REPUBLIC OF KENYA

SCALING-UP RENEWABLE ENERGY PROGRAM (SREP)

INVESTMENT PLAN FOR KENYA

DRAFT

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SREP Investment Plan for Kenya

Executive Summary

Introduction

1. This is Kenya's Investment Plan (IP) for the Scaling-Up Renewable Energy (SREP) Program funding. The IP is in line with national renewable energy development strategy as set in the Least Cost Power Development Plan (LCPDP), Rural Electrification Master Plan, Sessional Paper No. 4 of 2004 (The energy policy document), the Energy Act of 2006, the Feed-in Tariff (FiT) Policy, the Kenya National Climate Change Response Strategy and Kenya Vision 2030 (the National economic development blueprint).

2. Kenya is one of the six Pilot Countries selected to benefit from SREP. The SREP program will support Kenya's initiatives towards achieving a transformational change that will lead the country towards low greenhouse gas (GHG) emission development pathway by harnessing the abundant renewable energy resources in country.

Country and Sector Context

3. Kenya has a long-term development strategy, The Vision 2030, whose aim is to drive the country into a globally competitive and prosperous economy with high quality of life. Covering the period 2008 to 2030, the country's new development blueprint aims to transform Kenya into a newly industrializing, "middle-income country providing a high quality life to all its citizens by the year 2030." The Medium-Term Plan (MTP - 2008 to 2012) was prepared to implement the first phase of the strategy. It calls for rehabilitating the road network, upgrading the railways, improving urban public transport, and expanding access to electricity and safe water

4. The private sector is a key contributor to economic growth particularly in the tourism, building and construction, transport and communication, agriculture, manufacturing, and financial service though internal infrastructural challenges impede the sector from reaching its full potential.

5. The energy sector has been restructured as per the Sessional Paper No.4 of 2004 and the Energy Act No.12 of 2006. The institutional arrangement in the electricity sub sector in Kenya comprises - the Ministry of Energy (MOE), Energy Regulatory Commission (ERC), Kenya Generating Company (KenGen), Kenyan Power and Lighting Company (KPLC), the Rural Electrification Authority (REA), Kenya Electricity Transmission Company (KETRACO), Geothermal Development Company (GDC) and Independent Power Producers (IPPs).

6. The current electricity demand is 1,191 MW while the effective installed capacity under normal hydrology is 1,429 MW. Generation capacities from Hydro, Geothermal, baggase (cogeneration) and wind are 52.1%, 13.2%, 1.8% and 0.4% respectively while fossil based thermal contributes at 32.5%%. The peak load is projected to grow to about 2,500MW by 2015 and 15,000 MW by 2030. To meet this demand, the projected installed capacity should increase gradually to 19,200 MW by 2030.

7. It costs approximately KES 35,000 (US$422 at an exchange rate of 83) to connect to the grid and about 15 US cents equivalent per kWh of electricity service. The costs are high because of the substantial investments needed to build new generation, transmission and distribution

facilities, combined with the high operating cost of electricity supply. This high cost is a major obstacle to the expansion of electricity connection to low-income households.

8. Weak transmission and distribution network, low countrywide electricity access and over-reliance on hydropower which is vulnerable to vagaries of weather, are some of the challenges facing the electricity sector sub-sector. To address the challenges the Government has formulated strategies whose objectives are to rapidly expand installed electricity capacity, expand and upgrade the transmission and distribution networks, and develop renewable sources of energy: geothermal, solar, wind, biomass and small hydropower.

9. In keeping with the Millennium Development Goals, Kenya is committed to reducing by half the number of people who lack access to modern energy services by 2015 and reducing by half the number of people living in poverty. Access to affordable energy is an essential prerequisite to achieving economic growth and poverty reduction in Kenya. The majority of people who rely on biomass for thermal energy and who lack access to electricity are in rural areas and the specific "'people" who cook with biomass or coal are almost universally women. The lack of access to affordable energy services -- "energy poverty" -- disproportionately affects women and girls due to their traditional roles, household responsibilities, and low socio-political status. The Government is expanding access of electricity to the rural areas through the rural electrification programme covering both grid extension and off-grid systems. Further, in collaboration with development partners, Non-Governmental Organizations and the private sector the Government is promoting the growth of wood fuel as well as the efficient and sustainable use of biomass resources. The Government is also formulating a strategy to make the country "kerosene free" by substituting kerosene with renewable energy for lighting.

Renewable Energy Sector Context

10. Through Sessional Paper No. 4 of 2004, Energy Act of 2006 and the Feed-in-Tariff (FiT) policy, the Government is committed to promoting electricity generation from Renewable Energy Sources (RES). The Government further intends to set up a Green Energy Fund Facility under the National Task Force on Accelerated Development of Green Energy and whose purpose is to lend funds to viable Renewable Energy projects at concessional rates.

Wind

11. Kenya's wind installed capacity is 5.1 MW operated by KenGen at the Ngong site. The low exploitation level of the resource prompted the Government to develop the Feed-in Tariffs (FiT) Policy which provides for a fixed tariff not exceeding US Cents 12.0 per Kilowatt-hour of electrical energy supplied in bulk to the grid for wind generated electricity.

12. High capital cost and lack of sufficient wind regime data are some of the barriers affecting the exploitation of wind energy resource. Moreover, potential areas for wind energy generation are far away from the grid and load centres requiring high capital investment for the transmission lines.

13. The Ministry of Energy developed the Wind Atlas in 2003 with indicative data to guide investors. To augment the information contained in the Wind Atlas, the Ministry, with the assistance of Development Partners is installing 53 Wind Masts and Data Loggers to collect site specific data.

Solar

14. Kenya receives daily insolation of 4-6kWh/m2. Solar utilization is mainly for Photovoltaic (PV) systems, drying and water heating. The Solar PV systems are mainly for telecommunication, cathodic protection of pipelines, lighting and water pumping.

15. High initial capital costs, low awareness of the potential opportunities and economic benefits offered by solar technologies, and lack of adherence to system standards by suppliers are some of the barriers affecting the exploitation of solar energy resource

16. The Government has zero-rated import duty and removed Value Added Tax (VAT) on renewable energy, equipment and accessories. The Energy Regulatory Commission has prepared Solar Water Heating Regulations. These steps are intended to mitigate the challenges faced in exploiting the solar energy resource

Small Hydros

17. Kenya's total installed large hydropower capacity is 743 MW. Small hydro potential is estimated at 3,000MW of which it is estimated that less than 30MW have been exploited and only 15MW supply the grid.

18. High installation cost averaging US$ 2,500 per KW, inadequate hydrological data, effects of climate change, limited local capacity to manufacture small hydro power components have combined to impede exploitation of small-scale hydro-electricity.

19. To mitigate the challenges the Government is carrying out phased feasibility studies to establish the capacities as well as appraise and determine the viability of various small hydro sites across the country

Biomass

20. Biomass contribution to Kenya's final energy demand is 70 per cent and provides for more than 90 per cent of rural household energy needs. The main sources of biomass for Kenya include charcoal, wood-fuel and agricultural waste.

21. The Government has identified the existence of a substantial potential for power generation using forestry and agro-industry residues including bagasse. The total potential for cogeneration using sugarcane bagasse is 193MW. Mumias Sugar Company (Private entity) generates 35MW out of which 26MW is dispatched to the grid. However, opportunities by other sugar factories have not been exploited.

22. The FiT policy provides for biomass energy resource generated electricity with a firm power fixed tariff not exceeding US Cents 8.0 per Kilowatt-hour of electrical energy supplied in bulk to the grid operator at the interconnection point. Under this policy, 18MW cogeneration project for use of cane bagasse at the coastal region of Kenya has been approved.

Geothermal

23. Geothermal resources in Kenya are located within the Rift Valley with an estimated potential of between 7,000 MWe to 10,000 MWe spread over 14 prospective sites. Geothermal has numerous advantages over other sources of power: it is not affected by drought and climatic variability; has the highest availability at over 95 %; is green energy with no adverse effects on the environment; indigenous and readily available in Kenya unlike thermal energy that relies on imported fuel. This makes geothermal the most suitable source for base load electricity generation in the country.

24. The current installed capacity in the country is 198 MW with 150 MW operated by KenGen and 48 MW by OrPower 4, both in the Olkaria Block. An additional 280 MW, scheduled for commissioning in 2013, is also under development in the same Block. Drilling is ongoing in the Menengai Field for Phase I of 400 MW whilst initial project development activities have commenced for the development of 800 MW in the Bogoria – Silali Block. These are geared towards meeting the Vision 2030 Medium Term target of 1,600 MW by 2016 and eventually 5,000 MW by 2030.

25. Realizing the need to reduce the long gestation periods in the development of geothermal the Government has set up the Geothermal Development Company (GDC) to undertake integrated development of geothermal through initial exploration, drilling, resource assessment and promotion of direct utilization of geothermal. GDC is 100% owned and funded by the Government. By undertaking the initial project activities, GDC will absorb the attendant risks associated with geothermal development and therefore open up opportunities for both public and private participation.

26. The Government is cognizant that joint efforts will be required from both the public and private sectors for accelerated development of the country's geothermal resources. Therefore, under the FiT Policy, the Government has gazetted a fixed tariff not exceeding US Cents 8.5 per Kilowatt-hour of electrical energy supplied in bulk to the grid operator at the interconnection point for upto 75 MW.

Contribution to National Energy

27. The Least Cost Power Development Plan (LCPDP) envisions that Kenya's electricity peak demand will increase from 1,302 MW in 2011 to 15,026 MW by 2030 in line with the Vision 2030 which envisages energy as a key enabler for economic growth across the country. Accordingly, through the Rural Electrification Master Plan, the Government seeks to have 100% connectivity across the country through grid extensions and off-grid systems. To meet the increased electricity demand due to the enhanced economic activities various generation sources have been considered, targeting 5,110 MW from geothermal, 1,039 MW from hydro, 2,036 MW from wind, 3,615 MW from thermal, 2,000 MW from imports, 2,420 MW from coal and 3,000 MW from other sources. The investments required for generation, transmission and distribution to meet this demand are enormous.

Program Description

28. This program proposes the development of solar, wind, hydro, biomass, geothermal and transmission line projects.

Hybrid Mini-grids

29. The Hybrid Mini-grid Project proposes to increase the proportion of renewable energy (solar and wind) in existing and planned mini-grids to 30%. The Government has initiated incorporation of solar PV and wind systems in existing off-grid diesel power plants in arid and semi-arid areas to substitute part of the generation provided through fossil fuel. The proposed project would result in increased renewable energy in the system as well as increased energy generation. SREP funds would enhance the ongoing and planned hybrid projects . The private sector will be invited to participate in the hybrid projects under the Feed-in-tariffs so as to complement Government efforts in the programme.

Solar Water Heating Systems

30. The Government has developed Solar Water Heating Regulations to promote uptake and guide the incorporation of low temperature solar water heating systems in industrial, commercial and residential buildings. This has the potential to reduce both energy use and peak demand. The proposed solar water heating project involves the replacement of existing electrical water heaters with Solar Water Heating (SHW) systems.. The project aims at removal of market barriers as a preparation for implementing of solar water heating regulations which are to be effected by the Government to reduce both energy use and peak demand. To successfully overcome these barriers, SREP intervention would enhance the engagement of the private sector in this market.

Small Hydro Power (SHP)

31. It is estimated that about 1,000 MW of small hydro is economically viable for exploitation .. The Government of Kenya (GoK) in 2006 established the first Feed-in-Tariffs for various renewable energy technologies that guaranteed developers of sale of the generated electricity to the national utility at fixed price for a certain period with periodic reviews. Further, the Government is carrying out feasibility studies for various sites across the country and has completed 12 sites for tea factories. Funding is being sought to develop these SHP projects. The proposed SREP funding intervention would lead to the development of the 12 SHP sites

Improved Cook Stoves

32. In Kenya there are approximately 20,000 institutions each consuming 270 tonnes of wood fuel per year. Improved cook stoves have been developed for institutions, households and small and micro enterprises. However, their uptake have been slow due to capacity constraints. The proposed project will ensure that the capacity of stove-producers is enhanced and that the benefits and business potential of improved stoves is communicated to policy makers, financial institutions, investors and end users. It will facilitate the acquisition and installation of improved cook stoves and the planting of woodlots by in order to make them self-reliant on firewood.

Geothermal

33. The LCPDP proposes the development of about 5,000 MW of electricity from geothermal by 2030. The development of 400 MW in Menengai Field is part of the programme. In the past, geothermal development in Kenya has been characterized by long gestation periods due to various constraints including financing and geothermal resource risks. GDC seeks to reduce project development period in Menengai to five years by accelerating the initial project activities which include detailed surface exploration, infrastructural development, drilling of exploratory and appraisal wells. Government and SREP funding will be utilized for drilling appraisal and production wells and power evacuation.

34. Electricity transmission for the proposed geothermal projects is planned in order to support the evacuation of the generated power. This transmission line project will specifically evacuate power from Menengai geothermal project to the national grid. This will improve power reliability, stability and reduce system losses on the national grid. It will also avail additional capacity that will facilitate extension of the grid to other areas.

Financing plan

SREP Allocation	Investments	GoK	SREP	AfDB/ WBG	Development Partners	Private Sector	Financing Gap	Total
SREP Initial Allocation	Geothermal (Phase A)	126	39	230				395
	Capacity Building		1	4				5
	Geothermal (Phase A) Total	**126**	**40**	**234**	**-**	**-**	**-**	**400**
	Mini-grids	1	9	10	42	5		**67**
	Capacity Building		1					**1**
	Mini-grids Total	**1**	**10**	**10**	**42**	**5**	**-**	**68**
SREP Reserves	Geothermal (Phase B)		25	75	200	100		**400**
	Solar Water Heating (Including Capacity Building)	1	10	2		47		**60**
Total		**128**	**85**	**321**	**242**	**152**	**-**	**928**

Results Framework for Kenya SREP Investment Plan

Results	Indicators	Baseline (year 2010)	Targets
Project Outputs and Outcomes			
1. Increase in number of women and men supplied with electricity	Number of customers connected to Main grid	1,441,139	2,200,000 (by 2015)
	Number of customers connected to Mini- grid	22,500	33,500 (by 2015)
2.Decrease in GHG emissions	Displaced amount of GHG emission in the Isolated Mini-Grid in tonnes per year	0	10
	Displaced amount of GHG emission in the Nation Grid in tonnes per year	0	1,061
3. Increased RE supply	a) Amount of energy in GWh from RE annually	3,525	5,167 (by 2015)
	b) Additional geothermal power connected to the national grid	198 MW	400 MW by 2015
	c) Replication of the development model	198MW	5,110 MW by 2030
	d) Length (Km) of electricity transmission line constructed	0	20 Km by 2015
	e) Number of electricity transmission sub-stations constructed	0	2 No. by 2015
4. Decreased cost of electricity	Reduction in annual generation costs in the isolated mini-grids	TBC	TBC
	Reduction in annual generation costs in the main-grids		
5. Learning about demonstration, replication and transformation captured, shared in Kenya and to other countries in SSA especially in EAC.	Number and type of knowledge assets (e.g., publications, studies, knowledge sharing platforms, learning briefs, communities of practices, etc.) created	TBC	3
6. New and additional resources for renewable energy projects	Leverage factor of SREP funding; $ financing from other sources (contributions broken down by Donors (MDBs and Bilateral), Government of Kenya, CSOs, private sector) (USD Millions)	-	1:08
Catalytic Replication			
1. Increase in renewable energy generation investments	a) Percentage (%) of RE investment of total new energy investment	TBC	TBC
	b) Amount of RE generated by the private sector in new RE plants	TBC	TBC
2. Improved enabling environment for RE production and use	a) Adoption of and implementation of low carbon energy development plans	TBC	TBC
	b) Enactment of policies, laws and regulations for renewable energy	TBC	TBC
3. Increased economic viability of renewable energy sector	a) Percentage (%) of private sector RE investments of total new energy investments	TBC	TBC
	b) Change in percentage (%) of total energy sector employment working in RE (women/men)	TBC	TBC
Transformative Impacts in KENYA			
Transformed energy supply and use by poor women and men in Kenya, to low carbon development pathways	a) Number of new households connected to electricity in the rural areas.	TBC	TBC
	b) Population (rural) consuming energy services from new hybrid RE systems	TBC	TBC
	c) Change in the energy development index - EDI (per capita electricity consumption)	TBC	TBC

Contents

I. Introduction

35. This document is Kenya's Investment Plan (IP) for the development of renewable energy in the country under the Scaling-Up Renewable Energy Program in Low Income Countries (SREP) funding. Kenya is one of the six pilot countries selected to benefit from SREP. The SREP program will support Kenya's initiatives towards achieving a transformational change that will lead the country towards low greenhouse gas (GHG) emission development pathway by harnessing the renewable energy resources.

36. SREP operates under the Strategic Climate Fund (SCF) that supports programs with potential for scaled-up, transformational action aimed at a specific climate change challenge. SCF is part of the Climate Investment Funds (CIF), which promote international cooperation on climate change and support developing countries as they move toward climate resilient development that minimizes greenhouse gas (GHG) emissions and adapt to climate change. CIF resources are available through Multilateral Development Banks (MDBs), and in case of the SREP program for Kenya, the African Development Bank (AfDB) and the World Bank Group (WBG), including the International Finance Corporation (IFC), will jointly manage the SREP program, with the World Bank (WB) acting as the lead institution.

37. The IP is in line with national renewable energy development strategy as stipulated in the Least Cost Power Development Plan (LCPDP), Rural Electrification Master Plan, Sessional Paper No. 4 of 2004 (The energy policy document), the Energy Act of 2006, the Feed-in Tariff (FiT) Policy, the Kenya National Climate Change Response Strategy, Gender Audit of Energy Policies and Programmes in Kenya June 2007 and Kenya Vision 2030 (the National economic development blueprint).

38. The Gender Audit undertaken in 2007 by the Ministry of Energy found that the major constraints to gender sensitive planning in Kenya were:- a) limited availability of gender disaggregated data; b) absence of active gender mainstreaming into the energy sector policy, program and projects; and c) need to make clear the links between access to energy and poverty. The IP seeks to address some of the recommendations of the Audit.

II. Country and Sector Context

Broad overview of the country

39. Kenya, with an area of 582,646 sq. km, is located on the East Coast of Africa, the capital being Nairobi. Its strategic location makes it one of the continent's regional hubs. It is also the gateway to the Eastern and Southern Africa. The population of the country was 38.6 million according to the 2009 Kenya Population and Housing Census, with an annual increment of one million. The country's GDP was US $30 billion (2010) with a growth rate of about 5.6% (CBK).

40. The Kenya Vision 2030 is a long-term development strategy, whose aim is to drive the country into a globally competitive and prosperous economy with high quality of life. It envisages that Kenya will be transformed into a newly-industrializing, middle-income country providing high quality life to all Kenyans in a clean and secure environment. Simultaneously, the strategy aspires to achieve the Millennium Development Goals (MDGs) for Kenya by 2015. Infrastructure, including energy, is identified as one of enablers of the envisaged socio-economic transformation of the economy with a vision to provide cost-effective, world class infrastructure facilities and services.

41. The Government has prepared a Medium-Term Plan (MTP) to implement the first phase of the strategy, covering 2008 to 2012. A key element in attaining Vision 2030, is reaching an average annual economic growth rate of 10 per cent between 2012 and 2030. This high economic growth will require modern, efficient infrastructure facilities to expand the productive sectors of the economy and improve access to markets. To upgrade the infrastructure platform, the MTP calls for rehabilitating the road network, upgrading the railways, improving urban public transport, and expanding access to electricity and safe water. In an effort to improve equity of opportunity, the overall program gives a special emphasis to expanding the access of the rural and urban poor to basic services such as electricity, water, and sanitation.

42. Riding on the enabling environment provided by Government, Kenya's private sector has become key contributor to economic growth particularly in the tourism, building and construction, transport and communication, agriculture, manufacturing, and financial services. However, the private sectors full potential has not been tapped due to internal infrastructure challenges.

43. Kenya's electricity mix is dominated by hydro generation (over 50%) and thus highly vulnerable to weather conditions and climate change. The climatic conditions of 1998 – 2000 and 2008 - 2009 curtailed hydropower generation and led to severe energy shortages which culminated into power rationing. This fluctuation in hydropower generation made the country appreciate the linkages between energy, environment and the country's socio-economic development.

44. A study conducted by the Stockholm Environment Institute (SEI) on the economic impacts of climate change in Kenya (2009) found the country's Green House Gas GHG emissions, both total and per capita to be relatively low. However, Kenya's GHG emissions are rising quickly and the energy sector emissions are estimated to have increased by as much as 50% over the last decade.

45. As one measure of mitigation and adaptation to climate change, the Government of Kenya has been spearheading promotion of development and use of alternative sources of energy

and has developed the National Climate change Response Strategy of 2010. Kenya is pursuing an energy mix that greatly emphasises on carbon–neutral energy sources such as geothermal, wind, solar and renewable biomass. In addition, the country's building codes are being reviewed to incorporate measures that will encourage climate–proofing and the construction of energy–efficient buildings.

46. It is estimated that in Kenya 77% people do not have electricity connections. Over 85 % of the population rely on traditional fuels such as wood, charcoal, dung, and agricultural residues for cooking and heating. Many urban and rural poor are not reached by grid-based electrical power nor is there adequate distribution of gas or other cooking and heating fuels.

- *Firewood remains the predominant fuel for cooking* [1]. Nationally 68.3 percent of all households use firewood as their main sources of cooking fuel. Over 80 percent of households in the rural areas rely on firewood for cooking compared to 10 percent of urban households.
- *Charcoal is the second most popular type of cooking fuel* used by 13.3 percent of households.
- *Kerosene is ranked the third predominant cooking fuel*, but is the most common type of fuel for cooking among 44.6 percent of urban dwellers.

47. The lack of access to affordable energy has a number of implications for poor households, and for women in particular including:

(a) Women and children disproportionately suffer from health problems related to gathering and using traditional fuel and cooking in poorly ventilated indoor conditions. These include respiratory infections, cancer, and eye diseases.
(b) High opportunity costs related to time spent gathering fuel and water which limits their ability to engage in educational and income-generating activities resulting in dramatically different literacy rates and school enrolment levels between men and women;
(c) Lack of electricity in rural areas is an added hindrance to women's access to useful media information such as market for their produce, health information and civic education.

48. Kerosene-based lamps are the leading source of lighting for Kenyan households[2]. Over 79% of households use paraffin lamps. Electricity is the second most common source of lighting about 14% while paraffin is the most predominant in rural areas (87% of rural households).. In the urban areas, electricity was more common (42%), although the lantern/ paraffin lamp still remained the main source of lighting for 55% of households. The lack of electricity for lighting has serious gender-related dimensions. The continued exposure to kerosene fumes in the kitchen while cooking leads to disproportionate vulnerability of women to associated indoor pollution.

49. There are disparities in energy use between female - headed and male - headed households. About 15% of male-headed households compared to 11% of the female-headed ones use electricity for lighting, but a larger proportion of female-headed households (81%) use Kerosene lamps or other unspecified sources as compared to male-headed (78%). Female headed households rely more on the fuel wood than the male headed households.

[1] Kenya Integrated Household budget Survey 2005/6, Central Bureau of Statistics, 2007
[2] Kenya National Bureau of Statistics - National Census, 1999

Table below shows the Distribution of Households by Gender of Household Head and Type of Lighting

Gender	Electricity	Lantern/Paraffin lamps	Other
Male	15.2	77.9	6.9
Female	10.8	81.2	8

Source: Kenya Population Census 1999

50. In Kenya, exploitation of renewable energy has a great potential to contribute towards gender equity access to energy services. Reduced drudgery for women and increased access to non-polluting power for lighting, cooking, and other household and productive purposes can have dramatic effects on women's levels of empowerment, education, literacy, nutrition, health, economic opportunities, and involvement in community activities. These improvements in women's lives can, in turn, have significant beneficial consequences for their families and communities enabling access to educational media and communications in schools and at home and allowing access to better medical facilities for maternal care, including refrigeration and sterilization.

51. While undertaking the proposed investments, SREP will aim to address the key recommendations of Gender Audit undertaken in 2007 by the Ministry of Energy which found that the major constraints to gender sensitive planning in Kenya include: (i) limited availability of gender disaggregated data, (ii) the need for training, capacity building to mainstream gender into the energy sector policy, program and projects, and (iii) need to make clear the linkages between access to energy and poverty.

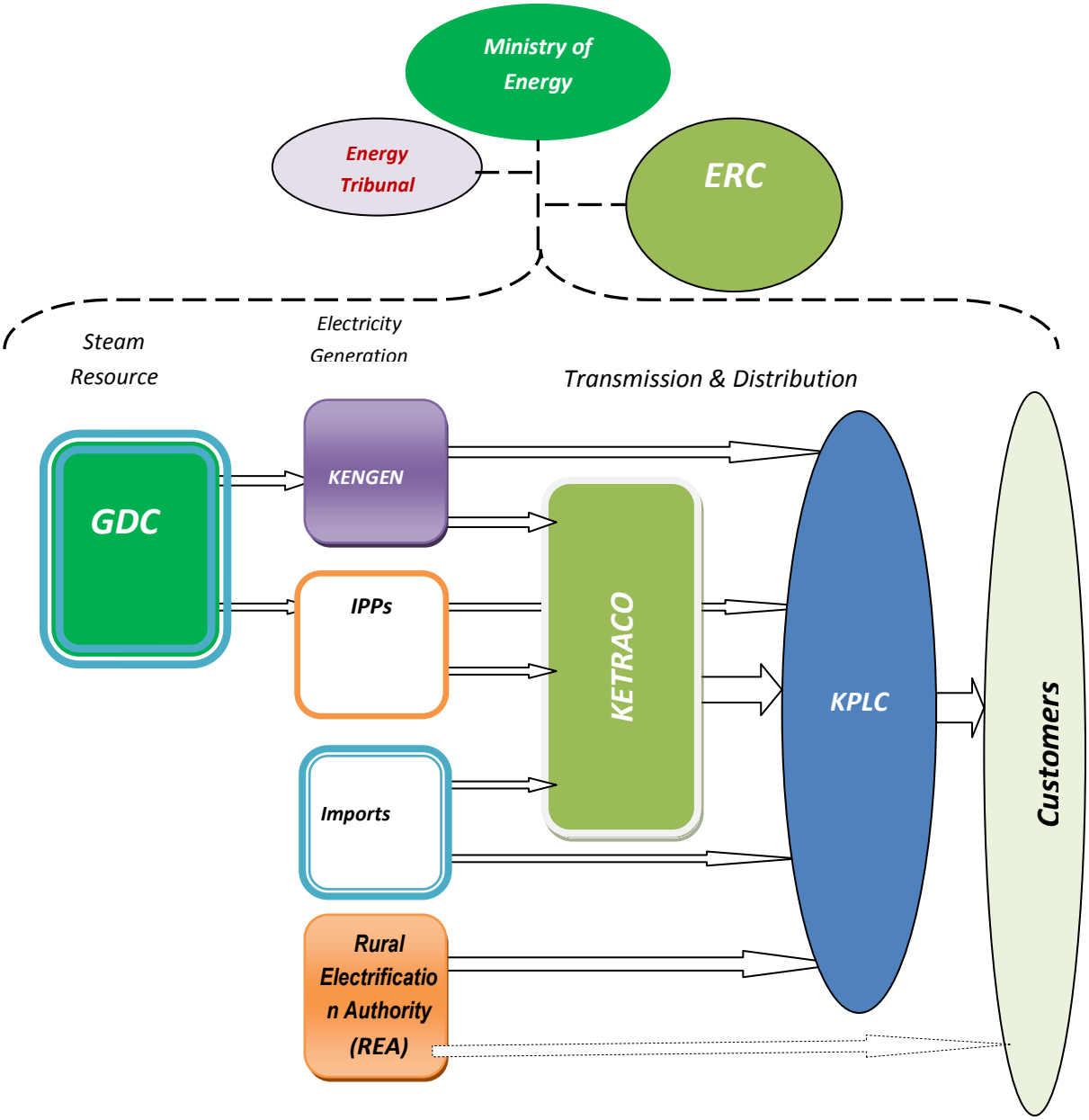
Market Structure and Institutional Framework of the Electricity Sub-Sector

52. The Kenya electricity sub-sector market is liberalized with the several players involved. There are three distinct levels in the market; generation, transmission and distribution. The energy sector as a whole has been undergoing restructuring and reforms as articulated in the Sessional Paper No.4 of 2004 and the Energy Act No.12 of 2006. The institutional arrangement in the electricity sub sector in Kenya comprise the Ministry of Energy (MOE), Energy Regulatory Commission (ERC), Kenya Generating Company (KenGen), Kenyan Power and Lighting Company (KPLC), the Rural Electrification Authority (REA), Kenya Electricity Transmission Company (KETRACO), Geothermal Development Company (GDC) and Independent Power Producer (IPPs).

53. The **Ministry of Energy** (MoE) is mandated by both the Policy and the Law for overall coordination of the Sector. It is also responsible for formulation and articulation of policies through which it provides an enabling environment to all operators and other stakeholders in the energy sector.

54. The **Energy Regulatory Commission** (ERC) is an independent single sector regulatory agency established under the Energy Act, 2006 with the responsibility for economic and technical regulation of electric power, renewable energy and down-stream petroleum sub-sector.

55. **Rural Electrification Authority** (REA) is an Authority established under the Energy Act, 2006 mandated to, inter alia, implement the rural electrification programme, develop and update the rural electrification master plan, and promote the use of renewable energy sources. The authority reports to the Ministry of Energy



56. **Kenya Electricity Generating Company** (KenGen) is the leading electricity generator providing over 70% of the effective generating capacity to the national grid. The company is listed at the Nairobi Stock Exchange with 70% share holding in Government and 30% private.

57. **Kenya Power and Lighting Company** (KPLC), is the national power utility responsible electricity distribution and supply. It purchases power in bulk from KenGen and IPPs currently in operation through Power Purchase Agreements approved by the ERC.

58. **Kenya Electricity Transmission Company Ltd** (KETRACO) is a corporation wholly owned by the Government and mandated to plan, design, construct, own, operate and maintain high-voltage (132kV and above) electricity transmission infrastructure that will form the backbone of the national transmission grid and regional interconnection.

59. **Geothermal Development Company Limited** (GDC) is a special purpose vehicle company wholly owned by the Government established to accelerate geothermal development in the country.

60. **Independent Power Producers** (IPPs): currently six IPPs are operating in the country contributing approximately 30% of the effective generating capacity to the national grid.

61. The **Energy Tribunal** arbitrates on disputes within the energy sector.

Electricity Demand and Supply

62. Electricity demand in the country is significantly rising mainly due to the accelerated productive investment and increasing population. Historically, energy demand is positively correlated with economic and population growth rates. Currently the electricity demand is 1,191 MW against an effective supply of 1,429 MW under normal hydrology. This gives a reserve margin of 238 MW (20%). However during low hydrology, the reserve margin diminishes necessitating load shedding and procurement of expensive emergency power. The peak load is projected to grow to about 2,500MW by 2015 and 15,000 MW by 2030. To meet this demand, the projected installed capacity should increase gradually to 19,169 MW by 2030.

63. The historical demand over the last three years against installed capacity is as follows:

Indicator	2007/08	2008/09	2009/10	May 2011
Peak Demand MW	**1,036**	**1,072**	**1,107**	**1,191**
Installed Capacity MW	**1,310**	**1,345**	**1,473**	**1,531**
Effective Capacity MW	**1,267**	**1,280**	**1,416**	**1,429**

64. The consumption of electricity in GWh by consumer category over the last six years is as follows:

TARIFF	COVERED BY THIS TARIFF	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
DC	Domestic	956	1,028	1,113	1,255	1,254	1,290
SC	Small Commercial	522	522	558	590	823	823
B	Commercial (Medium) and Industrial(Medium)	885	901	985	996	n/a	n/a
C	Commercial (Large) and Industrial (Large)	1,776	1,877	2,054	2,108	n/a	n/a
CI	Commercial and Industrial					3,020	3,153
IT	Off-peak	53	54	50	74	43	36
SL	Street lighting	8	9	11	13	15	16
	TOTAL	**4,200**	**4,391**	**4,771**	**5,036**	**5,155**	**5,318**
	% Increase P.A.	**6.6%**	**4.5%**	**8.7%**	**5.6%**	**2.4%**	**3.2%**

Source: KPLC 2010 Annual Report and Financial Statement

65. The historical and forecast demand as developed in (LCPDP) is as follows:

YEAR	GWh	MW	Growth Rate
2006	5,674	916	
2007	6,073	979	6.88%
2008	6,338	1,036	5.82%
2009	6,468	1,072	3.47%
2010	7,296	1,107	3.26%
2011	7,775	1,302	17.63%
2012	9,084	1,520	16.75%
2013	10,560	1,765	16.08%
2014	12,376	2,064	16.98%
2015	15,155	2,511	21.64%
2016	17,300	2,866	14.13%
2017	19,902	3,292	14.87%
2018	22,685	3,751	13.94%
2019	25,512	4,216	12.40%
2020	28,795	4,755	12.79%
2021	32,651	5,388	13.31%
2022	36,652	6,048	12.25%
2023	41,130	6,784	12.18%
2024	46,147	7,608	12.13%
2025	51,771	8,528	12.10%
2026	58,069	9,556	12.06%
2027	65,133	10,706	12.03%
2028	73,065	11,994	12.03%
2029	81,964	13,435	12.01%
2030	91,946	15,026	11.85%
2031	103,518	16,905	12.51%

Energy Mix

66. The main sources of electricity generation are hydro, diesel thermal plants, and geothermal plants. There also is generation from biomass, wind and small hydro plants . The current energy mix is as tabulated

Category	*Capacity Installed (MW)*	*%*	*Effective*	*%*
Large Hydro	*749.2*	*48.5%*	*732.2*	*51.2%*
Small Hydro	*15.3*	*1.0%*	*12.8*	*0.9%*
Geothermal	*198*	*12.9%*	*189*	*13.2%*
Co-generation (biomass)	*26*	*1.7%*	*26*	*1.8%*
Wind	*5.1*	*0.3%*	*5.1*	*0.4%*
Thermal (Fossil)	*525*	*34.3%*	*448*	*31.4%*
Off Grid (Fossil)	*18.0*	*1.2%*	*15.6*	*1.1%*
	1,531	*100%*	*1,429*	*100%*

Source: LCPDP 2011-2031

67. Currently the base load generation source for electricity is hydro and geothermal. However, due to climate change effects in the country, hydro generation has become unreliable resulting in the decrease in the hydro component of base load supply. This

has necessitated the country to run expensive thermal power plants as base load leading to high tariffs culminating in high inflation and consumer dissatisfaction. Kenya's abundant geothermal energy is a viable alternative to hydropower as the main source of power but most of the resource base remains undeveloped. In addition to being a renewable energy source, the main advantages of geothermal energy are its reliability, absence of fuel cost, and long plant life. Kenya's geothermal resources potentially could support power generation capacity of about 7,000 – 10,000 MW. The Government has therefore identified geothermal as the suitable source to supply electricity for base load

Cost of Electricity and Pricing

68. The cost of household connection, paid up-front to KPLC, starts at approximately KES 35,000 (about USD 422). In addition, once connected, a modest amount of grid electricity (about 134 kWh per capita consumption) costs about 15 US cents equivalent per kWh The high cost of electricity service is a major obstacle to the expansion of electricity connection to low-income households, and in particular, female headed households. These electricity costs are high because of the substantial investments needed to build new generation, transmission and distribution facilities, as well as the high operating electricity supply cost. All the costs are inbuilt in the current retail electricity tariff structure which is as follows:

Tariff	Type of Customer	Supply Voltage (V)	Consumption (kWh/ month)	Fixed Charge (KES/ month)	Energy Charge (KES/ kWh)	Demand Charge (KES/ kVA/ month)
DC	Domestic Consumers	240 or 415	0-50	120.00	2.00	-
			51-1,500		8.10	
			Over 1,500		18.57	
SC	Small Commercial	240 or 415	Up to 15,000	120.00	8.96	-
CI1	Commercial/ Industrial	415-3 phase	Over 15,000 No limit	800.00	5.75	600.00
CI2		11,000		2,500.00	4.73	400.00
CI3		33,000/ 40,000		2,900.00	4.49	200.00
CI4		66,000		4,200.00	4.25	170.00
CI5		132,000		11,000.00	4.10	170.00
IT	Interruptible Off-Peak supplies	240 or 415	Up to 15,000	240.00 – when used with DC or SC	4.85	-
SL	Street Lighting	240	-	120.00	7.50	-
Source: ERC						

69. The consumer electricity tariff structure is such that there is cross-subsidy whereby the high electricity consumers subsidize the low consumers. The life-line consumers utilize less than 50 Kwh/per month and pay the generation costs only.

Challenges

70. The electricity sub-sector is experiencing the following challenges/constraints:

(i) Slow rate of capacity addition hence inadequate supply;
(ii) Over-reliance on hydropower
(iii) High cost of power

(iv) Weak transmission and distribution network
(v) Long lead times in the development of power infrastructure
(vi) Low investments in power sector by private investors
(vii) High cost of rural electrification
(viii) Low countrywide electricity access and connectivity

Energy Sector Strategies

71. The broad objective of the energy policy is to ensure adequate, quality, cost effective and affordable supply of energy through use of indigenous energy resources in order to meet development needs, while protecting and conserving the environment. Kenya's energy needs remain a key determinant of economic growth given its importance in the long term development goal as articulated in the Vision 2030. Energy has been identified as a key driver of growth in supporting productive sectors of the economy and a key input in both social and political pillars. In addition, energy is a key input in realization of the Millennium Development Goals (MDGs) Therefore, the Government is heavily investing in power generation expansion as well as putting in place adequate system support infrastructure including an extensive transmission and distribution network.

72. In line with global environmental concerns, a cross-cutting theme of the Energy Sector Strategy is to promote the use of green energy (low-carbon emission) for electricity generation where feasible, along with improving efficiency in the supply and end use of electricity. This will mitigate the climate change effects associated with electricity generation.

73. In order to spur economic growth the following intervention measures, aimed at developing renewable sources of energy, will be undertaken:

(i) Rapid expansion of electricity generation capacity in order to increase supply and access across the country;
(ii) Developing renewable energy programmes targeting the low income population;
(iii)Increasing the market penetration of renewable energy systems;
(iv)Enhancing energy security through diversification of energy sources; and
(v) Promotion of energy efficiency and conservation.

74. The guiding principle of the Government's strategy for expanding infrastructure in the electricity sub-sector is to "promote equitable access to quality energy services at least cost while protecting the environment. The strategy has three objectives:

(a) to increase electricity generation capacity to eliminate supply shortages;
(b) to expand and upgrade the transmission and distribution networks to enhance quality and reliability of supply; and,
(c) to increase affordable household electricity access, with particular attention to reducing regional imbalances in the country. In particular, the Government target in the short term is to increase electricity connectivity level in rural areas to 22% by 2012..In the medium term, the rural areas connectivity target level is 65 % by 2022 while the long term target is 100% by 2030.

75. The LCPDP 2011 – 2031 envisions that Kenya's electricity peak demand will increase from the current 1,302 MW to 15,026 MW by 2030. This is in line with the Vision 2030 which envisages energy as a key enabler for economic growth across the country. To meet the increased electricity demand due to the enhanced economic activities, the LCPDP has identified various generation sources targeting 5,110 MW from geothermal, 1,039MW from

hydro, 2,036 MW from wind, 3,615MW from fossil thermal, 2.000 MW from imports, 2,420 MW from coal and 3,000 MW from other sources. The investments required for generation, transmission and distribution to meet this demand are enormous.

76. The base load generation is currently from hydro and geothermal resources. However, the hydro component has become unreliable due to the frequent droughts being experienced across the country as a result of climate change. This has led to deployment of fossil fuel-fired plants for base load generation and load-shedding. Continuous running of fossil-fuel fired plants increases tariffs as well as GHG emissions. To mitigate this trend, the Government is promoting the use of renewable energies that are clean, environmentally friendly and less susceptible to climate change disruptions. Geothermal, being abundant in Kenya, has been identified as a suitable replacement for hydro for base load supply.. SREP funding will be utilized to support the renewable energy projects in order to achieve accelerated development of the resources and increase their contribution to the generation capacity energy mix.

III. Renewable Energy Sector Context

77. The Sessional Paper No. 4 of 2004 and Energy Act of 2006 are the policy and legal frameworks for energy development in Kenya respectively. Through these, the Government is committed to promoting electricity generation from Renewable Energy Sources (RES). In addition, a Feed-in-Tariffs (FiT) Policy has been formulated to promote the generation of electricity using renewable energy resources and improve the rating of Kenya's Renewable energy sector as an attractive destination for substantial private sector investment. Under the FiT system, investment security and market stability for investors in electricity generation from Renewable Energy Sources is provided whilst encouraging private investors to operate their power plants prudently and efficiently to maximize returns. This will facilitate the exploitation of the abundant renewable energy sources available in the country. The FiTs were introduced in 2008 and revised in 2010 to accommodate additional renewable energy sources and reviewed the tariffs.

78. The FiT Policy has so far elicited a total of 49 expressions of interest from potential investors to develop renewable energy sources. The table below illustrates the proposals received with most being for wind projects.

		Received Proposals			**Approved Proposals**	
	Technology Type	**No.**	**Capacity (MW)**	**% of Total**	**No.**	**Capacity (MW)**
1	Wind	23	1,118	74%	20	1,008
2	Biomass	4	164	11%	4	164
3	Hydro	19	111	7%	16	81
4	Geothermal	1	70	5%	0	0
5	Biogas	1	40	3%	1	40
6	Cogeneration	1	18	1%	1	18
	Total	**49**	**1,521**	**100%**	**42**	**1,311**

79. In order to effectively plan and implement the incorporation of electricity generated by small-scale renewable energy plants into the interconnected and isolated grids, the Government with the support from Development Partners is undertaking a study aimed at developing feasible renewable electricity generation options, regulatory instruments and guidelines needed for their integration. The study will involve review of the existing FiT policy and supporting frameworks, as well as projects proposed under the FiT policy, to determine challenges and constraints leading to low implementation of power projects under this policy and propose specific recommendations to address these weaknesses.

80. The Government intends to set up a Green Energy Facility to pool donor contributions to help finance Government equity participation and loan contributions to help firms and other institutions to develop clean energy projects. The Facility will lend funds to viable projects at concessional rates. The facility will be established under the National Task Force on Accelerated Development of Green Energy whose mandate is to promote and fast-track the development of renewable energy projects.

81. Through the LCPDP Committee, the Government has instituted an integrated power planning process which seeks to increase the contribution of renewables to the national energy mix.

The planning process projects future energy requirements and identifies suitable least cost sources of energy to meet the forecast demand. The LCPDP is a 20-Year rolling plan that is reviewed on an annual basis to take cognizance of new developments and changes. Timely implementation of ongoing power generation and transmission projects and preparation for the future projects is paramount.

Wind

82. Kenya has a proven wind potential of as high as 346w/m2 in some parts of Nairobi, Rift Valley, Eastern North Eastern and Coast Provinces. The current installed capacity is 5.1 MW operated by KenGen at the Ngong site.

83. The Ministry of Energy developed a Wind Atlas in 2003 with indicative data to guide investors. To augment the information contained in the Wind Atlas, the Ministry, with the assistance of Development Partners is installing Wind Masts and Data Loggers to collect site specific data.

84. The low exploitation level of the resource prompted the Government to develop the Feed-in Tariff (FiT) Policy to attract private investment. The FiT policy provides for wind generated electricity a fixed tariff not exceeding US Cents 12.0 per Kilowatt-hour of electrical energy supplied in bulk to the grid operator at the interconnection point. This tariff applies to individual wind power plants (wind farms) whose effective generation capacity is above 500kW and does not exceed 100 MW.

85. As a result of the publication of the FiT, there has been a lot of interest among potential investors to exploit the resource. The Government has given approval to 20 applications with a combined proposed capacity of 1,008 MW and a further 300MW under negotiated terms. The proposed projects are at various stages of implementation with two having signed PPAs and others undertaking feasibility studies.

86. The Government is introducing wind power generation in existing diesel isolated/off-grid power stations. One such station has been commissioned and is operational. SREP funds will be used expand and accelerate the programme.

Solar

87. Kenya lies astride the equator and receives daily insolation of 4-6kWh/m2. Sessional Paper No 4 of 2004 recognizes the need to promote the use of solar energy as an alternative source of energy. The Government is committed to implementing this policy by carrying out awareness and demonstration campaigns on the use of Solar systems for domestic and industrial use, as well as undertaking direct installation in institutions.

a) Solar PV

88. The Solar PV systems around the country are mainly for domestic installations with the private sector playing a major role. In addition, the private sector has been instrumental in the PV application in telecommunication, cathodic protection of pipelines, water pumping, and small commercial or non-commercial establishments. However, this efforts are mainly concentrated in areas where grid is within reach. The Government is undertaking efforts to provide lighting and water pumping PV installations to public institutions in Arid and Semi-Arid Lands where there is no access to the grid. These institutions are mainly primary and secondary schools, Dispensaries, Health Centres, Police and Administration units and public water wells. The programme has provided quality lighting for students; extended medical services including maternity and refrigerated medicines ; relieved women from the burden of

drawing water from the wells; and provided security, especially to women and children who are the most vulnerable.

89. Due to the relative high cost of solar PV technology, the Government is initially targeting the use of this technology to supply the isolated/off-grid stations to partly displace the thermal generation. The current FiT Policy provides the private sector opportunities to supply solar power at a fixed tariff not exceeding US Cents 20.0 per Kilowatt-hour and a non-firm power fixed tariff not exceeding US Cents 10.0 per Kilowatt-hour of electrical energy supplied in bulk to the grid operator at the connection point.

90. The Government is constructing more isolated/off-grid systems in its efforts to increase rural electrification. These stations provide electricity for productive use and are spurring economic activities in these areas. The availability of electricity is improving the livelihood of rural communities especially women and children. However, the generation modes in these stations is mainly diesel based and therefore the use of SREP funds for constructing solar/diesel hybrid systems would reduce the cost of fuel and thus the cost of electricity.

91. To streamline the manufacture, supply, design, installation, maintenance and use of solar PV systems or components so as to improve distributed electricity service delivery, facilitate sustainability of the PV market in Kenya and ensure that end users obtain value for money, the ERC is developing the Energy (Solar Photovoltaic Systems) Regulations, 2011. These regulations are expected to provide a licensing framework for the solar PV value chain and facilitate proper design, installation and use of Solar PV systems while avoiding supply of sub-standard components and installations

b) Solar Thermal

92. Solar thermal is mainly used for drying and water heating. Utilization of solar water heaters (SWH) is mainly in households and institutions such as hotels and hospitals. The number of solar water heating units currently in use is estimated at over 140,000 and is projected to grow to more than 400,000 units by 2020.

93. Solar dryers are widely used in the agricultural sector for drying of cereals and other farm produce such as coffee, pyrethrum and mangos. The private sector has introduced solar cooking to rural groups in various parts of the country albeit with limited success.

94. The uptake level of solar water heating systems in Kenya is extremely low compared with the enormous potential provided by the abundant availability of the solar energy resource and the demand for low temperature water for both domestic and commercial applications. The Government has developed the solar water heating Regulations to promote uptake and guide the incorporation of low temperature solar water heating systems in industrial, commercial and residential buildings

Small Hydro

95. Kenya's drainage system consists of five major basins: Lake Victoria; Rift Valley; Athi/Sabaki River; Tana River; and Ewaso Ng'iro North River. These basins contain the bulk of the country's hydro resources for power generation. Kenya's total installed large hydropower capacity is 764.5 MW. The potential for small, mini and micro-hydro system (with capacities of less than 10MW each) is estimated at 3,000MW nationwide. However, the installed grid connected small-scale hydro-electric projects contribute about 15.3 MW, though there are several other small hydro schemes under private and community generation especially in the tea estates across the country which are not grid connected.

96. The Government is carrying out phased feasibility studies to establish the capacities as well as appraise the viability of various small hydro sites across the country. In 2009 a feasibility study for 12 sites was carried out and confirmed viable for providing a total capacity of 22MW at a cost of USD 53 million. Funding is being sourced from potential investors and developers. Another feasibility study is on-going for 14 other sites.

97. The FiT policy provides for stepped fixed tariffs for electrical energy supplied in bulk to the grid operator at the interconnection point. The tariffs are as follows:

Power Plant Effective Generation Capacity (MW)	**Firm Power Tariff (¢/kWh)**	**Non-Firm Power Tariff (¢/kWh)**
< 1	12.0	10
1 – 5	10.0	8.0
5 – 10	8.0	6.0

As a result of this policy, private investors have submitted expressions of interest for 19 projects totaling to 111MW of which 16 projects with combined capacity of 81MW have been approved.

Biomass

98. Biomass contribution to Kenya's final energy demand is 70 per cent and provides for more than 85 per cent of rural household energy needs. The main sources of biomass for Kenya include charcoal, wood-fuel and agricultural waste

99. Kenya's forest cover currently stands at less than the world recommended 10%. This is largely due to land use activities and over-dependence on wood fuel as a source of energy particularly in the rural setting. Over 70% of the country's fuel needs are met from wood fuel resulting in depletion of the major forested areas which are also the water catchment zones for the country. The resultant effect has been unpredictable weather and drought patterns.

100. There are approximately 20,000 institutions including prisons, schools, clinics and hospitals in Kenya consuming about 270 tonnes each of wood fuel per year. In addition, a majority of Small and Medium Size Enterprises such as hotels, food vendors and small scale processing facilities use biomass resources as the primary source of energy.

101. The Government has identified the existence of a substantial potential for power generation using forestry and agro-industry residues including bagasse from the sugar industry for own consumption and supply to the grid. The total potential for cogeneration using sugarcane bagasse amounts to 193MW. Mumias Sugar Company (Private entity) generates 35MW out of which 26MW is dispatched to the grid. However, opportunities by other sugar factories have not been exploited.

102. The FiT policy provides for biomass energy resource generated electricity with a firm power fixed tariff not exceeding US Cents 8.0 per Kilowatt-hour of electrical energy supplied in bulk to the grid operator at the interconnection point. Under this policy, an 18MW cogeneration project for use of cane bagasse at the coastal region of Kenya has been approved.

Geothermal

103. Geothermal has numerous advantages over other sources of power. It is not affected by drought and climatic variability; has the highest availability at over 95 %; is green energy with no adverse effects on the environment; indigenous and readily available in Kenya unlike

fossil thermal energy that relies on fuel imports. This makes geothermal the most suitable source for base load electricity generation in the country.

104. Geothermal resources in Kenya are located within the Rift Valley with an estimated potential of between 7,000 MWe to 10,000 MWe spread over 14 prospective sites. Geothermal exploration started in the late 1950's spearheaded by the Government of Kenya with support from Development Agencies. The first geothermal plant, 45 MW Olkaria I, was fully commissioned in 1985.The 105 MW Olkaria II Power Plant was fully commissioned in 2009, more than seventeen years later.

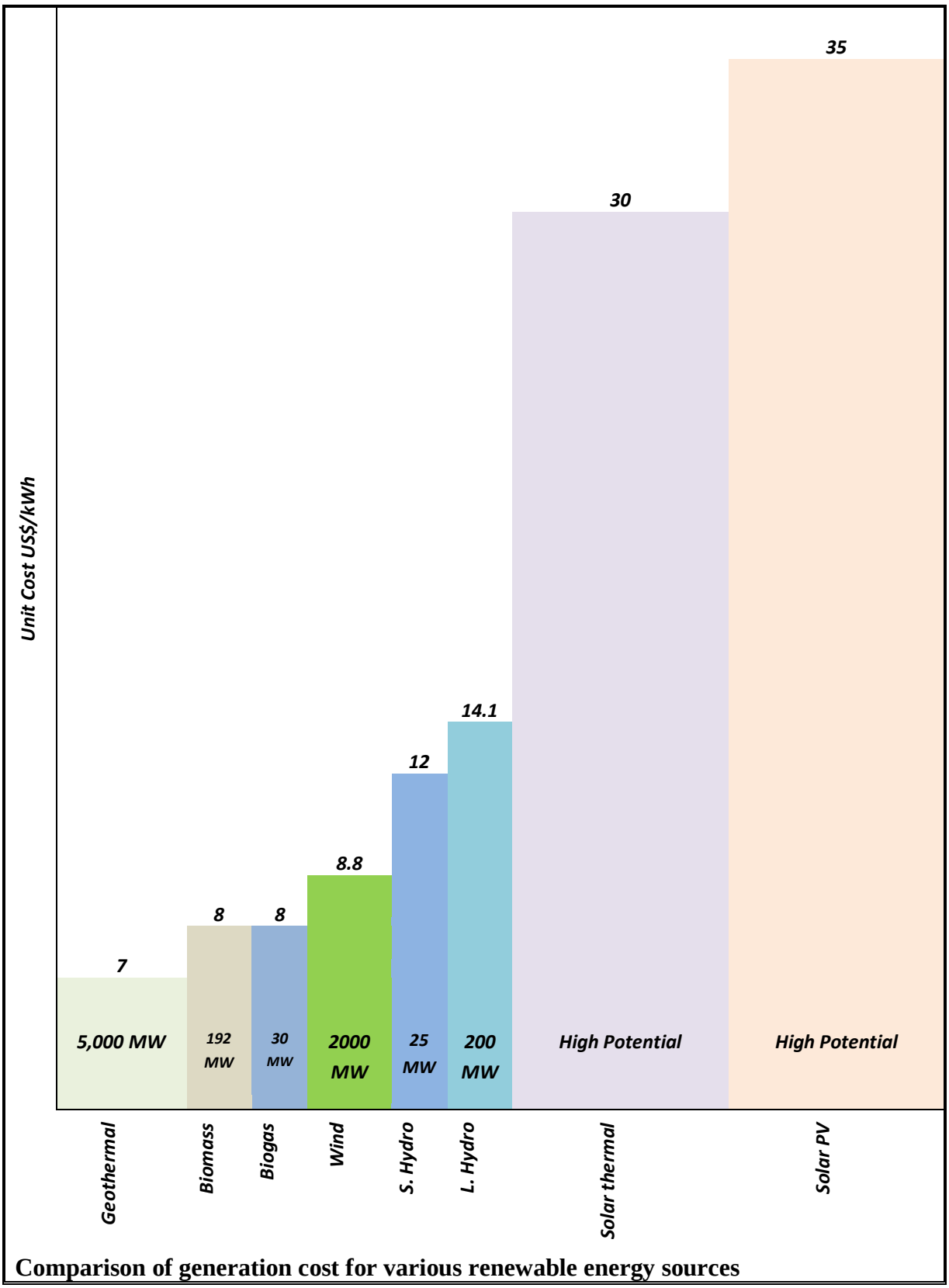
105. The Government has opened up the industry for private sector participation with the first IPP, OrPower 4, operating in Olkaria III and generating 48 MW. Additionally IPP's have been licensed to develop Suswa and Longonot geothermal prospects.

106. The current installed capacity in the country is 198 MW with 150 MW operated by KenGen and 48 MW by OrPower 4, both in the Olkaria Block. An additional 280 MW under development by KenGen and GDC is scheduled for commissioning in 2013. In the Menengai Field with a potential of 1,600MW GDC is undertaking drilling operations for Phase I development for 400 MW. The first exploratory well in Menengai has been successfully completed with a capacity to generate more than 8MW. Initial project development activities have also commenced for the development of 800 MW in the Bogoria – Silali Block. This is geared towards meeting the Vision 2030 Medium Term target of 1,600 MW by 2016 and eventually 5,000 MW by 2030.

107. Realizing the need to reduce the long gestation periods in the development of geothermal resource, the Government set up the Geothermal Development Company (GDC) to undertake integrated development of geothermal through initial exploration, drilling, resource assessment and promotion of direct utilization of geothermal. GDC is 100% owned by the Government. By undertaking the initial project activities, GDC will underwrite the attendant risks associated with geothermal development and therefore open up opportunities for both public and private sector participation.

108. The Government is cognizant that joint efforts are required from both the public and private sectors for accelerated development of the country's geothermal resources. Therefore, the FiT Policy provides for a tariff not exceeding US Cents 8.5 per Kilowatt-hour of electrical energy supplied in bulk to the grid operator at the interconnection point for up to 70 MW geothermal.

109. The table below gives a comparison of generation cost for the various renewable energy sources and also illustrates their potential capacities. Geothermal is the most cost effective sources as well as having a very high capacity. On the other extreme end, the unit cost for Solar is the highest despite the abundance of the resource.



Comparison of generation cost for various renewable energy sources

110. The barriers affecting the exploitation of Renewable Energy Resources and the Government's mitigation effort are as follows:

Barriers/ Constraints	Mitigation	Resources affected
High capital cost.	• Designed incentive packages to promote private sector investments by zero rating import Duties and Taxes on equipment and accessories. • Annual budget allocation of approximately USD 120 Million to develop geothermal • Partnering with Development Partners in funding geothermal development • Introduction of the Green Energy facility.	Wind, Solar, Small Hydro, Geothermal
Insufficient/inadequate data	• Installation of Wind Masts and Data Loggers for data collection to enrich the existing Wind Atlas. • Undertake feasibility studies and avail the reports to potential investors and developers	Wind, small hydro, biomass, Geothermal
Renewable energy resource distribution relative to existing grid/load centres	Strategic expansion of the transmission lines taking into consideration new areas with potential to generate electricity.	Wind, Geothermal
Challenges in reaching financial closure.	• Introduction of the Green Energy facility. • FiT Policy guarantees priority purchase, transmission and distribution of all electricity from renewable energy sources. • Periodic review of the FiT Policy • Partnering with Development Partners to provide guarantees to private investors	Wind, Solar, Geothermal
lack of appropriate and affordable credit and financing mechanisms	Introduction of the Green Energy facility	Solar, biomass
Low awareness of the potential opportunities and economic benefits	• awareness creation through sensitization and demonstrations • promoting planting of fast growing tree species • Introduction of the Green Energy facility	Solar, wind, biomass
Lack of adherence to system standards by suppliers and Poor after-sales service	• Development of standards by Kenya Bureau of Standards and regulations by ERC	Solar

Barriers/ Constraints	Mitigation	Resources affected
High cost of resource assessment and feasibility studies	• Undertake feasibility studies and avail the reports to potential investors and developers	Small hydro, Geothermal, Wind
Climate change impact	• Re-afforestation	Small hydro
Limited capacity for equipment and human resource	• Procurement of drilling rigs • Training of Human Resource • Encourage manufacture of equipment locally	Solar, Small hydro, biomass, Geothermal
High resource risk	• GDC taking up the initial project preparation activities which have been a deterrent for geothermal development. These include infrastructure development, purchase of drilling rigs and materials, surface exploration and appraisal drilling	Geothermal

Cross-cutting issues

111. Most of the geothermal resources are located in under-developed areas. Through the development of this resource, the benefits to be achieved will include electricity generation; opening up of the areas through infrastructure development such as roads and water; opportunity for direct utilization of geothermal heat and condensate for industrial and agricultural based activities leading to employment creation and income generation; increased security in the areas as a result of the economic activities and social amenities. Provision of electricity as a source of energy, water, schools, roads and improved security will transform livelihoods as demonstrated in Olkaria and Sondu-Miriu areas.

112. Kenya's Vision 2030 development roadmap has attracted interest from both public and private investors. Development Partners have shown willingness to support the MoE to achieve its mandate of providing clean, sustainable, affordable, reliable and secure energy at least cost while protecting the environment. The use of SREP funds to undertake activities in renewable energy projects will leverage funds from these Development Partners and private sector.

IV. Program Description

Hybrid Mini-Grid Systems

113. Electricity access in rural Kenya is low despite the Government 's target to increase electricity connectivity from the current 15% to at least 65% by the year 2022. Diesel power generators are used to supply electricity to administrative towns and upcoming commercial centers in remote locations in Kenya. The cost of generation from these diesel plants is high and unpredictable due the fluctuating international crude oil prices. Besides the high cost, the diesel plants contribute to GHG emissions.

114. The Government is currently incorporating solar PV and wind systems in isolated diesel thermal power plants in arid and semi-arid areas to substitute generation provided through fossil fuel. The target for this project is to increase the proportion of renewable energy in existing and planned mini grids to 30%. The project will lower the cost of electricity generated as well as reduce the GHG emissions.

115. The existing isolated mini-grids are 12 with a total installed capacity of 11MW. The project proposes to install 3 MW of renewable systems (Solar and wind) in hybrid with the existing diesel generators. Further, the Government intends to construct 27 additional isolated mini-grids with an installed capacity of 13MW. This project proposes that renewable energy be incorporated into these systems as a hybrid once they have been constructed..

116. SREP funds will enhance the ongoing Hybrid power programme being undertaken by the Government.. The private sector will be encouraged to participate in the project under the Feed-in-tariffs so as to complement Government efforts. Availability of clean energy in rural areas will reduce dependence on biomass and kerosene. .

117. New isolated mini- grids supplied through renewable energy would result in more village centres being supplied with electricity and rural commercial centres accessing clean energy for productive uses. Further there will be increased security, access to medical services, education, and water services and reduce indoor air pollution. This will lead to improved livelihood in the target areas.

Solar Water Heating

118. The residential sector in Kenya consumes about 820 GWh of electricity annually for heating water. Growing electricity demand is putting a strain on the power infrastructure. Demand for water heating occurs during the morning and evening increasing the overall peak load. This necessitates dispatch of expensive thermal power. Use of Solar Water Heating Systems can reduce the peak demand arising from the need for water heating by domestic, institutional and commercial users.

119. The uptake of solar water heating systems in Kenya is extremely low compared to the enormous potential provided by the abundant solar energy resource and the demand for hot water for both domestic and commercial applications mainly due to capacity and financial barriers. The current cost of a typical 100 liter Solar Water Heating System is USD 1,500 which is unaffordable to many households. The SWH market lacks a critical mass of trained contractors and technicians to install and maintain systems. In addition, there is a low awareness regarding the technology and its financial benefits.

120. To increase uptake of SWH, the Government has developed the Solar Water Heating Regulations, whose adoption and enforcement will deliver the following benefits to the Kenyan economy:

(a) Development and utilization of indigenous energy resources;
(b) Enhanced national energy security through diversification of energy supply mix and reduction in the over reliance on petroleum imports;
(c) Reduced demand for expensive fuel fired peaking power plants resulting from grid electricity peak demand attributed to water heating;
(d) Increased environmental conservation through reduction of GHG;
(e) Increased employment, capacity building and income generation resulting from the expanded solar water heating industry.

121. The regulations will make it mandatory for all premises within the jurisdiction of a local authority with hot water requirements exceeding 100 litres per day to install and use SWH. Existing facilities will also be required to comply within a period of five (5) years upon gazettement of the regulations. These regulations are in line with policy directions under Sessional Paper No. 4 of 2004 on Energy which support usage of SWH and natural ventilation in all new buildings where technically feasible.

122. In addition to the regulations, addressing the market barriers (finance, capacity and awareness) will be essential to facilitate increased uptake of Solar Water Heating Systems and mitigation of power system peaks. The goal of the proposed project is to increase uptake of SWH through removal of market barriers and reduce peak demand. SREP funds will leverage other funds to buy down transaction costs, build capacity for SWH technicians and create awareness.. The project targets a minimum 50,000 solar water heating systems to catalyze the market.

123. The project will have three components, namely: a) financing scheme; b) capacity building targeted at enhancing installation techniques, quality control and follow up support for SWH technicians and contractors; and c) awareness creation.

Small Hydropower Development

124. Several studies conducted indicate that a potential of 3,000 MW exists for small hydro power (SHP) out of which 1,000 MW is economically viable for exploitation. Of this ,32 MW has been developed by both the public and private sector investors

125. Tea factories consume a substantial amount of energy, mainly from furnace oil, wood fuel and electricity, leading to adverse impact on the environment. Energy constitutes about 24 % out of which, electricity accounts for 56.3% of the energy cost. This is considered expensive due to the high cost of power occasioned by intermittent supply leading to frequent use of the diesel-generated power whose cost is three times higher. The average annual cost of electricity per factory is about US $ 350,000. Thermal energy is also expensive due to the high cost of furnace oil. Annual costs are influenced by the fluctuations in fuel prices, and frequency of use of standby diesel generated power.

126. The increasing cost of energy makes the Kenyan tea industry uncompetitive in the international market. This denies the country foreign exchange necessary for economic growth. The continued high cost of production would lead to unsustainable operation of the factories on which the entire livelihoods of the small-scale farmers depends. There is an urgent need to address the increased production costs by coming up with sustainable and economically viable power generation.

127. In collaboration with KTDA, MoE has identified and earmarked for further evaluation 12 potential sites on which the Agency had undertaken pre-feasibility studies but could not conduct detailed feasibility studies due to financial constraints. MoE conducted studies on the sites which rated the total capacity at 22 MW for development at a total cost of US $ 53.43 million. MoE forwarded reports of the studies to KTDA for the next phase of development.

128. The FiT for small hydro offers a stepped tariff of between US$ 0.06/ kWh and US$ 0.12/kWh. KTDA has expressed interest to develop the sites under FiT Policy and sell surplus power to the national grid. Under the financing arrangement, KTDA will provide 35% of the project costs as equity while the balance of 65% will be sourced from financiers. Currently, the Agency has obtained EIA and water permits as well as 50% of the equity component for the 12 sites but has been unable to secure the 65% debt component that is critical for the development of the sites

129. The proposed intervention from SREP funding will lead to the development of the 12 SHP sites to enable the factories release their current power, in addition to the surplus of 16 MW to the national grid for other purposes. The factories will also realize financial savings equivalent to the cost of the electricity from the utility. SREP Funds will provide the required critical co-financing for the implementation of the projects that will add 22 MW installed capacity of RE to the National Energy Mix and also contribute to risk reduction measures.

130. The reduction in the cost of energy will improve the earnings of farmers facilitating them to acquire and service loans for grid connection as part of rural electrification as well as promoting the local economy. This will enhance access to electricity generated from renewable energy sources. The generated power will seek to address the emission of greenhouse gases from thermal power stations and the emergency generators that are necessitated by outages.

131. The sites identified will be run-of-the river schemes, hence ensuring minimal interference with natural habitats and productive farmlands, and no relocation of people nearby since no large reservoirs are required. This will ensure environmental sustainability and acceptance of the projects by the communities.

Scaling Up Improved Biomass Cook Stoves in Institutions

132. In Kenya there are approximately 20,000 institutions (prisons, schools, clinics and hospital) each consuming 270 tonnes/year. In addition, a large percentage of SMEs (hotels, food vendors, small scale processing facilities etc.) use biomass resources as the primary source of energy. More than 80% of rural and 10% of urban households depend on wood fuel for cooking and heating.

133. Use of traditional sources of energy coupled with the use of inefficient firewood and charcoal stoves pose the following threats; severe health risks especially to women and children, biomass depletion, deforestation, forest degradation and loss of biodiversity. Massive scale up of the cook stove technologies is needed to mitigate these. Constraints to scale up include:

(a) low-income levels combined with lack of accessible and affordable financing;
(b) high cost of improved stoves; and
(c) inability of local populations to raise the initial capital outlay needed.

134. Increased adoption of efficient cook stoves and the establishment of biomass plantations will improve energy security and facilitate the recovery of degraded biomass resources,

contributing to environmental conservation and climate change mitigation while promoting private sector investment in the biomass sub-sector. These will lead to increased job opportunities, improved livelihood and incomes.

135. The proposed project aims to mitigate the social and financial barriers to the adoption of improved stoves in households, SMEs and institutions. The project will enhance stove production capacities and increase awareness among policy makers, financial institutions, investors and end users regarding the benefits. It will also facilitate acquisition and installation of improved cook stoves and the establishment of biomass plantations in order to achieve sustainability.

136. The project will be implemented through existing institutional arrangements developed from previous activities of the MoE and its Development Partners including UNDP. The project – Market Transformation for Highly Efficient Biomass Stoves for Institutions and Medium Scale Enterprises in Kenya and other previous experiences implemented in the last two decades have fully prepared the country for scaling up improved cook stoves programme nationally.

137. Previous activities in the last two decades in Kenya began to remove market barriers to the adoption of sustainable biomass energy technologies by institutions households SMEs in rural and urban areas of Kenya. The projects have promoted highly efficient improved stoves, and established woodlots and contributed to reduction of GHGs. for example, a project implemented recently by the Ministry of Energy and UNDP GEF, will deliver GHG reductions of between 400,000 and 960,000 tons of CO2e by 2020. Over a four year-period, the project installed about 2,000 institutional stoves in over 1,000 schools and supplied over 20 SMEs stoves and about 500 household stoves. More than 550,000 trees have been planted in several schools that had adopted the stoves. It is projected that up to 5 million trees will have been planted by households, SMEs and institutions over the first five year period. A National Wood fuel Strategy and Action Plan drafted by the project is under consideration by the Ministry of Energy.

Development of 400 MW of Geothermal in Kenya

138. The Least Cost Power Development Plan (LCPDP) projects that Kenya's demand for electricity by 2030 will be 15,000 MW. To meet this projected demand, the GoK targets to generate 1,600 MW of geothermal by 2016 and 5,000 MW by 2030. Further, the GoK strategy is to change the base load electricity supply from hydro, which is affected by droughts, to geothermal that is reliable and cost effective. The Kenyan Rift Valley offers vast geothermal potential of between 7,000 MWe to 10,000 MWe that is largely untapped.

139. Currently, in the Olkaria Block 198 MW is generated and 280 MW is under development. Initial project development activities have commenced for the development of 800 MW in the Bogoria-Silali Block. The Menengai geothermal area is one of the priority prospects in the current ranking with an estimated potential of 1,600 MW to be developed under a three-phase programme. Drilling is ongoing in the Menengai Field for the first phase of 400 MW. The first exploratory well is complete with an estimated capacity of more than 10 MW. These activities are geared towards meeting the Vision 2030 Medium Term target.

140. The GoK strategy for geothermal development is to address the perceived risks at the nascent stages of geothermal development which deter the private sector and funding institutions from participating. This project is designed to eliminate these perceived risks and prove the

existence of the geothermal resource which will build the investors' confidence for eventual participation in the development.

141. By accelerating geothermal development the ratio of contribution from renewable energy sources to the national grid will increase. Further, this will realize the GoK strategy of changing the electricity base load supply from hydro to geothermal.

142. The development of geothermal has been slow as highlighted below;

i. **45 MW Olkaria I Power Plant:** Drilling started in 1955 and the last unit of the plant was commissioned in 1985. This was about **30 years**.

ii. **105 MW Olkaria II Power Plant:** Drilling using a rig owned by KenGen, started in 1986 and the plant was commissioned in 2003 (Unit 1 & 2) and 2010 (Unit 3). This was about **17 and 24 years** later.

iii. **280 MW Olkaria IV and I (Unit 4&5):** Exploration drilling through own rig was done in 1998 to 1999. Appraisal and production drilling mainly through hired rigs started in 2006 and the plant is scheduled for commissioning by December 2013. This will be **15 years** later.

iv. **100 MW Olkaria III: Concessioned in 1998.** By 2009 (**11 years** later), the IPP had developed only 48 MW and the additional 52 MW plant is scheduled for commissioning by 2013 which will be **13 years** after concession. Similarly, concessions for the undeveloped prospects in Suswa (2007) and Longonot (2009) have not registered any progress.

143. Realizing the need to reduce the long gestation periods in the development of geothermal the Government has set up the Geothermal Development Company (GDC) to undertake integrated development of geothermal through initial exploration, drilling, resource assessment and promotion of direct utilization of geothermal. GDC is 100% owned and funded by the Government. By undertaking the initial project activities, GDC will remove the attendant risks associated with geothermal development and therefore open up opportunities for both public and private participation.

144. In the development of 400MW project at Menengai, GDC seeks to reduce project development period to about **five years** by undertaking the initial project activities which include detailed surface exploration, infrastructural development, drilling of exploratory and appraisal wells.

145. Further, the following transformative initiatives will be achieved:

a) The perceived risks associated with the initial geothermal development activities which deter the private sector and funding institutions from participating will be eliminated. This will enhance private sector confidence in the project.

b) Funding from the private sector will be mobilized by offering development opportunities on competitive basis;

c) Generation from Hydro will be replaced as the base load source of electricity supply with geothermal. This will lead to a more reliable and cost effective electricity supply;

d) Increase the contribution of renewable energy into the energy mix and displace generation from thermal thereby resulting in reduced GHG emissions thus mitigating pollution of the environment.

e) Improved livelihoods to the communities around geothermal areas through direct use programmes from geothermal products through supply of water and process heat for farming, industrial use and social amenities. This will spur economic activities in these areas.

146. The following activities are being undertaken by GoK indicative of its willingness for the implementation of the project:

a) Increased budgetary allocation to Geothermal Development Company (GDC), to cover initial project preparation activities, exploratory and appraisal drilling. The GoK is committed to the project and in the past two years, it has provided GDC with USD 73 million and USD 85 million through budget support for the year 2009/2010 and 2010/2011 respectively. It is expected that GDC will receive a further USD 188 million in year 2011/2012 from the Government.

b) Procurement of rigs and associated equipment.

- GoK, through its own funding has procured two rigs which are currently drilling in the Menengai Field.
- Two other rigs funded by the French Development Agency (AFD) are expected by December, 2011 and will be deployed in Menengai.
- The African Development Bank is extending funding to GDC for procurement of two additional rigs and materials for drilling 40 wells.

c) Detailed surface exploration work is complete and reports available

d) The ESIA for drilling has been completed and the NEMA license obtained

e) Efforts to build geothermal capacity are underway with recruitment and training of drilling staff ongoing

f) By Kenya being nominated as a Pilot SREP Country and the funding opportunity envisaged from this, initiatives are being undertaken to mobilize funding to leverage on the SREP. This has generated interest from development partners namely; AFD, AfDB, China Eximbank, World Bank, JBIC, EIB, USTDA.

147. The project will increase the installed electricity capacity and energy from renewable energy sources by an additional 400 MW, and result in a replication of the model to achieve the Government's long term commitment of 5,000 MW by 2030. Evacuation of the generated power will require extensions and new constructions on the existing transmission systems resulting in increased access to energy from renewable energy sources.

148. Generation from geothermal does not contribute to Green House Gas emissions and is friendly to the environment. The Screening Curve Analysis under the LCPDP demonstrates that electricity generation from geothermal is the least cost option for Kenya. The Government's plan to displace expensive thermal generation will result in reduced air pollution and affordable power that will in turn spur economic growth and the competitiveness of Kenyan products.

149. A lot of interest and support has been generated from both the private sector and development partners for this project and this should result in maximized leverage on the SREP funds. GDC is already working with AfDB, AFD, USTDA, EIB, World Bank, IFC, KfW to further this project.

150. There is an urgent need in Kenya to address the growing demand for electrical energy. Currently, inadequate capacity has been addressed by using thermal generated electricity whereby the fuel cost is passed over to the consumer which has led to increased cost of power. Accelerated development of geothermal will help lower this cost by addressing the electricity supply gap in a reliable and sustainable manner. SREP funds will have a lead role to play in accelerating geothermal development to addresses energy security.

151. Geothermal has replaced Hydro as the base load source of electricity supply according to the LCPDP since Hydro has become unreliable due to droughts. SREP funds are sought to help accelerate geothermal development as the energy source that the country relies on to boost its electricity supply.

152. Slow pace of growth has contributed to its low installed capacity of 198 MW in 30 years. The GoK annual budgetary allocation will go into Project Preparation activities as well as drilling. SREP funds will speed up the production drilling stage envisaged in the Financing Plan by supplementing government efforts to take care of perceived upfront risks to geothermal development and shorten period taken to realize the 400 MW target. These activities will lead to early realization of the resource (steam) translating to early energy for the country to meet its electricity demand.

153. Under drilling component, the SREP funds will be directed to production drilling. Exploration wells' drilling is done with the aim of proving steam existence. Availability of steam will pave way to drilling of the appraisal wells to prove whether the resource (steam) is viable as an investment venture. By Gok undertaking both exploratory and appraisal drilling and SREP funding going into production drilling, the stage will be set for increased investor confidence and private sector participation.

154. The current electricity transmission network has low coverage and limited capacity to support the current and planned generation capacity. This has led to unreliable electricity service and unnecessarily high technical losses in the public electricity system. This has led to the need for substantial investments to expand the national grid. Therefore, more effort will be necessary in order to increase electricity access, reliability and reduce system losses in line with international best practice.

155. In order to meet the growing demand and provide adequate, reliable, safe and environmental friendly power, the Government is diversifying energy sources. This is achieved by shifting the focus away from unreliable hydro and expensive thermal sources to renewable energy sources. In this case, geothermal power has been identified and it has a high potential. Massive geothermal power generation investment has been planned. However, in order to support these efforts and evacuate the generated power, transmission lines are quite necessary. Some specific areas/projects have been identified for geothermal generation such as the Menengai Field in the Rift Valley. Therefore, the proposed transmission line i.e. Menengai – Rongai 220kV double circuit 20km transmission line, will specifically evacuate power from Menengai to a new sub-station at Rongai. This line will connect to the national grid by joining with the planned Olkaria-Lessos-Kisumu transmission line.

156. This line will evacuate power from the identified generation plants with the aim of connecting it to the national grid. This will increasing electricity access and improve power reliability, stability and reduce system losses within the grid.

157. Implementation of the transmission lines project will depend on the following:

(i) Feasibility study;
(ii) Environmental and social impact assessment & RAP;
(iii) Acquisition of way leave;
(iv) Detailed design and contract preparation

158. KETRACO is currently undertaking preparatory activities to construct Olkaria-Lessos-Kisumu 220kV double circuit line expected to be complete by 2015. It is expected that feasibility study and environmental and socio-economic impact assessment for the proposed Menengai – Rongai line will be undertaken together with the feasibility study for the 400MW Menengai geothermal project.

159. There is a need to fast-track the construction of the transmission line and thus the proposal aims at supporting the Government to raise counterpart funds. It is expected that multiple development partners will support the project once the counterpart funds are guaranteed.

160. The following results are expected to be achieved:

a) Addition of 400 MW from geothermal to the national grid by 2015
b) Replication of the development model to achieve the 5,000MW by 2030
c) Increased private sector participation in power generation
d) Length (20 km) of electricity transmission line constructed;
e) Number (2 No.) of electricity transmission sub-stations constructed;

V. Selection 0f Projects to be Funded by SREP

161. The IP has identified the following 5 projects to be considered for SREP funding:

a) Hybrid Mini-Grid Systems

b) Solar Water Heating

c) Small Hydropower Development
d) Scaling Up Improved Biomass Cook Stoves in Institutions

e) Development of 400 MW of Geothermal in Kenya

All the above projects meet the SREP investment criteria. However, due to the limited funds available under SREP, a new set of criteria have been developed in consultation with stakeholders to prioritize the projects to be presented for funding.

162. The criteria developed to screen the proposed projects so as to prioritize them are as follows:-

a) Potential to scale up
b) Potential for new direct beneficiaries
c) Cost effectiveness (USc/KWh)
d) Contribution to base load/strategic relevance
e) Scale-up, leveraging for additional resources
f) Avoiding duplication/crowding out
g) Project readiness (e.g. availability of studies)

163. The following table presents the outcome of the evaluation based on the criteria:

Criteria	Hybrid Mini-Grid Systems	Solar Water Heating	Small Hydropower Development	Scaling Up Improved Biomass Cook Stoves in Institutions	Development of 400 MW of Geothermal in Kenya
Potential to scale up	High	High	Medium	Low	High
Potential for new direct beneficiaries	Medium*	Medium*	Low	High*	High
Cost effectiveness	High	High	High	High	High
Contribution to base load/Strategic relevance	High	High	Low	Low	High
Leveraging for additional resources	Medium	Medium	High	Low	High
Avoiding duplication/crowding out	High	Medium	Medium	Low	Medium
Project readiness (e.g. availability of studies	High	High	Medium	High	High

164. The following scores were used to rank the proposals: High =3, Medium =2 and Low = 1. The aggregated scores for the projects were:

PROJECT	AGGREGATE SCORE
Hybrid Mini-Grid Systems	19
Solar Water Heating	18
Small Hydropower Development	14
Scaling Up Improved Biomass Cook Stoves in Institutions	13
Development of 400 MW of Geothermal in Kenya	20

165. Additionally the Government of Kenya has made a conscious decision that to effectively use the SREP funds and also have widespread effect in the country, there should be at least one project on-grid and one off-grid. Consequently, the following projects have been selected for implementation in order of priority:

a) Development of 400 MW of Geothermal in Kenya

b) Hybrid Mini-Grid Systems

c) Solar Water Heating

Financing Plan and Instruments

166. The financing plan for the entire program is indicated in the table below:

SREP Allocation	Project Cost/ Estimated Cost		Financing (USD)										
		Cost (MUSD)	MoE/ REA/ KPLC	GDC/ MoE	KETRACO	SREP	MDB's			AFD / NDF/ DFI's	Private Sector/ Developers/ KenGen	Financing Gap	Total (MUSD)
							AfDB	WBG	IFC				
SREP Initial Allocation	***200 MW of Geothermal - Phase A***	***400.0***											
	Resource Development												
	Project Preparation	82.0	-	82.0	-	-	-	-	-	-	-	-	**82.0**
	Rig Procurement 2 @ MUSD 35	70.0	-	-	-	-	70.0	-	-	-	-	-	**70.0**
	Exploratory Program (3 Wells)	10.5	-	10.5	-	-	-	-	-	-	-	-	**10.5**
	Appraisal Program (Drill 6 Wells)	21.0	-	21.0	-	-	-	-	-	-	-	-	**21.0**
	Feasibility Study	2.0	-	-	-	-	-	2.0	-	-	-	-	**2.0**
	Production Drilling (35 Wells)	122.5	-	-	-	39.0	38.5	45.0	-	-	-	-	**122.5**
	Reinjection Wells (8 Wells)	28.0	12.5	-	-	-	-	15.5	-	-	-	-	**28.0**
	Steamfield Development	36.8	-	-	-	-	-	36.8	-	-	-	-	**36.8**
	Wellhead Equipment	22.3	-	-	-	-	10.0	12.3	-	-	-	-	**22.3**
	Capacity Building	5.0	-	-	-	1.0	4.0	-	-	-	-	-	**5.0**
	Sub Total	**400.0**	**12.5**	**113.5**	**-**	**40.0**	**122.5**	**111.5**	**-**	**-**	**-**	**-**	**400.0**
	Hybrid Mini-Grid Systems	***68.0***											
	Equipment	49.5	-	-	-	-	-	2.5	-	42.0	5.0	-	**49.5**
	Grid	16.5	-	-	-	9.0	5.5	2.0	-	-	-	-	**16.5**
	Supervision	0.7	0.7	-	-	-	-	-	-	-	-	-	**0.7**
	Transaction	0.1	0.1	-	-	-	-	-	-	-	-	-	**0.1**
	Studies /Design	0.2	0.2	-	-	-	-	-	-	-	-	-	**0.2**
	Capacity Building	1.0	-	-	-	1.0	-	-	-	-	-	-	**1.0**
	Sub Total	**68.0**	**1.0**	**-**	**-**	**10.0**	**5.5**	**4.5**	**-**	**42.0**	**5.0**	**-**	**68.0**
SREP Reserves	***200 MW of Geothermal - Phase B***	***400.0***											
	Power Plant Construction												
	Power Plant Construction	385.6	-	-	-	14.6	25.0	50.0	-	200.0	96.0	-	**385.6**
	Sub Total	**385.6**	**-**	**-**	**-**	**14.6**	**25.0**	**50.0**	**-**	**200.0**	**96.0**		**385.6**
	Transmission & Substations												
	Way Leave acquisition	2.0	-	-	2.0	-	-	-	-	-	-	-	**2.0**
	Design & Contract	2.0	-	-	2.0	-	-	-	-	-	-	-	**2.0**
	Transmission line (20 km)	5.4	-	-	-	5.4	-	-	-	-	-	-	**5.4**
	Sub-stations - 220kV (2 N0.)	5.0	-	-	-	5.0	-	-	-	-	-	-	**5.0**
	Sub Total	**14.4**	**-**	**-**	**4.0**	**10.4**	**-**	**-**	**-**	**-**	**-**		**14.4**
	Solar Water Heating Component	***60.0***											
	SWH Equipment & Installation	59.0	-	-	-	10.0	-	-	2.0	-	-	47.0	**59.0**
	Project Design & Market Review	0.2	0.2	-	-	-	-	-	-	-	-	-	**0.2**
	CDM Project Development	0.1	-	-	-	-	-	-	-	-	-	0.1	**0.1**
	Capacity Building	0.6	0.6	-	-	-	-	-	-	-	-	-	**0.6**
	Awareness	0.2	0.2	-	-	-	-	-	-	-	-	-	**0.2**
	Sub Total	**60.0**	**1.0**	**-**	**-**	**10.0**	**-**	**-**	**2.0**	**-**	**-**	**47.0**	**60.0**
	Total	**928.0**	**14.5**	**113.5**	**4.0**	**85.0**	**153.0**	**166.0**	**2.0**	**242.0**	**101.0**	**47.0**	**928.0**

VI. Additional Development Activities

167. The following table illustrates Initiatives by Development Partners on Renewable Energy in the country

Donor	Title	Description
AFD	Energy Sector Recovery Project - Component D	Co-financing of ESRP - Financing of rehabilitation of KPLC's sub-stations in Nairobi and Coast provinces. Review of KPLC's connection policy and implementation of pilot projects to enhance connectivity in Kenya, including the set-up and funding of a connection revolving fund
AFD	Off-grid rural electrification	Conversion of diesel generators into hybrid generators (wind, solar, biomass) and construction of new generators and associated mini-grids in rural areas
AFD	Scaling -up Access	Scaling up of pilot revolving fund to enhance connectivity in Kenya, complemented by a CFL distribution component
AFD/ PROPARCO	Mumias Sugar co-generation	Financing of 25W through co-generation (IPP Project) (20 MUSD Proparco +15 MUSD AFD).
AFD/ PROPARCO	Lake Turkana Wind Farm	Partial financing of the 300 MW wind farm (IPP project (15 MEUR Proparco + 20 MEUR AFD)
Proparco	Olkaria III	Partial financing of 35 MW generation capacity at Olkaria III (IPP Project)
AFD	Olkaria II-3rd Unit	co-Financing of the Olkaria II Geothermal Plant Extension (3rd Unit) - 35 MW
AFD	Olkaria I and IV Project	Extension of the 280 MW geothermal plant
AFD	Support to the development of renewable energy and geothermal energy	Support to the Geothermal development company + funding of a national master plan
AFD	Renewable Energy and Energy Efficiency credit line	Credit line to commercial banks to promote renewable energy and energy efficiency projects in the agri-business and hostelry sectors
AFD	Wind feasibility study	Preparation of feasibility studies for 12 additional wind sites
AfDB	Menengai Geothermal Power Project	Partial financing of drilling activities for the development of the Menengai geothermal field for power generation
AfDB	Lake Turkana Wind Power	Partial financing of a 300 MW wind park near lake Turkana in Northern Kenya
EIB	Olkaria II Extension	Part-financing of a third steam turbine at the Olkaria II geothermal power plant

Donor	Title	Description
European Commission	Promoting use of Sustainable Energy in Wajir District	Installation of energy systems in at least 80% of the 20 target institutions by the end of the project, installation of 2 wells using solar technology to pump water, installation of 1 community well using wind energy to pump out water, planting of 20,000
European Commission	Community based mini hydropower development in upper Tana river basin for poverty alleviation	Construction of 7 mini-hydro power plants with total capacity of 3185kW, Installation of distribution power lines to 23538 households, 28 markets centres, 59 Schools, 3 Tertiary Institutions, 12 Health centres, 8 factories and 33 churches, 7 tree nurseries
European Commission	Up scaling the smaller biogas Plants for agricultural producers and processors	At least 330 additional rural households in 5 provinces will get access to clean energy, indoor air pollution in 330 rural households will be reduced by 30%, 330 rural households will have reduced fuel wood consumption by 60%, at least 30 agricultural enterprises.
European Commission	Community Based Green Energy Project (CB-GEP)	To increase access to modern, affordable and sustainable energy services for 268,000 households, 48 institutions and 48 rural community based groups in rural and peri-urban areas in Kenya
European Commission	The Improved Cook Stoves for Households and Institutions Project	Contribute to improving livelihoods of rural and peri-urban poor households in Kenya by improving their access and use of efficient, renewable and clean energy options by both men and women
European Commission	Solar Energy for rural Kenya	Improving the access of poor people to sustainable and affordable energy services in a perspective of combating climate change and achieving the MDGs and WSSD objectives on energy. Providing safe, environmentally friendly and affordable light, independent
European Commission	Support to and expansion of Malindi Bio – Fuel Cluster – Jatropha farming	To promote the oil tree Jatropha as a renewable, sustainable and decentralized source of biofuel for cooking and lighting for small-scale farming communities in Malindi and Magarini Districts at the Kenyan North Coast.
GIZ	Renewables Made in Germany - Project Development Programme	Technical assistance; advisory and facilitation of matchmaking and business-to-business partnerships between German and East African renewable energy companies for technology partnerships and investment promotion
Government of PRC/ CHINA EXIMBANK	Olkaria I and IV Geothermal Project	Provide Concessional Loan to fund drilling services for 26 production wells
Government of Finland	"Decentralized Re-system for electrification and Empowerment"	Village lighting, and electrification for productive purposes
Government of Belgium	Electrification project	Enhance the reliability of the electricity network in the Thika region by installing a 132 kV transmission line, strengthening the existing 66 kV grid, and expanding the 33 kV rural electrification network (Phase II)
Government of Belgium	Ngong wind power project expansion	Ngong wind I Phase II is a project which is envisioned to inject 6.8MW to the grid after completion of construction in September 2012. Commencement date for this project is set to be May 2011.

Donor	Title	Description
Government of Spain	Solar PV installations to 380 Public Institutions	Provide electricity to schools, health facilities in Arid and Semi Arid Land will be undertaken using grants from Spanish Government.
Government of Spain	Ngong wind power project expansion	Ngong wind II project is projected to add 13.6MW to the grid when it will be commissioned in October, 2011. Spanish Government will finance this project.
IDA /WB	Energy Sector Recovery Project	Sector reform; KPLC corporate recovery; strengthening of ERC, MoE, and KEBS; upgrading of KPLC distribution lines and sub-stations; electricity meters to connect 400,000 customers; Olkaria II 3rd unit.
IDA/WB	Energy Sector Recovery Project Additional financing	Financing of financing shortfalls of ESRP; scaling up distribution component to connect additional customers in peri-urban areas.
IDA/WB	Electricity Expansion Project	Generation, transmission, distribution, off-grid, renewable energy.
IDA/WB	Agricultural productivity and Agribusiness project	Small hydro, solar, wind, or bio-gas
IDA/ IFC/ GEF	Lighting Africa	Support to innovative renewable energy lighting products
IDA/ Carbon finance	Community Development Carbon Fund - Emission reductions purchase agreement	
IFC	Advisory Service on Geothermal Power Development	Private Sector Barrier analysis and development of appropriate solutions
IFC	Advisory Service on Small/ Mini-Hydro development (<10 MW)	Technical assistance to private sector clients to help them raise commercial financing from local banks for small/mini- hydro projects
IFC	Investment Support to the Private Sector for Geothermal Power Development	Early stage financial support in the form of concessional loans for the feasibility stage (resource development stage) for at least 2 geothermal projects (totaling 100 MW) so as to mobilize more private sector investment. Discussion ongoing with key large geothermal power developers e.g. Magma, Enel etc who are interested in developing Geothermal Power in Kenya. Expected leverage 1:10
IFC	Investment Support to the Development of Small/Mini-Hydro and biomass/ biogas based power projects	First loss deficiency guarantee or other form of risk mitigation (portfolio level or individual project level) for supplementing a credit line from IFC to commercial banks in Kenya providing senior / mezzanine loans to small power developers. Expected to help develop 50 MW i.e. indicative leverage of at least 1:10.
MIGA/ WB	OrPower4 (Olkaria III)	MIGA guarantee
JICA	Olkaria-Lessos-Kisumu Transmission Line Upgrading Project	Construction of about 213 km double circuit Olkaria-Lessos 220kV line and about 77km single circuit Lessos-Kisumu 220kV Line
JICA	Olkaria I Unit 4 and 5 Geothermal Power Project	Construction of Geothermal Power Plant unit 4 and 5 at 70MW each at Olkaria

Donor	Title	Description
JICA	Renewable Energy Promotion Program	Project for Empowering Rural Communities through Renewable Energy Technologies in Kenya (TRICECRET-K) 1. Project for Capacity Development for Promoting Rural Electrification Using Renewable Energies in Kenya 2. Project for Establishment of Rural Electrification Model Using Renewable Energy
KfW	Olkaria IV appraisal drilling (geothermal)	Co-finance for appraisal drilling (6 wells) up to establishment of feasibility study for subsequent production drilling
KfW	Olkaria IV Transaction Advice	Transaction Advice to support the tender process for private investment (BOT/BOO) regarding the power plant Olkaria IV (64MW)
KfW	Olkaria I and IV Project	Extension of the plants
KfW/ DEG	Olkaria III (geothermal)	Construction of 48 MW Geothermal Power Plant, IPP
NDF	Energy Sector Recovery Project - Component D contract V	
UNEP/GEF	Removal of barriers to energy conservation and energy efficiency in small and medium scale enterprises.	Reduction in CO2 emissions resulting from increased energy efficiency within Kenya's small and medium enterprises
UNEP/ GEF	Market transformations for efficient biomass stoves for institutions and small and medium enterprises	Project to remove market barriers to the adoption of sustainable biomass energy practices and technologies by institutions and small businesses in rural and urban Kenya.
UNEP/ GEF	Cogen for Africa	This regional project aim to help transform the cogeneration industry in Eastern and Southern Africa into a profitable cogeneration market and promote widespread implementation of highly efficient cogeneration systems by removing barriers to their application.
UNEP/ GEF	Greening the Tea Industry in East Africa (GTIEA)	Regional project installing hydro with tea factories in Kenya, Tanzania, Uganda, Rwanda and Malawi. Excess power to the grid or rural electrification
UNEP/ GEF	Sustainable Transport Solutions for East Africa (SUSTRAN)	Regional project increasing awareness of and support for the implementation of sustainable transport solutions amongst policy makers, stakeholders and the general public in East Africa and beyond.
UNEP/ GEF	African Rift Geothermal Development Facility (ARGEO)	Regional project targeting promotion of geothermal energy development in several countries in the Rift Valley. The project will provide technical assistance for exploration and utilization of geothermal energy for power generation through a regional network, and financial incentives and risk mitigation for exploratory drilling.

Donor	Title	Description
UNDP	Access to Clean and sustainable energy services	Promotion, development and distribution of sustainable energy services to serve basic household needs, income generating opportunities and service economy while reducing poverty as well as reversing environmental degradation. This will address areas of Capacity building, Solar thermal, bio-fuels, pico and micro hydros, wind energy, feed in tarrifs for wind, solar and biomass, Biogass development, Biomass gasification and East African Energy scaling up strategy.
UNDP (GEF)	Market transformations for efficient biomass stoves for institutions and small and medium enterprises	Project to remove market barriers to the adoption of sustainable biomass energy practices and technologies by institutions and small businesses in rural and urban Kenya. Reduction in CO2 emissions resulting from increased energy efficiency within Kenya's small and medium enterprises
UNDP	Standards and Labeling in Kenya	To remove barriers to market transformation to energy efficient products and services in Kenya with a replication effect to four other east African Countries (EAC) of Burundi, Rwanda, Tanzania, and Uganda. All these countries have adequate energy to meet their development goals. The introduction and implementation of the initiative will therefore improve energy efficiency, increase availability of a “new" power and reduce GHG emissions thus mitigating climate change
UNDP	Promoting Public Private partnerships: Sustainable land management through Sustainable charcoal production	Promoting sustainable charcoal production through private public partnerships. The project provides new technologies for charcoal production, promotes formation of Charcoal producer associations and use / enforcement of charcoal rules. Charcoal producers are encouraged / expected to plant trees after cutting for charcoal production for sustainability.

VII. Sectoral Environmental Impact Assessment

168. With a view to implementing energy sector investment programs in a sustainable and environmentally friendly manner, the Government carried out a Sectoral Environmental Impact Assessment (SEIA) for the energy sector investments in 2009. The SEIA identified environmental policies that will trigger various investments in the sector. The SEIA specifies potential cumulative environmental and social impacts as well as possible mitigation measures.

169. The SEIA identifies the following main impacts associated with future geothermal power developments: loss of vegetation during construction, air pollution due to H2S emissions, over abstraction of water during drilling, and noise and interference with wildlife. For transmission and substations, the main impacts identifies are deforestation due to clearing of vegetation along the right of ways, interference with wildlife, loss of land and crop production due to wayleave. In both cases, the SEIA finds the significance of impacts is generally to be moderate.

- Country/regional risks - institutional, technology, environmental, social, financial
- Absorptive capacity for SREP and leveraged resources

VIII. Monitoring and Evaluation

170. The catalytic replication effect of the Program will come from: (a) investments resources that SREP will leverage; from (b) learning and demonstration; and (c) impetus to policy development.

a. Leverage of resources: SREP resources will leverage investments resources from AfDB, IDA, the other development partners and the private sector for Renewable Energy development in a ration of 1 to 8. The investment mobilized by SREP for geothermal resource development will catalyze downstream geothermal IPPs. Geothermal IPPs – representing approximately US$100 million in private financing - by themselves will have transformative impact due to their scale.

b. Learning and Demonstration: In addition, the catalytic replication effect of the Program will come from the capacity building and knowledge creation that the program will leverage. For example the learning in geothermal resource development including participation of IPPs will be shared in Kenya and in other countries with significant geothermal resource development potential such as Uganda, Rwanda and Ethiopia. Similarly the programs interventions in hybrid mini-grid systems will have significant demonstration effect in the region.

c. Policy Development: The IP will give impetus and help sustain the policy, institutional and regulatory environment, being supported by other MDB operations including the Kenya Electricity Expansion Project (KEEP of IDA). Specific technical assistance under KEEP for example will elaborate regulations for grid connected renewable energy. Technical assistance intervention under the IP will catalyze private sector.

171. The following objectives and indicators have been used to develop the Results Framework:

a) Objectives:
- **Increase in number of women and men supplied with electricity**
- Additional resources leveraged for geothermal and off-grid systems investments
- Improved enabling environment for renewable energy production and use

b) Indicators:
- Leverage factor of SREP funding; $ financing from other sources (contributions broken down by Donors (MDBs and Bilateral), Government of Kenya, CSOs, private sector) for geothermal and mini-grids using renewable energy sources
- Percentage (%) change in number of project beneficiaries with access to energy services from geothermal and mini-grids using renewable energy sources (women/men)
- Enactment of policies, laws and regulations for renewable energy

172. Results framework for Kenya SREP Investment Plan

NB: RE in the table refers to hybrid (wind/solar) mini grids and geothermal energy for grid supply - the main focus of SREP program intervention in Kenya

Results	Indicators	Baseline (year 2010)	Targets	Responsibility for collection	Data Source	Data availability (Yes/No)
Project Outputs and Outcomes						
1. Increase in number of women and men supplied with electricity	**Number of customers connected to Main grid**	1,441,139	2,200,000 (by 2015)	KPLC	Project M&E	
	Number of customers connected to Mini- grid	22,500	33,500 (by 2015)	KPLC		
2.Decrease in GHG emissions	**Displaced amount of GHG emission in the Isolated Mini-Grid in tonnes per year**	0	10	REA	Project M&E	The amount of CO2 equivalent mitigated and the $ cost per ton in Kenya IP projects
	Displaced amount of GHG emission in the Nation Grid in tonnes per year	0	1,061	MoE		
3. Increased RE supply	**a) Amount of energy in GWh from RE annually**	3,525	5,167 (by 2015)	KPLC	Project M&E	Yes (KPLC Annual Reports)
	b) Additional geothermal power connected to the national grid	198 MW	400 MW by 2015	KPLC		
	c) Replication of the development model	198MW	5,110 MW by 2030	GDC		
	d) Length (Km) of electricity transmission line constructed	0	20 Km by 2015	KETRACO		
	e) Number of electricity transmission sub-stations constructed	0	2 No. by 2015	KETRACO		
4. Decreased cost of electricity	**Reduction in annual generation costs in the isolated mini-grids**	TBC	TBC	MoE	Project M&E (Household Surveys)	
	Reduction in annual generation costs in the main-grids					
5. Learning about demonstration, replication and transformation captured, shared in Kenya and to other countries in SSA especially in EAC.	**Number and type of knowledge assets (e.g., publications, studies, knowledge sharing platforms, learning briefs, communities of practices, etc.) created**	TBC	3	GDC, REA	Project M&E (Entity reporting))	

Results	Indicators	Baseline (year 2010)	Targets	Responsibility for collection	Data Source	Data availability (Yes/No)
6. New and additional resources for renewable energy projects	**Leverage factor of SREP funding; $ financing from other sources (contributions broken down by Donors (MDBs and Bilateral), Government of Kenya, CSOs, private sector) (USD Millions)**	-	1:8	MoE,GDC, REA	Project M&E (Entity reporting))	
Catalytic Replication						
1. Increase in renewable energy generation investments	**a) Percentage (%) of RE investment of total new energy investment**	TBC	TBC	MoE		
	b) Amount of RE generated by the private sector in new RE plants	TBC	TBC	MoE		
2. Improved enabling environment for RE production and use	**a) Adoption of and implementation of low carbon energy development plans**	TBC	TBC	MoE		
	b) Enactment of policies, laws and regulations for renewable energy	TBC	TBC	Energy Regulatory Commission		
3. Increased economic viability of renewable energy sector	**a) Percentage (%) of private sector RE investments of total new energy investments**	TBC	TBC	MoE		
	b) Change in percentage (%) of total energy sector employment working in RE (women/men)	TBC	TBC	MoE		
Transformative Impacts in KENYA						
Transformed energy supply and use by poor women and men in Kenya, to low carbon development pathways	**c) Number of new households connected to electricity in the rural areas.**	TBC	TBC	REA		The amount of total electricity supply (GWh) coming from RE sources in KENYA.
	d) Population (rural) consuming energy services from new hybrid RE systems	TBC	TBC	REA		
	e) Change in the energy development index - EDI (per capita electricity consumption)	TBC	TBC	MoE	Household surveys	

Annexes

Annex 1: Hybrid Mini Grids Systems

1. The Government's near-term targets for scaling-up electrification are defined in the Medium Term Plan (MTP). The MTP is the first of a series of five-year plans aimed at achieving the objectives of the Government's long-term national development plan, "Vision 2030", which aims to transform Kenya into a middle-income country by 2030. Energy sector development is one of the foundations of Vision 2030, and improving the performance of the electricity sector is seen as an important step to unlocking the economic potential of the country. Vision 2030 specifically identifies high energy costs and poor energy infrastructure as constraints on Kenya's economic growth. The MTP describes two programmes aimed specifically at increasing access to electricity. These programmes are:

   - **The Energy Access Scale-Up Programme.** This programme aims to connect one million new households, roughly doubling the current number of connected customers
   - **The Rural Electrification Programme.** This programme aims to connect all **"**priority loads". Priority loads are defined as district headquarters, secondary schools, health facilities, and trading centres. .

2. To achieve this, institutions falling outside of the reach of the grid and off-grid systems by 2014 can be supplied with hybrid systems.. The government considers involvement of development partners essential to the success of the hybrid programs given the size and scale-up envisioned in the Investment Prospectus.

3. Electricity access in rural Kenya is low despite the Government's target to increase electricity connectivity from the current 15% to at least 65% by the year 2022.. The rural electrification program involves expansion of both renewable and non-renewable sources of energy in remote parts of rural area. However, the funds available can only enable roll out to a limited number of areas, leaving out other equally needy towns. In order to increase access, new mini grids are being constructed to be supplied by thermal/renewable energy sources. The planned hybrid projects mitigate the rising power tariffs and GHG emissions as well as expanding electricity supply to displace kerosene and wood fuel. The objective of this project is to use SREP funds to accelerate renewable energy development and increase the proportion of renewable energy in mini grids to 30%.

Proposed Contribution to initiating transformation

4. The Government's initiative of scaling up hybrid mini gridsrural areas in arid and semi-arid areas can be expanded to reach out to more rural markets and also to enable displacement of part of generation provided through fossil fuels. The program will transform e and positively impact livelihoods. It will lead to higher access to energy and low GHG emissions and less indoor air pollution in homes that previously used kerosene for lighting. Theoverall cost of electricity will reduce since fuel costs are shared by all electricity consumers.. Increased connectivity would further eliminate health risks to women and children arising from use of kerosene and wood fuel. Experience has shown established mini grids has attracted development of other related infrastructure that include clean water, quality health care, job creation, information and communication technology among others. These have impacted positively on the rural women and youth who can easily access relevant information.

Implementation Readiness

5. The GoK program is currently in progress involving introduction of renewable energy in existing and proposed mini grids in rural areas of the country. So far five projects for supply, installation and commissioning solar PV systems and two for wind have been tendered and awarded. The proposal is to increase renewable in the existing off-grid power stations and gradually expand the project. The first phase of the project would involve increasing the solar PV systems capacity from the current 160 kW being installed, to a total of 2,800 kW in existing off-grid thermal stations, so as to have 30% of generation capacity coming from renewable energy sources.

6. **New Mini Grid Projects:** The new constitution if implemented will result in requirement for more mini grids targeting areas where grid extension would be highly uneconomic. The Rural Electrification Master Plan has a list of some small rural towns that are targeted for mini-grids and grid extension. It is proposed that of 150kW solar PV systems be installed in identified market centre in order to meet the demand requirement and reduce the generation by thermal source. The Rural Electrification Master Plan categorized projects into three groups: Top Priority, High Priority, and Medium-High Priority projects.

7. **Capacity building and Technical Assistance**: SREP funds will be used in conducting feasibility studies to identify suitable sites for mini grids to evacuate power from the hybrid installations. This program will also build capacity for supervisory and technical personnel to ensure that only safe, quality and sustainable renewable energy equipments are installed for use in the hybrid systems. Follow up for system performance will also be done periodically to ascertain the projects meet their worthy cause. Positive feedback in this regard would further emphasize the viability to scale up the projects in future.

8. **Awareness Creation:** Rural population particularly women who are affected by energy inadequacy will be enlightened on the need for efficient use of energy to conserve renewable energy and allow for more connectivity. Awareness creation will also be done on the importance of utilizing the installed systems and avoid the usual kerosene and wood fuel. This measure is aimed at ensuring the hybrid systems are utilized to their installed capacities.

Sustainability hybrid mini grid Systems

9. The hybrid systems that shall be located in the existing off-grid thermal stations and be maintained alongside the existing power plants, but a well designed maintenance schedule shall be prepared to ensure that the systems are sustainable. The station operators will incorporate the solar/wind systems in their daily and monthly reports for the stations so as to keep track of any new developments including performance of the equipment

Rationale for SREP Financing

10. SREP funds would complement the ongoing Government funded hybrid mini grid projects in the country. The private sector would be encouraged to participate in the solar/wind projects under the FiT so as to complement government efforts in the programme. Availability of clean energy in rural areas would reduce dependence on biomass in domestic use. This would also reduce pressure on biomass resources which provide most of the energy requirements in the rural areas.

Results Indicators

11. The project would lead to increased connectivity to renewable energy in the existing and proposed mini grids supplied through thermal plants, and therefore result in reduced power generation costs. New hybrid mini grid projects supplied through solar and wind energy will supply more parts of the rural areas and accelerate growth. Women and children will easily access quality health care due to infrastructural changes arising from the positive face lift due to hybrid power installations. Other benefits include jobs created directly or by establishment of energy based business enterprises.

Financing Plan

12. The government would contribute part of the capital for rural electrification programme while other willing donors/financiers are invited to provide the funding so as to raise 80% of the required capital. SREP funds shall be used to bridge the remaining 20% gap.

Table 3: Financing Plan

Description	Total Cost USD	GOK	MDB's	Development Partners	Private Sector	SREP
Studies / Design	20,000,000	200,0000				
Equipment	49,500,000		2,500,000	42,0000	5,000.000	
Mini grid	16,500,000		7,500,000			9,000,000
Supervision	700,000	700,000				
Transaction	100,000	100,000				
Capacity Building						1,000,000
Total (US$)	**68,000,000**	**1,000,000**	**10,000,000**	**42,000,000**	**5,000,000**	**10,000,000**

Project Implementation Time Plan

13. Table 4 shows the proposed implementation plan for the two proposed project components involving solar PV systems for the rural mini grids.

Tablet 4: Project Implementation Plan

Description	*1Q2012*	*2Q2012*	*3Q2012*	*4Q2012*	*1Q2013*	*2Q2013*	*3Q2013*	*4Q2013*
Ongoing projects								
Tendering (Turnkey)								
Construction								
Commissioning								
Proposed New Projects								
Project Preparation /Preliminary Design								
Tendering (Turnkey)								
Construction								
Commissioning								

Requests for Investment Preparation Funding

14. SREP funds will be required to develop the detailed design and implementation of the proposed hybrid mini grid projects. The funds would be utilized to make field visits to each proposed town and undertaking a needs assessment, designing the solar system and the grid for the initial 33 towns. For each project, the outcome shall be documented in a report giving all the material requirements, implementation plan and total project costs among other details.

Annex 2: Solar Water Heating

1. The residential sector in Kenya consumes about 820 Gwh of electricity annually for heating water. Growing electricity demand is putting a strain on the power infrastructure. Demand for water heating occurs especially during the morning and evening thus increasing the overall peak load. This necessitates dispatch of expensive thermal power used for peaking. Use of Solar Water Heating Systems can reduce the peak demand arising from the need for water heating by domestic, institutional and commercial users.

2. The uptake of solar water heating systems in Kenya is extremely low compared to the enormous potential provided by the abundant solar energy resource and the demand for hot water for both domestic and commercial applications mainly due to capacity and financial barriers. The current cost of a typical 100 liter Solar Water Heating System is USD 1,500 which is unaffordable to many households. The SWH market lacks a critical mass of trained contractors and technicians to install and maintain systems. In addition, there is a low awareness regarding the technology and its financial benefits.

3. To facilitate increased uptake of SWH, the Government has developed the Solar Water Heating Regulations, whose adoption and enforcement is expected to deliver the following benefits to the Kenyan economy: a) Development and utilization of indigenous energy resources; b) Enhanced national energy security through diversification of energy supply mix and reduction in the over reliance on petroleum imports; c) Reduced demand for expensive fuel fired peaking power plants resulting from grid electricity peak demand attributed to water heating; d) Increased environmental conservation through reduction of GHG; e) Increased employment, capacity building and income generation resulting from the expanded solar water heating industry. Large scale uptake and development of the SWH industry will lead to reduced unit costs as a result of increased economies of scale.

4. The Solar Water Heating Regulations will make it mandatory for all premises within the jurisdiction of a local authority and with hot water requirements exceeding 100 litres per day to install and use SWH. Existing facilities will also be required to comply within a period of five (5) years upon gazettement of the regulations. These regulations are in line with policy directions under Sessional Paper No. 4 of 2004 on Energy which support usage of SWH and natural ventilation among other measures in all new buildings where technically feasible.

5. In addition to the regulations, addressing key market barriers - finance, capacity and awareness is essential to accelerate uptake of Solar Water Heating Systems and mitigation of power system peaks. The goal of the proposed project is to increase uptake of SWH through removal of these market barriers. This will result in:

    a) Increased utilization of indigenous energy resources and enhanced national energy security

    b) Reduced peak demand and the need for expensive fuel fired peaking power plants

    c) Reduced demand of biomass for water heating, increased environmental conservation through reduction of GHG; e)

    d) Increased employment, capacity building and income generation resulting from the expanded solar water heating industry.

6. SREP funds will leverage private sector funds to buy down transaction costs, build capacity and create awareness among industry stakeholders and end users. The project targets a minimum 50,000 SWH systems to catalyze the market.

7. The project will have three components, namely: a) financing scheme; b) capacity building targeted at enhancing installation techniques, quality control and follow up support for SWH technicians and contractors; and c) awareness creation.

Financing Scheme:

8. The financing scheme will centre on a local Bank that will invest in and manage the SWH Fund. SREP fund will be used to part guarantee disbursements from the bank to end users and also cover transaction costs of setting up the fund. Depending on the source of other additional funds put into the SWH fund, the bank will charge an interest to cover costs and obtain a fair return on the investment

9. Eligible end users will identify appropriate SWH systems from licensed installer companies and apply to the Bank for financing. The bank will conduct due diligence on the end user and installing company before disbursing for installation. Appropriate repayment terms, conditions and mechanisms will be developed by the bank taking into account the contribution from SREP and any other development financing agencies. The project is expected to discount the terms and conditions of the financing. The discount factor on the terms of the financing will then be progressively phased out as the market develops. This approach places the finance sector at the core of promoting clean energy and sustainable development. Figure 1 outlines the general structure of the proposed financing scheme

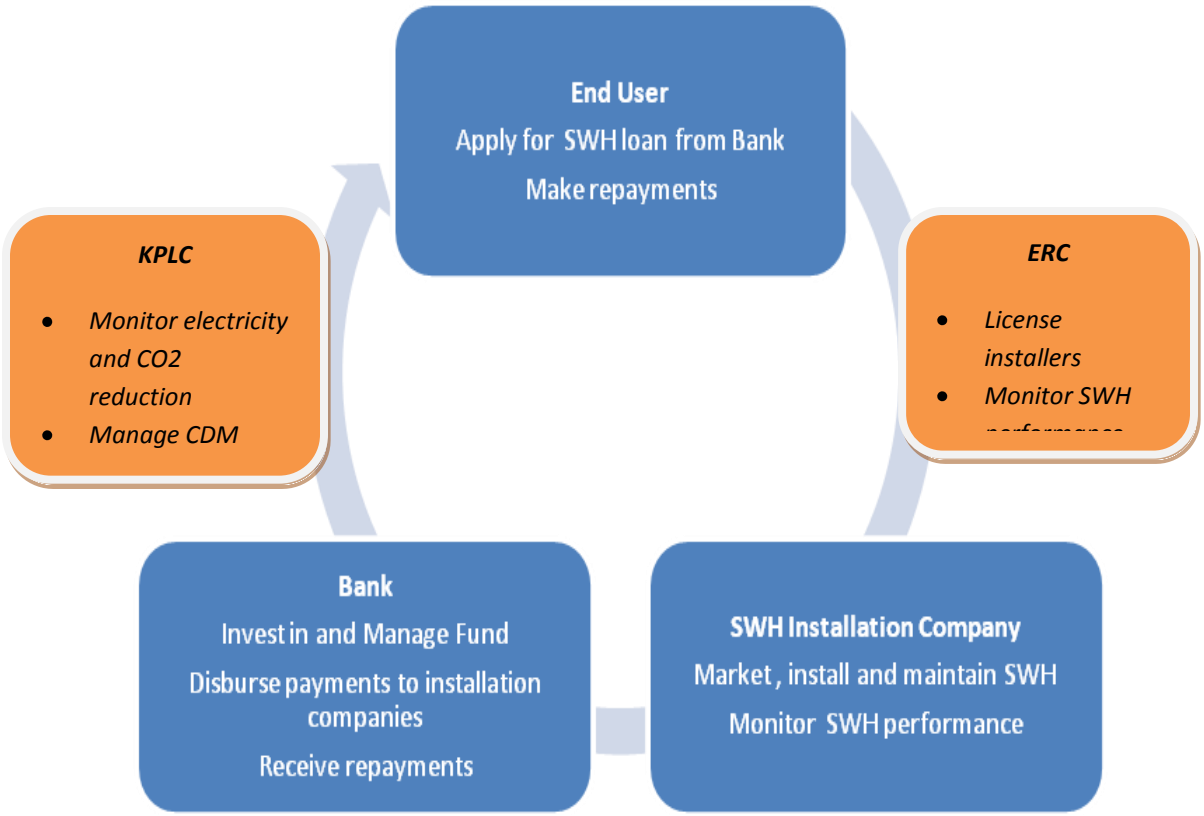


Figure 1: General structure of the proposed financing scheme

10. To ensure quality systems are delivered and installed the Energy Regulatory Commission (ERC) will license solar water heater installers and technicians as well as monitor performance of installed systems in accordance with the Solar Water Heating Regulations.

11. In order to share the benefits of the power system peak reduction, KPLC will implement a CDM project whose carbon revenues will be channeled back to electricity consumers through a tariff adjustment or a delayed upward tariff review. Consumers will therefore benefit from reduced power costs, while the utility will benefit from reduced systems stress and the delivery of improved services. Consequently KPLC will monitor the reduction in power consumption as well as develop and manage the SWH CDM component arising from the project.

Capacity building and Technical Assistance

12. The Kenyan SWH industry is characterized by lack of a critical mass of trained technicians and contractors to install and support SWH systems on a large scale. SREP funds will be used to conducting support technical training for technicians and SWH installation companies/ contractors on technology, installation techniques, quality control and customer follow up support. Training will also be provided to ERC staff and its regulations implementation agents to enable effective monitoring, documentation and reporting.

Awareness creation

13. Awareness on the benefits and business opportunities of using SWH is extremely low among a majority of the stakeholders. SREP funds will be used to support targeted awareness creation especially among banks, business, end users and policy makers. Additionally extensive awareness of the solar water heating regulations needs to be undertaken

Rationale for SREP financing

14. Energy demand side management by using domestic solar water heaters can reduce the energy demand by up to 820 GWh per year from the grid, the equivalent of building a 94 MW power station. Use of Solar Water Heating Systems can reduce the peak demand arising from the need for water heating by domestic, institutional and commercial users.

15. Unlocking the financing barriers arising from high installation cost of SWH will lead to scale up of uptake resulting in reduced unit costs arising from increased economies of scale. Increasing awareness will open the market further. This spiral effect will make SWH more affordable. Addressing the capacity barriers will ensure delivery of quality SWH systems and improved consumer and financier confidence. Thus through the multiplier effect the use of SREP funds to remove the barriers will catalyze and transform the SWH market.

Implementation Readiness

16. The Government through the Energy Regulatory Commission (ERC) has finalized the development of the Solar water Heating Regulation which are awaiting gazettement. These regulations make it mandatory for all domestic, institutional and commercial premises within the jurisdiction of a local authority with hot water requirements of a capacity exceeding 100 litres per day to install and use SWH. Existing facilities must comply within in a period of five (5) years upon gazettement of these regulations. These regulations a legal and timely basis for the implementation of the project.

Financing plan

17. The total indicative costs for SWH programme are USD 60,000,000 with USD 10,000,000 from the SREP. The SREP contribution is expected to leverage about USD 50,000,000 from MDBs, Development Partners and the private sector.

Table 1: Indicative Financing Plan for SWH Programme (Figures in USD)

Activity	Total	GoK	SREP	MDBs	Private Sector/Financing Gap
Project design and market reviews	200,000	200,000			
CDM Project development	50,000				50,000
Capacity building	600,000	600,000			
Awareness Creation	200,000	200,000			
SWH Equipment and installation Costs	58,950,000		10,000,000	2,000,000	46,950,000
Total	**60,000,000**	**1,000,000**	**10,000,000**	**2,000,000**	**47,000,000**

Indicative - 3 years Project Implementation plan

	Y1				Y2				Y3			
Activity	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Project design and market reviews												
CDM Project Development												
Capacity building												
Awareness Creation												
SWH marketing and installation												

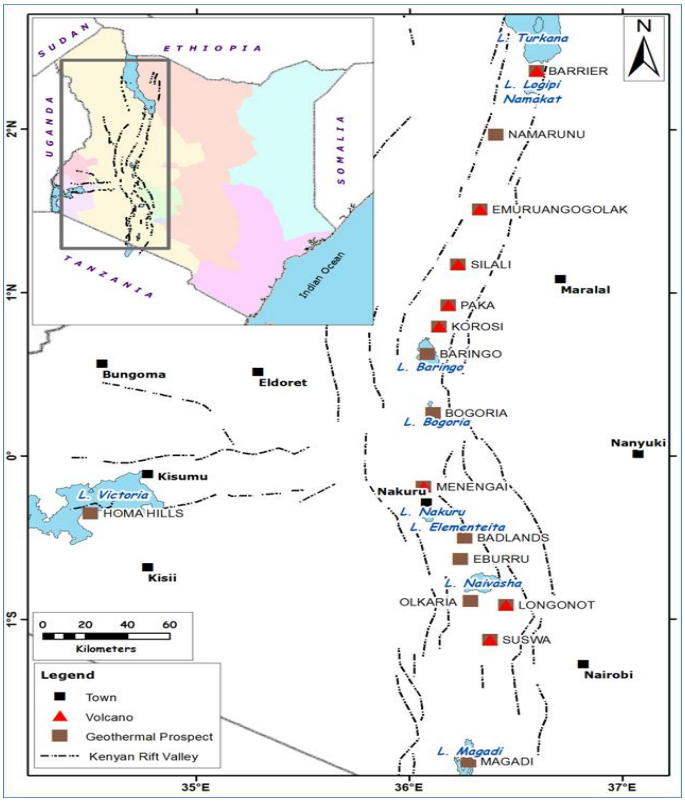
ANNEX 3: Development of 400 MW of Geothermal in Kenya

Problem statement

1. The Least Cost Power Development Plan (LCPDP) projects that Kenya's demand for electricity by 2030 will be 15,000 MW. In addition, the Government's Vision 2030 recognizes that one of the corners stones to achieve the Vision's objectives is adequate, reliable, quality and competitively priced electric power. To meet this projected demand, the GoK targets to generate 1,600 MW of geothermal by 2016 and 5,000 MW by 2030. Further, the GoK strategy is to change the base load electricity supply from hydro, which is affected by droughts, to geothermal that is reliable and cost effective. The Kenyan Rift Valley offers vast geothermal potential of between 7,000 MWe to 10,000 MWe that is largely untapped.

2. Currently, in the Olkaria Block 198 MW is generated and 280 MW is under development. Initial project development activities have commenced for the development of 800 MW in the Bogoria-Silali Block. The Menengai geothermal area is one of the priority prospects in the current ranking with an estimated potential of 1,600 MW to be developed under a three-phase programme. Drilling is ongoing in the Menengai Field for the first phase of 400 MW. The first exploratory well is complete with an estimated capacity of more than 8 MW. These activities are geared towards meeting the Vision 2030 Medium Term target.

Fig 1: Location of geothermal prospects within the Kenyan Rift valley

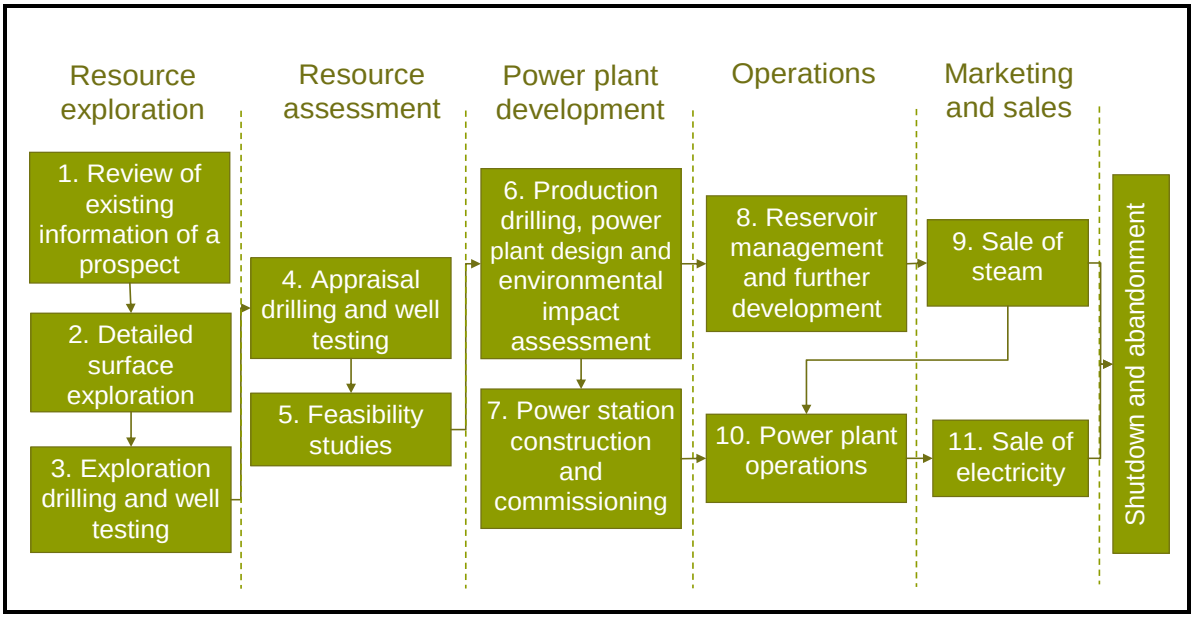


3. The GoK strategy for geothermal development is to address the perceived risks at the nascent stages of geothermal development which deter the private sector and funding institutions from participating. This project is designed to eliminate these perceived risks and prove the existence of the geothermal resource which will build the investors' confidence for eventual participation in the development.

4. In order to meet the growing demand and provide adequate, reliable, safe and environmental friendly power, the Government is diversifying energy sources. This is achieved by shifting the focus away from unreliable hydro and expensive thermal sources to renewable energy sources. In this case, geothermal power has been identified and it has a high potential. Massive geothermal power generation investment has been planned.

Phases of Geothermal Development

Figure 2: Geothermal Process Mapping



5. Resource Exploration: This phase consists of review and analysis of available data. The total cost of resource exploration ranges from $385,000-$1M on a timeframe of 3-6 months and involves the following activities.

   (i) Detailed Surface Exploration: The actual exploration must be driven by experience and the understanding of the local geological framework reducing the risk of resource wastage.

   (ii) Exploration Drilling and Well Testing: At this stage, three wells are normally drilled to confirm the existence of the required conditions for a geothermal resource namely; temperature, pressure and fluids capacity.

6. Resource Assessment: This phase involves the appraisal of the geothermal prospect to determine suitability for exploitation and has the following activities:

   (i) Appraisal Drilling and Well Testing: The aim of this stage is to estimate the size of the reservoir (in MWe of fluid equivalent) that can be commercially exploited for at least 25 years. About 6 (six) wells are drilled stepping from the three exploratory wells to determine the extent of the reservoir. At the end of this stage, there is more potential to attract partners, investors or developers to a project since the risk associated with confirmation drilling has been drastically lowered than at the field discovery stage. Initial negotiations for Power Purchase Agreements (PPA) or steam sales agreements are normally made at this stage.

   (ii) Feasibility Studies and Environmental Impact Assessment: A feasibility study is conducted to establish the commercial exploitability of the resource and to match the available power generating technology with the resource characteristics.

7. Power Plant Development: This stage involves the design of an appropriate drilling program, steam filed system, power plant construction and evacuation of power.

(i) Production Drilling and Power Plant Design: Once the field has been appraised and feasibility study shown favourable results, production drilling is undertaken to provide steam for the construction of the power plant. The data from the production wells is used for power plant design.

(ii) Power Plant Construction and Commissioning: Power plant construction can be undertaken through various forms of project packaging such as an Engineering-Procurement-Construction (EPC) contractor overseen by an "Owner's Engineer" under control of the entity responsible for generation.

(iii) Transmission Lines and Substations: These are constructed to evacuate the power from the power plant to the national grid and load centres.

8. Operations: Upon completion of the power plant construction, operations of the power plant and the steam field are undertaken to ensure sustainable generation of power.

(i) Reservoir management is undertaken to ensure consistent steam supply to the power station and to monitor the field characteristics to forestall adverse developments within the reservoir.

(ii) Power Plant Operations: This stage involves the generation aspects of the power plant.

9. Marketing and Sales: This has the aspect of sale of steam for the steam field operator and the sale of electricity for the power plant operator.

(i) Sale of Steam: Depending on the development model, once the steam is generated from the ground, it can be sold either for power generation, or for alternative uses. At this point, other by-products of geothermal resource development can be sold such as water, sulphur, carbon dioxide etc. The sales take place under a contractual agreement or steam supply agreement.

(ii) Sale of Electricity: The electricity generated by the power plant is sold through a power purchase agreement to the transmission/distribution company – in the case of Kenya, to KPLC (and perhaps other private companies in the future).

10. Shutdown and Abandonment: As a geothermal reservoir is exploited, it declines in pressure and steam output. In addition, surface equipment may start failing to an extent that it is no longer economical to run the plant and as such required to shut down and abandoned. However, since geothermal resources are renewable, so far no geothermal field in the world has been abandoned. The Lardarello field in Italy has been in operation since 1913, the Wairakei field in New Zealand since 1958 while the Geysers field in California since 1960. In Kenya, the Olkaria field has been in operation since 1982.

11. There is a dramatic increase in the value of a geothermal project as progress is made from one stage to another. Figure 7, presents a schematic diagram showing the increase in the relative value of a geothermal project as a function of the relative increase in investment in the various phases of a geothermal development. Each stages in geothermal development has activities and constraints unique to every stage as highlighted on the Table 1 below;

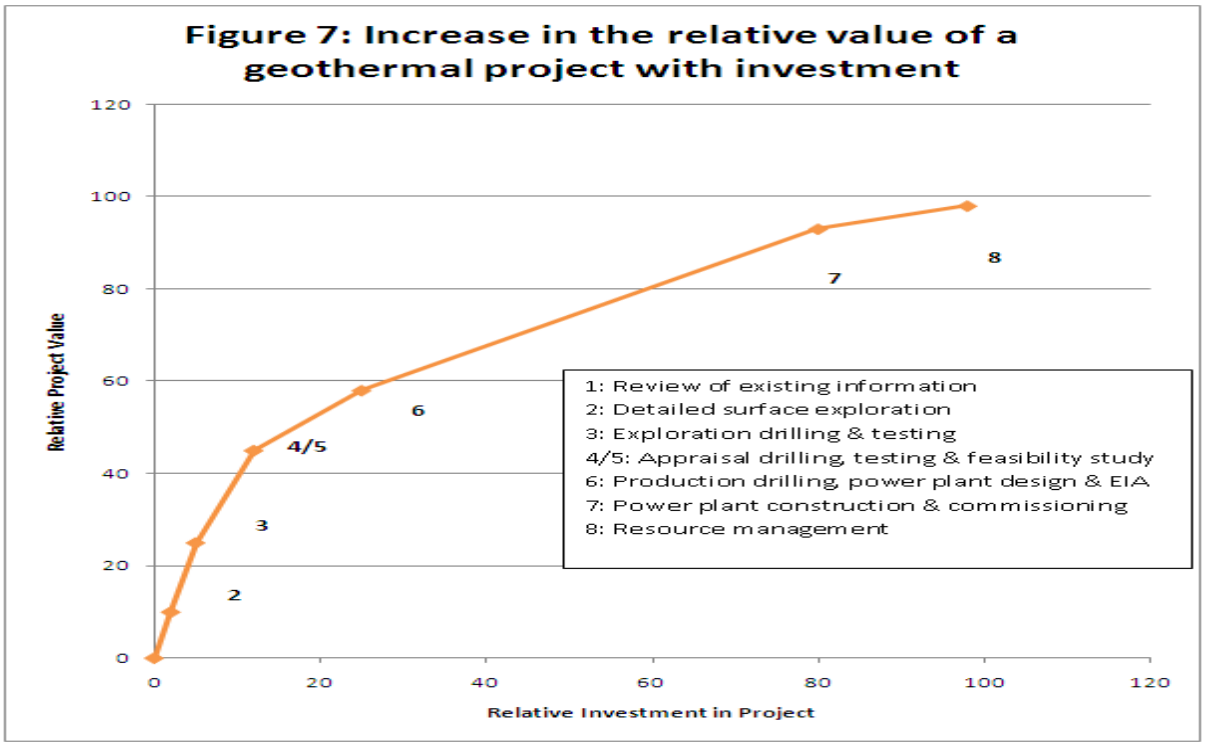


Table 1: Activities and Constraints in geothermal development

Development Stage	Activities	Constraints
Reconnaissance & Surface Studies	• Desktop Data Research & Analysis • Regional Reconnaissance • Geology & Geochemistry resource studies • Historical drilling data	• High Capital Outlay • Lack of funding • Procurement of technical expertise-long and tedious
Initial Project Preparation	• Infrastructure Development – Civil Works • Land Acquisition & Land Use Laws • Contact Local Authorities • Water Rights • Geothermal licensing • ESIA	• Location of resource in undeveloped areas • Acquisition of licensing and land rights to project sites. • Competition for limited resources e.g land, water with the locals, tourism & forestry activities.
Exploration Drilling	• Geochemical Analysis • Geophysical Survey • Resource Measurement • Exploratory Temperature Gradient Drilling	• Low funding due to high risks associated-No traditional lending • Well success rate
Appraisal Drilling & Feasibility Study	• Design characteristics • Geological structure • Predicted drilling curve • Extent of engineering requirements • Drilling permits • Reservoir management • Drilling Crew	• Feasibility Study outcome • Upfront activities producing positive resource assessment & feasibility

Production Drilling	• Project Feasibility • Initial Delineation • Drilling • Production Drilling • Drilling staff	• Probability of success-Well success & good production capacity • Capacity Building in terms of human capital and equipment for geothermal development
Steam Field Development	• Steam Gathering Facilities • Reservoir management • Casings, pumps	
Power Plant Construction	• Completed Power Purchase Agreement • Bankable geothermal reservoir report	External factors can bring constraints e.g • environmental and social issues • competition of resources e.g water with the local communities
Electricity Transmission	• Way Leave acquisition • Resettlement Action Plan (RAP) • Engineering Design & Contract preparation • Construction of the transmission line and sub-stations	• Long procurement procedures • High capital outlay • Way leave acquisition challenges

Historical and status of geothermal development in Kenya

12. The development of geothermal has been slow as highlighted below;

v. **45 MW Olkaria I Power Plant:** Drilling started in 1955 and the last unit of the plant was commissioned in 1985. This was about **30 years**.

vi. **105 MW Olkaria II Power Plant:** Drilling using a rig owned by KenGen, started in 1986 and the plant was commissioned in 2003 (Unit 1 & 2) and 2010 (Unit 3). This was about **17 and 24 years** later.

vii. **280 MW Olkaria IV and I (Unit 4&5):** Exploration drilling through own rig was done in 1998 to 1999. Appraisal and production drilling mainly through hired rigs started in 2006 and the plant is scheduled for commissioning by December 2013. This will be **15 years** later.

viii. **100 MW Olkaria III: Concessioned in 1998.** By 2009 (**11 years** later), the IPP had developed only 48 MW and the additional 52 MW plant is scheduled for commissioning by 2013 which will be **13 years** after concession. Similarly, concessions for the undeveloped prospects in Suswa (2007) and Longonot (2009) have not registered any progress.

13. Realizing the need to reduce the long gestation periods in the development of geothermal the Government set up the Geothermal Development Company (GDC) to undertake integrated development of geothermal through initial exploration, drilling, resource assessment and promotion of direct utilization of geothermal. GDC is 100% owned by the Government. By undertaking the initial project activities, GDC will underwrite the attendant risks associated with geothermal development and therefore open up opportunities for both public and private participation.

14. In the development of 400MW project at Menengai, GDC seeks to reduce project development period to about five years by undertaking the initial project activities which include detailed surface exploration, infrastructural development, drilling of exploratory and appraisal wells. KETRACO, a 100% government-owned company dealing with electricity transmission, is supplementing GDC plans by developing the Menengai-Rongai

transmission line to evacuate the power from the Menengai Field. This line will connect to the national grid by joining with the planned Olkaria-Lessos-Kisumu transmission line.

15. Further, the following transformative initiatives will be achieved:

    a) The perceived risks associated with the initial geothermal development activities which deter the private sector and funding institutions from participating will be eliminated. This will enhance private sector confidence in the project.

    b) Funding from the private sector will be mobilized by offering development opportunities on competitive basis;

    c) Generation from Hydro will be replaced as the baseload source of electricity supply with geothermal. This will lead to a more reliable and cost effective electricity supply;

    d) Increase the contribution of renewable energy into the energy mix and displace generation from thermal thereby resulting in reduced GHG emissions thus mitigating pollution of the environment.

    e) Improved livelihoods to the communities around geothermal areas through direct use programmes from geothermal products e.g farming, industrial use, social amenities and spurring of economic activities.

    f) The transmission line from Menengai to Rongai will open up new areas not currently covered by the grid hence increasing electricity access and improving standards of living.

Proposed Contribution to Initiating Transformation

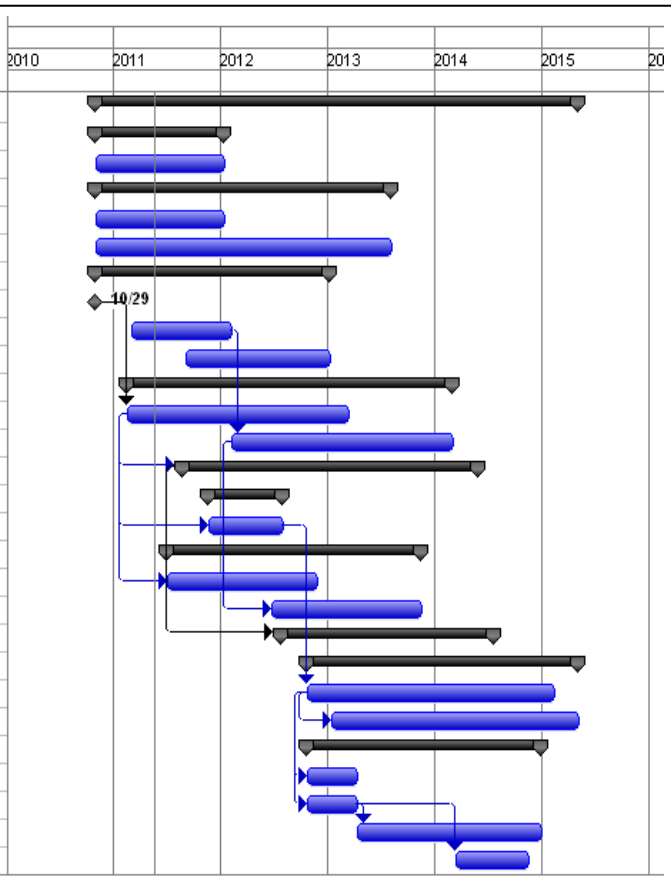
16. By accelerating geothermal development the ratio of contribution from renewable energy sources to the national grid will increase. This will translate to lower electricity tariffs given that expensive emergency power from thermal will be replaced by geothermal energy. Further, this will realize the GoK strategy of changing the baseload from hydro to geothermal. Climate change has had adverse effects on hydro being baseload given prolonged droughts necessitating a shift to the adequate, reliable, green, quality and competitively priced electric power from geothermal.

17. Most of the geothermal resources are located in under-developed areas. Through the development of this resource, the benefits to be achieved include electricity generation; opening up of the areas through infrastructure development such as roads and water; opportunity for direct utilization of geothermal heat and condensate for industrial and agricultural based activities leading to employment creation and income generation; increased security in the areas as a result of the economic activities and social amenities. These activities automatically transforms the life of women e.g water supply from geothermal development will lift the burden of searching for water from long distances, improve farming activities through irrigation leading to food security thereby boosting overall psychological and physical health for women.

18. By world average, geothermal development is estimated at 1 MW/employee and one support staff at the power plant. This is direct employment of two employees per MW.

Menengai Project Activity Schedule

Task Name	Duration	Start	Finish
400 MW Menengai Project	**1176 days**	**Fri 10/29/10**	**Thu 4/30/15**
Project Preparation	**315 days**	**Fri 10/29/10**	**Wed 1/11/12**
Water reticulation system	315 days	Fri 10/29/10	Wed 1/11/12
Civil Works	**720 days**	**Fri 10/29/10**	**Wed 7/31/13**
Access roads	315 days	Fri 10/29/10	Wed 1/11/12
Drill Sites Preparation	720 days	Fri 10/29/10	Wed 7/31/13
Rig Procurement	**570 days**	**Fri 10/29/10**	**Thu 1/3/13**
Rig 1&2, GoK Funded	0 days	Fri 10/29/10	Fri 10/29/10
Rig 3&4, AFD Funded	240 days	Wed 3/2/11	Tue 1/31/12
Rig 5&6, AfDB Funded	351 days	Thu 9/1/11	Thu 1/3/13
Drilling	**793 days**	**Sat 2/12/11**	**Tue 2/25/14**
Menengai I	540 days	Sat 2/12/11	Thu 3/7/13
Menengai II	540 days	Wed 2/1/12	Tue 2/25/14
Well testing	720 days	Mon 8/22/11	Fri 5/23/14
Feasibility Studies	**180 days**	**Fri 11/18/11**	**Thu 7/26/12**
Menengai I	180 days	Fri 11/18/11	Thu 7/26/12
Wellhead Generation	**618 days**	**Fri 7/1/11**	**Tue 11/12/13**
Menengai I	365 days	Fri 7/1/11	Thu 11/22/12
Menengai II	365 days	Wed 6/20/12	Tue 11/12/13
Steam Field Development	520 days	Mon 7/23/12	Fri 7/18/14
Power Plant Construction	**660 days**	**Fri 10/19/12**	**Thu 4/30/15**
Menengai I	600 days	Fri 10/19/12	Thu 2/5/15
Menengai II	600 days	Fri 1/11/13	Thu 4/30/15
Transmission Line	**570 days**	**Fri 10/19/12**	**Thu 12/25/14**
Way Leave acquisition	120 days	Fri 10/19/12	Thu 4/4/13
Design & Contract	120 days	Fri 10/19/12	Thu 4/4/13
Transmission line (20 km)	450 days	Fri 4/5/13	Thu 12/25/14
Sub-stations - 220kV (2 NO.)	180 days	Fri 3/7/14	Thu 11/13/14



Implementation Readiness

19. The following activities are being undertaken by GoK for the implementation of the project:

a) Increased budgetary allocation to Geothermal Development Company (GDC), a special purpose company mandated with accelerating development of geothermal energy in the country. Project preparation activities such as detailed surface studies, ESIA, infrastructural development, acquisition of licenses, permits and rights of access are at various stages of completion. The GoK is committed to the project and in the past two years, it has provided GDC with USD 73 million and USD 85 million through budget support for the year 2009/2010 and 2010/2011 respectively. It is expected that GDC will receive a further USD 188 million in year 2011/2012 from the Government.

b) Procurement of rigs and associated equipment. A total of six drilling rigs are to be deployed to this project.

- GoK, through its own funding has procured two rigs which are currently drilling in the Menengai Field. The first exploration well has been completed whilst the second well is near completion.
- Two other rigs funded by the French Development Agency (AFD) are expected by December, 2011 and will be deployed in Menengai.
- The African Development Bank is extending funding to GDC for procurement of two additional rigs and materials for drilling 40 wells.

c) Infrastructural development of the project site is ongoing. The main access roads, establishment of drilling water including electricity for powering the pumping system, well pads and drilling fluid recirculation ponds.

d) Detailed surface exploration work is complete and reports available

e) The ESIA for drilling has been completed and the NEMA license obtained

f) Efforts to build geothermal capacity underway with recruitment and training of drilling staff ongoing

g) By Kenya being nominated as a Pilot SREP Country and the funding opportunity envisaged from this, initiatives are being undertaken to mobilize funding to leverage on the SREP. This has generated interest from development partners namely; AFD, AfDB, China Eximbank, World Bank, JBIC, EIB, USTDA.

h) KETRACO is currently undertaking preparatory activities to construct Olkaria-Lessos-Kisumu 220kV double circuit line expected to be complete by 2015. It is expected that feasibility study and environmental and socio-economic impact assessment for the proposed Menengai – Rongai line will be undertaken together with the feasibility study for the 400MW Menengai geothermal project.

20. The current electricity transmission network has low coverage and limited capacity to support the current and planned generation capacity. This has led to unreliable electricity service and unnecessarily high technical losses in the public electricity system. This has led to the need for substantial investments to expand the national grid. Therefore, more effort will be necessary in order to increase electricity access, reliability and reduce system losses in line with international best practice.

21. In order to support the geothermal generation efforts and evacuate the generated power, transmission lines are quite necessary. Some specific areas/projects have been identified for geothermal generation such as the Menengai Field in the Rift Valley. Therefore, the proposed transmission line i.e. Menengai – Rongai 220kV double circuit 20km transmission line, will specifically evacuate power from Menengai to a new sub-station at Rongai. This line will connect to the national grid by joining with the planned Olkaria-Lessos-Kisumu transmission line.

Construction of the proposed transmission line will depend on the following:

(i) Feasibility study;
(ii) Environmental and social impact assessment & RAP;

(iii) Acquisition of way leave;
(iv) Detailed design and contract preparation

22. KETRACO, a 100% government-owned company dealing with electricity transmission, is currently undertaking preparatory activities to construct Olkaria-Lessos-Kisumu 220kV double circuit line expected to be complete by 2015. It is expected that feasibility study and environmental and socio-economic impact assessment for the proposed Menengai – Rongai line will be undertaken together with the feasibility study for the 400MW Menengai geothermal project.

Rationale for SREP Financing

23. The Government's long term plan is to develop the entire Menengai Geothermal Prospect in three phases. The first phase is targeting the development of 400 MW in units of 100MW over the next 5 years. SREP funding is being sought for the development of the first unit of the Menengai Phase 1 project.

24. The project will increase the installed electricity capacity and energy from renewable energy sources by an additional 400 MW, and result in a replication of the model to achieve the Government's long term commitment of 5,000 MW by 2030. Evacuation of the generated power will require extensions and new constructions on the existing transmission systems resulting in increased access to energy from renewable energy sources.

25. Generation from geothermal does not contribute to Green House Gas emissions and is friendly to the environment. The Screening Curve Analysis under the LCPDP demonstrates that electricity generation from geothermal is the least cost option for Kenya. The Government's plan to displace expensive thermal generation will result in reduced air pollution and affordable power that will in turn spur economic growth and the competitiveness of Kenyan products.

26. Already, a lot of interest and support has been generated from both the private sector and development partners for this project and this should result in maximized leverage on the SREP funds. The table 2 below shows the project's financiers to be leveraged by SREP funding.

Development Stage	Detailed Studies	Exploration Drilling	Appraisal Drilling	Feasibility Studies	Production Drilling	Steam Field Development	Power Plant	Transmission/ Sub Station
Funding Agency	GDC/ GoK	GDC/ GoK	GDC/ GoK	WB	AfDB/ AFD **SREP**	WB	IFC/ Private Sector/ AfDB	WB

Table 2: Menengai Phase 1 400 MW Project Financiers

27. There is an urgent need in Kenya to address the growing demand for electrical energy. Currently, inadequate capacity has been addressed by using thermal generated electricity whereby the fuel cost is passed over to the consumer which has led to increased cost of power. Accelerated development of geothermal will help lower this cost by addressing the electricity supply gap in a reliable and sustainable manner. SREP funds will have a lead role to play in accelerating geothermal development. (Addresses energy security)

28. Geothermal has replaced Hydro as the base load source of electricity supply according to the LCPDP. Hydro has become unreliable due to droughts. SREP funds are sought to help accelerate geothermal development as the energy source that the country relying on to boost its electricity supply.(Geo as base load)

29. Slow pace of growth has contributed to its low installed capacity of 198 MW in 30 years. The GoK annual budgetary allocation will go into Project Preparation activities as well as drilling. SREP funds will speed up the production drilling stage envisaged in the Financing Plan by supplementing government efforts to take care of perceived upfront risks to geothermal development and shorten period taken to realize the 400 MW target. These activities will lead to early realization of the resource(steam) translating to early energy for the country to meet its electricity demand. (Speed)

30. Under drilling component, the SREP funds will be directed to production drilling. Exploration wells' drilling is done with the aim of proving steam existence. Availability of steam will pave way to drilling of the appraisal wells to prove whether the resource (steam) is viable as an investment venture. By Gok undertaking both exploratory and appraisal drilling and SREP funding going into production drilling, the stage will be set for increased investor confidence and private sector participation.

31. There is a need to fast-track the construction of the transmission line and thus the proposal aims at supporting the Government to raise counterpart funds. It is expected that multiple development partners will support the project once the counterpart funds are guaranteed.

Results indicators

32. The following results are expected to be achieved:

a) Addition of 400 MW from geothermal to the national grid by 2015

b) Replication of the development model to achieve the 5,000MW by 2030

c) Increased private sector participation in power generation

d) Length (20 km) of electricity transmission line constructed;

e) Number (2 No.) of electricity transmission sub-stations constructed;

The Financing Plan

33. The total project cost is USD 800 million. This is the cost towards project preparation; rig acquisition; drilling for exploration, appraisal and production wells; steam field development; power generation; and the construction of transmission lines and substations. These costs will be financed from SREP, GoK, MDB's and the Private Sector as shown in Table 3 below.

Table 3: Financing Plan

Requests, if any, for investment preparation funding

34. The initial project activities include detailed surface exploration, civil infrastructural development such as construction of main access roads; establishment of drilling water and electricity for powering the pumping system; well pads and drilling fluid recirculation ponds; and well siting. GoK through GDC is funding the initial project activities as well as exploration drilling and appraisal drilling.

Requests, if any, for investment preparation funding

35. The initial project activities include detailed surface exploration, civil infrastructural development such as construction of main access roads; establishment of drilling water and electricity for powering the pumping system; well pads and drilling fluid recirculation

ponds; and well siting. GoK through GDC is funding the initial project activities as well as exploration drilling and appraisal drilling.

SREP Allocation	Project Cost/ Estimated Cost									
		Cost (MUSD)	GDC/ MoE	KETRACO	SREP	MDB's		AFD / NDF/ DFI's	Private Sector/ Developers	Total (MUSD)
						AfDB	WBG			
SREP Initial Allocation	***Resource Development***									
	Project Preparation	82.0	82.0	-	-	-	-	-	-	**82.0**
	Rig Procurement 2 @ MUSD 35	70.0	-	-	-	70.0	-	-	-	**70.0**
	Exploratory Program (3 Wells)	10.5	10.5	-	-	-	-	-	-	**10.5**
	Appraisal Program (Drill 6 Wells)	21.0	21.0	-	-	-	-	-	-	**21.0**
	Feasibility Study	2.0	-	-	-	-	2.0	-	-	**2.0**
	Production Drilling (35 Wells)	122.5	-	-	39.0	38.5	45.0	-	-	**122.5**
	Reinjection Wells (8 Wells)	28.0	12.5	-	-	-	15.5	-	-	**28.0**
	Steam field Development	36.8	-	-	-	-	36.8	-	-	**36.8**
	Wellhead Equipment	22.3	-	-	-	10.0	12.3	-	-	**22.3**
	Capacity Building	5.0	-	-	1.0	4.0	-	-	-	**5.0**
	Sub Total	**400.0**	**126.0**	**-**	**40.0**	**122.5**	**111.5**	**-**	**-**	**400.0**
SREP Reserves	***Power Plant Construction***									
	Power Plant Construction	385.6	-	-	14.6	25.0	50.0	200.0	96.0	**385.6**
	Sub Total	**385.6**	**-**	**-**	**14.6**	**25.0**	**50.0**	**200.0**	**96.0**	**385.6**
	Transmission & Substations									
	Way Leave acquisition	2.0	-	2.0	-	-	-	-	-	**2.0**
	Design & Contract	2.0	-	2.0	-	-	-	-	-	**2.0**
	Transmission line (20 km)	5.4	-	-	5.4	-	-	-	-	**5.4**
	Sub-stations - 220kV (2 N0.)	5.0	-	-	5.0	-	-	-	-	**5.0**
	Sub Total	**14.4**	**-**	**4.0**	**10.4**	**-**	**-**	**-**	**-**	**14.4**
Total		**800.0**	**126.0**	**4.0**	**65.0**	**147.5**	**161.5**	**200.0**	**96.0**	**800.0**

Table 3: Financing Plan