The implementation of this EMP for all life cycle phases (i.e. construction, operation and de-commissioning) of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
- ii. The project proponent should undertake Environmental Audits(EA) of the project after every 12 months after completion of the project to confirm the efficiency and adequacy of EMP

## 1. INTRODUCTION

### 1.1 Background and Rationale for an Environmental Impact Assessment

In the recent years, the government of Kenya through the Ministry of Energy has been formulating laws, regulations and policies to guide sustainable energy in Kenya. This is in a bid to beat the high demands of energy in Kenya in pursuant of the *Millennium Development Goals* (MDG) and the Kenya's vision 2030 and current government effort of developing 5000MW+ capacity.

In such pursuant, a breakthrough was made through the enactment of *Energy Act 2006*, which empowered the Feed-in-tariffs policy of which renewable energy falls under. Kenya is hugely dependant on hydro power and this has come with its share of challenges. As we grapple with the global warming, it is more hostile in the Sub-Saharan region where Kenya falls, it is clear that large dams' power plants have recently proved unreliable due to high dependency on expansive water catchment areas and large floods required to run their turbine generators. Solar photovoltaic energy provides clean electricity through the action of solar radiation on photovoltaic cells or sheets manufactured from semiconductor materials.

The generation of solar photovoltaic energy is based on the so-called photovoltaic effect, which occurs when light is directed onto semiconductor materials. This effect generates a flow of electrons and a difference in potential that can be harnessed to supply electricity for domestic consumption in isolated areas or fed into the national grid.

The prime objectives for the development of energy agenda in Kenya are four and as below:

- (i) Solar energy accelerates development (economic and empowerment) in the poor rural areas where majority people live.
- (ii) Development of solar energy at a level which will affect domestic economy with a goal to increase accessibility of affordable energy.
- (iii) Enhancing the solar power to improve reliability of the national grid.
- (iv) Reduce dependence on the expensive imported fossil fuels, thus reducing cost of electricity to the final consumer, as well as reducing outflow of foreign currency.

It is the Mandate of the Ministry of Energy to support the feasibility study and the feed-in-tariffs policy framework.

Kenya has great potential for the use of solar energy throughout the year because of its strategic location near the equator with 4-6 kWh/m<sup>2</sup>/day levels of insolation. Presently solar energy is utilized in photovoltaic solar home systems, most of which are rated between 10We and 20We and generate 9GWh of electricity annually, primarily for lighting and powering television sets. However, there are no grid connected solar systems in Kenya despite the supply deficit that plagues the interconnected system. To narrow this supply gap, Malindi Solar Group Limited intends to develop a 40MW grid connected PV plant at Weru Group Ranch No. 19, in Lango Baya area of Malindi in Kilifi County.

Kenya ranks 22nd in Africa for the amount of electricity it generates, and 46th in the world in the generation of solar energy. But it could rank third for solar in the next four years, according to figures from the Energy Regulatory Commission, a government agency. Kenya's policy to promote the development of renewable energies was spelled out in the Session Paper Number 4 on Energy for the period 2004-2023 which sets a target of 300 MW from renewable energy sources by 2015. This policy was put into operation by the Energy Act Number 12 of 2006 encouraging the implementation of the indigenous renewable energy sources to enhance the country's electricity supply capacity.

In relation to this policy, the Ministry of Energy established a feed-in tariff (FiT) policy in 2008 covering wind, small hydro and biomass sources, for plants with capacities not exceeding 10 MW and 40 MW respectively. The FiT levels are technology specific and based on the plant's investment cost, O&M costs, fuel costs (where applicable), financing costs and return of capital, estimated lifetime of the project, and amount of electricity generated.

The FiT policy was scheduled for review every three years from the date of publication. However, a mid-term review was carried out in 2010 to facilitate accelerated investment in generation from renewable sources and to incorporate other renewable energy sources such as geothermal, biogas and solar resources. A second revision was carried out in December 2012 that provided for grid connected solar power plants.

The project proponent wishes to develop the Malindi project under the Feed-In-Tariff policy.

Under this policy the maximum installed capacity for a grid connected PV plant is capped at 40MW.

As environmental concerns now need to be part of the planning and development process and not an afterthought, it is therefore advisable to avoid land use conflicts with the surrounding area. To avoid unnecessary conflicts that retard development in the country, the proponent undertook this EIA Study report and incorporated environmental concerns as advised by the Authority. Finally, a comprehensive Environmental Management is mandatory for a project of this magnitude and nature.

### **The Energy Sector in Kenya**

The power sector in Kenya falls under the Ministry of Energy (MoE) and is regulated by Electricity Regulatory Commission (ERC). The latter regulates the entire energy sector having replaced Electricity Regulatory Board (ERB) after repeal of Electric Power Act of 1997 and consequent enactment of Energy Act of 2006. The new Act also led to creation of Rural Electrification Authority (REA), responsible for government's Rural Electrification Programme, historically managed by KPLC. KETRACO has also been recently created and is a government company charged with the development of the transmission grid. KETRACO can also be contracted to build transmission lines for a private company. The Act provides for establishment of a special purpose Geothermal Development Company to undertake geothermal resource assessment and steam production drilling. In essence, the energy sector in Kenya has been devolved significantly thereby making it favorable for investment.

The feed-in-tariffs policy is a policy created through parliament Sessional Paper 1 of 2004 in Energy and now soundly based on Energy Act of 2006. It provides three excellent features; by the fact that it has pre-negotiated pricing and procedures, exempts the investor from going through the normal government procurement process since it was pre-negotiated and approved with all necessary details. Thirdly, the approval of investor to be an Independent Power Provider (IPP) under the feed-in-tariff is approved by the Feed-in-tariff Committee made up of Kenya Power and Lighting Company (KPLC), Ministry of Energy and ERC without a charge as it covered in other business licenses.

The Kenyan interconnected power transmission and distribution network is owned and operated

by KPLC. The main public sector generator is Kenya Electricity Generating Company (KenGen) which supplies 70% of the national electricity demand, with the balance being supplied by Independent Power Producers (IPPs). KPLC and the Uganda Electricity Transmission Company Limited (UETCL) have an electricity exchange contract currently with net power export to Uganda. Mumias Sugar Company is the only major local IPP supplying to the grid and currently injects up to 26 MW from its sugar factory in Western Kenya. The current national installed interconnected capacity is about 2,294.82 MW comprising of 827.02 MW hydroelectric, 751.3 MW thermal, 592 MW geothermal, 60MW biomass, 38MW cogeneration, and 25.5 MW Wind.

Kenya's electricity supply remains erratic in view of the country's over-reliance on hydro-power which is susceptible to hydrological conditions particularly along the River Tana cascade. This has made power supply unreliable and consequently the government's decision to diversify into geothermal and other sources which are forecast to replace hydro sources as the base load in the near future. Apart from unreliability, the inadequate installed power generation capacity in Kenya leaves the country with a very small reserve margin. The Government is therefore encouraging investment in power generation by independent power producers in order to complement its efforts and power the country's Vision 2030. The total net energy is projected by the government to increase from 7,032 GWh in 2008/09 to 55,544 GWh in 2028/29 for an average growth rate of 10% in the forecast period. The Vision 2030 development blue-print envisages a 10% economic growth per annum and the country's attainment of a middle income economy status by 2030. This would be difficult to achieve with the current levels of electricity generation. The industrial and domestic customer categories will continue to be the main drivers to continued growth in electricity demand in Kenya. Increased electricity consumption will come from growing applications of electronic technologies and from more automation in general as well as increased connectivity in the country hence a continued upsurge in electricity demand in Kenya.

The global approach to power generation has shifted to renewable energy sources as world leaders' grapple with the challenge of climate change and global warming partly attributed to power generated from fossil fuels. The Government of Kenya on its part is encouraging the development of projects relying on renewable energy sources such as geothermal, solar, Hydros, wind, biomass, ocean waves among others. To this end, the Ministry of Energy has put in place a

feed-in-tariff policy that provides tariff information based on the nature of the renewable energy project. This serves as a useful input to promoters' financial models aimed at assessing the viability of their projects.

## **1.2 Scope Objective and Criteria of the Environmental Impact Assessment (EIA)**

### **1.2.1 Objective of the study**

The main objective of this study is to analyze all the factors available in Malindi Solar Project site to establish if there are reliable facts supporting the extraction of electricity. This is to ensure that the anticipated output capacity of 40MW potential is ascertained and maximum utilization of the potential is made useful. Further is to establish that all the studies undertaken can be relied to firm up commitments by the developer, financial institutions and the partners for the objective of exporting electricity to Kenya Power through a PPA under the feed-in-tariffs policy framework.

### **1.2.2 Scope**

The Kenya Government policy on all new projects, programmes or activities requires that an environmental impact assessment be carried out at the planning stages of the proposed undertaking to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation and decommissioning of the facility. The scope of this Environmental Impact Assessment, therefore, covered:

- The baseline environmental conditions of the area,
- Description of the proposed project,
- Provisions of the relevant environmental laws,
- Identification and discussion of any adverse impacts to the environment anticipated from the proposed project,
- Appropriate mitigation measures,
- Provision of an environmental management plan outline.

### **1.2.3 Terms of Reference (TOR) for the EIA Process**

Kenplan Kenya Limited a NEMA registered and licensed firm of Experts in Environmental Impact Assessment and Auditing were appointed as a consultant to conduct the Environmental



Impact Assessment of the proposed Malindi Solar Power Plant (40MW), Located at Weru Group Ranch No. 19, in Lango Baya area in Malindi, Kilifi County lead by **Faith Moses** an Associate Expert and **Kenneth Bii Ng'eny** as the Lead Expert. The scope of the assessment covered construction works of the proposed line which included clearing of the project area, ground preparation, masonry, and installation of solar panels as well as the utilities required. The output of this work was an Environmental Impact Assessment Study report for the purposes of applying for an EIA license.

The Environmental Impact Assessment exercise included the necessary specialist studies to determine the environmental impacts relating to the biophysical and socio-economic aspects and to determine the issues or concerns from the relevant authorities and interested and/or affected parties. The appropriate measures to ensure co-existence of the proposed development with other social and economic activities in the area are provided as part of Environmental Management Action Plan.

The main objective of the assignment was to assist the project proponent prepare an EIA report for the proposed Malindi Solar Power Plant (40MW) Project to ensure the proposed development takes into consideration appropriate measures to mitigate any adverse impacts to the environment. The study identified existing and potential environmental impacts and possible concerns that interested and/or affected parties have with the development, as well as the associated prevention and mitigation measures for the negative impacts as stipulated in the Environmental Management Plan (EMP) proposed.

The consultant on behalf of the proponent conducted the EIA by incorporating but not limited to the following terms of reference:

- i. The proposed location of the project
- ii. A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project.
- iii. The objectives of the project.
- iv. The technology, procedures and processes to be used, in the implementation of the project.

- v. The materials to be used in the construction and implementation of the project.
- vi. The products, by-products and waste to be generated by the project.
- vii. A description of the potentially affected environment.
- viii. The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- ix. To recommend a specific environmentally sound and affordable wastewater management system.
- x. Provide alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- xi. Analysis of alternatives including project site, design and technologies.
- xii. An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- xiii. Provide an action plan for the prevention and management of the foreseeable accidents and hazardous activities in the cause of carrying out development activities.
- xiv. Propose measures to prevent health hazards and to ensure security in the working environment for the employees, residents and for the management in case of emergencies.
- xv. An identification of gaps in knowledge and uncertainties which were encountered in compiling the information.
- xvi. Such other matters as the Authority may require.

#### **1.2.4 Data Collection Procedures**

First, the Consultant undertook environmental screening and scoping to avoid unnecessary data. The data collection was carried out through questionnaires/standard interview schedules, use of checklists, observations and photography, site visits, desktop environmental studies and scientific tests, where necessary in the manner specified in Part V (section 31-41) of the Environmental (Impact Assessment and Audit) Regulations, 2003.

#### **1.2.5 EIA Organization and Structure**

The EIA was carried out to full completion within a period of fourteen (14) days from the date of undertaking. The Consultant coordinated the day-to-day functions and any related institutional

support matters. Otherwise, all formal communications were directed to NEMA through the Management of Malindi Solar Group Limited, concerning the proposed solar project.

### **1.2.6 Reporting and Documentation**

The Environmental Impacts Assessment Study Report from the findings was compiled in accordance with the guidelines issued by NEMA for such works and was prepared and submitted by the proponent for consideration and approval. The Consultant ensured constant briefing of the client during the exercise. Description plans and sketches showing various activities are part of the Appendices.

### **1.2.7 Responsibilities and Undertaking**

The Consultant undertook to meet all logistical costs relating to the assignment, including those of production of the report and any other relevant material. The consultant arranged for own transport and travels during the exercise. On the site of the proposed development of Malindi Solar Power Plant, the management provided a contact person(s) to provide information required by the Consultant.

The output from the consultants includes the following:

- An Environmental Impact Assessment report comprising of an executive summary, study approach, baseline conditions, anticipated impacts and proposed mitigation measures,
- An Environmental Management Plan outlines which also forms part of the report recommendations.

### **1.2.8 Methodology Outline**

Since the proposed site is located within an area with no rich natural resources whose total effect to the surroundings could not be adverse and noting that the intended development and use of the facility will be in line with what exists in the surrounding areas, an environmental study report would be seen to be adequate. The general steps followed during the assessment were as follows:

- Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule 2 of EMCA, 1999
- Environmental scoping that provided the key environmental issues

- Desktop studies and interviews
- Physical inspection of the site and surrounding areas
- EIA Public participation through filling of questionnaires and oral interviews
- Reporting.

### **1.2.9 Environmental Screening**

Screening is the first step in the EIA process. Screening of the Proposed Malindi Solar Project took place at two levels:-

(i): Pre-EIA Screening: The purpose of pre-EIA screening was to get an overview of the nature, scale and magnitude of the issues in order to determine the scope of the Environment and Social Impacts Assessment (ESIA) to be subsequently undertaken towards preparation of Project report for review by NEMA. As well, pre-EIA screening helps to determine and establish applicability of the Bank's environment and social safeguard policies and will therefore influence development of Terms of Reference for follow up EIA studies along with Government of Kenya's regulatory requirements.

(ii) Screening as part of the Statutory EIA process: Screening of projects for environmental and social impacts in Kenya is guided (controlled) by NEMA under Legal Notice 101 of EMCA. Regulation 4 (i) of Legal Notice 101 states that 'No proponent shall implement a project likely to have a negative environmental impact unless an environmental impacts assessment has been undertaken' while under regulation 4(2)/ (3), LN 101 prohibits granting of any licence under Kenyan Law unless an EIA Licence issued by NEMA is produced. Through both regulations, LN 101 thus anchors Environmental Screening as an important precondition to any development in Kenya. Issues considered included the physical location, sensitive issues and nature of anticipated impacts.

### **1.2.10 Environmental Scoping**

The purpose of the scoping study is to determine the diversity (scope) and severity of impacts anticipated so as to determine the scope of investigations needed and the requisite skills for the EIA study. The Scoping process helped narrow down onto the most critical issues requiring attention during the assessment. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects.

### **1.2.11 Desktop Study**

This included documentary review on the nature of the proposed activities, project documents, designs policy and legislative framework as well as the environmental setting of the area among others. It also included discussions with managers and design engineers as well as interviews with the neighbouring community.

### **1.2.12 Site Assessment**

Field visits were meant for physical inspections of the site characteristics and the environmental status of the surrounding areas to determine the anticipated impacts.

### **1.2.13 EIA Public Participation**

To ensure adequate public participation in the EIA process, the consultant carried out field visit on 19<sup>th</sup> - 21<sup>st</sup> November, 2015 in order to disseminate and inform the stakeholders about the project with special reference to its key components and location, gather comments, suggestions and concerns of the interested and affected parties. This process enabled the establishment of a communication channel between the general public and the team of consultants, the project proponents and the Government and the concerns of the stakeholders be known to the decision-making bodies at an early phase of project development.

### **1.2.14 Monitoring and Reporting**

In addition to constant briefing of the client, this environmental impact assessment study report was prepared. The contents were presented for submission to NEMA as required by law, in order to: (i) ensure early detection of conditions that necessitate particular mitigation measures, and (ii) furnish information on the progress and results of mitigation.

The EMP provides a specific description of institutional arrangements--who is responsible for carrying out the mitigatory and monitoring measures (e.g., for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training). To strengthen environmental management capability in the agencies responsible for implementation, EMPs suggest (a) technical assistance programs, (b) procurement of equipment and supplies, and (c) organizational changes.

## 2. BASELINE INFORMATION OF THE STUDY AREA

### 2.1. BIOPHYSICAL

#### 2.1.1. Location

After analysis of several locations, Weru Group Ranch No. 19, in Lango Baya site was selected to be the most favorable for the development of a 40 MW PV Power Plant. The proposed site is located in Malindi District, Kilifi County. The site is located approx. 125 km northeast of the city of Mombasa and 40km west of the centre of Malindi town along Malindi – Kakoneni – Lango Bara road (C103) and 20 Km from KETRACO 220 kV substation at Kakuyuni.

Taking into account the established site selection criteria and after a complete analysis of the data collected, this site has been selected to be the most favourable for the construction of a 40 MW Solar PV power plant. Malindi District covers an area of 7,750.5 Km<sup>2</sup>. The District was carved out of the larger Kilifi District. A further division in 2007 created Kinango and Msambweni Districts respectively. Malindi borders Tana River to the north, Kilifi to the south, Tsavo East National Park in Taita Taveta District to the west and the Indian Ocean to the east. Malindi district borders Kilifi to the south, Tana River to the north and northwest and Indian Ocean to the east. It lies between latitude 2 degrees 20' and 4 degrees south and longitude 39 degrees and 4 degrees 14' east.



Figure 1: A Map of Kenya showing the 47 counties

The district administrative divisions are shown in the Table below.

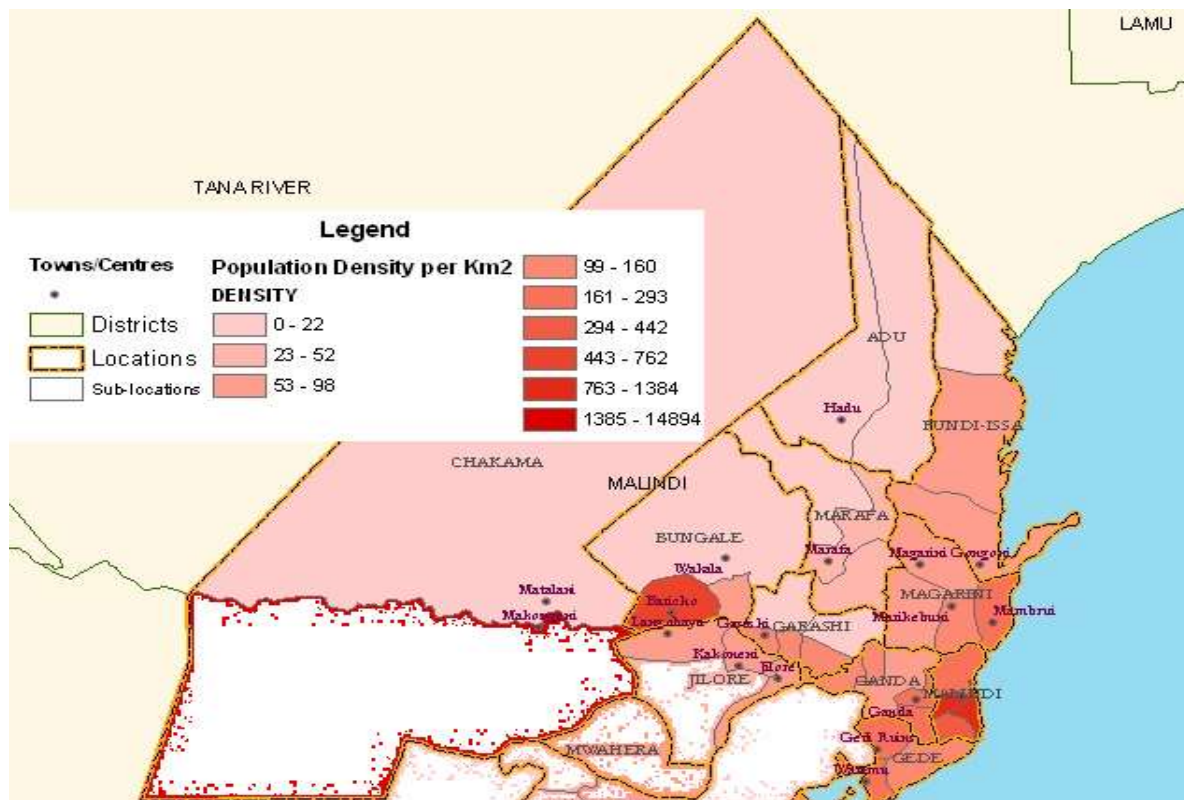
**Table 2: Administrative Units by Division and Size**

<b>Division</b>	<b>Area (sq km)</b>	<b>population</b>	<b>Population Density</b>	<b>Locations</b>
<b>Malindi</b>	<b>5,259</b>	<b>169,717</b>	<b>32</b>	<b>8</b>
<b>Marafa</b>	<b>1,617</b>	<b>51,368</b>	<b>26</b>	<b>5</b>
<b>Magarini</b>	<b>729</b>	<b>67068</b>	<b>92</b>	<b>3</b>
<b>Total</b>	<b>7,605</b>	<b>281,552</b>	<b>150</b>	<b>16</b>

The district is divided into 3 divisions, 16 locations and 56 sub-locations. The district headquarters is in Malindi town, Malindi Division. The area of the district is 7,605 km square excluding the Indian Ocean.

The district has two local authorities namely Malindi Municipal and and the County Council. Malindi County Council has 11 wards, 3 in Malindi division, 5 in Marafa division and 3 in Magarini Division. Malindi Municipal Council has 12 wards, all in Malindi Division. The wards follow the location boundaries.

Settlement pattern vary from one division to another. Malindi division has the largest number of people as it has all the topographic features and economic factors affecting human settlement. Map 1 shows the population density pattern in the district. Malindi town, which is in Malindi division, has higher population than other areas. The reasons include the availability of employment opportunities in the tourist establishments, formal and informal sectors.



**Figure 2: Location, Administrative Areas and Population Densities**

### 2.1.1.1 Geographic Location and Solar Irradiation

Lango Baya Sub-Location is in Kenya, situated between Mambo Sasa and Kakoneni Sub-Location, and is also nearby to Marikano Sub-Location.

- Location: Kenya, East Africa, Africa
- Latitude: 3° 8' (3.1333°) south
- Longitude: 39° 50' (39.8333°) east
- Average elevation: 46 meters (151 feet)

From SWERA database

- DNI: 2043 kWh/m<sup>2</sup>/a , minimum requirement 1,900 kWh/m<sup>2</sup> per year CSP
- GHI: 2096 kWh/m<sup>2</sup>/a , minimum requirement 1,750 kWh/m<sup>2</sup> per year for PV

The solar irradiation recorded at this location (GHI values and DNI values) seems to be suitable for both, photovoltaic and CSP technologies.



### 2.1.2. Physiographic and Natural Conditions

The district has four major topographical features which are: the coastal plain, the foot plateau, the coastal range, and the Nyika plateau. There are two major physical features in the district: the Indian Ocean and the Sabaki River.



**Plate 1: The project site**

### 2.1.3. Natural Ecosystem around Malindi Town

The renowned Malindi Marine National Park is a protected coastal area south of Malindi. Malindi Marine National Park has fine white-sandy beaches, emerald water and colorful fish (All fishing within the Park is forbidden). On the northwest of Malindi, near Marafa Depression exists an eroded wasteland of sandstone cliffs and precipices, locally known as Nyari or Hell's Kitchen, exists also a small Arabian town called Mambrui, and beyond that a small village and harbor called Ngomeni. The entire coastline from Mambrui to Lamu has minimal development, in terms of tourism, although wonderful beaches, coves and seascapes exist in plenty.

The nearby Watamu and the lost town of Gede (abandoned for no known reason in the 16<sup>th</sup> century), are located south of Malindi. The Arabuko Sokoke National Park hides a world of wonders such as rare endemic birds and mammals, and impressive herds of Elephant. The Malindi Museum is housed in the former home of an Indian trader, built in 1891. Exhibits include early photographs of Mombasa, wooden grave posts of the Gohu people, information about Vasco Da Gama among other interesting information.

#### **2.1.4. Malindi District**

Malindi District rises from the "coastal plains" through a "foot plateau" to a low "coastal range" up to the "Nyika plateau" to an elevation of 300m above sea level. The "coastal plains" comprise a coastal coral limestone reef, inland of which is sandy back-reef facies (Margarini sands). It is a narrow belt, varying in width between 3km and 20km. It lies below 30m above sea level. A creek in Mida breaks the belt and gives rise to excellent marine and swamps with mangroves.

The "foot plateau" lies west of the coastal plain with slightly undulating terrain between 60m and 135m altitudes. The plateau characterizes a seaward sloping plain whose surface has been dissected by numerous dry water courses, with underlying Jurassic sediments consisting of shells, sandstones and impervious clays. It supports grassland and stunted vegetation.

The "coastal range" consists of low range sandstone hills 150m to 420m high. The rest of the hinterland forms the "Nyika plateau", which is 130m to 300m above sea level. The highest point within the municipal boundary of Malindi is a point in the Arabuko Sokoke Forest rising to almost 120m. Considering that this is almost 10km away from Malindi old town the gradient is very low. At the northern border of Malindi Municipality flows the Sabaki River, one of the biggest rivers in Kenya. West of Watamu there is Mida Creek, an extended mangrove area. Mida Creek limits the development of Watamu in South and South-West direction.

#### **2.1.5. Geology and Soils**

The soil type within the District is composed of well drained, very deep, yellowish red, very friable, fine sandy loam to fine sandy clay loam.

#### **2.1.6. Land scape**

The landscape in Malindi is predominantly plain. Malindi town could be divided in three broad landscape units. Namely:

- i. The "beach",
- ii. The "coral landscape" and
- iii. The "plateau".

The "beach" is characterized by coral cliff, sandy soil and is an unstable new dune formation. The "coral landscape" consists of higher situated old reefs and lagoons. It is characterized by depressions with clayish soils and areas susceptible to water logging. The "plateau" is a prominent area of shallow sandy clay soils underlain by coral limestone rock.

Through the old town from the old market until the Law fords Hotel stretches a depression, which was an old lagoon. It is a geological sea arm whose level is below sea level. Most of the surface run off and storm water of Malindi West and North catchments with an area of approximately 10.56km<sup>2</sup> drains towards this central lagoon.

### **2.1.7. Climatic Conditions**

The District has a monsoon type of climate with hot and humid conditions all year round. It is hot and dry from January to April while June to August is the coolest period. Average annual temperatures range from 22.3°C to 26.6°C in the coastal lowlands, while the hinterland temperatures range from 30°C to 34°C. Average temperature ranges from 21°C in July to 24°C in August.

The rainfall pattern has two distinct seasons: the long rains which occur between the months of March of June, with 60% reliability; and the short rains which start towards the end of October and last until December or January. The mean annual rainfall is about 1,100mm, with the months of May and June recording the heaviest rains. The month of May has the highest precipitation with a mean monthly rainfall of about 375.44 mm, although these long rains decrease gradually after May.

### **2.1.8. Biological Diversity**

The natural vegetation found in the District is mainly grassland, stunted vegetations and mangrove forests growing in the shallow swampy areas along the creeks. The Arabuko Sokoke forest is also found within the district which has suitable varieties of trees. The proposed site is few kilometres from the forest.

The area of the Malindi can be divided into three major vegetation zones as follows:

#### **a) Lowland dry forest on coral rag:**

This vegetation zone covers the coastal strip stretching some 1 to 1,5km from the coastline inward and from the Mida Creek in Watamu all the way to Sabaki River Delta. The natural forest remnant is found near Gede with indicator species like *Combretum Schumanii*, *Ficus Bussei* and *Gyrocarpus Americanus*. Most of this area is covered with dense thicket with scattered cultivated

plots planted mainly with cassava, maize and cowpeas.

**b) Lowland dry forest (Arabuko-Sokoke Forest):**

This vegetation zone covers the most land of the municipality and is mainly cultivated with cashew nuts, mangoes, coconuts and food crops and is mainly grassland. It is found in Ganda, Kanuyuni, Mijamboni, Gede and Malindi Town. The major remnant of this type of vegetation is the protected Arabuko Sokoke Forest. The main indigenous trees are e.g. Mtandarusi, Mrihi and Mbambakofi.

**c) Mangroves and swamps:**

This vegetation zone covers only a small portion of Malindi Municipal area mainly on the sides of the Mida Creek in Watamu. There are only a few species, which form dense forest. Mainly three different vegetation zones cover the hinterland of Malindi, namely Manilkara-Acacia Savannah, Tropical monsoon forest and the Acacia Euphorbia bush land.



**Plate 2: Forms of vegetation at the project site**

**2.1.9. Drainage and Hydrology**

There are two main rivers that drain into the coast - river Tana and river Sabaki. River Tana is the longest originating from Mt Kenya into Indian Ocean, a distant of about 850km. It has a catchment area of 132,000 km<sup>2</sup> and discharges an annual average of 4.7 x 10<sup>9</sup> million m<sup>3</sup> of freshwater and 3.0 million tones of sediment into the Indian Ocean with peak discharges during the rainy season from April to June. It enters the ocean at Kipini. About 30 km upstream, River Tana branches and the tributary proceeds to form the Tana delta.

The Sabaki river has its origin as Athi river in the central highlands around Nairobi. When joined by Tsavo river in its lower basin the river is known as Galana. The river is known as Sabaki when it drains into the Indian Ocean, a few kilometers north of Malindi Town. The entire Athi-Galana-Sabaki system extends for 390km and drains a catchment area of 70,000 km<sup>2</sup>. The annual discharge of Sabaki river is  $1.3 \times 10^9$  million m<sup>3</sup> of freshwater and 2 million tones of sediment into the ocean.

High sediment loads in these rivers largely precipitated by poor land use practices upstream threaten the sustainability of coastal habitats (mangroves, seagrass beds and corals) and the aesthetic quality of beaches which are a major tourist attraction. The integrated river basin management approach may be a key in addressing these problems.

Other semi permanent rivers at the coast include Mwache, Kombeni, Tsalu, Nzovuni, Mwachema, and Voi, which drain into the coastal region from arid and semi arid catchments. In the South coast the major rivers are Ramisi and Umba discharging about 6.3 million m<sup>3</sup> and 16million m<sup>3</sup> fresh water into Funzi and Shirazi bay respectively.

There are several lakes at the coast especially at the Tana Delta. Most of them are recharged through ground water seepage or by periodic flooding of the Tana river e.g. Lake Shakabobo and Bilisa among others. The waters of these lakes apart from providing water for humans and livestock also provide fishery.

The coast region has immense potential for groundwater resources due to the prevailing geological structure which enhances infiltration and percolation and subsequent recharge. Most of the rock formation have a shallow water table of between 20 – 30 m, and have erratic yields of varying salinity. The highest water quality is found in areas covered with Kibiongoni beds and Magarini and Kilindini sands e.g. in Tiwi area of the south coast. Areas covered with Jurassic shales and Pleistocene limestone tends to have poor quality water and the volumes are low.

#### **2.1.10. Social and Economic Issues**

### 2.1.10.1 Settlement Patterns

Settlement patterns vary from division to division. Malindi division has the largest number of people as it has all the topographic features (Coastal Plains to Nyika Plateau) and suitable economic factors that encourage human settlement.

In Magarini, high settlement is found in the foot plateau and the Coastal Range areas of Gongoni, Mambrui, Marereni and Magarini. This is because these areas have a fairly good soils and high rainfall for agriculture, good road network (Malindi –Garsen Highway) and employment opportunities in the salt firms. In the hinterland locations of Fundissa, which have Nyika Plateau characteristics, the population densities are lower.

Generally, the majority of the people in the division are poor with poverty level increasing towards the hinterland. In Marafa division, settlement patterns tend to be fairly homogeneous since climate and soil conditions are homogenous. Most of the parts of the division are in Nyika region with scattered population with many settlements near River Sabaki.



**Plate 3: Human Settlements near the project site**

### 2.1.10.2 Population

Malindi is the second largest coastal town of Kenya. Malindi Municipality has a population of about 145,000 inhabitants (in the year 1999) with the two most important townships namely Malindi (app. 81,000 inhabitants) and Watamu (app. 17,000 inhabitants). The Municipality's population forms 51.3% of the District's population. It also houses 58.1% of the total district's households.

The main communities residing in district include seven Mijikenda sub-groups (Giriama, Chonyi, Jibana, Kambe, Kauma, Rabai and Ribe), the Bajuni, Swahili, and people of Arab, Indian and European descent who have permanently settled in the county. Over time, these people have had close interactions with each other, and fostered the Swahili culture and language. Most of the people are either Christians or Muslims, though other smaller religious communities exist.

The district has witnessed a high population growth rate of 3.9% between over the past decade. Factors attributed to the high population increase range from improved health services which have reduced infant and child mortality rates, reduced cases of mortality from curable diseases and increase in fertility.

Another factor that explains the increase in population has been the in-migration from other districts and countries. Migration from other districts has basically been for the purpose of looking for employment opportunities in the tourism industry. The percentage of population less than 15 years formed about 47% of the total population at the beginning of 2002. The district has a dependency ratio of 100:99 implying that for every 100 persons in the labour force, there are 99 dependants.

### **2.1.10.3 Health**

The district has 3 hospitals (1 GOK and 2 private); 24 dispensaries (17 GOK; 7 NGO), 4 private chemists. The average distance to the nearest health facility for urban areas is 1 km and 3 kms for rural areas. Most of the health facilities are therefore not accessible to the majority of the population. High poverty levels, cost sharing and long distances inhibit people from visiting these facilities. The doctor/patient ratio is 1:19,502. The most prevalence diseases are; malaria, respiratory diseases, diarrhea, intestinal worms, STIs, Anaemia and eye infections.

The adult HIV/AIDS prevalence rate is between 15 – 17% according to Ministry of Health. Promiscuity, prostitution, drug addiction, alcoholism, traditional practices (i.e. wife inheritance, polygamy and belief in witchcraft) – are believed to be the main cause of the high prevalence.

Challenge associated with HIV/AIDS includes; orphan, child prostitution; decline in agricultural production, loss of labour by the sick.

#### 2.1.10.4 Economy

The economy consisted of agriculture and trade with various ports in the Indian Ocean. There were large plantations with fruits (i.e. lemons, oranges and mangoes among others), coconut palm trees, vegetables and cattle around it. The district mainly depends on Tourism and salt manufacturing industries. However, it has great potential for farming and fishing which are yet to be fully exploited.



**Plate 4: Varieties of fruits being sold near the project site**

#### Agriculture

More than half of the land in Malindi is arable, however only 31% of the farmers hold titles of their land. The average precipitation of 900 mm and mean-annual temperature of 27°C hold potential for agricultural development. Horticultural crops and vegetables such as chillies, brinjals, okra, onions and tomatoes can be cultivated along the Coastal plains. Staples like maize, rice, bananas, cow peas, green grams and beans can also do well. Northwards, along the Sokoke Forest, is land with medium agricultural potential. Further north, are the pineapple fields in Magarini district that can provide large scale farming. Jatropha, aloe vera and vanilla grow well in the County and could be promoted for the production of bio- diesel, pharmaceuticals, cosmetics and food products.

#### Livestock

Livestock and poultry farming is a major economic activity in the county. There are 4 private



and 8 group ranches in Kilifi on which both dairy and beef cattle are kept. Other livestock species reared include goats, sheep, pigs and rabbits; mainly on small-scale basis by subsistence farmers and bee-keeping is also practised. Opportunities exist in livestock holding grounds, ranching, export slaughterhouses and the establishment of tanneries.

### **Fishing**

Deep-sea fishing is a lucrative venture due to high demand for fish from the hotel industry. The county has 14 landing beaches and over 5,000 fishermen. Sport fishing has also taken root, with fishing clubs established at various spots associated with tourist hotels and resorts

### **Mining and Manufacturing**

County is rich in minerals; mainly titanium and iron ore, that have spurred extensive industrial mining activities. Other minerals extracted include barites, galena, rubies, pozzolana, gypsum and limestone. Salt mining and sand harvesting have been carried out over the years to take advantage of the sandy, salty waters. While these are economically lucrative, they are equally responsible for destruction of its mangrove forests. As for manufacturing sector there are:

- Two Cement factories in Kaloleni (Bamburi Cement and Athi River mining)
- Salt extracting companies in Malindi
- Milly fruit processing at Mtwapa
- Sandal factory in Kikambala
- Milk processing factory in Kilifi

In Malindi, there exist 6 salt manufacturing companies/ firms which also play pivotal role in the area's economy. They include Kensalt, Mombasa Salt, Krystaline, Kemu Salt, Malindi salt and Kurawa salt manufacturing companies.



**Plate 5: KEMU salt, one of salt production company**

## **Tourism**

Tourism is very important for the country. It creates opportunities for employment in the service industries associated with it, such as transport, entertainment and advertising.

There has been an up-trend in tourism over the last few years and the County is well positioned to benefit from; local tourism, ecotourism, pro-poor tourism, educational tourism, cultural tourism and sport tourism. All these trends offer opportunities for significant growth of the tourism sector in Kilifi County.

### **Main attractions:**

- Rabai Church
- Gede Ruins
- Vasco da Gama Pillar
- Mnarani Ruins
- Mangrove Forests
- Arubuko Sokoke Forest which hosts the Tsavo East National Park
- Indian Ocean
- Kafuloni
- Sabaki and Rare Rivers

Marine parks of Malindi, Watamu and Mtwapa are a great tourist attraction.

### **2.1.10.5 Infrastructure**

Transport infrastructure in the district has been developed along the coastline to support its lucrative tourism industry, stimulate trading activities and facilitate transit to neighbouring counties. The high influx of foreign tourists into the County necessitated the establishment of the Malindi International Airport to handle international charter flights.

Basic services such as healthcare and banking, as well as major trading markets are concentrated along the road networks. This has resulted in unequal distribution of basic amenities and services within the County, and hampered easy access to these services by the far-flung rural

communities. As a result, this inequality has inadvertently reduced the level of social cohesion. Sadly, a mere 6% of the households in the county are connected to electricity while 44% have access to piped water.

#### **2.1.10.6 Education**

The district has 105 primary schools. The total enrolment rate for primary school is 47,073 with the number of boys (26,671) being higher than that of girls (20,402). Teacher/pupil ratio is 1:44. The 1999 Population and Housing Census captured 31,603 boys and 30,891 girls within the age of primary school going. These figures are expected to rise to 42,916 boys and 41,949 girls in 2008. This age group has a female/male ratio of 100:102. Primary school drop out is 44.7% for boys and 59.9% for girls.

There are 12 secondary schools. Total enrollment rate is 2,098 with 1,783 boys attending secondary schools as compared to 730 girls. Teacher pupil ratio is 1:10. The 1999 Population and Housing Census enumerated 12,582 boys and 11,839 girls within the age of secondary school going. These figures are expected to increase to 17,086 boys and 16,077 girls in the year 2008. The female/male ratio of this age group is 100:106 indicating that males are more than females. This age group accounts for 9% of the total population. 46 centres offer adult education. More females (1,094) attend these classed as compared to men (179). The literacy level in the district is 68%.

Majority of women remain uneducated due to customs, which favour men. Only a small percentage of them finish primary education and even a smaller percentage joins secondary schools. Early marriages and placement in wage employment as domestic workers hinder girls from pursuing education.

#### **2.1.10.7 Labour Force**

The district labour force numbered 70,051 males and 68,418 females which 50% of the total population. This is projected to increase to 95,128 males and 92,910 females by 2008. Due to cultural and religious beliefs, most of the female population is not widely engaged in paid

employment although they carry out other equally productive domestic activities.

Most of the labour force is unskilled with only a small percentage engaged in fishing, boat making, wood carving and embroidery. It is estimated that 46 per cent of the labour force is literate which implies that only a small proportion of the labour force can be absorbed as skilled labour required for poverty reduction programmes in the district. With an increase in the number of vocational institutions, it is expected that the percentage of semi-skilled and skilled labour will increase.

#### **2.1.10.8 Poverty Analysis**

An estimated 198,120 persons were in absolute poverty as found out by the 1994 Welfare Monitoring Survey. The affected group has the following characteristics;

- High morbidity
- Shanty dwellings, poor sanitation, lack of access to clean water.

Poverty in the district is caused by poor returns from agriculture, collapse of the cashew nut industry and lack of market for coconuts, pineapples and cotton; decline of tourism and industry and landlessness. A big portion of the population is made of squatters. Emergence of informal settlements in Malindi town i.e. Muyeye, Maweni, Kwa Ndomo, Kisumu ndogo, Kwa chocha, and Majengo mpya is a reflection of landlessness. In the rural areas many people have no title deeds and this discourages utilization of land.

### 3. PROJECT DESCRIPTION

#### 3.1. Site description

Malindi District is located on the South Eastern part of Kenya on the Indian Ocean in the coastal region of Kenya. The proposed solar PV power plant is located approx. 125 km northeast of the city of Mombasa and 40 km west of the centre of Malindi town along Malindi – Kakoneni – Lango Bara road (C103) and 20 Km from KETRACO 220 kV substation at Kakuyuni.

#### 3.2. Project Site Location:

- SITE NAME: Weru Group Ranch No. 19
- GEOGRAPHICAL CO-ORDINATES:

<b>Latitude</b>	
Degrees	S 3
Minutes	11
Seconds	43.25399999999885
Decimal	-3.1953483333333333
<b>Longitude</b>	
Degrees	E 39
Minutes	47
Seconds	5.38199999998767
Decimal	39.784828333333333
Bearing	106.81
Altitude	74.3 meters
Accuracy	18.40 meters
Last Update	6/19/15 10:59 AM

- NEAREST SHOPPING CENTRE: Kakoneni Market
- NEAREST URBAN CENTRE: Malindi Township
- DISTRICT: Malindi
- COUNTY: Kilifi

#### 3.3. Infrastructure Connection Points Remarks Distance (km)

- Road network Malindi – Kakoneni- Lango Baya road (C103) Good gravel road 1
- MV grid connection 33 kV 20 kms
- HV grid connection 220/132 kV 0kms

- Water supply From pipeline or ground water Pipe runs along the road 0 km
- Waste water system (sewage, etc.)
- On-site disposal system Septic tanks



**Plate 6: High Voltage Electricity line cross cutting the project site**

### **3.4. Proximity to Infrastructure**

- Since the site is surrounded by existing gravel road and therefore no construction of access road would be necessary to access the site.
- Plant water may be retrieved from deep wells on site. The public water supply in that region may not be sufficient for a CSP plant. Nevertheless, PV technology may be sufficiently supplied from this public water pipeline. The capacity of the pipeline has to be further investigated.
- The disposal of waste water shall be dealt with on site, e.g. by means of a small waste water treatment plant. Sludge can be disposed by truck to the nearest sludge disposal in Malindi town.



**Plate 7: A well maintained road network around the project site**

### **3.5. Possible Connection to the National Grid**

Kakuyuni 220/132/33 kV Substation is located 20 km from the project site. Depending on the amount of power generated by the solar power plant and the relative distance between the substation and the power plant, the solar power plant connection to the grid could be either on the 220 kV, or 132 kV or 33 kV busbars of Kakuyuni Substation. The installation of a solar power plant creates the option to de-load Rabai - Malindi - Kikambala long lines.



**Plate 8: Kakuyuni sub-station**

### 3.6. Position of the Load Centres Served by the Power Plant

Load centres served by a potential power plant at this location are located in Malindi, some 40km to the south east. Since the power plant will most likely be connected to Kakuyuni Substation, the load centres will be the entire network of the coastal region.

### 3.7. Land Availability and Socio-Environmental Considerations

There is available land, (651 acres) however, it is important to note that while so much land may appear idle and without any building structures, the land may not necessarily be automatically available for the project. The land is solely owned by Weru Group Ranch members who are 500 members in total. Consultations may be due with the local communities especially where they use the land seasonally for grazing or farming. Thus, availability can only be ascertained after consultations with the landowners.

**Current utilization:** The land is totally idle. No human settlements on the project site.

**Effects on the environment:** No negative impacts to be expected, rather benefits.

- No residential structures exist in this area. Hence, the proposed plant would not have any social impact on the population in the area.
- The project will provide job opportunities especially during construction.
- There will be improvement of economic conditions of the area due to the creation of jobs and the availability of a market for small businesses based on service provision mainly.
- There will be migration of people from surrounding and other areas, thus altering the population status of the area, even if for a short period of time only. This might raise demand for certain services.
- As a result of the migration, social conflicts may arise between the immigrants due to the competition for jobs and other business opportunities. The situation may also result in insecurity, which typically arises in project areas due to such migration of people from different areas.
- Social conflicts may also arise due to the cultural differences between the immigrants from different areas.
- Communicable disease incidences may also rise due to the social interactions between the



different immigrants.

- There will be clearing of vegetation which will most likely change the microclimate and interfere with the small and micro flora of the area.
- No direct obstacles have been identified that would shadow the site.

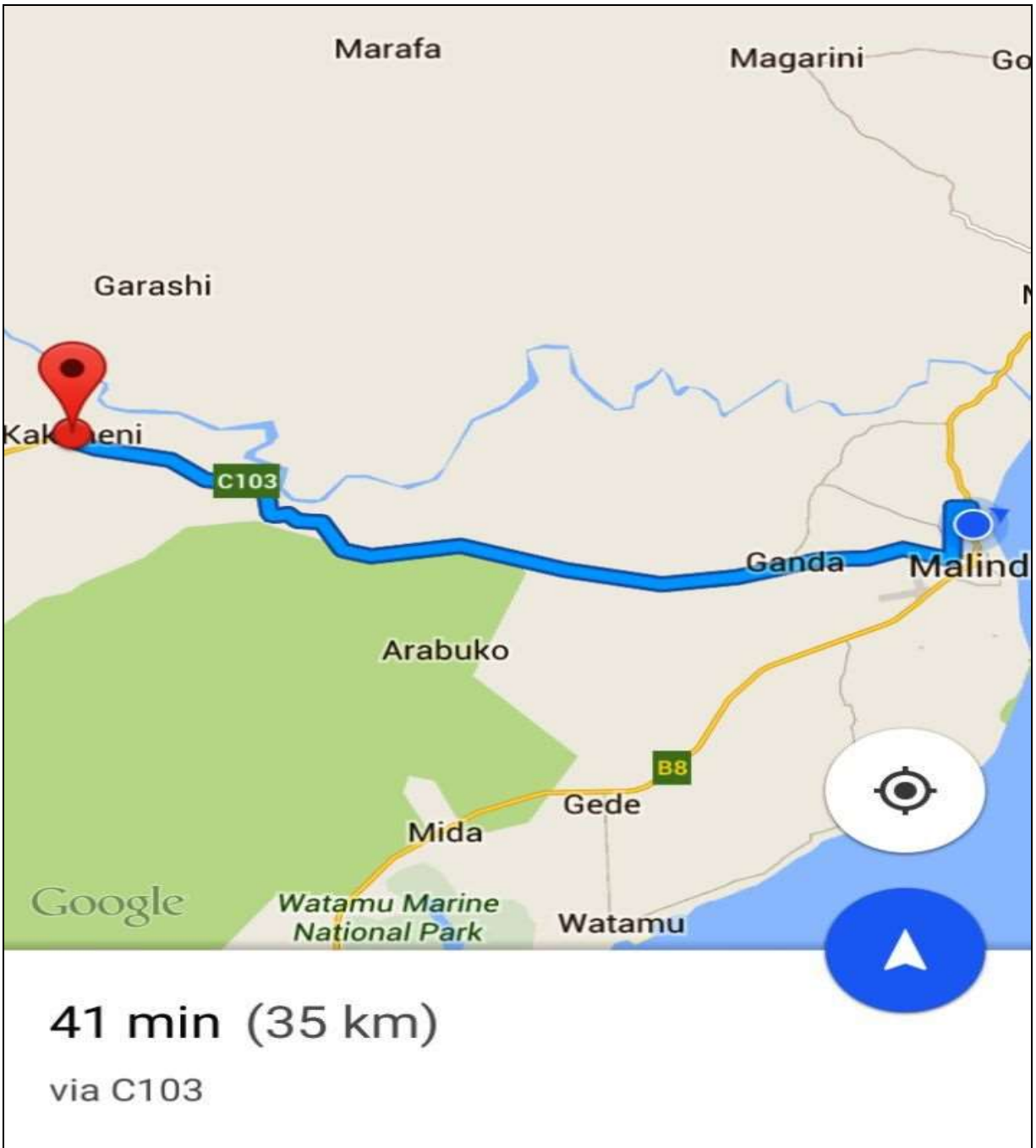


Figure 3– The road map to the site

### 3.8. The Concept

A photovoltaic power plant generates electricity using the sun's energy by means of solar panels (or PV modules) that convert the solar irradiation into direct current. Grid-connected PV systems require conversion of generated power into grid-compatible alternating current electricity, which is then supplied to the national or local grid. The Malindi Solar PV Plant will be connected to the national grid at 220kV. Figure 6 below shows the main components of a grid connected solar PV plant.



**Figure 4: Components of a Grid Connected PV System**

The main components of a PV power plant as per the figure are:

1. A Photovoltaic (PV) generator composed of modules converting solar irradiation into DC power;
2. Inverter(s) converting the DC power to AC grid-compatible electricity;
3. Connection to the grid which may include transformer, switchgear and protection devices.

Further components are required to complete a PV power plant. This includes: module mounting and support structures, cabling, junction boxes, DC switches, protection devices, and other auxiliary components. PV modules consist of photovoltaic cells, busbars, and encapsulation material and connection box with connection cables. Encapsulation protects PV cells from the environmental effects such as mechanical forces and humidity. Especially thin film cells are sensitive to humidity and require highly reliable encapsulation and sealing.

### 3.9. Solar Power Technology

Solar Power project Sunlight can be converted directly into electricity using PhotoVoltaics (PV), or indirectly with Concentrating Solar Power (CSP). CSP use reflective panels to focus the sun's energy to heat a solution (typically saline brine). The absorbed thermal energy is then utilized to generate electricity. In contrast a PV system uses solar cells to convert sunlight into electrical Direct Current (DC) through a photovoltaic effect.

The technology to be employed is Solar PV with a proposal to generate a maximum of 40 MW. There are plans to generate more and integrate all the sources within the project area as Kenya Power expand with time.

### 3.10. PV Solar Power

The photovoltaic effect is the creation of a voltage (or a corresponding electric current) in a material upon exposure to light<sup>1</sup>. A PV system consists of cells containing the photovoltaic material, mechanical and electrical connections, mountings and means of regulating and/or modifying the electrical output. Several solar cells are combined into PV modules (solar panels), which are in turn connected together into an array.

The electricity generated can be either stored, used directly (standalone plant) or fed into a large electricity grid, typically the public electricity grid (grid-connected system). The feeding of electricity into the grid requires the transformation of Direct Current (DC) from the PV array into Alternating Current (AC) by a specialized, grid-controlled inverter. These solar inverters contain special circuitry (transformers, switching and control circuits) to precisely match the voltage and frequency of the grid and to disconnect from the grid if the grid voltage is turned off.

Types of PV module can be classified by the following 4 types:

- Silicon Type: such as Mono-crystalline, Poly-crystalline
- Compound Type: such as compound semiconductor (CdTe,, CIS etc)
- Organic Type: Organic thin film
- Quantum Dot Type

Selection of appropriate type of PV module depends on :

- Cost
- Efficiency
- Temperature Characteristic
- Life Time
- Environmental consideration
- Effect of Shade

Accordingly, the basic design suggested 3 types of modules namely, the Poly Crystalline Silicon, the Multi-Layer Thin Film (MLTF) type, and the Copper Indium Selenium (CIS).

Electro and Electromechanical equipment: such as transformers, inverters and switchgear used to control and condition the power output of the solar field.

Connection to the grid: method and site of routing generated power to the unified Egyptian electricity grid.

There are two dominant competing technologies in the field, crystalline silicon and thin film.

- Thin-film technology is cheaper but it has a lower efficiency than polycrystalline systems. The active material tends to be less stable than crystalline causing degradation over time. Thin-film technology systems would require more space and hardware to produce the same amount of power output as polycrystalline systems. Thin-film modules have a glass like appearance with higher visibility and reflections.
- Polycrystalline modules have a uniform, dark blue colour. They are non-reflective and has a homogenous appearance. The active material is silicon which is derived from sand. These systems have a 10% higher efficiency and a higher durability than thin-film systems but are more expensive.

### **Advantages of PV solar power**

- No need for a heat conversion system which is perforce complex and consequently generates technological risks and a heavy financial cost;

- No need for operating fluid(s);
- Short installation period for solar farms;
- Very limited maintenance needs;
- Minimal water consumption for operational needs;
- Panel production costs are falling rapidly because of current mass production, especially over the last 2 years;
- Tested technology: several GWs currently in operation in the world;
- The panels generate electricity even when there is a cloudy sky.

### 3.11. Panel installation

The solar panels are mounted into metal frames which are usually aluminum. Concrete or screw pile foundations are used to support panels. The arrays shall be orientated at 0° North at fixed inclination of 30° to gather maximum exposure of sunlight. Panels shall be between 3m – 4m above ground level.



**Plate 9: A sample Solar Farm**

### 3.12. Layout of Solar Field

The solar panels are connected in series to form strings with each string having 23 modules. The strings are then connected in parallel to the inverters, with each inverter having 186 Strings. The output of every two inverters, having a power output of 1.25MW is treated as one power block. Every block of 1.25MW is connected to one 400V/20kV transformer. Therefore the number of 400V/20kV transformers to be used to evacuate power from the solar field is forty. Connection to the Grid will be done through one 40MVA 20kV/132kV transformer as shown in Figure 5.

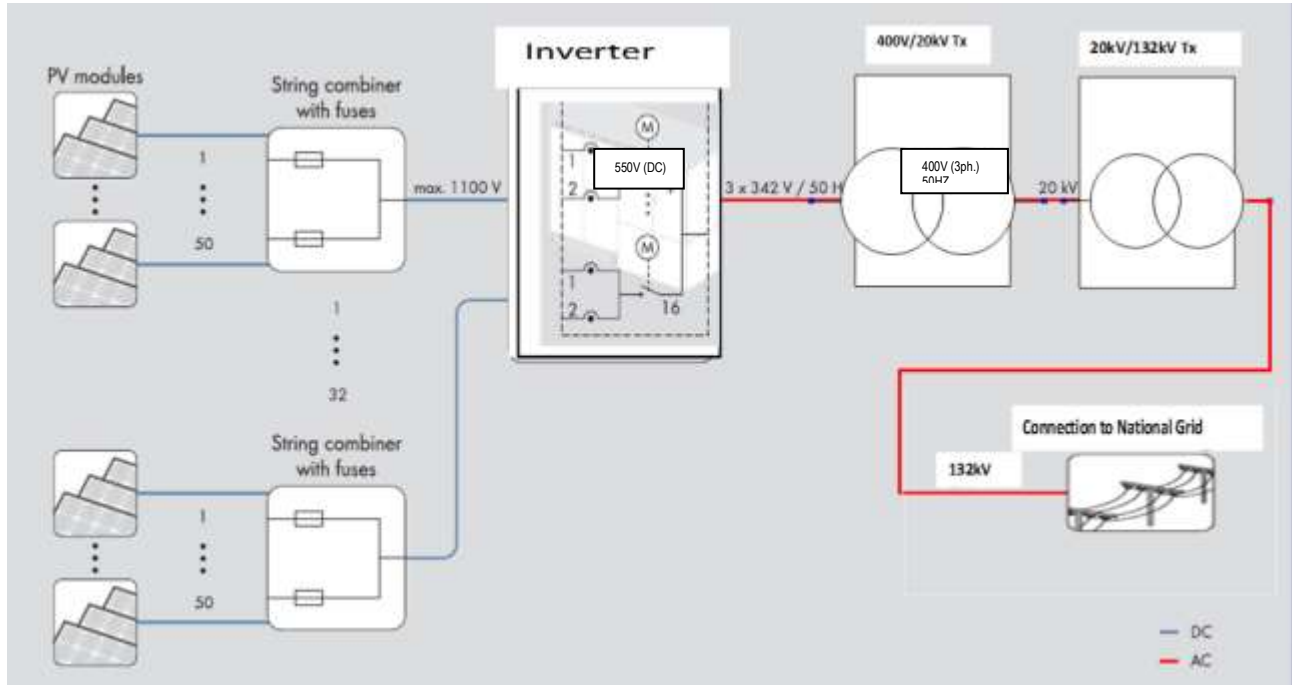


Figure 5: Single line diagram of the electrical interconnection in the solar field

### 3.13. Design of Solar Field

To design the solar field, the system is divided into blocks for 1.25MW such that the entire field will comprise of 40 blocks. The following configuration was simulated for the 1.25 MW block with PVsyst:

**Table 3: Main Characteristics for 1.25 MW Block Simulated with PVsyst Software**

Number of inverters	2
Nominal power per inverter	850 kW/inverter
Number of modules per inverter	4278 modules

Peak power per module	255 Wp/module
Peak power per inverter	66.2.7 kWp
Configuration per inverter	186 strings made of 23 modules connected in series

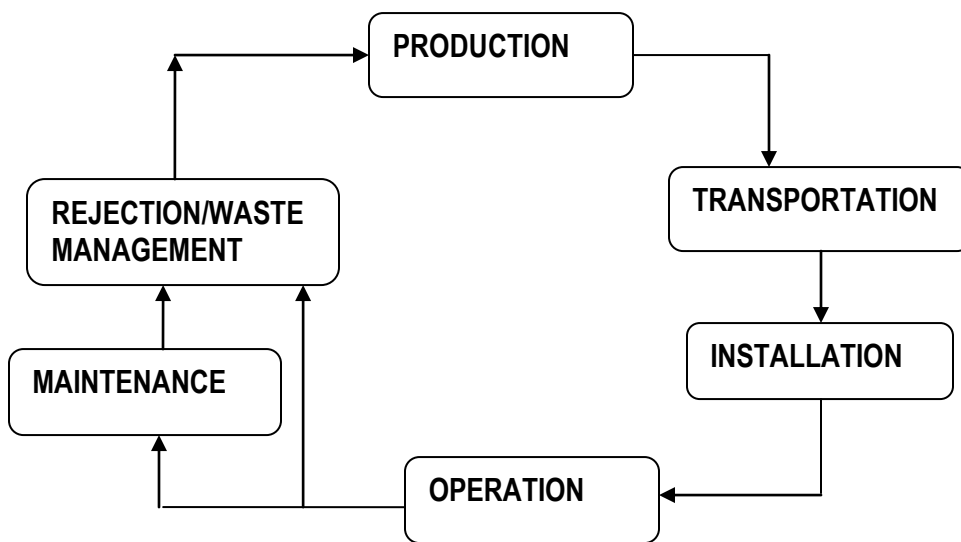
The output of the simulation for 40 MW which is taken from the report of the simulation. The reason for multiplying by 5 is because the direct simulation report was done at 10mw. The estimation of the energy (E\_Grid) is surrounded by a red line  $20260 \times 4 = 81,040$ . E\_Grid is the estimation of the energy injected into the grid in 315Vac (at the output of the inverters).

### 3.14. Benefit Overview

The PV technology to be utilized at the proposed Malindi Solar Power Plant has several key benefits, when compared to the conventional energy sources, contributing to the sustainable development including:

- Safe for Construction and Operations of the photovoltaic facility have no heavy duty components to be installed during the construction phase of the development, preventing exposure of risks to workers such as fire, explosions and volatile organic emissions associated with thermal fluid-based solar thermal technologies;
- Low Environmental Impact. The Photovoltaic (PV) technology is land-efficient, water-less, with a lower direct project impact and a lowering the environmental risk throughout the project life cycle;
- local manufacture, material and labour supply to comprise a high percentage of the project value;
- Promotes Solar Industry Growth. The Photovoltaic (PV) technology is uncomplicated, reliable, is sustainable and allows automated manufacture, thereby leveraging the strengths of the manufacturing sector.
- The surface layer of vegetation is not cleared underneath the facility, allowing for reduced ecological impact.
- Non-depletable source (the sun)
- Pollution free (no fuel, no emissions, recyclable)
- No noise

- No moving parts to wear out (if fixed panels are used). PV installations can operate for many years with little maintenance.
- PV systems are modular. You can start with a small system and expand as demand for power increases.
- PV systems have a long life & durability. Cells last 25-30 years.
- Systems installed and operated anywhere including areas of difficult access and remote locations.
- Do not require water
- Reduction of the CO2 emissions;
- Improvement of the quality of water supplies;
- Reclamation of degraded land;
- Reduction of the number of the required power transmission lines.



**Figure 6: Stages of Life Cycle Analysis and Assessment for Solar Energy Systems.**

From the socio-economic viewpoint the benefits of the use of solar energy systems include:

- Reduction of the national dependency on fuel imports;
- Diversification and security of energy supply;
- Provision of significant job opportunities and working positions;
- Support of the energy market deregulation;
- Acceleration of the rural electrification in developing countries.



### 3.15. Environmental impacts

**(i) Environmental benefits:** Significant emission reductions can be accomplished through PV electricity (PVe) production since PVs do not generate noise or chemical pollutants during their normal operation. Besides, PV cells help the increase of soil humidity and improve flora formation in dry/arid areas.

**(ii) Social impacts:** Some direct benefits are related to lighting for domestic and community activities and mainly to the opportunity to suburban and borderland's habitants to have access to computers, lighting, radio and phone. Therefore PVe improves the quality of life and reduces migration. During installation and maintenance full- and part-time jobs creation improves local microeconomics and drives to poverty alleviation.

**(iii) Land use:** The impact of land use on natural ecosystems is depended on specific factors such as the topography, the area and the type of the land covered by the system, the distance from areas of natural beauty or sensitive ecosystems and the biodiversity. The impacts and the modification on the landscape are likely to come up during construction stage, by activities such as earth movements and by transport movements. Also an application of a system in once-cultivable land is possible to reserve soil productive areas. Thus the siting in arid areas is recommended.

**(iv) Visual impact:** Visual intrusion is highly dependent on the frame design and the surroundings of the PVs. It is obvious that, for a system near an area of natural beauty, the visual impact will be significantly high.

**(v) Effect on building:** PV is a viable technology in an urban environment, to replace the existing building's cladding materials. Also, PV panels can be directly used into the façade of a building instead of mirrors.

**(vi) Accidental releases and occupational health:** Emissions into soil and groundwater may be caused by inadequate storage of materials. In large-scale plants a release of these hazardous materials is likely to occur as a result of abnormal plant operations, damaged modules or fire and

therefore to pose a small risk to public and occupational health. The increased potential danger of electrocution from the direct current produced by systems, needs to be taken into account especially by untrained users.

**(vii) Air pollution:** The emissions associated with transport of the modules are minor in comparison to those associated with manufacture. Transport emissions were still only 1% of manufacturing related emissions.

**(viii) Depletion of natural sources and energy consumption:** The production of current generation poly- and mono-crystalline modules is rather energy intensive. Other indirect impacts include their requirement of large quantities of bulk materials and small quantities of scarce (In/Te/Ga) and/or toxic (Cd) materials. Options for energy demand reduction must always be considered along with the assessment of PV applications.

**(ix) Waste management:** In the case of standalone systems the effects on health of chemical substances included in the batteries should also be studied. Moreover a large amount of energy and raw materials is required for their production. A battery-recycling scheme can assist. As it usually goes for construction activities, there will be little noise during operation of electrical equipment

### **3.16. Technologies/Techniques to mitigate the environmental impacts**

Almost all the negative environmental impacts can be faced:

- PVs can be used in isolated areas, avoiding ecologically sensitive areas or archeological sites. The integration in large commercial buildings (facades, roofs) it is also recommended as well as the use as sound isolation in highways or nearby hospitals, on condition of proper siting and frequent maintenance.
- Careful system design and production of cells in variable shapes, which can be easily integrated in buildings as architectural elements and replace mirrors or metallic areas used to decorate modern buildings. Furthermore the PV use as a cladding material for commercial buildings is showing their architectural possibilities. Referring to construction activities, site restoration is needed to alleviate visual impacts. Color can be used to assemble the PV modules in large-scale systems.

- Occupational accidents can be averted by good working practices and by the use protective sunglasses and clothing during construction, maintenance and decommission stage.
- Integrated PVE schemes help to regenerate rural areas.

### **3.17. Development Procedures**

All Development activities including ground preparation, earth moving, materials delivery, installation of the solar panels and related amenities (power, communication equipment, etc.), fittings (electricity cables, safety provisions, etc.) will be carried out by competent personnel obtained through respectable contractors/sub-contractors to ensure consistent high standard of finish and providing superb value for money.

#### **3.4.1 Construction activities Outline**

Construction activities will involve the following:

- i. Site preparation (clearance of existing vegetation, preparation of a site office and stores, fencing to avoid intrusion
- ii. Disposal of excavation and site clearance wastes,
- iii. Landscaping, earth moving and filling
- iv. Procurement of construction materials and delivery of the same to the site,
- v. Civil, mechanical, and electrical works,
- vi. Building works, trampling and removal of construction wastes,
- vii. Storage and utilization of materials,
- viii. Installation of transformers
- ix. Cabling
- x. Solid waste collection and commissioning of the Solar power project

#### **3.4.2 Input Materials**

The Solar power project will be constructed using common construction materials and construction procedures that are not expected to compromise the safety of the neighbouring communities as well as the general environment. The following inputs will be required for construction:

- (i) Raw construction materials e.g. sand, cement, natural building stone blocks, hard core, ballast, gravel, timber for the control room

- (ii) Paints, solvents, white wash, etc.,
- (iii) Other equipment associated with the Solar project
- (iv) Steel structure members
- (v) A construction labour force (of both skilled and unskilled workers).
- (vi) Water

### **3.18. Project Budget**

The estimated project cost for the 40MW Solar Plant is **One Billion Five million Eight Hundred and Twenty Four Thousand Five Hundred and Twenty Kenya Shillings (Kshs 1,005,824,520).**

## **4. RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORK**

### **4.1. Introduction**

This EIA has been prepared to fully comply with environmental legislations and Procedures as outlined in the various Regulations by National Environment Management Authority, in Kenya.

### **4.2. Constitutional Provisions**

Before we review the statutes relevant to environmental protection in Kenya, it is important to ascertain any provision relating to environmental protection in the national constitution. Although the current Constitution of Kenya does not have direct environmental protection provisions, it has been argued that Section 71 of the Constitution which deals with the right to life encompasses the right to a clean and healthy environment, as this right can only be meaningful if enjoyed within a conducive environment.

### **4.3. Kenya's Environmental Legislation**

The preparation of this EIA has taken into account the requirements for Environmental Assessment under Kenyan laws, mainly under Section 58 of the Environmental Management and Co-ordination Act, 1999. The section also requires project proponents to obtain an EIA License before the implementation of a project. Some of the relevant laws in Kenya are:

### **4.4. National Environment Management Authority (NEMA) Environmental Laws**

#### **4.4.1. Environmental Management and Co-ordination Act (EMCA)**

The Environmental Management and Co-ordination Act, 1999, is the legislation that governs Environmental Impact Assessment (EIA) studies. DHCL carried out an Environmental Impact Assessment (EIA) as per the second schedule of this act. This schedule lists the projects required to undergo EIA studies in accordance with section 58 (1-4) of the act. Malindi Solar Power Project can also be classified as rural per-urban and urban development.

The Act provides for the National Environmental Management Authority (NEMA) whose objective and purpose is to exercise general supervision and coordination over all matters relating to the environment and to be the principal instrument of the Government in the implementation of all policies relating to the environment.

The introduction of Environmental Impact Assessment and Audit Regulations, 2003 issued through Kenya Gazette Supplement No. 56 of 13 June 2003, the submission of environmental reports became mandatory. According to these regulations no proponent shall implement a project likely to have a negative environmental impact or for which an Environmental Impact Assessment has been concluded and approved in accordance with these regulators.

#### **4.4.2. The Environmental (Impact Assessment and Audit) Regulations, 2003**

Environmental Impact Assessment (EIA) is a critical examination of the effects of a project on the environment. The goal of an EIA is to ensure that decisions on proposed projects and activities are environmentally sustainable. An EIA is conducted in order to identify impacts of a project on the environment, predict likely changes on the environment as a result of the development, evaluate the impacts of the various alternatives on the project and propose mitigation measures for the significant negative impacts of the project on the environment.

The EMCA, 1999 requires that during the EIA process a proponent shall in consultation with the Authority seek views of persons who may be affected by the project or activity through posters, newspaper, radio and hold at least three public meetings with the affected parties and communities. The Project proponent pays for the entire EIA process. The fee payable to NEMA is 0.05% of the project cost.

Environmental Audit (EA) is the systematic documentation, periodic and objective evaluation of activities and processes of an ongoing project. The goal of EA is to establish if proponents are complying with environmental requirements and enforcing legislation. The purpose of EA is to determine the extent to which the activities and programs conform to the approved environmental management plan. A comprehensive EA ensures a safe and healthy environment at all stages of project operations and decommissioning.

An initial environmental audit and a control audit are conducted by a qualified and authorized environmental auditor or environmental inspector who is an expert or a firm of experts registered by the Authority. In the case of an ongoing project the Authority requires the proponent to

undertake an initial environmental audit study to provide baseline information upon which subsequent environmental audits shall be based.

Self Audits are carried out after the environmental impact assessment study report has been approved by the Authority or after the initial audit of an ongoing project. The proponent shall take all practical measure to ensure the implementation of the environmental management plan by carrying out a self auditing study on a regular basis.

#### **4.4.3. Water Quality Regulations**

Water Quality Regulations apply to water used for domestic, industrial, agricultural, and recreational purposes; water used for fisheries and wildlife purposes, and water used for any other purposes. Different standards apply to different modes of usage. These regulations provide for the protection of lakes, rivers, streams, springs, wells and other water sources.

The objective of the regulations is to protect human health and the environment. The effective enforcement of the water quality regulations will lead to a marked reduction of water-borne diseases and hence a reduction in the health budget.

The regulations also provide guidelines and standards for the discharge of poisons, toxins, noxious, radioactive waste or other pollutants into the aquatic environment in line with the Third Schedule of the regulations. The regulations have standards for discharge of effluent into the sewer and aquatic environment. While it is the responsibility of the sewerage service providers to regulate discharges into sewer lines based on the given specifications, NEMA regulates discharge of all effluent into the aquatic environment.

The regulations provide for the creation of a buffer zone for irrigation schemes of at least fifty (50) metres in width between the irrigation scheme and the natural water body.

Standards for irrigation water are given in schedule nine of the regulations.

Everyone is required to refrain from any actions, which directly or indirectly cause water pollution, whether or not the water resource was polluted before the enactment of the

Environmental Management and Coordination Act (EMCA) gazetted in 1999. It is an offence to contravene the provisions of these regulations with a fine not exceeding five hundred thousand shillings

#### **4.4.4. Waste Management Regulations**

The Minister for environment and natural resources gazetted these regulations in 2006. These Regulations may be cited as the Environmental Management and Co-ordination (Waste Management) Regulations, 2006. Waste Management Regulations are meant to streamline the handling, transportation and disposal of various types of waste. The aim of the Waste Management Regulations is to protect human health and the environment.

Currently, different types of waste are dumped haphazardly posing serious environmental and health concerns. The regulations place emphasis on waste minimization, cleaner production and segregation of waste at source.

#### **4.4.5. Controlled Substances Regulations, 2007 (Legal Notice No.73 of 2007)**

The Controlled Substances Regulations defines controlled substances and provides guidance on how to handle them. This regulation mandates NEMA to monitor the activities of persons handling controlled substances, in consultation with relevant line ministries and departments, to ensure compliance with the set requirements. Under these regulations, NEMA will be publishing a list of controlled substances and the quantities of all controlled substances imported or exported within a particular. The list will also indicate all persons holding licenses to import or export controlled substances, with their annual permitted allocations.

The regulations stipulate that controlled substances must be clearly labeled with among other words, “Controlled Substance-Not ozone friendly”) to indicate that the substance or product is harmful to the ozone layer. Advertisement of such substances must carry the words, “Warning: Contains chemical materials or substances that deplete or have the potential to deplete the ozone layer.”

Producers and/or importers of controlled substances are required to include a material safety data sheet. Persons are prohibited from storing, distributing, transporting or otherwise handling a controlled substance unless the controlled substance is accompanied by a material safety data



sheet.

Manufacturers, exporters or importers of controlled substances must be licensed by NEMA. Further, any person wishing to dispose of a controlled substance must be authorized by NEMA. The licensee should ensure that the controlled substance is disposed of in an environmentally sound manner. These regulations also apply to any person transporting such controlled substances through Kenya. Such a person is required to obtain a Prior Informed Consent (PIC) permit from NEMA.

#### **4.4.6. Conservation of Biodiversity**

Kenya has a large diversity of ecological zones and habitats including lowland and mountain forests, wooded and open grasslands, semi-arid scrubland, dry woodlands, and inland aquatic, and coastal and marine ecosystems. In addition, a total of 467 lake and wetland habitats are estimated to cover 2.5% of the territory. In order to preserve the country's wildlife, about 8% of Kenya's land area is currently under protection.

Kenya has established numerous goals, as well as general and specific objectives that relate to these issues, among others: environmental policies and legislations; involvement of communities; documentation of national biological resources; sustainable management and conservation of biodiversity; fair and equitable sharing of benefits; technical and scientific cooperation; biodiversity assessment; dissemination of information; institutional and community capacity building; and integration of biodiversity concerns into development planning.

#### **4.4.7. Draft Air Quality Regulations, 2008**

This regulation is referred to as "The Environmental Management and Coordination (Air Quality) Regulations, 2008". The objective is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources such as mobile sources (e.g. motor vehicles) and stationary sources (e.g. industries) as outlined in the Environmental Management and Coordination Act, 1999. It also covers any other air pollution source as may be determined by the Minister in consultation with the Authority. Emission limits for various areas and facilities have been set. The regulations provide the procedure for designating controlled areas, and the

objectives of air quality management plans for these areas.

The following operations (provided they are not used for disposal of refuse), are exempt from these regulations:

- i. Back-burning to control or suppress wildfires;
- ii. Fire fighting rehearsals or drills conducted by the Fire Service Agencies
- iii. Traditional and cultural burning of savanna grasslands;
- iv. Burning for purposes of public health protection;

#### **4.4.8. Draft Noise Regulations**

This regulation is referred to as “The Environmental management and coordination (Noise and Excessive vibration Pollution Control) Regulation, 2008”. It has given general prohibitions on excessive vibrations, and permissible noise levels. It gives provision related to noise from certain sources such as radio and television, and other sound amplifiers, parties and social events, hawkers, peddlers, touts street preachers, machinery, noise from motor vehicle, construction at night and noise, excessive vibrations from construction, demolition, mining or quarrying sites.

#### **4.4.9. Energy Act, 2006**

The Energy Act 2006 became law on 2nd January 2007. The Act establishes an energy commission, which is expected to become the main policy maker and enforcer in the energy sector. This commission among other things shall be responsible for: Issuing all the different licenses in the energy sector.

- Prescribing the licensing processes
- Setting and enforcing energy policies
- Collecting and disseminating energy data
- Public education and enforcing energy conservation

With this Act, all the different aspects of energy e.g. electricity, petroleum and renewable energy are brought under one ambit unlike the case as was before.

##### **4.9.1.1 Generation, Transmission, Distribution**

The act prescribes the manner with which licenses shall be obtained for generating, transmitting and distributing electricity. It clearly exempts private users from these licensing requirements for any power less than 1MW generated at the user's premises.

However, a license is required if:

- Generating is more than 1MW or
- The power requires a transmission system from the generation site to the consumption site or
- The power will be distributed to others (members of the public)

The specific requirements e.g. how much to pay for a license shall be determined by the energy commission. There is an unclear clause exempting power up to 3MW from some licensing issues, but this seems to be excluded by the specific exemptions that use the 1MW figure. Section 41(A) makes provisions for treating several licenses belonging to the same licensee as one e.g. if you have several wind energy sites and you wish to compile one amalgamated annual report. The act requires electrical installations to be done by an registered electrician. The Act also requires that all accidents and fatalities at energy facilities be reported officially to the commission.

#### **4.9.1.2 Rural Electrification Authority**

The act in section 67 establishes a rural electrification authority. Among other tasks, this authority is mandated to:

- Facilitate the access to electricity in rural areas
- Promote the development of renewable energy (including solar, wind and micro hydro)
- Levy a fee on all electricity sold for the rural electrification fund
- Nothing in the act prevents the authority from using funds collected under the rural electrification fund for financing renewable energy - it is not a special fund just for grid electricity

#### **4.4.10. The Wildlife (Management and Conservation) Act**

This Act was enacted to consolidate and amend the law relating to the protection, conservation and management of wildlife in Kenya, and for purposes connected therewith and thereto. Section 9 of the Act states that ‘the Director of Wildlife Conservation shall, through the officers of the service, control, manage and maintain all national parks’. It also states that within the National Park, the Director may:

- Reserve or set aside any portion of the park as a breeding place for animals or as nurseries for vegetation;

- Authorize the construction of such roads, bridges, airfields, buildings and fences, the provision of such water supplies, and the carrying out of such other works, as may be necessary for the purposes of the park;
- With the approval of the Minister, let sites for the erection of hotels, or other accommodation for the visitors to the park Provided that nothing in any document connected with the letting shall be construed as in any manner abridging the overall control of the Park by the Service, or as preventing the Director from giving directions as to the manner in which the premises concerned shall be managed.

#### **4.4.11. The Agricultural Act**

Legislative control over soil conservation and land development are mainly controlled within this Act, and many of the provisions can be generally applied beyond those lands suitable for agriculture.

The Minister administering the Act, after concurrence with the Central Agricultural Board and consultation with the District Agricultural Committee, can impose land conservation orders on lands to control cultivation, grazing and clearing. These controls may be necessary to protect the land against soil erosion, to protect fertility, and to maintain catchments. Local authorities are generally empowered to administer these sections of the Act, and the District Agricultural Committee is entitled to make regulations relating to these controls. Agricultural Rules are prescribed under the Act, whereby vegetation clearing in steep slopes areas or adjacent watercourses, without authorization, is controlled.

#### **4.4.12. Land Acquisition Act**

It is possible, under the provisions of this Act, for land to be acquired or granted access to for the purposes of new projects. Acquisition or access must be shown to be in the public benefit and compensation must be provided to the land owners whose land is acquired or damaged.

We have in Kenya a plethora of enactments all governing land and transactions in land. Thus the substantive land law is to be found in two different statutes while the adjectival land law is to be found in five different statutes not forgetting the customary land law of the various tribes in Kenya.

There are two systems of substantive land law, three systems of conveyance and five systems of registration. The two systems of substantive law are under:

- The Indian Transfer of Property Act 1882 as amended by 1959 Amendment Act
- The Registered Land Act
- The three systems of conveyancing are those applicable to land registered under:
  - Government Lands Act Cap 280, part X Laws of Kenya and Land Titles Act Cap 282, Part III Laws of Kenya
  - Registration of Titles Act
  - Registered Land Act.
  - Registration Systems

The five registration systems are those under:

- The Government Lands Act (G.L.A)
- Registration of Titles Act (R.T.A)
- The Land Titles Act (L.T.A)
- The Registration of Documents Act Cap 285 Laws of Kenya (R.D.A)
- The Registered Land Act (R.L.A)

The Registration of Documents Act is not peculiar to land law, as documents completely unrelated to land are resistible under it.

#### **4.4.13. Land Ownership**

Complete ownership can be said to be in the state. Under G.L.A the commissioner of Lands, on behalf of the Republic of Kenya grants leases of town plots for any term not exceeding ninety nine (99) years and of agricultural land for 999 years. The grantee becomes owner and subject to the terms and conditions of the lease he possesses the bundle of rights of ownership. The 999-year leases can be converted into freehold and the 99 years to 999. On conversion or expiry of lease the new grant may be issued under R.T.A or R.L.A. All un alienated land other than trust land and all reversion of government leases are vested in the government. Others whether held on freehold or leasehold are vested in grantees as owners having the rights over them. The power of the state to qualify (extinguish) property rights in the public interest is embodied in Section 75 of the Kenyan Constitution. The section however makes the exercise of that power subject to the process of law. Section 117 of the Constitution further provides that an Act of Parliament may

empower a county council to set apart trust land for: The use and occupation of any public body or authority for public purposes; or Prospecting or mining purposes; or The use and occupation of any person or persons for a purpose which is likely to benefit the residents of the area.

Section 117 part 4 stipulates that the setting apart is void unless the law under which it is made makes provision for the prompt payment of full compensation. The Trust Land Act, in Sub-sections 7 to 13, makes provision for the setting apart of land and payment of compensation with regard thereto. All land in urban areas of Kenya and much of the land in rural areas has a registered title. The title to land is either freehold or leasehold. The development and use of freehold title is controlled by land planning regulations which are administered by both the Central Government and the Local Authority in which the Land is situated. (A Local Authority is either a County Council or a Municipal Council whose activities are established and controlled by Local Government Legislation).

Leasehold land is held on leases from the Central Government or, less frequently, from the Local Authority and such leases will contain provisions governing the development of the land and the use to which the land can be put. The leases frequently contain provisions against any dealing with the land without the consent of the landlord. The Central Government administers its land through a Department of Lands which is headed by a Commissioner of Lands.

#### **4.4.14. Kenya Power Land Acquisition Procedure**

##### **4.4.14.1. Power Lines for Low Voltage**

A reconnaissance survey is first done to search for the best possible route. It is Kenya Power policy to avoid existing structures as much as possible. Once the best route has been established, a meeting between the Kenya Power staff, the locals and the local administration is arranged. During this meeting Kenya Power formally requests for permission to survey the area. Once this is agreed upon, the surveyor moves to site and takes detailed profiles of the area and also places pegs where the poles are to be located. The surveyor then prepares a cadastral map of the area showing the plot numbers and the route of the power lines as well as the position of the poles.

The Way leaves section of the Kenya Power then prepares a way leaves agreement showing the specific affected plot and the proposed route. The individual owner is then approached with this

proposal and his consent is requested. The owner is compensated for buildings or crops that are on the land. However, the owner is not allowed to grow anything higher than 12 feet within five meters of the poles or line.

Kenya Power also consult with other relevant institutions such as Telkom Kenya, County Councils, Airport Authorities, Kenya Pipeline Company, Kenya Ports Authority, Department of Defense, Kenya Wildlife Service, Conservatoire of Forests and Ministry of Public Works and Housing to ensure that their proposal is in harmony with other proposed developments.

#### **4.4.14.2. High Voltage Lines**

A similar procedure is undertaken in assessing the best route as in the case for the low voltage lines. The land required is of 30 meters width. Once the best route is established the landowner is approached with this proposal and his consent is requested. The owner is compensated for the land through negotiations to agree on a compensation rate. The owner is also compensated for buildings or crops that are on the land.

#### **4.4.15. The Occupational Safety and Health Act, 2007**

This Act applies to all workplaces where any person is at work, whether temporarily or permanently. The purpose of this Act is to secure the safety, health and welfare of persons at work, and protect persons other than persons at work against risks to safety and health arising out of, or in connection with, the activities of persons at work. Some of the areas addressed here are machinery safety, chemical safety and health, safety and welfare special provisions are also provided in the ILO conventions on safety and health in construction recommendation, 1988 R175.

#### **4.4.16. Public Health Act 1986 Revision**

The public Health Act regulates activities detrimental to human Health. An environmental nuisance is one that causes danger, discomfort or annoyance to the local inhabitants or which is hazardous to human health. Although the Act is primarily concerned with domestic water supplies and sources of water used for human consumption, its regime may be extended to cover rivers, streams, lakes and underground water resources since these are the basic water sources for the majority of Kenya's population.

It also outlines the standards of construction of various facilities of any place. In terms of air pollution thermal plants are said to emit a variety of gases, volatile organic compounds and particulate matter depending on the amount and type of fuel used and method used for burning. It is therefore necessary to monitor the air pollution. The Act prohibits activities (nuisances) that may be injurious to health. The primary purpose of the Act is to secure and maintain public health. It defines nuisances on land and premises and empowers public health authorities to deal with such conditions.

Part IX, section 115, of the Act states that no person/institution shall cause nuisance or condition liable to be injuries or dangerous to human health. Section 116 requires that Local Authorities take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injuries or dangerous to human health.

On responsibility of the Local Authorities Part XI, section 129, of the Act states in part “It shall be the duty of every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes. Section 130 provides for making and imposing regulations by the local authorities and others the duty of enforcing rules in respect of prohibiting use of water supply or erection of structures draining filth or noxious matter into water supply as mentioned in section 129. This provision is supplemented by section 126A that requires local authorities to develop by laws for controlling and regulating among others private sewers, communication between drains, power lines, and sewers as well as regulating sanitary conveniences in connection to buildings, drainage, cesspools, etc. for reception or disposal of foul matter. Part XII, Section 136, states that all collections of water, sewage, rubbish, refuse and other fluids which permits or facilitates the breeding or multiplication of pests shall be deemed nuisances and are liable to be dealt with in the matter provided by this Act.

#### **4.4.17. Factories and Other Places of Work Act (Cap, 514)**

Before any premises are occupied or used, a certificate of registration must be obtained from the chief inspector. The occupier must keep a general register. The act covers provisions for health,



safety and welfare.

### **Safety**

The Act provides for a provision that ensures that for the interest of public that all dangerous points of the projects are clearly marked or fencing of premises and dangerous parts of other machinery is mandatory. Training and supervision of inexperienced workers, protection of eyes with goggles or effective screens must be provided in certain specified processes. Special precaution against gassing is laid down for work in confined spaces where persons are liable to overcome by dangerous fumes. Air receivers and fittings must be of sound construction and properly maintained. Adequate and suitable means for extinguishing fire must be provided in addition to adequate means of escape in case of fire must be provided.

### **Health**

The premise must be kept clean, daily removal of accumulated dust from place of work. The circulation of fresh air must secure adequate ventilation of workrooms. There must be sufficient and suitable lighting in every part of working place. There shall also be sufficient and suitable sanitary conveniences separate for each sex, must be provided subject to conformity with any standards prescribed by rules. Food and drinks shall not be partaken in dangerous places or workrooms. Provision of suitable protective clothing and appliances including where necessary, suitable gloves, footwear, goggles, gas masks, and head covering, and maintained for the use of workers in any process involving expose to wet or to any injurious or offensive substances.

### **Welfare**

An adequate supply of both quantity and quality of wholesome drinking water must be provided. Maintenance of suitable washing facilities, accommodation for clothing not worn during working hours must be provided. Sitting facilities for all female workers whose work is done while standing shall be provided to enable them take advantage of any opportunity for resting. Section 42 stipulates that every premise shall be provided with maintenance, readily accessible means for extinguishing fire and person trained in the correct use of such means shall be present during all working periods. Section 45 states that regular individual examination or surveys of health conditions of industrial medicine and hygiene must be performed and the cost will be met by the

employer. This will ensure that the examination can take place without any loss of earning for the employees and if possible within normal working hours. Section 55B provides for development and maintenance of an effective program of collection, compilation and analysis of occupational safety. This will ensure that health statistics, which shall cover injuries and illness including disabling during working hours, are adhered to.

#### **4.4.18. Local Government Act**

The Local government Act is concerned with a wide range of matters that affect the day to day activities of individuals and organizations. The sections, which have the most direct relevance, are Sections 145, 146, 147 and 163:

Section 145 is concerned with the miscellaneous powers of local authorities. Subsection (w) empowers a local authority to take measures that may be necessary or desirable for the preservation or protection of wildlife, and provide amenities for the observation of wildlife. Section 146, Subsection (d) empowers a local authority, with the consent of the Minister, to make grants for the establishment and maintenance of game parks and other related facilities. Section 147, Subsection (d) controls the cutting of timber and the destruction of trees and shrubs.

Section 163, Subsection (e) empowers municipal councils, town councils and urban councils to control or prohibit all businesses, factories and workshops which by reason of smoke, fumes, chemicals, gases, dust, smell, noise or vibration or other cause may be a source of danger discomfort or annoyance to the neighbourhood and to prescribe the conditions subject to which business, factories and workshops shall be carried on.

#### **4.4.19. Kenya Electricity Grid Code & Kenya Safety Code**

The consultant also reviewed the Kenya Electricity Grid Code, which sets out detailed arrangements for the regulation of the Kenya electricity supply industry and is enforceable under the Electric Power Act, No 11 of 1997. In addition to the Kenya Electricity Grid Code, the consultant reviewed the Kenya Safety Code, which recognizes the Factories Act, 1962 (Rev.1972) which requires an employee to use any means or appliance provided by the Employer for securing safety and also not willfully to do anything likely to endanger himself or others.

#### **4.4.20. The Water Act**

The water Act, 2002 provides the legal framework for the management, conservation, use and control of water resources and for the acquisition and regulation of right to use water in Kenya. It also provides for the regulation and management of water supply and sewerage services. In general, the Act gives provisions regarding ownership of water, institutional framework, national water resources, management strategy, requirement for permits, state schemes and community projects. Part IV of the Act addresses the issues of water supply and sewerage. Specifically, section 59 (4) of the Act states that the national water services strategy shall contain details of:

- Existing water services
- The number and location of persons who are not being provided with basic water supply and basic sewerage
- Plans for the extension of water services to underserved areas
- The time frame for the plan; and
- An investment programme

#### **4.4.21. The Constitution of Kenya**

The provisions of Chapter V (Protection of Fundamental Rights and Freedoms of The Individual) shall have effect for the purpose of affording protection to those rights and freedoms subject to such limitations of that protection as are contained in those provisions, being limitations designed to ensure that the enjoyment of those rights and freedoms by any individual does not prejudice the rights and freedoms of others or the public interest. The constitution protects citizens from deprivation of property. No property of any description shall be compulsorily taken possession of, and no interest in or right over property of any description shall be compulsorily acquired, except where it is necessary for public interest.

#### **4.4.22. Forests Act 2005**

The Act highlights the integration of the community on the management, utilization and conservation of forests and its resources. It prohibits wanton destruction of the forests. As hydro dams depends on good water catchments protection and management, on the upstream and around the reservoirs the enforcement of this Act will minimize the flow of sediments into the rivers which are being utilized for generation of hydro electric power generation. There a no formally identified forests along Assignment-I transmission line routes, but there are some

localities with significant tree and vegetation cutting needs.

#### **4.4.23. Government Lands Act, Cap. 280 (revised 1984)**

This Act deals with all actions, suits and proceedings by or on behalf of the Government respecting; Government land or any contract relating to Government land or any breach of any such contract, any trespass on Government land or any damages accruing by reason of such trespass, the recovery of any rent, purchase money or other monies in respect of Government land, any damages or wrongs whatsoever in any way suffered by the Government in respect of Government land or any other land, the recovery of any fine or the enforcement of any penalty under this Act The Government may at any time enter upon any land sold, leased or occupied under a license under this Act, and may there set up poles and carry electric lines across such land, and may lay sewers, water-pipes or electric lines therein, without paying compensation, but making good all damage (Sec 86). Where any damage or loss has been caused to any land by or as a result of entry thereon under section 86 or section 87 by reason of the injury or destruction of trees, bushes or shrubs planted thereon, a reasonable sum, not exceeding the market value of the standing trees, bushes or shrubs, shall be paid by way of compensation for the damage or loss notwithstanding that compensation is not otherwise payable under any of those sections.

#### **4.4.24. Trust Lands Act Cap. 288 of 1962 (revised 1970)**

This Act applies to all land which for the time being is Trust land. Under section 38 a way leave license may be granted to any person empowering him and his servants and agents to enter upon Trust land vested in the council and to lay pipes, make canals, aqueducts, weirs and dams and execute any other works required for the supply and use of water, to set up electric power or telephone lines, cables or aerial ropeways and erect poles and pylons therefore, and to make such excavations as may be necessary for the carrying out of any such purposes, and to maintain any such works as aforesaid. However compensation for loss of the use of land in any case where the usefulness of the land for agricultural purposes is impaired must be made before the license is awarded.

#### **4.4.25. Land Adjudication Act, Cap. 284 of 1968 (revised 1977)**

This Act applies to any area of Trust land where the county council in whom the land is vested so requests; and the Minister considers it expedient that the rights and interests of persons in the land should be ascertained and registered; and where the Land

Consolidation Act does not apply to the area.

#### **4.4.26. Physical Planning Act (Cap 286)**

An Act of Parliament to provide for the preparation and implementation of physical development plans and for connected purposes enacted by the Parliament of Kenya

Under this Act, no person shall carry out development within the area of a local authority without a development permission granted by the local authority under section 33. The local authority concerned shall require the developer to restore the land on which such development has taken place to its original condition within a period of not more than ninety days. If on the expiry of the ninety days notice given to the developer such restoration has not been effected the concerned local authority shall restore the site to its original condition and recover the cost incurred thereto from the developer.

#### **4.4.27. Registered Lands Act, Cap 300 of 1963**

This is an Act of Parliament to make further and better provision for the registration of title to land, and for the regulation of dealings in land so registered, and for purposes connected therewith.

#### **4.4.28. Geothermal Resources Act 1982**

This act is geared towards licensing of geothermal wells while taking into consideration the need to dispose the waste products from the geothermal processes appropriately.

Whilst part of the projects enters into a geothermal power station and reserve, it is not expected this legislation will impact on the project.

#### **4.4.29. Employment Act No 11 of 2007**

The Act is enacted to consolidate the law relating to trade unions and trade disputes, to provide for the registration, regulation, management and democratization of trade unions and employers organizations and federations. Its purpose is to promote sound labour relations through freedom of association, the encouragement of effective collective bargaining and promotion of orderly and expeditious dispute the protection and promotion of settlement conducive to social justice and economic development for connected purposes. This Act is important since it provides for employer – employee relationship that is important for the activities that would promote management of the environment within the energy sector.

#### **4.4.30. Labour Institutions Act No. 12 of 2007**

The purpose of the Act is to establish labour institutions and to provide for their function, powers and duties. The Act provides for the establishment of National Labour Board, which provides advice to the Minister on all matters concerning employment and labour.

#### **4.4.31. Building Code 1997**

The Local Government By-Laws are Building By-Laws that give the Municipalities or County Councils powers to approve building plans. Such plans are expected to provide for public buildings and factories among others. The By-Laws covers factory chimney shafts, stairs, lifts, rain water disposal, refuse disposal, ventilation of buildings, drainage, sanitary conveniences, sewers, septic and conservancy tanks, fire and means of escape in case of fire. Compliance with this Act in up scaling of power supply is necessary. Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local authority for a permit to connect to the sewer line and all the wastewater must be discharged into sewers. The code also prohibits construction of structures or buildings on sewer lines and under power lines.

#### **4.4.32. Use of Poisonous Substances Act rev. 1983 Cap 247**

This Act under Sections 3,4,6,8 imposes restrictions and conditions on the use of poisonous substances and requires that persons concerned with storage, transportation and disposal or use of poisonous substances be registered or licensed. It also requires observance of precautions against poisoning and provides for periods of exposure to risk of poisoning.

#### **4.4.33. Traffic Act Cap 403**

This Act specifies that motor vehicles use proper fuel. The Traffic regulations promulgated under the Act specifies that every vehicle is required to be so constructed, maintained and used so as not to emit any smoke or visible vapour.

#### **4.4.34. Penal Code Cap 63**

Section 191 of the penal code states that if any person or institution that voluntarily corrupts or foils water from public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons

/institution, dwelling or business premises in the neighbourhood or those passing along public

way, commit an offence.

#### **4.4.35. Relevant International Conventions and Treaties**

Kenya is signatory to several international conventions and treaties that would need to be adhered to in implementing this project and are geared towards environmental protection and conservation. Some of these include;

- a) ILO Conventions ratified by Government of Kenya- Kenya have ratified 43 ILO conventions and those that are relevant to this study includes
  - Safety and Health in Construction Recommendation, 1988
  - Recruiting of Indigenous Workers Convention, 1936 (No.50)
  - Contracts of Employment (Indigenous Workers) Convention, 1939 (No. 64)
  - Minimum Age Convention, 1973 (No. 138) Minimum age specified: 16 years
  - Migrant Workers (Supplementary Provisions) Convention, 1975 (No. 143)
- b) Convention on Wetlands or the Ramsar Convention
- c) Convention on Biodiversity
- d) The Convention on International Trade in Endangered Species (CITES)
- e) Convention on the Conservation of Migratory Species
- f) United Nations Framework Convention on Climate Change
- g) United Nations Convention to Combat Desertification
- h) Important Bird Areas
- i) The World Heritage Convention
- j) UNESCOs Man and Biosphere
- k) New Partnership for Africa Development (NEPAD)
- l) East African Community.

The Ministry of Foreign Affairs deals with international treaties at the primary stages of negotiation. The ministry offers advisory guide to the government on the need to ratify such a treaty if considered to be of national interest. Implementation portfolio then moves to the line ministry, relevant departments and co-operating agencies.

#### **4.5 Applicable World Bank Policies**

The World Bank's environmental and social safeguard policies (ten of them) are a cornerstone of its support to sustainable poverty reduction. The objective of these policies is to prevent and

mitigate undue harm to people and the environment in the development process. These policies provide guidelines for the identification, preparation, and implementation of programs and projects. The following operational policies of the World Bank are relevant for the proposed Malindi Solar project from an environmental and social viewpoint:

**Table 4:** Safeguard Policies Triggered in Malindi Solar Project

<b>Safeguard Policies Triggered by the Project</b>	<b>Yes</b>	<b>Potential</b>	<b>No</b>
Environmental Assessment OP/BP 4.01	X		
Natural Habitats OP/BP 4.04			X
Forests OP/BP 4.36		X	
Pest Management OP 4.09			X
Physical Cultural Resources OP/BP 4.11		X	
Indigenous Peoples OP/BP 4.10	X		
Involuntary Resettlement OP/BP 4.12		X	
Safety of Dams OP/BP 4.37			X
Projects on International Waters OP/BP 7.50			X
Projects in Disputed Areas OP/BP 7.60			X

#### **4.5.1 Environmental Assessment (OP/BP 4.01)**

OP/BP 4.01 is triggered because the activities/interventions proposed under this project may have low impacts on the natural environment and human health. As the project during construction requires clearing up of sites, excavations, which have impacts (though minimal) to physical and biological environment within the project site.

Environmental Assessment is used by the World Bank to identify, avoid, and mitigate the potential negative environmental impacts associated with the Bank's operations early on in the project cycle. The policy states that Environment Assessment (EA) and mitigation plans are required for all projects having significant adverse environmental impacts or involuntary resettlement. Assessment should include analysis of alternative designs and sites, including the "no project option" and require public participation and information disclosure before the Bank approves the project.

In World Bank-funded operations, the purpose of Environmental Assessment is to improve decision making, to ensure that project options under consideration are sound and sustainable, and that potentially affected people have been properly consulted and their concerns addressed. The World Bank's environmental assessment policy and recommended processing are described



in Operational Policy (OP)/Bank Procedure (BP) 4.01: Environmental Assessment.

#### **4.5.2 Physical Cultural Resources (OP/BP 4.11)**

The World Bank Policy OP/BP 4.11 defines physical cultural resources as movable or immovable objects, sites, structures, groups of structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from the development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower's national legislation, or its obligations under relevant international environmental treaties and agreements. The borrower addresses impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment (EA) process. The World Bank will also follow compliance with Kenya's chance find policy.

#### **4.5.3 Indigenous People (OP/BP 4.10)**

Indigenous People (OP/BP 4.10) is triggered because of the presence of Maasai in the project area Kambas and other vulnerable groups are also present in the project area. This policy states that any development process under World Bank financing should fully respect the dignity, human rights, economies, and cultures of Indigenous Peoples (IPs). The project should engage in a process of free, prior, and informed consultation with IPs that should result in broad community support to the project by the affected Indigenous Peoples.

Projects should include measures to avoid potentially adverse effects on the IP's communities or when avoidance is not feasible, minimize, mitigate, or compensate for such effects. They should ensure that the IPs receive social and economic benefits that are culturally appropriate and gender and inter-generationally inclusive.

#### **4.5.4 Involuntary Resettlement (OP/BP 4.12)**

As per World Bank policy, Involuntary Resettlement (OP/BP 4.12) is triggered in case the

project results into loss of private properties such as land, houses, structures and commercial places or disruption of formal /informal sources of income and livelihoods happens due to project interventions. The Malindi Solar Project interventions are, however, not likely to involve physical displacement through involuntary land taking as the required land area for the project will be managed from SEL owned land. Nevertheless, the Project will require to comply fully with the mitigation measures specified in Table 4 to address the adverse social impacts in case the involuntary resettlement issue is triggered as a result of project's interventions. .

OP/BP 4.12 recognizes that involuntary land-taking resulting in loss of shelter, assets or access and income or sources of income should be addressed in World Bank-financed projects. Displaced persons should be meaningfully consulted, given opportunities to participate in planning and implementing resettlement programs and assisted in their efforts to improve their livelihoods and standards of living. Absence of legal title to land should not be a bar for compensation, resettlement, and rehabilitation assistance. Vulnerable groups such as IPs, women-headed households, and senior citizens should be entitled to special benefit packages in addition to compensation and resettlement. The Operational Policy is applicable whenever there is involuntary land taking resulting in displacement of people and / or loss of livelihood or source of livelihood.

#### **4.5.5 Forestry (OP 4.36)**

There is no community or Government's forest in within the candidate site of Malindi Solar Project. However, the alignment of the transformation line has not been fixed or spelled out in the project document: it is uncertain which site would need new transformation line and what would be the route. Hence possibility of transformation line passing through forest may not be ruled out (this may be confirmed only during detailing of each sites after selection). Hence, this policy is triggered. In each case, EMP prepared under OP 4.01 will have mitigation measures if impact on forest is likely.

## 5 CONSULTATIONS AND PUBLIC PARTICIPATION

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### 5.1 Introduction

This chapter describes the process of the public consultation followed to identify the key issues and impacts of the proposed project. Views from the local residents, local leaders, surrounding institutions and development partners who in one way or another would be affected or rather interested in the proposed project were sought through interviews and public meetings as stipulated in the Environment Management and Coordination Act, 1999.

The overall objective of the Government is to involve communities in policy formulation and implementation at the local level. More specifically, the Community Action Planning Programme objective is to put in place a durable system of intra-community co-operation through collective action, which creates communal discussion forums for the implementation of development activities.

### EIA and Audit Regulations

Section 17 of the Environmental (Impact Assessment and Audit) Regulations 2003, states that an EIA should “*seek the views of persons who may be affected by the proposed project.*”

### 5.2 Objectives of the Consultation and Public Participation

The objective of the consultation and public participation was to:

- 1) Disseminate and inform the stakeholders about the project with special reference to its key components and location.
- 2) Gather comments, suggestions and concerns of the interested and affected parties.
- 3) Incorporate the information collected in the EIA study.

In addition, the process enabled,

- 1) The establishment of a communication channel between the general public and the team of consultants, the project proponents and the Government.
- 2) The concerns of the stakeholders to be known to the decision-making bodies at an early phase of project development.

### **5.3 Methodology used in the CPP**

The Consultation and Public Participation (CPP) Process is a policy requirement by the Government of Kenya and a mandatory procedure as stipulated by EMCA 1999 section 58, on Environmental Impact Assessment for the purpose of achieving the fundamental principles of sustainable development. The environmental assessment study exercise which was conducted on the 19<sup>th</sup> to 21<sup>st</sup> November, 2015. The exercise was conducted by a team of experienced registered environmental experts in three ways, namely, (i) focus group and Key informant interviews and discussion, (ii) field surveys and observations and (iii) filling questionnaires which captured the concerns of the people especially the neighbours to the Solar project. The identification of the specific issues from the stakeholders' response which provided the basis upon which the aspects of the Environmental Impact Assessment were undertaken.

The purpose for such interviews was to identify the positive and negative impacts and subsequently promote proposals on the best practices to be adopted and mitigate the negative impacts respectively. It also helped in identifying any other miscellaneous issues which may bring conflicts in case project implementation proceeds as planned.

### **5.4 Background**

The integration of public participation/involvement of stakeholders in EIA process is very important in terms of its implication for sound decision making and the sustainability of development activities. In this regard, the Kenya EIA Procedures provide for the involvement of stakeholders and the public in the assessment and review of proposed undertakings. This is achieved through a number of mechanisms, including the administration of questionnaires.

Public participation is a key component of an EIA and is used to integrate citizens into the environmental decision-making process. Traditional decision-making approaches such as closed-door discussions between politicians and experts are no longer appropriate. Public participation, if it is to be democratic, must foster trusting relationships through open and honest negotiations between proponents and the public (Barrington et al., 2003).

But it should be evident, when necessary, that a plan for public involvement was developed early in the process. The public should be provided with sufficient information about the proposed

project and properly understand the project and issues to be able to give informed comments and participate fully in the process (Huang et al., 2003). It is important that there is evidence that all public comments are considered in the formulation of the list of concerns. All public comments should be recorded without judgment or prioritizing in the initial stages of the process (UNEP, 2002; Huang et al., 2003).

The public must be involved early in the process (Barrington et al., 2003). The public must not be placed in a reactive position. Decisions must not be evaluated after they have been made but rather participants must be involved at all stages of the EIA process. The public must be given sufficient time to digest information and prepare its comments, while keeping the whole procedure within a reasonable time frame.

Public and Stakeholders' involvement in the EIA process is essential and may lead to enormous benefits for the proponent, stakeholders and the nation. Where this is ignored, conflicts and problems may be created for project implementation and sustainability. Not only does the involvement of the public in the EIA process often strengthen the project, but public participation is required by the Environmental Management and Coordination Act (Environmental Impact Assessment) (EMCA-1999). The participation of beneficiaries and partners and the public in general has been identified as an essential component in ensuring sustainable and conflict free development.

To accomplish the mission of getting the public's opinion on the proposed project, one on one discussion with neighbors to gather the public opinions on the proposed solar project. The respondents included business people and the residents of the region. All the respondents were in support for the project. Issues raised included job creation, infrastructure improvement, gains in local and national economy, potential noise pollution, potential dust emissions, and potential increase in water demand, potential increased solid and liquid waste generation, risks of Accidents and Injuries to Workers and the public among others. **See appendix** for the list of participants in the CPP by interviews through a public baraza. However, all the environmental issues which were raised can be adequately mitigated as exhaustively explained in chapter seven of this report.



**Plate 10: Residents sited during the public baraza**

## **5.5 Issues Raised**

Interviews with the stakeholders were carried out on 18<sup>th</sup> to 20<sup>th</sup> June, and confirmed on 20<sup>th</sup> November, 2015 through administering well-structured questionnaires and a public baraza respectively.

### **5.5.1 Positive Issues**

The following is a summary of the views of the local community and stakeholders interviewed:

- The project is good for the development of the county since it will boost power supply and improve on industrial development, and should therefore be undertaken.
- The project will improve businesses in the area and also create job opportunities to the local youth during construction and operational phases.
- There would be interaction with other cultures especially during construction phase.

### **5.5.2 Negative Issues**

The Solar power project would have very few social economic and environmental impacts as viewed by the surrounding community. However some of the stakeholders had a few reservations about the project and raised the following concerns:

- There would be increased pollution from transport vehicles during construction.

- There would be possibility of insecurity in the areas due to the influx of other people during construction phase.
- The project will lead to cutting down of trees.

### 5.5.3 Stakeholders' Suggestions

The following suggestions were raised during the consultations:

- The project proponent should consider making arrangements with Kenya Power to provide power to the resident's neighbouring the project site for domestic use at a lower price.
- The proponent should assist the local communities in other projects e.g. construction of classrooms for nearby schools, assist students from the villages to attend Secondary schools, assist in control of HIV/AIDS, etc.
- The Proponent should ensure proper environmental management practices are put in place.
- The proponent should consider employing casual workers from the local areas during construction phase of the project.
- Noise pollution should be controlled.
- The proponent should put up security lights.

### 5.5.4 Analysis of the public consultation

The overall conclusion from the interviews and analysis of public consultation led to determination of the following:

- The project is located in an idle land and is unlikely to have adverse effects to the environment if managed properly.
- The proposed project is acceptable to all the respondents.
- The project will uplift the market value and economic viability of the premises around the site.
- The proposed project will benefit the members of the community at large through boosting of the area economically and creation of jobs
- If the EMP is adhered to, all the potential negative impacts will be addressed conclusively



**Plate 11: The area chief addressing the gathering**



**Plate 12: One of Weru ranch director addressing the baraza**



## **6 IDENTIFICATION OF THE PROPOSED IMPACTS**

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### **6.1 Introduction**

Planning for sustainable development in Kenya seeks to attain the twin goals of poverty alleviation and environmental sustainability, a theme that permeates all GOK National Development Plans since the 1980s but which was most eloquently expounded on through the NEAP process of 1994. From the NEAP process, unemployment, poor access to services such as better housing, power supply, water supply and sanitation, transport, waste management and exposure to water-borne diseases emerged as some of the main challenges facing majority of the population in Kenya.

This Section identifies both negative and positive impacts associated with the proposed project involving the construction of a 40 MW solar power plant at a selected location in Weru Group Ranch No 19 in Lango Baya area, Malindi District in Kilifi County, Coastal region of Kenya to ensure that design and implementation of this investment remains sensitized to local baseline challenges and remains focused towards their solution..

### **6.2 CONSTRUCTION PHASE**

#### **6.2.1 Positive Impacts**

Based on project feasibility study report, scoping report, inception report including the TOR on the project ,desktop and ground assessments on the existing baseline data, potential positive impacts have been identified that are likely to result from the proposed project, construction of proposed solar power. The proposed project will likely to have the following positive impacts.

##### **6.2.1.1 Creation of Employment and business opportunities**

There will be massive job opportunities especially to casual workers. Employment opportunities are a benefit both in economic and social sense. In the economic sense, it means abundant skilled/unskilled labour will be used in economic production. In the social sense, these young and energetic otherwise poor people will be engaged in productive employment other than remaining idle. Remaining idle may attract them into social ills like drug abuse and other criminal activities like robberies. Several workers are expected to work at the solar plant for a period that the project will start to the end. Apart from casual labour, semi skilled and

unskilled labour and formal employees are also expected to obtain gainful employment during the period of construction. Consultants will also benefit from the short-term opportunities occasioned by the design and supervision work on the sub-projects. Additionally, there will be massive business opportunities in the supply of construction material and provision of food to the construction workers.

#### **6.2.1.2 Improvement of access routes into project target areas**

The construction of access roads for motorised, non-motorised and paved walkways will improve the aesthetics of the project area. Since the construction of roads will be built to the required standards, incidents of emergency vehicles not being able to access areas of distress will be minimised. Depending on the extent of paving, soil erosion and dust in the areas will be reduced, hence reduction in respiratory diseases that are brought about by dust.

#### **6.2.1.3 Gains in the Local and National Economy**

There will be gains in the local and national economy. Through consumption of locally available materials including: power cables, steel structures, hardware materials such as nuts, bolts, and cement. The consumption of these materials, fuel oil and others will attract taxes including VAT which will be payable to the national and local governments. The cost of the materials will be payable directly to the suppliers.

#### **6.2.1.4 Market for Supply of structural construction materials**

The project will require supply of large quantities of structural construction materials most of which will be sourced locally in within the country and a few from imports. This provides ready market for structural and building construction materials suppliers such as quarrying companies, hardware shops, companies, and individuals with such materials.

### **6.2.2 Negative Impacts**

#### **6.2.2.1 Noise pollution**

The construction works will most likely be a noisy operation due to the moving machines (mixers, tippers, communicating workers) and incoming vehicles to deliver construction materials and workers to site. The immediate surrounding will experience an increase in human traffic and noise during ground preparation. In a construction site, noise is likely to be produced

by the construction machinery doing the civil works. To prevent this, machine operators and workers who will be in close proximity to the machinery will be required to wear protective gears such as earmuffs. The prevalence of acute noise damages occur when the ear is exposed to a single or relatively few exposures of sound at threshold levels of 100-120 dB and these damages to the ear can be either temporary or permanent. However, the immediate construction site workers are likely to be affected since noise beyond some level is itself a nuisance if not maintained within acceptable limits.

#### **6.2.2.2 Disposal of Excavated Soil for pads and access roads**

Little excavation is likely to take place at the project site, except the launch pads of the structures on which the support beams will occur. The excavation works to level the site will result in the generation of small amounts of excavated material. Nevertheless, there will be no carrying away of excavated material. It will all be utilized on site to adjust levels where necessary. Therefore, there will be no different types of excavated soil mixed up and no problem of dumping excavated soils.

#### **6.2.2.3 Oil Spills**

The machines on site may be containing moving parts, which will require continuous oiling to minimize the usual corrosion or wear and tear. Possibilities of such oils spilling and contaminating the soil and water at the project site are real. Likewise, moving vehicles on site may require oil change. These dangers can be contained by maintaining the machinery in specific areas designed for this purpose.

#### **6.2.2.4 Increased water demand and demand on other natural resources**

Both the workers and the construction works will create additional demand for water in addition to the existing demand. Water will be mostly used in the preparation of concrete for construction works and for wetting surfaces or cleaning completed structures

#### **6.2.2.5 General safety and Dust Emissions**

Particulate matter pollution is likely to occur during the site clearance, excavation and spreading of the topsoil. There is a very small possibility of PM10 suspended and settle able particles affecting the site workers and even neighbours health, it is minimal given the construction

method of minimum excavation and will carry away top soil. It is anticipated that during the construction phase, it will involve the use of sharp and noisy machines in a dusty environment. Because of the intensive engineering and construction activities including erection and fastening of reinforced steel materials, metal grinding and cutting, concrete work, steel erection and welding among others, construction workers will be exposed to risks of accidents and injuries. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others. The contractor will therefore, be required to provide them with PPE like boots, gloves, proper work clothes, dust masks, and earmuffs and adhere to the safety precautions as stipulated in the Occupational Health and Safety Act. Other safety precautions will include:

- Wetting the ground to prevent dust.
- Relevant warning signs to be displayed in all sections of site, dangerous areas and machines
- Restrict the movement of unauthorized personnel at site
- Litter and debris to be collected, stored, and disposed appropriately to avoid injuries during and after the construction.
- Trained health and safety personnel to be at the construction site and provided with the necessary equipment to handle emergencies.
- It is suggested that the project design should be such that every steel tower and pole will have a danger sign and an anti-climbing barbed wire for the safety purposes.
- Warning DANGER/HATARI cable markers will also be laid along the cable routes

Significant amounts of dust maybe produced during the excavation and civil works. Enclosing the project site should be done first before most of the other civil works, to minimize the dust being blown off by the winds especially if construction will be done during dry spells.

#### **6.2.2.6 Human faecal waste management**

The project is expected to attract a large pool of human labour and their concentration in an area can result in this waste management problem. The construction workers will generate faecal waste during their day-to-day operations. The generated waste needs proper handling to prevent disease, for example diarrhoea, outbreak on the site. Hence, one of the significant health concerns associated with such projects includes shortage of facilities like toilets and catering

facilities for construction workers. It is the role of the contractor to ensure that his or her workers are provided with these sanitary facilities. Either temporary facilities should be put in place before the construction of the line commences or, alternative arrangements could be done such that the personnel working along the line could get the facilities from the immediate communities.

#### **6.2.2.7 Overcrowding and mushrooming of informal settlement**

There is a likelihood of food kiosks starting to appear closer to the project site due to the meal demands from the construction workers. Most of the foods sold at such places are cheap. The food kiosk owners will be looking for shortcut means to get easy money. The proposed project may involve mushrooming of informal settlements in the surrounding area owing to workers preference to stay near their places of work. The long- term negative impact again will be the mushrooming of informal settlements in the neighbourhood owing to the job opportunities that would be available in the project lifetime. Such settlements often compromise security in the neighbourhood. However, workers accommodation plans have to be included in the development plan so that this issue is dealt with as far as is directly possible within the development.

#### **6.2.2.8 Destruction of existing vegetation**

The construction process will involve clearing of the existing vegetation cover. The developer intends to replace this with some planting of many indigenous and other useful firewood and fodder trees and grass in all the gardens and strategic green areas as proposed in the landscape plan. Proposed project may have negative safety impacts on the immediate environment including flora and fauna. However, the proponent must put in place measures towards protecting vegetation and organisms surrounding the project.

#### **6.2.2.9 Generation of Exhaust Emissions**

Exhaust emissions are likely to be generated by the construction equipment during the construction phase. Motor vehicles used to mobilise the work force and materials for construction would cause a potentially significant air quality impact by emitting pollutants through exhaust emissions. Because large quantities of building materials are required, some of which are sourced outside the project area, such emissions can be enormous and may affect a wider geographical area. The impacts of such emissions can be greater in areas where the

materials are sourced and at the construction site because of frequent gunning of vehicle engines, frequent vehicle turning, and slow vehicle movement in the loading and offloading areas. The air emissions from construction machinery and traffic will be minor and they will have negligible impact on ambient air quality.

#### **6.2.2.10 Possible exposure to workers to diseases**

During construction phase, workers are likely to be exposed to diseases from construction materials. It is therefore recommended that before the construction commences, there is need for the materials to be well inspected according to the occupational health and safety standards. Other concerns will include incidences of vector borne and water borne disease. When solid wastes are not well managed there is potential of disease outbreak due to suitable breeding conditions for vectors of cholera and typhoid. If the wastes find their way to water body its quality may be lowered. Malaria outbreak could also be exacerbated by the presence of open water ditches for breeding of anopheles mosquitoes. The major vulnerable groups are children who could be exposed to these conditions.

#### **6.2.2.11 Solid Waste Generation**

During construction, solid waste will be generated. These include papers used for packing solar panels, metal, plastics and timber remains among others. Dumping along the site will interfere with the aesthetic status of the area. This has a direct effect to the surrounding community. Disposal of the same solid wastes off-site could also be a social inconvenience if done in the wrong places. The off-site effects could be aesthetic, pest breeding, pollution of physical environment, invasion of scavengers and informal recycling communities. There is likely loss of existing under growth during the clearing of the way leaves for the cable installation work. There will also be solid waste generated from the excavation works. To dispose the soil, some of the excavated soil will be reused as backfill while the rest will be disposed of to the designated areas. Other solid wastes will include metallic pieces, wooden planks, and stone debris. All the wastes will be disposed of according to Waste Disposal and Management Regulations, 2006.

#### **6.2.2.12 HIV/AIDS**

Today the world has 42 million people living with HIV and the number is rising in every region of the world. The impact has a devastating effect on individuals and families as well as whole

communities. The movement of people exposing them to new situations, meeting new people and experiencing a change of their daily life creates an enhanced risk of acquiring HIV and/or other sexually transmitted diseases (STDs). Even small changes in a normally structured life can cause people to change behaviour and react in different ways than usual.

Also the influx of new people – like construction workers - can affect the number of new cases of HIV, because they often interfere with an otherwise stable situation and at the same time the newcomers themselves are at higher risk. During the construction phase of the project, there May be an increase in the interaction of persons of both genders. This interaction May at times result in sexual relations with potential subsequent increase in HIV/AIDS infection rates.

## **6.3 OPERATION PHASE**

### **6.3.1 Positive Impacts**

#### **6.3.1.1 Clean Energy Generation**

In response to international commitments as agreed to by the Kenyan government for the reduction of atmospheric greenhouse gas emissions, the proposed Malindi Solar project facility contributes to this goal. A mix of energy sources including wind, solar, hydro, wave and biogas form some of the identified areas of opportunity for energy capture in Kenya.

In line with commitments to reduce greenhouse gas emissions, Kenya's largest contributing sector, the energy sector, is taking steps to address this need. As a result, a transformation program is currently being employed to diversity to energy mix, so as to reduce a current dependency on fossil fuel derived electricity.

The Independent Power Producer company intends to see the contribution and feed-in of clean energy into the Kenya Power national grid. It is through development of Malindi Solar Power (40 MW) plant that the proponent shall contribute to this goal

#### **6.3.1.2 Improved visibility and security in the night**

Installation of street lighting will be a major positive impact to the residents of the project area. The lighting will enhance night vision to pedestrians, drivers, cyclists and other road users. Through the lighting, security is expected to improve.

### **6.3.1.3 Minimal Solid and Liquid Waste**

At the operation phase, there will be minimal waste generation. The nature of the project does not concern any activity leading to a lot of waste generation either solid or liquid waste.

### **6.3.1.4 Employment creation**

Employment opportunities are one of the long-term major impacts of Malindi Solar Power Plant project that will be realized after construction and during the operation and maintenance of the project components. These will involve security personnel, plant management staff and creation of businesses that will be located within the project sites.

### **6.3.1.5 Additional Power Capacity**

The project, upon completion will result in the additional energy generation source, sub-stations and power lines and the proponent will be enable energy suppliers to increase the electric power reliability and power supply capacity. This additional capacity would have a positive impact on the increasing power demands across the areas, in terms of economic empowerment, because Kenya Power would be able to supply more electric power, which supplementing by the existing energy generation sources.

### **6.3.1.6 Increased Company and Government Revenue**

There will be positive gain from the revenue obtained through sale of electricity to consumers and this adds revenue base for the proponent, Kenya power and the government at national and local levels.

### **6.3.1.7 Increase in volume of national electricity grid**

An electrical grid is an interconnected network for delivering electricity from suppliers to consumers. When referring to the power industry, "grid" is a term used for an electricity network, which may support all or some of the following three distinct operations:

- Electricity generation
- Electric power transmission
- Electricity distribution

The sense of grid is as a network, and should not be taken to imply a particular physical layout,



or breadth. "Grid" may be used to refer to an entire continent's electrical network, a regional transmission network or may be used to describe a sub network such as a local utility's transmission grid or distribution grid. The electric power, which is generated, is stepped up to a higher voltage—at which it connects to the transmission network. The transmission network will move (wheel) the power long distances—often across state lines, and sometimes across international boundaries—until it reaches its wholesale customer (usually the company that owns the local distribution network). Upon arrival at the substation, the power will be stepped down in voltage—from a transmission level voltage to a distribution level voltage. As it exits the substation, it enters the distribution wiring. Finally, upon arrival at the service location, the power is stepped down again from the distribution voltage to the required service voltage(s).

### **6.3.2 Negative Impacts**

#### **6.3.2.1 Increased pressure on infrastructure**

Huge projects of this magnitude have a potential of increasing pressure on existing infrastructure such as road and natural habitats, etc. This would be due to increased volumes on human and vehicle traffic along the access road.

## **6.4 DECOMMISSIONING PHASE**

### **6.4.1 Positive Impacts**

#### **6.4.1.1 Rehabilitation**

Upon decommissioning of the project, rehabilitation of the project site will be carried out to restore the site to its original status. This will include replacement of topsoil and re-vegetation which will lead to improved visual quality of the area.

#### **6.4.1.2 Employment opportunities**

Several employment opportunities will be created for the demolition staff.

### **6.4.2 Negative Impacts**

#### **6.4.2.1 Solid waste**

Demolition of the project structures and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including solar panels,

concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia which may be released as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

#### **6.4.2.2 Dust**

Large quantities of dust will be generated during demolition works. This will affect demolition staff as well as the neighbouring residents.

#### **6.4.2.3 Noise and Vibration**

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas.

## 7 MITIGATION MEASURES AND MONITORING PROGRAMMES

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This section highlights the mitigation measures for the expected negative impacts of the proposed Malindi Solar Power Plant project. The potential impacts and the possible mitigation measures have herein been analyzed under two categories: Construction and Operational.

### 7.1 MITIGATION OF CONSTRUCTION RELATED IMPACTS

#### 7.1.1 Air quality

Controlling dust during construction is useful in minimizing nuisance conditions. It is recommended that a standard set of feasible dust control measures be implemented for all construction activities. Emissions of other contaminants (NO<sub>x</sub>, CO<sub>2</sub>, SO<sub>x</sub>, and diesel related PMB<sub>10B</sub>) that would occur in the exhaust from heavy equipment are also included. The proponent is committed to implementing measures that shall reduce air quality impacts associated with construction. All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Construction vehicles drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon, and minimize idling of engines.

Dust emissions will be controlled by the following measures:

- Watering all active construction areas as and when necessary to lay dust.
- Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.
- Sweep daily (with physical sweepers) all paved access roads, parking areas and staging areas at construction sites.
- Fast growing trees will be planted around the construction site to act as a wind breaks to reduce the uplift of particulate matter that lead to respiratory diseases.

### **7.1.2 Minimize the effects of noise emitted from the site**

Significance of noise impacts depends on whether the project would increase noise levels above the existing ambient levels by introducing new sources of noise. Noise impacts would be considered significant if the project would result in the following:

- Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
- Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels.
- A substantial permanent increase in ambient noise levels (more than five dBA) in the project vicinity above levels existing without the project.
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

The proponents shall put in place several measures that will mitigate noise pollution arising during the construction phase. The following noise-suppression techniques will be employed to minimize the impact of temporary construction noise at the project site.

- Install portable barriers to shield compressors and other small stationary equipment where necessary.
- Use quiet equipment (i.e. equipment designed with noise control elements).
- Co-ordinate with relevant agencies regarding all substation construction activities in the residential areas.
- Install sound barriers for pile driving activity.
- Limit pick up trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.
- Construction/Demolition works should be done during the day when people are away and also the outside environment is also noisy.
- Adhere to the provisions of Noise Prevention and Control Rules 2005, Legal notice no. 24 regarding noise limits at the workplace.

### **7.1.3 Minimise the effects of exhaust emission**

In order to control exhaust emissions the following measures shall be implemented during

construction:

- Vehicle idling time shall be minimized
- Alternatively fuelled construction equipment shall be used where feasible
- Equipment shall be properly tuned and maintained

This will also be achieved through proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road.

#### **7.1.4 Hydrology and water quality degradation**

Several measures shall be put in place to mitigate the impacts that are likely to lead to Hydrology and water quality degradation. The proponent will prepare a hazardous substance control and emergency response plan that will include preparations for quick and safe clean up of accidental spills. It will prescribe hazardous-materials handling procedures to reduce the potential for a spill during construction, and will include an emergency response programme to ensure quick and safe cleanup of accidental spills. The plan will identify areas where refueling and vehicle maintenance activities and storage of hazardous materials, if any, will be permitted.

Soil sampling and trial holes digging will be conducted before construction begins and soil information will be provided to construction crews to inform them about soil conditions and potential hazards. If hazardous sub-stances are unexpectedly encountered during trenching, work will be stopped until the material is properly characterized and appropriate measures are taken to protect human health and the environment. If excavation of hazardous materials is required, they will be handled in accordance with applicable regulations. If suspected contaminated groundwater is encountered in the depths of the proposed construction areas, samples will be collected and submitted for laboratory analysis of petroleum hydrocarbons, metals, volatile organic compounds and semi-volatile organic compounds. If necessary, ground water will be collected during construction contained and disposed of in accordance with all applicable regulations. Appropriate personal protective equipment will be used and waste management will be performed in accordance with applicable regulations. Oil absorbent material, tarps and storage drums will be used to contain and control any minor releases of engine and other equipment oil.

### **7.1.5 Mushrooming of Kiosks and informal settlement**

In order to alleviate the impact of mushrooming of kiosks, on-site kiosk services with adequate sanitation during construction shall be provided. In addition commercial facilities have been provided for in the design. All plans in the area will require approval from relevant Government Departments.

### **7.1.6 Worker accidents and hazards when handling hazardous wastes**

Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided. In addition the proponent is committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Health and Safety Act, 2007. In this regard, the proponent is committed to provision of appropriate personal protective equipment, as well as ensuring a safe and healthy environment for construction workers as outlined in the EMP.

### **7.1.7 Populations of disease vectors**

Disease vectors such as rats, flies, and cockroaches increase where refuse is exposed or uncollected and can be a hazard. Complete refuse collection and handling service will be provided by the proponent so that this is not a hazard in compliance with the Public Health Act and as also required in the Occupational Safety and Health Act, 2007 regarding hygiene at the workplace.

### **7.1.8 Increased runoff**

Increased runoff from paved grounds and solar pannels causing extreme flooding and overflows of drainage systems shall be mitigated. Surface runoff and roof water shall be harvested and stored in underground reservoir for reuse. A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structures will be designed.

### **7.1.9 Possible exposure of workers to diseases**

Possible exposure of workers to diseases from building materials at construction site shall be mitigated by occupational health and safety standards enforcement as required in the OSHA, 2007.

#### **7.1.10 Worker accidents during construction and operation**

Workers accidents during the construction phase shall be mitigated by enforcing adherence to safety procedures and preparing contingency plan for accident response in addition safety education and training shall be emphasized.

#### **7.1.11 Reduction of impacts at extraction sites and efficient use of raw materials**

The proponent will source building materials such as sand, ballast and hard core from registered quarry and sand mining firms, whose projects have undergone satisfactory environmental impact assessment/audit and received NEMA approval. Since such firms are expected to apply acceptable environmental performance standards, the negative impacts of their activities at the extraction sites are considerably well mitigated.

To reduce the negative impacts on availability and sustainability of the materials, the proponent will only order for what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted or purchased in excessive quantities. Moreover, the proponent will ensure that wastage, damage or loss (through run-off, wind, etc) of materials at the construction site is kept minimal, as these would lead to additional demand for and extraction or purchase materials.

In addition to the above measures, the proponent shall consider reuse of building materials and use of recycled building materials. This will lead to reduction in the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites

#### **7.1.12 Minimization of vegetation disturbance**

Clearance of part of the vegetation at the project site to pave way for construction will be inevitable. However, the proponent will ensure proper demarcation of the project area to be affected by the construction works. This will be aimed at ensuring that any disturbance to flora and fauna is restricted to the actual project area and avoid spill over effects on the neighbouring areas. In the same vein, there will be strict control of construction vehicles to ensure that they operate only within the area to be disturbed by access routes and other works.

Another important measure aimed at reducing disturbance of vegetation in the project area will be preservation of individual trees within the site. In addition, the proponent has committed itself to re-vegetation of some of the disturbed areas through implementation of a well designed landscaping programme. It is recommended that part of the topsoil excavated from the construction site be re-spread in areas to be landscaped to enhance plant health.

#### **7.1.13 Minimization of run-off and soil erosion**

The proponent will put in place some measures aimed at minimizing soil erosion and associated sediment release from the project site during construction. These measures will include terracing and levelling the project site to reduce run-off velocity and increase infiltration of rain water into the soil. In addition, construction vehicles will be restricted to designated areas to avoid soil compaction within the project site, while any compacted areas will be ripped to reduce run-off.

#### **7.1.14 Minimization of construction waste**

It is recommended that demolition and construction waste be recycled or reused to ensure that materials that would otherwise be disposed of as waste are diverted for productive uses. In this regard, the proponent is committed to ensuring that construction materials left over at the end of construction will be used in other projects rather than being disposed off. Such measures will involve the sale or donation of such recyclable/reusable materials to construction companies, local community groups, institutions and individual residents or home owners.

The proponent shall put in place measures to ensure that construction materials requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal.

It is further recommended that the proponent should consider the use of recycled or refurbished construction materials. Purchasing and using once-used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste.

Additional recommendations for minimization of solid waste during construction of the project include:-

- i. Use of durable, long- lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time



- ii. Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements
- iii. Use of construction materials containing recycled content when possible and in accordance with accepted standards.

#### **7.1.15 Reduction of energy consumption**

The proponent shall ensure responsible electricity use at the construction site through sensitization of staff to conserve electricity by switching off electrical equipment or appliances when they are not being used. In addition, proper planning of transportation of materials will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the proponent shall monitor energy use during construction and set targets for reduction of energy use.

#### **7.1.16 Minimization of water use**

The proponent shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water use. The proponent will install water-conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff.

#### **7.1.17 Controlling oil spills during construction phase**

The proponent will control the dangers of oil, grease and fuel spills during construction by maintaining the machinery in specific areas designed for this purpose. Machinery site repair will be discouraged and repair work restricted to only approved garages to avoid pollution from oil, grease and fuel.

#### **7.1.18 Public Health safety and Awareness**

- i. The contractor should provide a small section of the construction site with a shed and a water stand where the food can be served to the construction workers to promote hygiene and health of the employees.
- ii. A fully equipped first aid kit should be provided at the site.
- iii. The contractor must have workmen's compensation cover as required by law (The Workmen's Compensation Act), as well as relevant ordinances, regulation and union's

agreements.

- iv. The workers, immediate neighbour and other stakeholders should be sensitized on the dangers and risk associated with the construction works for enhanced self responsibility on personal safety.
- v. Disabled access features and safety signage should be placed strategically around and within the project area.
- vi. Appropriate sanitation conveniences should be provided at the site as required in the OSHA, 2007 and echoed in the Public Health Act.

#### **7.1.19 Mitigate HIV/Aids**

The objective of the HIV/AIDS initiatives would be to reduce the risks of exposure to and spread of the HIV virus in the project area. Major targets would be construction workers, institutional communities and the general members of the community, particularly the youth. Recommended measures are as follows:

- Develop appropriate training and awareness materials for information, education and communication (IEC) on HIV/AIDS;
- Identify other players (local CBOs, NGOs, and government organizations) on HIV/AIDS for enhanced collaboration;
- Develop an intervention strategy compatible with the Solar project construction programmed to address success of the HIV/AIDS prevention and provide peer educators for sustainability in collaboration with other stakeholders; and
- Integrate monitoring of HIV/AIDS preventive activities as part of the Solar project supervision. Basic knowledge, attitude and practices are among the parameters to be monitored, and particularly on provision of condoms, status testing and use of ARVs.

## **7.2 MITIGATION OF OPERATION PHASE IMPACTS**

### **7.2.1 Ensuring efficient solid waste management**

The proponent will be responsible for efficient management of the small solid waste if any generated by the project during its operation. In this regard, the proponent will provide waste handling facilities such as waste bins and skips for temporarily holding domestic waste generated at the site. In addition, the proponent will ensure that such disposed of regularly and appropriately. The proponent will adhere to the Environmental Management and Coordination (Waste Management), Regulations 2007.

### **7.2.2 Ensure efficient energy consumption**

The proponent plans to install an energy-efficient lighting system at the project area. This will contribute immensely to energy saving during the operational phase of the project. To complement these measures, it will be important to monitor energy use during the operation of the proposed solar project and set targets for efficient energy use.

### **7.2.3 Ensure general safety within the facility**

A perimeter fence will be erected round the project site and a security lighting system installed. A competent security firm may be engaged to ensure the general safety and security at all times within and around the solar project.

## **7.3 MITIGATION OF DECOMMISSIONING PHASE IMPACTS**

### **7.3.1 Efficient solid waste management**

Solid waste resulting from demolition or dismantling works will be managed as described in Section 7.2.1.

### **7.3.2 Reduction of Dust Concentration**

High levels of dust concentration resulting from demolition or dismantling works will be minimized as described in Section 7.1.1.

### **7.3.3 Minimization of Noise and Vibration**

Significant impacts on the acoustic environment will be mitigated as described in Section 7.1.2.

## 8 ANALYSIS OF PROJECT ALTERNATIVES

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The Environmental Impact Assessment study also involved the examination of the alternatives to the proposed solar power project. This is essential since it allowed the project proponent to make an informed decision regarding not only the location of the project, but also technologies that will be applied during the construction phase. This process also ensured that the project activities are located in suitable locations and are cost effective. The following sections provide the analysis of alternatives were considered in the case of the proposed project.

The alternative consists of the proponent's/applicant's final proposal with the inclusion of the legal guidelines, regulations and procedures as stipulated in the EMCA, 1999 which aims at reducing environmental impacts to the maximum extent practicable. This section analyses the project alternatives in terms of site and technology options.

### 8.1 Site Alternatives

In determining the most appropriate sites for the establishment of the new PV solar power plant, various options were investigated. This site selection process considered the following criteria:

- The availability and accessibility of primary resources required for the operation of the power plant, such as sun (i.e. the required Direct Normal Insolation) and water;
- Availability of land to locate the site and associated infrastructure;
- The availability and accessibility of infrastructure for the provision of services, manpower and social structure for the construction and operation of the power plant;
- The ease of integration of the new power plant into the existing National Transmission network/grid and the environmental impacts associated with this integration; and
- General environmental acceptability in terms of social impacts, water utilisation, general ecology, etc.

Through a series of feasibility and high-level screening studies undertaken, the Weru Ranch site is ranked as the most favourable area for the establishment of the Proposed Malindi solar power and photovoltaic plant (40 MW).

## 8.2 No Project Option

The *No Project option* in respect to the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. This option will however, involve several losses both to the proponent, government and the society as a whole. The *No Project Option* is the least preferred from the socio-economic and partly environmental perspective due to the following factors:

- There will be no added values to the proposed project site.
- Lack of attempts to achieve Vision 2030, working toward clean energy production.
- There will be no added value to other developments in the neighbourhood.
- The proponent will not benefit from the revenue expected from the Solar power facility.
- The government kitty will not benefit from the revenue to be earned due to the establishment of the proposed solar project.
- The economic status of the Kenyans and the local people would remain unchanged.
- The local skills would remain under utilized.
- Reduced interaction both at local, national and international levels.
- No employment opportunities will be created for thousands of Kenyans who will work in the project
- Increased urban and rural poverty and crime in Kenya.
- Discouragement for investors to produce this level of affordable facility to the public.
- Development of infrastructural facilities (roads, electrical etc. will not be undertaken).

From the analysis above, it becomes apparent that the *No Project Option* is no alternative to the proponent, local people, Kenyans, and the government of Kenya.

## 8.3 The Proposed Development Option

Under the *Proposed Development Option*, the developer of the proposed project would be issued with an EIA License. In issuing the license, NEMA would approve the proponent's proposed development of the Project, provided all environmental measures are complied with during the

construction period and operational phases.

The alternative consists of the proponent's/applicants final proposal with the inclusion of the NEMA guidelines and regulations and procedures. This is as stipulated in the Environmental Management and Coordination Act (EMCA) of 1999, which aims at reducing environmental impacts to the maximum extent practicable.

#### **8.4 The comparison of Alternatives**

Under the proposed Development Alternative, the project would fully develop the proposed Malindi Solar power project. This would provide employment directly and indirectly to the Kenyan population. It would provide jobs for the workers during construction. After completion more jobs would be generated for management of the project. More energy will also be provided in the market thus giving consumers a wider range of products as well as reduced prices. The project would also increase government revenue through the payment of the various fees by the occupier before engaging in any business. This way, the industrial development would expand and the country's GDP would go up.

Under the No Action Alternative, there would be no development whatsoever. There would be no increased benefits from the site neither would there be the insignificant environmental Impacts. With the implementation of the proposed mitigation measures, including sound construction management practices, the anticipated impacts on soils and drainage, air and water quality will be reduced and where possible avoided. Commitment associated with this alternative would ensure that potential negative impacts are avoided or reduced to levels of insignificance.

#### **8.5 Alternative to technology**

Choice of technology is normally an engineering decision informed by consideration of site conditions, availability of appropriate materials, labour versus capital intensive policy, budgetary provisions, requirements for Operation and Maintenance etc. the choice of entire design will be subjected to review to ensure that the selected technology offers a combination of technical feasibility, economic viability and socially acceptable. The proposed technology seems suitable both to the proponent and the environment since it has minimal environmental pollution or even

degradation.

### **8.6 Analysis of Alternative Construction Materials and Technology**

The proposed development will be constructed using modern, locally and internationally accepted materials to achieve public health, safety, security and environmental aesthetic requirements. Equipment that saves energy and water will be given first priority without compromising on cost or availability factors. The concrete will be made using locally sourced stones e.g. cabro paving , cement, sand (washed and clean), metal bars and fittings that meet the Kenya Bureau of Standards requirements.

## 9 ENVIRONMENTAL MANAGEMENT/MONITORING PLAN

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### 9.1 Introduction

This Section presents the Environmental Management Plan (EMP) that will need to be implemented by the proponent to prevent or reduce significant negative impacts to acceptable levels. EMP for development projects provides a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition the EMP assigns responsibilities of actions to various actors and provides a timeframe within which mitigation measures and monitoring can be done.

EMP is a vital output of an Environmental Impact Assessment as it provides a checklist for project monitoring and evaluation. The EMP outlined in the sections below has addressed the identified potential negative impacts and mitigation measures of the proposed solar project, based on the Chapters of Environmental Impacts and Mitigation Measures of the expected Negative Impacts.



**Table 5: Environmental Management/Monitoring Plan**

Negative Impacts	Mitigation Measures	Responsibility	Timeframe	Monitoring Frequency	Cost (Kshs)
<b>A. CONSTRUCTION PHASE</b>					
<b>Bio-Diversity Conservation (Vegetation)</b>					
1. Bio-diversity degradation (vegetation)	Replanting of trees along the edges of the project site.	Project Engineer, Contractor, Environmental Officer.	Construction Phase	Regularly	30,000
<b>Management of storm-water</b>					
2. Soil erosion	Adopt an appropriate landscaping programme to curb soil erosion within the project area	Project Engineer, Contractor,	Construction Phase	Daily, weekly or monthly through progress reports	150,000
3. Alteration of natural drainage can lead to localized flooding	Ensure well engineered site leveling and ground grading to minimize flooding where	or, Environmental	Construction Phase		

Negative Impacts	Mitigation Measures	Responsibility	Timeframe	Monitoring Frequency	Cost (Kshs)
	applicable	Officer.			
	Utilize spoil earth materials as filling for low lying flood prone areas		Construction Phase		
4. Works coinciding with rain may adversely affect drainage	Schedule works during dry season to the extent possible	Contractor	Construction Phase	Through monthly progress reports	100,000
5. Impeded drainage and or inefficiency of drainage structures	Any area beyond project boundaries compacted as a result of project activities should be ripped to enhance ground water infiltration		Construction Phase		
<b>Reduce air pollution within the project site</b>					
6. Air pollution by dust	Enforcement of air quality standards accepted locally and internationally	Contractor/Propo nent	Construction Phase	Continuous	50,000
<b>Curb noise pollution within the project site</b>					
7. Noise pollution from site activities	Enforcement of standards accepted locally and	Contractor or	Construction Phase	Daily	50,000

Negative Impacts	Mitigation Measures	Responsibility	Timeframe	Monitoring Frequency	Cost (Kshs)
	internationally				
	Strictly use appropriately tuned/ maintained equipment			Daily	
	Provision of ear plugs			Daily	
<b>Improved health and sanitation throughout project cycle</b>					
8. Poor health and sanitation as a result of the project activities	Provide adequate mobile toilets and maintain them for use by site workers	Contract or	Throughout Construction Phase	Daily	40,000
	Workers to utilize toilets for locals on consent	Contract or		Daily	
	Create awareness prevention on HIV/AIDS and other related diseases	Contract or & Propone nt		Continuous	50,000
	Project wastes to be collected and judiciously disposed	Contract or		Daily	10,000
	Create awareness on the dangers posed by stagnant	Contract or &		Continuous	

Negative Impacts	Mitigation Measures	Responsibility	Timeframe	Monitoring Frequency	Cost (Kshs)
	water	Proponent			
<b>Waste management at the project site</b>					
9. Litter at the project site	Provide adequate waste collection facilities on site	Contractor	Throughout Construction Phase	Daily	10,000
	Dispose collected waste regularly	Contractor		Daily	
	Dispose solid waste in accordance with the Environmental Management and Coordination (Waste Management) Regulations, 2006	Contractor		Continuous	
<b>Socio-environmental Management</b>					
10. Disruption of established Socio-environmental values of the society	Notify the locals prior to commencement and settle any dispute	Contractor and Ppoponent	Construction Phase	Continuous	20,000
	Respect any culturally sensitive area and avoid disturbing	nt	Construction Phase	Continuous	

Negative Impacts	Mitigation Measures	Responsibility	Timeframe	Monitoring Frequency	Cost (Kshs)
	Avoid settled areas as far as it is practically sound		Construction Phase	Continuous	
	Give priority to locals in employment matters		Construction Phase	Always	
<b>Safe Workplace</b>					
	Adoption of the prepared Health and Safety Plan			1 Month	50,000
11. Degradation of Conservancy areas	Enhanced Conservation activities	Propone nt/Private Entities	Operation Phase	Continuous	100,000

## 10 MONITORING PLAN

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### 10.1 Introduction

An Environmental Monitoring Plan is vital for any Environmental Impact Assessment of a development project. The monitoring plan helps in assessing the effectiveness of proposed mitigation measures, in assessing changes in environmental conditions and to provide warning of significant deterioration in environmental quality for further preventive action. The activities and frequency of monitoring is as presented in the proposed EMP

Environmental monitoring will be carried out to ensure that all the proposed project activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. The Contractor in liaison with the Proponent will engage a responsible person for implementation of social/environmental requirements. The contractor and the proponent have the responsibility to ensure that the proposed mitigation measures are properly implemented during all the project phases.

The principle elements of a monitoring plan are:

- A clear statement of aims and objectives,
- Proposed frequency of monitoring,
- An estimate of the resources required for project implementation,
- Delineation of responsibility to implement the monitoring plan,
- Clear project demarcation to avoid encroachment into protected and sensitive areas,
- Occupational Health and Safety aspects to ensure the site is safe,

Specific attention has been made to ensure that the monitoring plan conforms to the following criteria, it is auditable in that it:

- Identifies specific quantifiable monitoring regimes,
- Delineates key lines of accountability,
- Associates mitigation and monitoring tasks to specific impacts,
- Gives guiding costs of implementation,

- Ensures flexibility to enable incorporation of additional monitoring and mitigation techniques as deemed necessary throughout the life of the project,
- Conforms to all best practice principles by acknowledging the existence of both long time and immediate impacts and the resulting mitigation measures necessary to deal with such and,
- Identifies key corporate commitments made by the proponent, with regard to its environmental performance.

### **10.2 Monitoring Requirements**

To ensure that the Environmental Impact Assessment is effective, environmental monitoring is mandatory. Factors to be monitored should include:

- Climatic factors (wind, temperature, rainfall, etc),
- Solid waste management systems effectiveness in all the project phases,
- Effects of the proposed project impacts to the environmental resources (soil, water and air) in the traversed area,
- Effects of the proposed project on the Socio-economic status of the communities living in the traversed area,
- Biodiversity changes in the area traversed by the proposed project using various indicators,

### **10.3 Monitoring Responsibilities**

The law requires that the Proponent of any proposed project ensure that no segment of the environment is threatened by the activities of the proposed project. Therefore, project management will be required to conduct regular monitoring of the project to comply with the laws of the land. However, it is recommended that the monitoring responsibility for the construction phase only be vested on the contractor through a written agreement with proponent who legally ought to be the responsible party. Otherwise overall monitoring through all the other project phases rests on the proponent in liaison with the other parties as presented in the EMP.

## 11 CONCLUSION AND RECOMMENDATION

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The contents of this study report have sought to identify and assess key issues relating to the proposed construction of the Malindi Solar Power (40 MW) Plant facility on a 651 acres of land, in Weru Group Ranch in Lango Baya Location in Malindi District, Kilifi County.

The project is considered one of the best and safe energy production projects. The nature of the project does not involve significant negative environmental impacts such as emissions or other pollutants. The main potential impacts are minor and related to the construction including land leveling and support structure which are considered minor and localized for relatively short duration. Impacts of the environment on the project will be minimized through implementation of design integrated measures.

Significant environmental impacts associated with the EIA process included:

- Positive Socio-economic impacts on the local community and at a regional context.

Socio-economic impacts will be further enhanced through skills development training in the community, financial guidance from the assistance of a financial advisor and investigations to retrofit the facility to ensure continued long-term income and employment. In addition, the visual impact assessment also states that the visual impact as perceived by the community is neutral as they are in favor of the development.

In consolidation thereof, no environmental fatal flaws were identified to be associated with the proposed facility. Majority of impacts identified were of a medium to low significance and can be suitably mitigated to acceptable levels, provided that specifications are stipulated in the Environmental Management Program are followed and adhered to.

It is thus in the view of the environmental assessment consultants, supported by the findings of specialist determinations, that the development of the proposed the Malindi 40 MW PV facility



with the guidance of the Environmental Management Program be allowed to commence. The following recommendations are given:

- Should further amendments to the design of the facility be made, a copy of the revised layout must be submitted to the Department of Environmental Affairs for approval prior to the commencement of construction.
- A comprehensive storm water management plan should be completed prior to the initiation of construction, for effective handling and diversion of rain and surface water.
- The use of designated roads should be maintained under all circumstances, except under exceptional circumstances.
- Disturbed areas should be rehabilitated as soon as possible after the construction and decommissioning periods.
- The facility and compliance with the Environmental Management Plan should be monitored sporadically during the operational phase of the project.

## REFERENCES

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1. The Making of a Framework Environmental Law in Kenya, *by ACTS press, UNEP-ACTS, 2001*
2. Environmental Assessment Sourcebook Volume I (Policies, procedures, and cross-sectoral issues), Volume II ( sectoral guidelines) Volume III (guidelines for Environmental assessment of energy and industry projects) *by, World Bank, Washington, 1991*
3. Malindi District Development Plan, *2012.*
4. *Dharani N. 2002. Field guide to common Tree & Shrubs of East Africa. Struck Publishers, Cape Town, South Africa*
5. Environmental Management and Coordination Act, *1999.*
6. Relevant government Acts.
7. Sanitation Engineering, volume I and II; *by R.S. Deshpan*
8. Pollution prevention and abatement handbook – Part III, (September, 2001)
9. <http://www.kenya districts.org/content/view/69.60>.
10. Africa Development Bank, Integrated Environmental and Social Impact Assessment Guidelines, October 2003

## Appendices

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1. Minutes of public baraza
2. List of participants during the public baraza
3. Certificate of Incorporation
4. Land Lease/Sale Agreement
5. Summary of bill of quantities
6. Approved Site Plans and layouts

## **Appendix 1: Minutes for Public Baraza**

### **MINUTES OF PUBLIC MEETING FOR THE PROPOSED MALINDI SOLAR POWER PLANT (40MW) PROJECT IN WERU GROUP RANCH NO. 19 IN LANGO BAYA LOCATION, MALINDI DISTRICT IN KILIFI COUNTY, MEETING HELD ON 20<sup>ND</sup> NOVEMBER, 2015 AT JILORE HALL**

#### **AGENDA**

1. Opening Remarks.
2. Project Description
3. Issues raised
4. Suggestions
5. A.O.B

#### **Preliminary**

The meeting began at 10.00a.m, chaired by the Area Chief, Mr. Charles M. Mulewa. One of the residents, David Karisa Lazaro gave a word of prayer, after which the chairperson requested the members present to introduce themselves. The Chief then briefed the community about the meeting agenda and welcomed the EIA consultants.

#### **Min 1/11: Opening Remarks**

The Consultants gave a brief overview of the whole evolution of environmental concerns and law that led to the present situation .They explained that in the Environmental Impact Assessment process public consultation was a must, acknowledging that the public meeting was an important stage as is a requirement in the Environmental Management and Coordination Act (EMCA) 1999. They also stated that the purpose of the meeting was to create awareness of the proposed Malindi Solar project, to obtain views/ concerns of the stakeholders, and to clarify issues that are not clear about the Solar project. The consultant also gave a breakdown of the procedures involved in the capturing the views, presentation in the report and the follow up to the resolutions thus formulated to the time when a decision is made by the authority (NEMA).

#### **Min 2/11: Project Description**

The consultant gave a brief description of the project, stating that it will involve construction a 40MW grid connected PV plant at Weru Group Ranch No. 19, in Lango Baya area of Malindi in Kilifi County. The project proponent, Malindi Solar Group wishes to develop the Malindi project under the Feed-In-Tariff policy. Under this policy the maximum installed capacity for a grid connected PV plant is capped at 40MW. Development of renewable energy projects it's a priority given to investors by the Kenyan government in order to curb the power crisis experienced country wide.

**Min 3/11: Issues Raised**

The Consultant invited the members to give their views regarding the project as they wished, and the following concerns were raised:

**• Positive impacts**

The community applauded the project construction, with each of them giving a go ahead of the project. Some of the reasons for the project appraisal were as follows:-

- Job creation for the community: the community felt that the project development would create job vacancies at all levels of the construction and implementation process, hence improving means of livelihood of the people.
- Increased electricity power supply source at the neighbourhood.
- Enhanced Security due to lighting in the neighbourhood at night.
- Increased business in the locality.
- Increased boda boda business opportunity in the vicinity.
- Contribution to the national economy growth.
- Enhance development to Were Ranch area and its Environment.

**Min 4/11: Community Suggestions to the proponent**

It was suggested that the proponent to consider putting the following issues into practice once the project starts:-

- Ensure that there enough security in the area.
- Once employing personnel to consider giving priority to the local community.
- To put some community service facilities for livelihood improvement.
- Conserve the environment.

**Min 5/11: A.O.B**

The Consultants requested the people present to follow-up on any communications and memorandum issued so that the final .Environmental Impact Assessment Study Report and put in their comments for further action, and that NEMA will also request for Public comments through the Newspapers. It was also said that the report would be available at the County Environment office in Malindi, where the residents and other stakeholders may go to review it and give their comments.

The Consultant assured the residents that recommendations for the project will be made accordingly.

**Adjournment**

There being no other business for discussion the meeting was adjourned at 1.00 pm with prayer from the one of the Weru Group Members.

**SECRETARY- EIA EXPERT**

NAME: FAITH M. MOSES SIGN..... DATE.....

**Confirmed by Proponent:**

NAME: Jared Keburi SIGN..... DATE: 01.12.2015

**Appendix 2: List of Participants During Public Baraza**

<b>PROPOSED MALINDI SOLAR POWER PROJECT</b>				
<b>Environmental Impact Assessment Baraza held in Jilore Social Hall on 20<sup>th</sup> November 2015</b>				
S/NO	NAME	ID NO	TEL.NO	SIGNATURE
1.	CHARLES M. MULEWA	4965094	0723532024	[Signature]
2.	FRANKLIN C. MUELDI	3883950	0710244302	[Signature]
3.	NATHANIEL GALDI NGOROYO	4581221	0717715852	[Signature]
4.	SHADRACH CHOGO KERRA	5336965	071238876	[Signature]
5.	EMMANUEL KOMBE JEREMIA	16128465	0700807449	[Signature]
6.	SAMUEL M. K. BAYA	1880022	0722816398	[Signature]
7.	JONES BAYA MWERI	3650094	0703132919	[Signature]
8.	REV DANIEL KAHIKI HARE	016014	0706710597	[Signature]
9.	ROBEN TUMBA JARRET	4583432	0707529832	[Signature]
10.	ALFRED K. BAYA	0749819	0719869876	[Signature]
11.	JOSHUA NZAI KAIANA	6583588	0726336920	[Signature]
12.	GEORGE MARHA KAMBI	2122263	0726089840	[Signature]
13.	DAVID KARISA LAZARO			[Signature]
14.	MONICA MWERI MAITA	8527595	0729325451	[Signature]
15.	ALBERTON KITSAO NGUMBAO	0746484	0706570916	[Signature]
16.	HARIEL KITUNGA	0310415	0707442661	[Signature]
17.	JOHN MWARUWA UMENGO	2156609	0725620274	[Signature]
18.	NAOMI JUMUKI KAHISO	4026407	075258890	[Signature]
19.	HANNINGTON KAIANA GACAMA	9772230	0716641652	[Signature]
20.	ISHUMAELE KENGA IHA	4970587	0713306700	[Signature]
21.	PETER MIURI	6720908	0721204716	[Signature]
22.				
23.				