

THIRD DRAFT

REPUBLIC OF KENYA



MINISTRY OF ENERGY

NATIONAL ENERGY POLICY

MAY 11, 2012

TABLE OF CONTENTS

TABLE OF CONTENTS	2
LIST OF ACRONYMS	11
FOREWORD BY THE HONOURABLE MINISTER FOR ENERGY	14
PREFACE BY PERMANENT SECRETARY	15
EXECUTIVE SUMMARY	16
1.0 - INTRODUCTION	19
1.1 The Role of Energy in Economic Development	19
1.2 Energy Policy Objectives	20
1.3 Legal and Regulatory Framework	21
1.3.1 The Constitution of Kenya, 2010.....	21
1.3.2 Current Policy and Legislation	21
1.4 Institutional Arrangements	23
1.4.1 Challenges in the Institutional Arrangements.....	26
2.0 – FOSSIL FUELS	27
2.1 BACKGROUND.....	27
2.2 PETROLEUM.....	27
2.2.1 Petroleum Exploration	27
2.2.2 Petroleum Consumption.....	30
2.2.3 Demand for Petroleum.....	31
2.2.4 Petroleum Supply and Distribution	31
2.2.4.1 Petroleum Infrastructure Issues	32
2.2.4.2 Import/Offloading Facilities in Mombasa	32
2.2.4.3 Storage Facilities in Mombasa	32
2.2.4.4 Strategic Petroleum Reserves	32
2.2.4.5 Common User Truck and Rail Loading Facilities in Mombasa	33
2.2.5 Petroleum Refining	33
2.2.6 Petroleum Transportation	33
2.2.6.1 Pipeline.....	33
2.2.6.2 Rail Transport	34
2.2.6.3 Sea and Lake Transport	34
2.2.6.4 Road Transport.....	34
2.2.7 Oil Marketing Companies	35
2.2.8 Open Tender System (OTS).....	35
2.2.9 Price Comparison with other Countries.....	35

2.2.10	Global Geo-Political Issues	35
2.2.11	Lamu Port and Lamu-South Sudan-Ethiopia Transport Corridor (LAPSSET).....	37
2.2.12	Natural Gas	38
2.2.13	Challenges in Petroleum	39
2.2.13.1	Petroleum Upstream Activities	39
2.2.13.2	Petroleum Mid and Downstream	39
2.2.14	Policies and Strategies in Petroleum	40
2.2.14.1	Petroleum Exploration Policy	40
2.2.14.2	Petroleum Supply and Distribution Policy	40
2.2.15	AGENDA FOR ACTION – IMPLEMENTATION ACTION PLAN.....	41
2.2.15.1	Short Term 2012 – 2016.....	41
2.2.15.2	Medium Term 2012 – 2022.....	43
2.2.15.3	Long Term 2012 – 2030	43
2.3	COAL RESOURCES	44
2.3.1	Overview	44
2.3.2	Demand for Coal.....	44
2.3.3	Coal Supply.....	44
2.3.4	Coal Reserves.....	44
2.3.5	Challenges in Coal exploration.....	46
2.3.6	POLICIES AND STRATEGIES.....	46
2.4	AGENDA FOR ACTION – IMPLEMENTATION ACTION PLAN	46
2.4.1	Short Term 2012 – 2016	46
2.4.2	Medium Term 2012 - 2022.....	47
2.4.3	Long Term 2012 - 2030.....	47
3.0	RENEWABLE ENERGY	48
3.1	BACKGROUND.....	48
3.2	BIOMASS 48	
3.2.1	Background	48
3.2.2	Challenges	49
3.2.3	Policies and Strategies.....	49
3.2.4	Implementation Agenda.....	50
3.3	BIO FUELS	51
3.3.1	Background	51
3.3.2	Challenges	51
3.3.3	Policies and Strategies.....	52

3.3.3	Implementation Agenda.....	52
3.4	BIOGAS	53
3.4.1	Background	53
3.4.2	Challenges	54
3.4.3	Policies and Strategies	54
3.4.4	Implementation Agenda.....	54
3.5	SOLAR ENERGY	55
3.5.1	Background	55
3.5.2	Challenges	56
3.5.3	Policies and Strategies	56
3.5.4	Implementation Agenda.....	57
3.6	WIND ENERGY	58
3.6.1	Background	58
3.6.2	Challenges	59
3.6.3	Policies and Strategies	59
3.6.3	Implementation Agenda.....	60
3.7	SMALL HYDROS	60
3.7.1	Background	60
3.7.2	Challenges	61
3.7.3	Policies and Strategies	62
3.7.3	Implementation Plan	62
3.8	MUNICIPAL WASTE	62
3.8.1	Background	62
3.8.2	Challenges	63
3.8.3	Policies and Strategies	63
3.9	BIOMASS CO-GENERATION.....	63
3.9.1	Background	63
3.9.2	Challenges	63
3.9.3	Policies and Strategies	64
3.9.4	Implementation plan	64
3.10	FEED IN TARIFFS.....	65
3.10.1	Background	65
3.10.2	Challenges	66
3.10.3	Policies and Strategies	66

3.10.4	Implementation Agenda.....	66
3.11	OTHER RENEWABLES.....	67
3.11.1	Background.....	67
3.11.2	Challenges.....	67
3.11.3	Policies and Strategies.....	67
3.12	CROSS CUTTING ISSUES.....	67
3.12.1	Challenges.....	67
3.12.2	Action Plans.....	67
4.0	ELECTRICITY.....	69
4.1	BACKGROUND.....	69
4.2	DEMAND FOR ELECTRICITY.....	70
4.3	ELECTRICITY GENERATION.....	71
4.3.1	Hydro Electric Power.....	71
4.3.1.1	Background.....	71
4.3.1.2	Challenges.....	72
4.3.1.3	Policies and Strategies.....	72
4.3.1.4	Agenda for Action.....	73
4.3.2	Geothermal Electric Power.....	73
4.3.2.1	Background.....	73
4.3.2.1	Advantages.....	74
4.3.2.2	Challenges.....	75
4.3.2.3	Policies and Strategies.....	75
4.3.2.4	Agenda for Action.....	75
4.3.3	Thermal Electric Power.....	76
4.3.3.1	Background.....	76
4.3.3.2	Advantages.....	76
4.3.3.3	Challenges.....	76
4.3.3.4	Policies and Strategies.....	77
4.3.3.5	Agenda for Action.....	77
4.3.4	Nuclear Electric Power.....	78
4.3.4.1	Background.....	78
4.3.4.2	Advantages.....	79
4.3.4.3	Challenges.....	79
4.3.4.4	Mitigating factors.....	80
4.3.4.5	Policies and Strategies.....	80
4.3.4.6	Agenda for Action.....	81
4.4	ELECTRIC POWER TRANSMISSION.....	82

4.4.1	Background	82
4.4.2	Extension of the National Transmission Network.....	82
4.4.3	Regional Interconnection	83
4.4.3.1	Imports and Exports	83
4.4.3.2	Benefits of Regional Interconnectivity	84
4.4.4	Transmission Plan	84
4.4.5	Challenges	84
4.4.6	Policies and Strategies.....	84
4.4.7	Agenda for Action	85
4.5	ELECTRIC POWER DISTRIBUTION	85
4.5.1	Background	85
4.5.2	Distribution Expansion Plan	86
4.5.3	Distribution Plan 2015-2030	86
4.5.4	Challenges in Distribution.....	87
4.5.5	Policies and Strategies.....	87
4.5.6	Agenda for Action	87
4.5.7	Rural Electrification	88
4.5.7.1	Background.....	88
4.5.7.2	Challenges in Rural Electrification	88
4.5.7.3	Policies and Strategies	89
4.5.7.4	Agenda for Action	89
4.6	CROSS CUTTING ISSUES	90
4.6.1	Challenges	90
4.6.2	Policies and Strategies.....	90
4.6.3	Agenda for Action	91
5.0	ENERGY EFFICIENCY AND CONSERVATION.....	93
5.1	BACKGROUND.....	93
5.2	CHALLENGES	94
5.3	POLICIES AND STRATEGIES.....	94
5.4	AGENDA FOR ACTION	95
5.4.1	Short Term 2012 – 2016	95
5.4.2	Medium Term 2012 - 2022.....	96
5.4.3	Long Term 2012 - 2030.....	96
6.0	LAND, ENVIRONMENT, HEALTH AND SAFETY	97
6.1	BACKGROUND.....	97

6.2	ENERGY SUPPLY SIDE ENVIRONMENTAL CONCERNS	98
6.2.1	Electricity	98
6.2.2	Fossil Fuels.....	98
6.2.2.1	Exploration and Production	98
6.2.2.2	Petroleum	98
6.2.2.3	Coal	99
6.2.3	Renewable Energy	99
6-2-3.1	Geothermal.....	99
6-2-3.2	Large Hydro	99
6-2-3.3	Biomass.....	99
6.2.4	Nuclear Energy.....	100
6.3	CONSERVATION OF CATCHMENT AREAS	100
6.4	DEMAND SIDE ENVIRONMENTAL CONCERNS	101
6.5	CLIMATE CHANGE ISSUES	101
6.6	DISASTER PREPAREDNESS AND MITIGATION	103
6.7	LAND AND SOCIO-ECONOMIC IMPACTS.....	104
6.8	POLICIES AND STRATEGIES.....	104
6.8.1	Land and Socio-Economic Issues	104
6.8.2	Environment Health and Safety	106
6.8.3	Climate Change	107
6.8.4	Electricity	107
6.8.5	Fossil Fuels.....	107
6.8.6	Renewable Energy	108
6.8.7	Nuclear Electricity.....	108
6.8.8	Conservation of Catchment Areas	108
6.8.9	Disaster Prevention and Management	108
6.9	AGENDA FOR ACTION	110
6.9.1	Short Term 2012- 2016.....	110
6.9.2	Medium Term 2012-2022.....	112
6.9.3	Long Term 2012 -2030.....	113
7.0	DEVOLUTION AND ACCESS TO ENERGY SERVICES.....	115
7.1	BACKGROUND.....	115
7.2	KENYA AND ITS 47 COUNTIES.....	116
7.3	ACCESS TO ENERGY SERVICES BY COUNTY.....	117
7.4	CHALLENGES	117

7.5	POLICIES AND STRATEGIES.....	117
8.0	- ENERGY FINANCING, PRICING AND SOCIO-ECONOMIC ISSUES.....	118
8.1.	BACKGROUND.....	118
8.2.	CHALLENGES.....	118
8.3.	POLICIES AND STRATEGIES.....	118
8.4.	ENERGY FINANCING OPTIONS.....	120
8.4.1	Consolidated Energy Fund.....	120
8.4.2	Agenda for Action.....	121
8.5.	ENERGY PRICING AND SOCIAL ECONOMIC ISSUES.....	122
8.5.1	Energy Pricing.....	122
8.6.2	Implications of High Energy Prices.....	124
8.6.3	Household Energy Consumption Patterns.....	125
8.6.4	Policies and Strategies.....	126
8.6.5	Agenda for Action.....	127
9.0	-CROSS CUTTING ISSUES.....	129
9.1	LEGAL AND REGULATORY FRAMEWORK.....	129
9.1.1	Challenges.....	129
9.1.2	Policies and Strategies.....	129
9.2	INTEGRATED ENERGY PLANNING.....	131
9.2.1	Background.....	131
9.2.2	Challenges.....	131
9.2.3	Policies and Strategies.....	132
9.2.4	Agenda for Action.....	132
	Short Term 2012-2016.....	132
9.3	RESEARCH AND HUMAN RESOURCE DEVELOPMENT.....	132
9.3.1	Background.....	132
9.3.2	Challenges.....	132
9.3.3	Policies and Strategies.....	132
9.4	GENDER 133	
9.4.1	Challenges.....	133
9.4.2	Policies and Strategies.....	133
9.5	POLICY IMPLEMENTATION, MONITORING AND EVALUATION.....	134
9.6	DATA 134	
9.7	AGENDA FOR ACTION.....	134

9.7.1 Short Term 2012 – 2016	134
9.7.1.1 Institutional Arrangements	134
9.7.1.2 Legal and Regulatory Framework	134
9.7.1.3 Energy Pricing	135
9.7.1.4 Research, Development and Dissemination	135
9.7.1.5 Gender.....	135
9.7.2 Medium Term 2012 – 2022.....	136
9.7.2.1 Research, Development and Dissemination	136
9.7.2.2 Human Resource Development and Capacity Building	136
9.7.3 Long Term 2012 - 2030	136
9.7.3.1 Research, Development and Dissemination	136
10.0 ANNEXURES	137
SUMMARY OF THE ENERGY STATUS IN THE COUNTIES	142
Sharing of licensing activities between national and County Governments	150

LIST OF ACRONYMS

AGO	Automotive Gas Oil (Diesel)
BTU	British Thermal Units
CCTs	Clean Coal Technology
CAPEX	Capital Expenditure
CCGT	Combined Cycle Gas Turbine
CEEC	Centre for Energy Efficiency and Conservation
CNG	Compressed Natural Gas
CRA	Commission for Revenue Allocation
DPK	Dual Purpose Kerosene
EAC	East African Community
EAPP	East African Power Pool
ERC	Energy Regulatory Commission
FiT	Feed in Tariff
FY	Financial Year
GDC	Geothermal Development Company
GDP	Gross Domestic Product
GHG	Green House Gases
GoK	Government of Kenya
GWh	GigaWatt Hour
IAEA	International Atomic Energy Agency
IPPs	Independent Power Producers
KEBS	Kenya Bureau of Standards
KenGen	Kenya Electricity Generating Company
KETRACO	Kenya Electricity Transmission Company
KIPPRA	Kenya Institute of Public Policy Research and Analysis
KIRDI	Kenya Industrial Research & Development Institute
koe	Kilogrammes of Oil Equivalent
KPC	Kenya Pipeline Company
KPLC	Kenya Power and Lighting Company
KPRL	Kenya Petroleum Refineries Limited
KR	Kenya Railways
KRA	Kenya Revenue Authority
kV	Kilo Volts
KVA	Kilo Volt Ampere

kWh	KiloWatt Hour
LCPDP	Least Cost Power Development Plan
LNG	Liquefied Natural Gas
LPG	Liquified Petroleum Gas
LRMC	Long Run Marginal Cost
MMBTU	Million British Thermal Units
MMCFD	Million Cubic Feet per Day
MoE	Ministry of Energy
MSD	Medium Speed Diesel
MTPA	Million Tonnes Per Annum
MW	Mega Watt
MWe	Megawatt Electric
NEMA	National Environmental Management Authority
NEPC	Nuclear Electricity Project Committee
NGO	Non-Governmental Organization
NOCK	National Oil Corporation of Kenya
OMCs	Oil Marketing Companies
OPEX	Operating Expenditure
PIEA	Petroleum Institute of East Africa
PMS	Premium Motor Spirit
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PV	Photo Voltaic
RD&D	Research, Development and Dissemination
REA	Rural Electrification Authority
REP	Rural Electrification Programme
RMS	Regular Motor Spirit
SAPP	Southern Africa Power Pool
ToE	Tonnes of Oil Equivalent
VAT	Value Added Tax
Wp	Watt Peak

VISION

AFFORDABLE QUALITY
ENERGY FOR ALL KENYANS

MISSION

TO FACILITATE PROVISION OF CLEAN,
SUSTAINABLE, AFFORDABLE,
RELIABLE AND SECURE ENERGY
SERVICES AT LEAST COST WHILE
PROTECTING THE ENVIRONMENT

FOREWORD BY THE HONOURABLE MINISTER FOR ENERGY

This Sessional Paper sets out the national policies and strategies for the energy sector that are aligned to the new Constitution and are in tandem with the Vision 2030.

Kenya Vision 2030 (the Vision) is a long-term development blueprint which aims at transforming the country into a globally competitive, newly industrialized, middle income and prosperous country. The Vision seeks to ensure a high quality of life to all citizens in a clean and secure environment by 2030. The objectives of the Vision have been adopted as GoK's national development objectives.

The Vision has identified Short, Medium and Long-term strategies aimed at transforming the social and economic well-being of its citizens. Among the Short-term strategies was the enactment of a New Constitution. The Constitution of Kenya, 2010 has drastically and substantially altered the governance structure of the country. It has also enhanced participation by the citizens in decision making processes. This has necessitated the need to review the energy sector framework in order to align it with the new constitutional dispensation.

The overall national development objectives of the Government of Kenya are accelerated economic growth; increasing productivity of all sectors; equitable distribution of national income; poverty alleviation through improved access to basic needs; enhanced agricultural production; industrialisation; accelerated employment creation and improved rural-urban balance. The extent to which these objectives can be realised on a sustainable basis and environmentally sound manner, is dependent on the degree and economic efficiency with which critical factors of production are made available and combined with each other to produce the desired results. The realisation of these objectives is only feasible if quality energy services are availed in a sustainable, cost effective and affordable manner to all sectors of the economy ranging from manufacturing, services, mining, and agriculture to households.

We submit these policy recommendations with optimism. The tasks ahead are great but achievable. To meet our energy challenge we must put to good use the resources around us and the talents within us.

I call upon all energy sector players both in public and private sectors to work together to ensure that the proposals contained in this policy are achieved. I also direct that an appropriate mechanism be set to monitor and evaluate the implementation process so as to ensure that the gains in this policy benefit all Kenyans.

Hon. Kiraitu Murungi, E.G.H. M.P.
Minister for Energy

PREFACE BY PERMANENT SECRETARY

In the past eight years the policy direction of the energy sector has been governed by the Sessional Paper No. 4 of 2004. However, a number of changes have taken place presenting new challenges and opportunities. The Kenya Vision 2030 development blueprint was unveiled in 2008 and the Constitution of Kenya was promulgated on 27th August, 2010. The achievement of these two milestones has necessitated the need to review the 2004 Sessional Paper.

The energy sector plays a critical role in the socio-economic development of a country. In Kenya, petroleum and electricity as sources of energy are the main drivers of the economy, while biomass is mainly used in rural communities and part of the urban population. Currently the energy sector relies wholly on the importation of all petroleum requirements. However, with the discovery of oil in Northern Kenya this trend is likely to change. Electricity generation is predominately hydro, supplemented by geothermal and thermal sources. Apart from wood fuel which is overexploited, the other renewable energy resources, though abundant, have not been fully exploited.

The major challenges facing the energy sector include improving the quantity, quality and reliability of energy supply; high initial capital outlay and the long lead times from feasibility studies to development of energy infrastructure; mobilizing adequate financial resources to undertake massive investment in the power sector, high cost of energy, low per capita incomes, and low levels of industrialization.

Successful implementation of this policy will require all stakeholders to play their role effectively keeping in mind the need to make the dream of affordable quality energy to all Kenyans a reality. In order to ensure timely implementation of the policies, programmes and projects of the plan, the ministry in charge of energy will put in place mechanisms to monitor progress of implementation and take any required remedial measures. In particular, an integrated energy sector management system will be set up to cover the Ministry headquarters and all the parastatals under it to facilitate online transmission of information.

The Ministry in charge of energy will provide overall leadership, oversight guidance and policy directions in the implementation of this Policy. To achieve the targets, the Ministry will ensure that managers in parastatals within the sector, not only sign performance contracts but also ensure that parastatals are prudently managed.

The private sector is currently involved in various economic activities in the energy sector such as oil, gas and coal exploration, petroleum distribution and power generation. The Ministry will continue to improve the investment environment to encourage more investments in the energy sector and involvement by the private sector.

Patrick M. Nyoike, C.B.S
Permanent Secretary, Ministry of Energy

EXECUTIVE SUMMARY

Introduction

1. The energy sector is governed by a number of statutes. With adoption of the Kenya Vision 2030 and the promulgation of the Constitution of Kenya 2010, there is need to review all these pieces of legislation so as to align them to the Vision and the Constitution. This pre-supposes the review and amalgamation of these laws into one statute.

Fossil Fuels Sub-Sector

2. The average consumption of petroleum products in Kenya has been increasing over the years. The recent discovery of oil in Northern Kenya has caused a lot of excitement in the sector and as such there is need to develop adequate petroleum production capacity in the country. There is a further need to develop the petroleum supply infrastructure to meet market requirements to match the increasing demand for petroleum products locally and in the region. These developments will include modernizing of the refinery by KPRL and setting up of a new refinery in Lamu. This will make petroleum products more competitive in the region, enable creation of wealth, ensure supply security and stabilize their prices. The Government will ensure that there are strategic Petroleum Reserves in the country and will undertake the necessary steps to achieve this end. The increased use of LPG shall be encouraged so as to reduce the over-reliance on bio-mass and eliminate the use of kerosene in households. The Government is also evaluating the possibility of using natural gas for power generation, transport and domestic purposes.
3. In order to fast track petroleum discovery in other exploration blocks in the country, the Government shall intensify primary data acquisition in the available blocks to make them more attractive to investors. The Government shall also develop mechanisms for sharing of revenue from petroleum production between the National and County Governments.
4. To ensure the security of supply of petroleum products the Government shall facilitate the construction of adequate import/off-loading, storage distribution and fuel dispensing facilities. The Government will facilitate private sector investor involvement in the development of a private port with a container terminal, gas terminal and oil jetty with a storage facility in Mombasa.
5. The Government will also review its policy with a view to removing all non-tariff barriers to market entry by abolishing requirements for minimum crude oil processing and contribution to pipeline line fill. The quality of petroleum products will be constantly reviewed to conform with international standards. To this end the institutional capacity in KEBS and ERC will be enhanced to enforce fuel quality specifications for both domestic and export market.
6. Coal has the potential to become the most reliable and easily accessible energy source, for electricity generation. Extensive coal exploration has taken place in the Mui Basin situated in Kitui County and a total of 70 wells have been drilled with 40 wells intercepting coal seams of various thicknesses at different depths. More wells are being drilled to confirm the coal reserves in the basin of which Block C has been confirmed to have 400million tonnes. More

coal exploration is going on in other parts of the country. These resources are expected to provide up to 2,400MW of electricity generation by 2030 as per the Least Cost Power Development Plan (LCPDP) 2011/2031.

7. The Government shall promote an intensive coal exploration programme and efficient utilisation of coal resources while minimising the environmental impacts associated with its use. It will establish data/Information on coal resources, intensify promotional campaigns in local and international conferences and exhibitions. A conducive investment environment for exploration and exploitation of coal will be created by providing fiscal incentives to attract investment in this sector. Similarly, the Government shall develop mechanisms for revenue sharing between the national and County Governments.

Renewable Energy Sub-Sector

8. Renewable energy has potential to enhance energy security, mitigate climate change, generate income, create employment and generate foreign exchange savings. The Government will create a Directorate to be responsible for renewable energy policy and designate a Renewable Energy Lead Agency to promote and accelerate the exploitation of this resource.
9. The Lead Agency shall, inter alia, provide a one stop shop for information and guidance to investors for renewable energy projects; develop and maintain a database on renewable energy resources and potential; formulate and implement a national strategy for coordinating production and promoting the efficient conversion and utilization of renewable energy.

Electricity Sub-Sector

10. Electricity, by virtue of its versatility in application, is crucial to the socio-economic development of the country and is the most sought after energy service by society. Access to electricity is associated with rising or high quality of life.
11. The National Government shall establish directorates within the ministry responsible for energy to be in charge of electrical energy, geothermal resources and nuclear energy for electric power generation. Through these directorates, the National Government shall:
 - (a) Develop and monitor implementation of electricity master plans for the country and the Eastern African Region.
 - (b) Set up a Hydro Risk Mitigation Fund to cater for risks such as prolonged droughts to cushion generators, transmitters, distributors and consumers against the effects of adverse hydrology, and establish an inter-ministerial committee comprising of relevant stakeholders to ensure coordination at policy, regulatory and operational levels on matters relating to the various uses of water resources.
 - (c) Support and fund the Geothermal Development Company (GDC) so as to manage the geothermal exploration risk to attract investors and encourage the private sector to invest in geothermal energy.

- (d) Ensure that all thermal power plants are designed, constructed, operated and maintained in a manner that minimises the environmental impact.
- (e) Transform the Nuclear Electricity Project Committee into a Nuclear Electricity Board to promote and implement a nuclear electricity generation programme.
- (f) Support open access to the transmission network, appoint an independent system operator, encourage regional integration of the power system to enhance regional power trade and continue to fund the development of the transmission system through KETRACO to enhance affordability.
- (g) Ensure that distribution services are provided efficiently by duly licensed network service providers and continue funding the development of the distribution network through REA.

Energy efficiency and Conservation

- 12. The importance of Energy efficiency and conservation measures in the Kenyan economy cannot be overemphasized. It is estimated that energy savings in excess of Kshs.2.5 billion are possible in the industrial sector. Key challenges to implementation of energy efficiency and conservation include lack of awareness of benefits and methods of conservation. Other challenges include: apathy, resistance, limited technical capacity and inadequate data.
- 13. The Government shall enhance energy efficiency and conservation activities to improve the energy security and mitigate the effects of climate change by lowering Green House Gas (GHG) emissions. Measures will also be introduced in the transport sector, to promote fuel efficiency by encouraging the use of mass transportation of passengers and cargo to capitalize on the economies of scale, as well as, the promotion of new and efficient technologies such as hybrid engines, fuel cell, electric vehicles and compressed natural gas (CNG).

Research Development and Dissemination (RD&D)

- 14. RD&D as well as human resource development are key components in achieving the objectives of this policy. Towards this end, the Government shall establish a National Energy Institute and allocate sufficient resources, financial and otherwise to spearhead RD&D in the sector.

1.0 - INTRODUCTION

1.1 The Role of Energy in Economic Development

1. The level and the intensity of energy use in a country is a key indicator of economic growth and development. The Kenya Vision 2030 identified energy as one of the infrastructure enablers of its social economic pillar. Sustainable, affordable and reliable energy for all citizens is a key factor in realization of the Vision.
2. Between 2000 and 2010 the economy grew at an average of 3.4%. Post-election violence in early 2008, coupled with the effects of the global financial crisis on remittance and exports, reduced GDP growth to 1.7% in 2008 but the economy rebounded to 2.6% in 2009 and 5.6% in 2010. In 2010 GDP stood at US\$32.187billion.
3. Factors responsible for this positive momentum include the new constitution, East Africa Community (EAC) integration, Information Communication Technology (ICT) innovations, strong macroeconomic management and recent investments in infrastructure. The service sector, the driver of previous years' growth, has moderated whilst agriculture and industry are rebounding after two years of a slump. ICT has been the main driver of Kenya's economic growth over the last decade growing on average by 20% annually. The implication of this is that the combined strength of the transport and communications sectors have blossomed into the second largest in Kenya's economy, only bettered by agriculture.
4. Real GDP is expected to continue to improve, largely because of expansion in tourism, telecommunications, transport, construction and recovery in agriculture.
5. According to the Budget Speech of 2011, the economic growth in 2011 is expected to slow down to about 5.3% on account of emerging evidence on the likely adverse impacts of the high fuel and food prices raising inflation and depreciation of the Kenya shilling. However, the timely implementation of the Constitutional reforms and ongoing public sector investment will help to boost business confidence.
6. The principal taxation policy pursued by the Government of Kenya (GoK) in the energy sector is based on the need to create a sustainable balance between fiscal revenue generation and ensuring accessibility of energy by the low income segments of the population at reasonable prices. GoK also uses taxation as a prudent policy instrument to discourage wasteful consumption of energy, and by extension, to encourage its efficient utilization in a cost effective manner. An example of this policy is exemption of Value Added Tax (VAT) for domestic users of electricity where total consumption is below 200 kilowatt hours per month.
7. Given this policy regime, the energy sector has continued to play its role as a significant contributor to fiscal revenues through taxes, levies and duties imposed on various petroleum products, electrical energy and materials sourced by service providers for operations, maintenance and infrastructure expansion. In 2010, the contribution of the energy sector to the overall tax revenue was about 20%, equivalent to 4% of Gross Domestic Product (GDP).

8. Energy shortages and supply disruptions coupled with high cost remain serious obstacles to economic activity. Tax and other concessions are planned to encourage investment in fossil fuel exploration, geothermal energy, hydroelectric power and other forms of renewable energy such as wind, solar and biomass.
9. Kenya imports all crude petroleum requirements, accounting for about 25% of the national import bill. Kenya Petroleum Refineries Limited (KPRL) operates the country's sole oil refinery at Mombasa, which meets about 40% of local demand for petroleum products. Most of the KPRL production is transported via the pipeline system.
10. The cost of energy has significant impact on economic activities particularly those that are energy intensive such as cement, steel, pulp and paper production. In a liberalized market such as Kenya's, energy prices are a significant determinant of competitiveness of locally manufactured goods relative to imports. In this regard, high energy prices impact negatively on domestic wealth creation, balance of payments and employment creation since consumers opt for cheaper imports.

1.2 Energy Policy Objectives

1. The overall objective of the energy policy is to ensure affordable, sustainable and reliable supply to meet national and county development needs, while protecting and conserving the environment.
2. Specifically these are to:
 - (a) Utilize energy as a tool to accelerate economic empowerment for the National and County Governments as well as urban and rural development.
 - (b) Improve access to quality, reliable and affordable energy services.
 - (c) Provide a conducive environment for the provision of energy services.
 - (d) Promote development of indigenous energy resources
 - (e) Promote energy efficiency and conservation.
 - (f) Ensure that prudent environmental, social, health and safety considerations are factored in energy sector developments.
 - (g) Ensure that a comprehensive, integrated and well informed energy sector plan is put in place for effective development.
 - (h) Foster international co-operation in energy trade, investments and development.
 - (i) Promote energy research, development, training and local manufacture of energy plant, equipment, appliances and materials.
 - (j) Promote appropriate standards, codes of practice and specifications for equipment, systems and processes in the energy sector.
 - (k) Promote diversification of energy supply sources to ensure supply security
 - (l) Promote healthy competition in the sector.

- (m) Protect consumer interests.
- (n) Promote both local and international investments in the energy sector.
- (o) Promote an elaborate response strategy in energy related disaster management.
- (p) Generate at least 70% of electricity from clean or renewable resources and build the infrastructure necessary to transmit that electricity.
- (q) Provide for the phased transfer of provision of energy services to the Counties in accordance with Article 174 of the Constitution.

1.3 Legal and Regulatory Framework

1.3.1 The Constitution of Kenya, 2010

1. The Constitution has enhanced protection and enforcement of fundamental rights amongst other gains. It provides for a two tier structure of government, i.e. the National and the County Governments. It distributes the functions and powers between the two levels as detailed in Chapter Eleven and the Fourth Schedule.
2. Specifically in relation to the energy sector, Part 1 of the Fourth Schedule provides that the National Government shall be responsible for:-
 - (a) Protection of the environment and natural resources with a view to establishing a durable and sustainable system of development including water protection, securing sufficient residual water, hydraulic engineering and the safety of dams
 - (b) Energy policy including electricity and gas reticulation and energy regulation
 - (c) Public investment.
3. In relation to the County Governments, Part 2 of the Fourth Schedule provides that they shall be responsible for county planning and development including electricity and gas reticulation and energy regulation.
4. It is necessary to review and align the energy sector policy, legal and regulatory framework with the provisions, spirit and aspirations of the Constitution.

1.3.2 Current Policy and Legislation

1. The energy sector is guided by Sessional Paper No. 4 of 2004 and several pieces of legislation, the principal ones being:
 - (a) The Energy Act, No. 12 which was enacted in 2006. It sought to amend and consolidate the law relating to energy, provide for the establishment, powers and functions of the Energy Regulatory Commission and the Rural Electrification Authority.
 - (b) The Geothermal Resources Act No. 12, enacted in 1982 to control the exploitation and use of geothermal resources, vest the resources in the Government.
 - (c) The Petroleum (Exploration and Production) Act, Chapter 308 of the Laws of Kenya was enacted to regulate the negotiation and conclusion by the Government of petroleum

agreements relating to the exploration for, development, production and transportation of, petroleum.

- (d) The Petroleum Development Fund Act was enacted in 1991 for the establishment of a Petroleum Development Fund and the imposition of a Petroleum Development Levy.
2. Alongside the foregoing principal Acts, there are several other Acts that impact the energy sector, including:-
- (a) The Standards Act, Chapter 496 of the Laws of Kenya that provides for establishment of minimum quality specifications, mode, materials and apparatus for energy used in the country.
 - (b) The Environmental Management and Co-ordination Act, 1999, which regulates the environmental aspect of the energy sector.
 - (c) The Local Government Act, Chapter 265 of the Laws of Kenya which grants authority for approval by local authorities of sites for construction and installation of fuel storage and dispensing facilities; business licensing and levies for electric power poles and wayleaves charges.
 - (d) The Physical Planning Act, Chapter 286 of the Laws of Kenya that provides for zoning of areas for storage, distribution and retailing of petroleum fuels and construction of electric power sub-stations and other infrastructure.
 - (e) The Weights and Measures Act, Chapter 513 of the Laws of Kenya under which storage tanks and dispensing equipment for sale of petroleum products are calibrated and regulated for accuracy.
 - (f) The Public Procurement and Disposal Act No. 3 of 2005 that establishes procedures for efficient public procurement and for the disposal of unserviceable, obsolete or surplus, stores, assets and equipment by public entities.
 - (g) The Anti-Corruption and Economic Crimes Act No. 3 of 2003.
 - (h) The Ethics and Anti-Corruption Commission Act No. 22 of 2011 that established the Ethics and Anti Corruption Commission pursuant to Article 79 of The Constitution.
 - (i) The Public Officer Ethics Act No. 4 of 2003 that seeks to advance the ethics of a public officer by providing for a code of conduct and ethics for public officers.
 - (j) The Land Act 2012.
 - (k) The Land Registration Act, 2012.
 - (l) The Commission of Revenue Allocation Act.
 - (m) The National Land Commission Act that established the National Land Commission pursuant to Article 67 of The Constitution.

- (n) The Environment and Land Court Act No. 19 of 2011 that established the Environment and Land Court pursuant to Article 162(2)(b) of The Constitution.
- (o) The Urban Areas and Cities Act No. 13 of 2011 that gives effect to Article 184 of the Constitution.
- (p) The National Government Loans Guarantee Act No. 18 of 2011 that ensures the transparent, prudent and equitable management of the authority to guarantee loans conferred on the National Government under Article 213 of The Constitution.
- (q) The Consumer Protection Act that establishes the regime of consumer protection law and to prevent unfair trade practices in consumer transactions and provide for matters for connected with incidental thereto.
- (r) The National Construction Authority Act that provides the establishment, powers and functions of the National Construction Authority for connected purposes.
- (s) The County Government Act that provides for the regulation required to implement the provisions relating to devolved government and to give effect to chapter 11 of the Constitution, to provide for county government powers, functions and responsibilities to deliver services and for connected purposes.

1.4 Institutional Arrangements

Sessional Paper No. 4 of 2004 and the Energy Act No.12 of 2006 restructured the sector in a bid to facilitate high level performance. The Policy has enabled increased private sector participation in the development of the sector whilst simultaneously focusing on improved management and delivery of energy services. This was intended to enable the sector address its mission of providing clean, sustainable, affordable, reliable and secure energy services at least cost while protecting the environment. The following are the key actors in the sector:-

1. Ministry of Energy (MoE)

It is responsible for formulation and articulation of energy policies through which it provides an enabling environment for all stakeholders. Its tasks include national energy planning, training of manpower and mobilisation of financial resources.

2. Energy Regulatory Commission (ERC)

It was established as an energy sector regulator under the Energy Act, 2006, with responsibility for economic and technical regulation of electric power, renewable energy, and downstream petroleum sub-sectors. Its functions also include tariff setting, review, licensing, enforcement, dispute settlement and approval of power purchase and network service contracts.

3. Energy Tribunal

This quasi-judicial body was established under section 108 of the Energy Act, 2006. It came into operation in July 2007 to primarily hear appeals against the decisions of ERC. It also has jurisdiction to hear and determine all matters referred to it relating to the energy sector.

4. The Kenya Power & Lighting Company Limited (KPLC)

KPLC is a State Corporation with GoK shareholding of 50.1% and private shareholding of 49.9% as at December 2011. It purchases electrical energy in bulk from KenGen and other power producers and carries out transmission, distribution, supply and retail of electric power.

5. Kenya Electricity Generating Company Limited (KenGen)

KenGen is a State Corporation with GoK shareholding of 70% and private shareholding of 30% as at December 2011. It is responsible for electric power generation and produces the bulk of electricity consumed in the country. The company utilises various sources to generate electricity ranging from hydro, geothermal, thermal to wind.

6. Rural Electrification Authority (REA)

REA was established under section 66 of the Energy Act as a body corporate with the principal mandate of extending electricity supply to rural areas, managing the rural electrification fund, mobilizing resources for rural electrification and promoting the development and use of renewable energy.

7. Geothermal Development Company Limited (GDC)

This is a state-owned company established by the Government of Kenya as a Special Purpose Vehicle for the development of geothermal resources in Kenya.

8. Kenya Electricity Transmission Company Limited (KETRACO)

This is a GoK wholly owned company established to be responsible for the development of the national transmission grid network. It is also responsible for facilitating regional power trade through its transmission network.

9. Independent Power Producers (IPPs)

IPPs are private companies which generate power and sell electricity in bulk to KPLC. As at 2011, they accounted for about 26% of the country's installed capacity and play an important role in bridging the demand gap. By December 2011, the operating IPPs are:-

- (a) Iberafrica Power (E.A.) Company Limited (thermal power plant)
- (b) Tsavo Power Company Limited (thermal power plant)
- (c) Mumias Sugar Company Limited (co-generation)
- (d) Orpower 4 Inc (geothermal power plant)

(e) Rabai Power Company Limited (thermal power plant)

(f) Imenti Tea Factory Company Limited (mini-hydro).

10. Kenya Petroleum Refineries Limited (KPRL)

Kenya Petroleum Refineries Limited is a limited liability company with its main business being processing of crude oil. The Company is co-owned on a 50-50% shareholding basis by GoK and Essar Energy Overseas Limited. The refinery has a name plate capacity of 3million tonnes per annum but processes 1.6million tonnes of crude oil per annum for the local market.

11. Kenya Pipeline Company Limited (KPC)

KPC is a State Corporation with 100% GoK ownership. Its business is mainly storage, transportation and handling of refined petroleum products in the country.

12. National Oil Corporation of Kenya Limited (NOCK)

NOCK is a wholly owned state corporation mandated to stabilise the petroleum supply market by participating in all aspects of the petroleum industry namely upstream, mid-stream and downstream activities.

13. Centre for Energy Efficiency and Conservation (CEEC)

The Centre was established jointly by GoK and the Kenya Association of Manufacturers to champion energy efficiency and conservation efforts in Kenya.

14. Oil Marketing Companies (OMCs)

OMCs are local and international companies licensed to undertake the importation, storage, wholesale, export and retail of petroleum products.

15. Petroleum Institute of East Africa (PIEA)

The Institute is a voluntary membership institution patronised by among others the major oil companies. It plays a key role in capacity building and awareness creation in the petroleum subsector.

16. Oil Exploration and Production Companies (OIEPs)

These are local and international companies licensed to undertake exploration and production of petroleum products.

17. The Nuclear Electricity Project Committee (NEPC)

NEPC was established vide The Kenya Gazette Vol. CXII-No.123, Gazette Notice No. 14188 on the 19th November 2010 in line with Vision 2030. It is charged with the mandate of spearheading and fast tracking development of nuclear electricity generation in order to enhance the production of affordable and reliable electricity.

Other key players in the energy sector include National Environmental Management Authority (NEMA), Kenya Railways Corporation (KR), Kenya Truckers Association (KTA), Kenya Association of Manufacturers (KAM) and Consumers.

1.4.1 Challenges in the Institutional Arrangements

These include governance issues, lack of a research institute, funding constraints and inadequate human resource capacity. Operational challenges including lack of synergy, overlap of mandates of the various institutions. This leads to duplication of roles and suboptimal utilisation of available resources.

2.0 – FOSSIL FUELS

2.1 BACKGROUND

1. Fossil fuels encompass petroleum (oil, oil shale and gas) and coal resources. As of June, 2011 petroleum accounted for 22% of the total primary energy consumed in the country. Petroleum is mainly used in the transport, commercial and industrial sectors. Coal provided about 1% of the primary energy consumed in the country mainly by cement manufacturers¹.
2. The Petroleum industry is broadly divided into three categories namely: upstream (exploration and production), mid-stream (storage, refining and transportation) and down-stream (supply and distribution).

2.2 PETROLEUM

2.2.1 Petroleum Exploration

1. Until recently, Kenya had no known commercial reserves of petroleum. However, in January 2012, Tullow oil, an OIEP, spudded Ngamia I Well located at Lokichar area within Turkana County. By May 2012, Tullow Oil had discovered crude oil with a total pay zone of 100 metres between depths of 850 metres to 1515 metres. According to Tullow, the API gravity of the oil was estimated at between 30^o and 35^o , indicating high quality oil. The drilling at the well is ongoing and expected to reach a maximum depth of 2,700 metres.
2. Further petroleum exploration is being undertaken both on-shore and off-shore in the country's four major Sedimentary Basins as shown in Table 2.1 with a view to discovering commercially viable deposits. The discovery will reduce reliance on imported crude oil and other related products.

Table: 2.1 Summary of the Basins and Wells Drilled

Basin	Area (km ²)	Wells drilled	Average Sediment thickness (m)
Lamu	261,000	16	12,000
Mandera	43,404	3	10,000
Anza	81,319	11	10,000
Tertiary Rift	105,673	3	4,000

3. The Government has taken the initiative to spearhead primary technical data acquisition in the exploration blocks in order to make them attractive to oil exploration companies and by May 2012 there were a total of 33 exploratory wells, 80,000 km of two dimensional (2D) and 6,300 km² of three dimensional (3D) seismic data.
4. Before 23rd March 2012, Kenya had a total of 38 exploration blocks. A further 8 ultra-Deep Off Shore Blocks were gazetted by the Minister for Energy on that date. This increased the total number of exploration blocks to 46. There has been a marked increase in petroleum exploration interest which is attributed to:

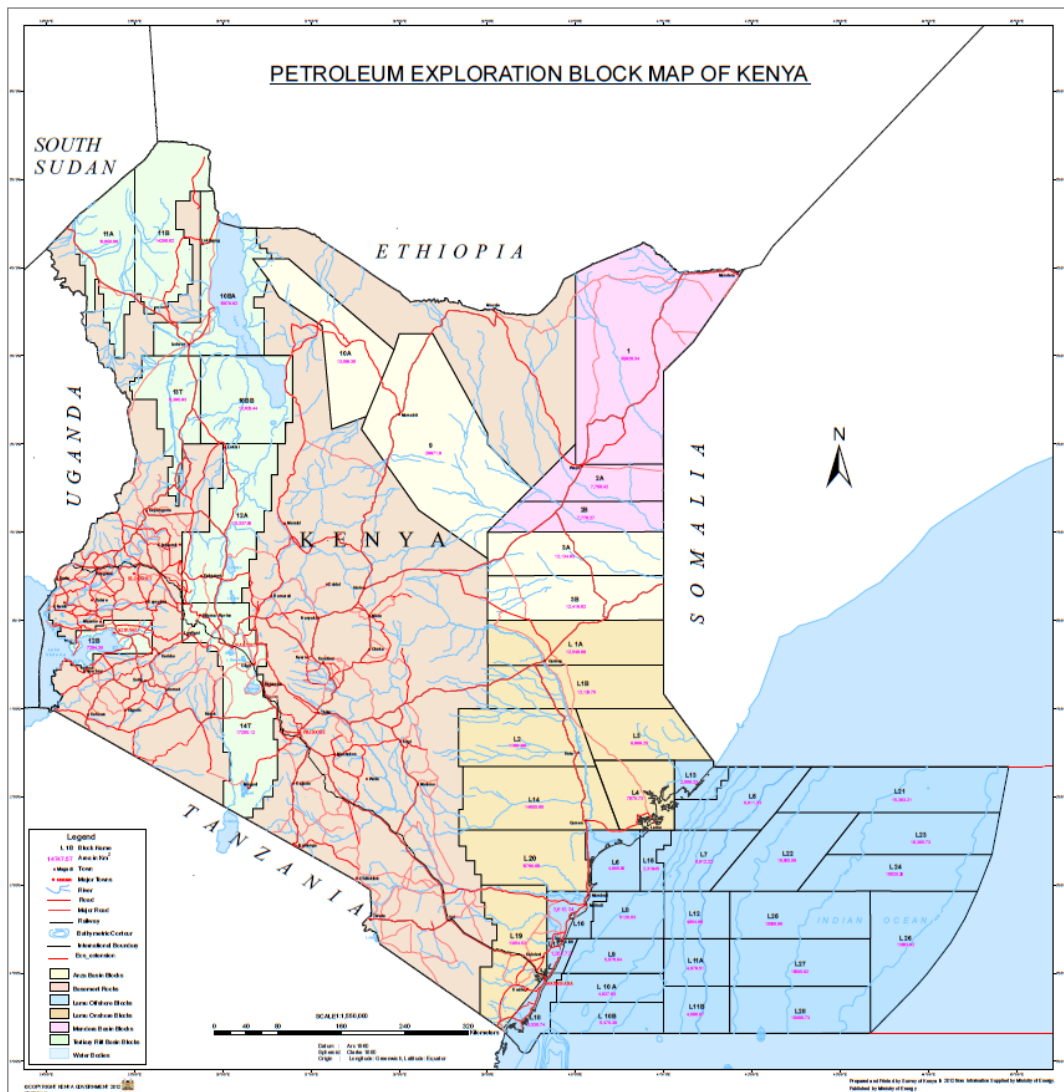
¹Economic Survey, 2011

- (a) Rising world crude oil prices.
 - (b) Discoveries of commercial quantities of petroleum in neighbouring Uganda.
 - (c) Intensive promotion activities by MoE and NOCK.
 - (d) The existence of an attractive legal, regulatory framework, fiscal and acceptable risk-reward balance.
 - (e) Creation of basin by basin data packages by NOCK.
 - (f) The recent discovery of oil in Turkana County.
5. As at May 2012, 30 blocks out of the gazetted 46 had been licensed to 14 exploration companies which are conducting exploration activities within their respective blocks. Of the 16 remaining blocks, 13 have expressions of interests from 9 oil companies. The entry of major foreign oil companies such as Anadarko, BG Group, Total, Tullow Oil, Africa Oil, Ophir, Apache has been a major boost for Kenya's petroleum exploration activities. Their entry has added immense value through acquisition of high quality data through the deployment of new data acquisition technologies such as 3D Seismic and Full Tensor Gradiometry (FTG).
6. Figure 2.1 shows the petroleum exploration blocks in the country while licensed petroleum exploration blocks are listed in Table 2.2 below.

Table 2.2: Licensed Petroleum Exploration Companies as at May 2012

	Exploration Companies	Exploration Block Nos.	Total No. of Blocks.
1.	Tullow Oil Corporation	10A, 10BB, 10BA, 13T, 12A, and 12B	6
2.	Anadarko	L-5, L-7, L-12, L-11A, L-11B	5
3.	BG Group	L-10A, L-10B	2
4.	Ophir/Dominion	L-9, L-15	2
5.	Apache	L-8	1
6.	Vanoil Resources	3A, 3B	2
7.	Africa Oil Corporation	9	1
8.	Zarara	L-4, L-13	2
9.	FAR/Flow Energy	L-6	1
10.	Lion Petroleum	2B	1
11.	NOCK	14T	1
12.	Simba	2A	1
13.	Afren	L-17/ L-18	2
14.	A-Z Petroleum	L1A & L3	2

Figure 2.1 – Petroleum Exploration Blocks Map of Kenya, May 2012



7. Licensing of Petroleum Blocks is currently governed by the Petroleum (Exploration and Production) Act CAP 308. All Production Sharing Contract (PSC) are based on a Model Production Sharing Contract and Heads of Agreement (HoA).
8. Obligations under the (PSC) include reinterpretation of existing data, technical data acquisition and drilling of an exploration well with a minimum vertical depth of 3,000 meters. The minimum work programme and expenditure obligation for each block is negotiable. The general structure of the PSC is summarized in Annex 10.1 in **10.0 - Annexure**.
9. The completed exploration activities for F/Y 2011/12 for the licensed blocks include:
 - (a) Full Tensor Gravity Gradiometry (FTG) survey in Blocks 10BB, 10BA, 13T and 12A .
 - (b) Geochemical data sampling in Block 14T using GORE-SORBER technology.
 - (c) 1,324 line km of 2D seismic data in L-17/L-18 and 750 line km of 2D seismic data in Block 9.
 - (d) Over 3,500 km² of 3D seismic data in Block L-5, L-7, L-12, L-11A and L-11B.
 - (e) Ground gravity data in Block 14T.

- (f) British Gas (BG) has completed 2D and 3D Seismic data acquisition in Blocks L-10A and L-10B.
10. Planned and ongoing exploration activities in 2011/12 for the licensed blocks include:
- a. Full Tensor Gravity Gradiometry (FTG) survey in Block 14T.
 - b. Tullow Oil Ngamia Well drilling in Block 10BB at Lokichar near Lake Turkana and further conduct 2D seismic survey in Blocks 13T and 12A.
 - c. Drilling of Paipai Well in Block 10A and Twiga 1 in 13T by Tullow Oil.
 - d. The Ministry of Energy is also undertaking primary data acquisition using gravity, magnetic and a planned tendering for a hydrocarbon gases seepage study in Block L-19.
 - e. Afren acquisition of 200 km of 2D seismic data in Mandera Block 1.
 - f. Additional seismic data acquisition and well drilling by Apache in Block L-8.
 - g. Planned 3D Seismic data acquisition by Vannoil in Block 3A and 3B.
11. An Inter-ministerial Committee, called National Fossil Fuels Advisory Committee (NAFFAC) shall be re-constituted under legislation whose mandate is to:
- (a) Negotiate with investors on the terms of the license of the petroleum and coal Blocks for exploration, production and development.
 - (b) Advise the Cabinet Secretary on all petroleum and coal exploration matters.
12. The reconstituted NAFFAC shall be composed of the seven core inter-ministerial members plus five co-opted members as follows: – Ministry in-charge of Energy, NOCK, Attorney General, NEMA, KRA and Ministry in-charge of Mineral Resources as well as co-opted members from PIEA, University of Nairobi (UoN), Directorate of Personnel Management (DPM) and Ministry of Finance (MoF).

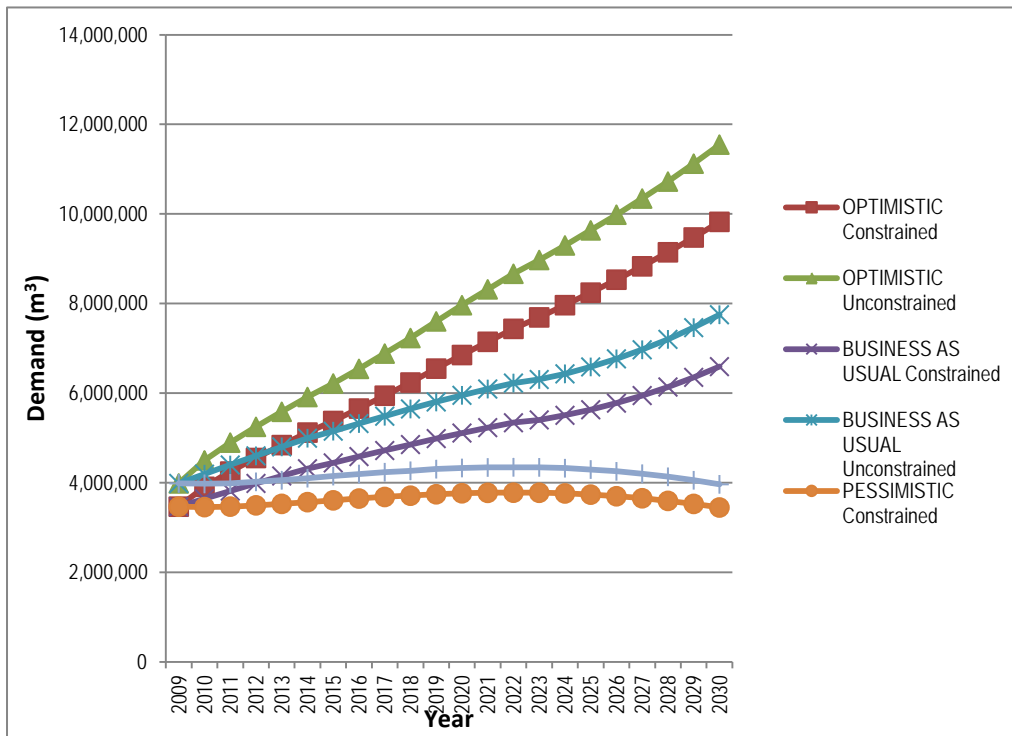
2.2.2 Petroleum Consumption

1. According to the Economic Survey 2011, consumption of petroleum fuels in Kenya rose from 2.9 million Tons of Oil Equivalent (TOE) in 2004 to 3.6million TOE in 2009. This is equivalent to a per capita consumption of 94.4 kilograms, which is still low compared to the standards of developing economies, and is attributable to low economic growth and over dependence on rain-fed agriculture.
2. The Survey further indicates that retail pump outlets and road transport accounted for approximately 63.4% of petroleum consumption, industrial and commercial sectors accounted for 11.4% while power generation accounted for 8%.
3. Also according to the Kenya Institute of Public Policy Research and Analysis (KIPPRA) study of August 2010, the estimated unconstrained demand of Liquefied Petroleum Gas (LPG) is projected to be over 300,000 metric tonnes in 2012. Suppressed LPG consumption in 2007 was more than 75,000 metric tonnes, while the refinery production was about 35,000 metric tonnes.

2.2.3 Demand for Petroleum

1. The average consumption of petroleum products in Kenya has been increasing over the years. In 2004, actual consumption was 2.9million TOE, in 2009 it stood at 3.6million TOE and in 2010 it was 3.77million TOE. Some of the factors that explain this variation in consumption include GDP growth, electrical energy demand, population growth, urban population growth, and increase in motorization and air transport.
2. Kenya imports petroleum in form of crude oil for domestic processing as well as refined products. During the period 2009 – 2010 petroleum imports averaged 3.95million Metric Tonnes per annum accounting for 25.3% of the country's total annual import bill.
3. Demand for petroleum products is projected to rise by 3.1% on average per annum for the years 2009 to 2030. The projections under different scenarios are given in Figure 2.2.

Figure 2-2 - National Demand Forecast for Petroleum Products (m³)



Source: KIPPRA Study on the demand of Petroleum products in Kenya, August 2010

2.2.4 Petroleum Supply and Distribution

1. The world economy emerged from the recession experienced in 2009 recording a significant growth of 4.6% in 2010. This influenced world oil demand and supply. In 2010 oil prices fluctuated between USD 73 and USD 86 per barrel most of the year but peaked at USD 91.85 per barrel in December 2010. The high international oil prices led to high prices of petroleum products in the domestic market.
2. The total quantity of petroleum products imported into the country dropped by 7.8% from 4,168,900 tonnes in 2009 to 3,844,600 tonnes in 2010. The domestic petroleum products exported continued to decline for the third year running from 97,400 tonnes in 2009 to 95,100 tonnes in 2010. During the same period, the total value of petroleum products exported,

including re-exports, increased by 36.35% while the total import bill of petroleum products rose to 25.3% in 2010. Total domestic demand for petroleum products rose by 4.3% in the same period.

2.2.4.1 Petroleum Infrastructure Issues

1. Sufficient and efficient infrastructural systems are key to ensuring adequate, reliable and cost effective supply of petroleum products. The increase in local and regional demand for petroleum products has not been matched by the development of the infrastructure to meet supply chain and market requirements.
2. In addition, the escalating international prices of petroleum products and the volatile foreign exchange rates have led to unpredictable consumer prices, more so in the local pump prices. From 2010 the resulting cost-push inflation has led to unsustainable increase in the cost of living.

2.2.4.2 Import/Offloading Facilities in Mombasa

1. Both refined petroleum products and crude oil are offloaded at the Kipevu Oil Terminal (KOT). The refined products are routed to the Kipevu Oil Storage Facility (KOSF) and crude oil to Kenya Petroleum Refineries facilities in Mombasa. KOT handles over 90% of the country's imports, some of which are transit products for Uganda, Northern Tanzania, Rwanda, Burundi, Eastern DRC, and South Sudan.
2. A smaller jetty at the Shimanzi Oil Terminal (SOT) is operated by the oil marketers for import and export of refined petroleum products. Products imported through SOT are evacuated by road and rail.
3. The long term plan of Kenya Ports Authority (KPA) is to cease the use of SOT for handling of petroleum fuels and to relocate KOT to pave way for the construction of a Container Terminal at Kipevu.

2.2.4.3 Storage Facilities in Mombasa

1. KOSF is the primary facility of receiving imported refined petroleum products (distillates and spirits) and has a storage capacity of 326million litres while its operational capacity is 269million litres. This comprises 58, 108 and 103million litres of petrol, diesel and dual-purpose kerosene, respectively.
2. The KOSF capacity is not adequate for regional demand of petroleum products estimated at 450million litres per month. The capacity is constrained by low product evacuations at Nairobi and low flow rate on Nairobi to Western Kenya pipeline. Frequent rehabilitation of aged tanks results to ullage constraints and lack of operational flexibility. There are plans to construct additional storage in Mombasa and along the pipeline network.

2.2.4.4 Strategic Petroleum Reserves

1. Kenya has hitherto remained without strategic petroleum stocks which are critical in cushioning the country against both onshore and offshore supply chain disruptions and to provide supply security. The Energy (Petroleum Strategic Stock) Regulations, 2008 (Legal Notice No. 43 of

2008) provides for strategic stocks of refined petroleum for 90 days of consumption. The regulations provide that NOCK shall procure the stock to be stored by KPC. There is therefore need for a fund to procure the stocks and develop the necessary storage facilities.

2.2.4.5 Common User Truck and Rail Loading Facilities in Mombasa

1. The truck and rail loading facilities in Mombasa are owned by a few Oil Marketing Companies (OMCs) who provide hospitality to the other marketers at premium tariffs, which inhibit competition. Most of the facilities are located at Shimanzi which is due for de-commissioning.

2.2.5 Petroleum Refining

1. KPRL refines 1.6million metric tonnes per annum (mmtpa) against a nameplate capacity of 4mmtpa of crude oil. The refinery produces premium motor spirit (PMS), regular motor spirit (RMS), automotive gas oil (AGO), dual purpose kerosene (DPK), liquefied petroleum gas (LPG), fuel oil, grease and bitumen.
2. In July 2009 the Government entered into an agreement with Essar Energy Overseas Limited where they both committed to modernize the refinery. The modernization would entail full capacity utilization, residue conversion, construction of an LPG handling facility, address environmental concerns and product quality requirements, and installation of a power plant. In addition, the government committed to continue supporting the refinery operations through fiscal and legal protection. Upon modernization, the refinery would have the following benefits:
 - (a) Competitive refined petroleum products.
 - (b) Increased employment and wealth creation opportunities.
 - (c) With the discovery of oil in the region, the refinery is a strategic asset for processing of such oil.
3. The Government is in the process of building another petroleum refinery in Lamu under Lamu Port and Lamu- South Sudan Ethiopia Transport Corridor (LAPSSSET) project.

2.2.6 Petroleum Transportation

2.2.6.1 Pipeline

1. The primary mode of transport for petroleum products is the pipeline system managed by the Kenya Pipeline Corporation (KPC). The oil pipeline is 896 km long running from the coastal town of Mombasa, through Nairobi to Eldoret and Kisumu and serves the local and neighbouring countries.
2. The Mombasa - Nairobi pipeline (Line 1) was commissioned in 1978 while the western Kenya extension from Nairobi with terminals in Nakuru, Eldoret and Kisumu was completed in 1994. A 14 inch diameter parallel pipeline has also been constructed from Nairobi to Eldoret to boost the supply of petroleum products to western Kenya. Products transported by the pipeline system are super petrol, regular petrol, diesel, illuminating kerosene and aviation fuel.

3. The pipeline system, which handles approximately 450million litres a month, is connected to the KOSF and draws some of the petroleum products from the KPRL after the crude oil has been processed.
4. There are plans to extend the pipeline from Eldoret to Kampala, Uganda under the Kenya Uganda Petroleum Products Pipeline Extension Project that is being developed jointly by the governments of Kenya and Uganda.
5. The pipeline will also be extended from Nakuru through Nanyuki to Isiolo to serve the central and northern parts of the country and the neighbouring countries. KPC has established points of presence in Taveta and Konza. The pipeline will be extended to these towns and additional storage facilities constructed.
6. The Mombasa – Nairobi pipeline system is a 450 km long. It is a 14 inch diameter pipe and has 8 pumping stations with enhanced operational pumping capacity of 830 m³ per hour, up from 440 m³ per hour. Line 1 which has been in use for 34 years, is due for replacement and the process is under way.
7. Congestion of the pipeline system and ullage constraints at KOSF and Nairobi Terminal are caused by low evacuation of products by the 53 OMCs. The product transfers from the KPC Nairobi Terminal to the OMCs' depots are currently at an average of 5,000m³ per day based on requests by the OMCs. This is against handling capacity of approximately 10,000m³ per day.

2.2.6.2 Rail Transport

As at 2011 only about 1% of petroleum products are transported by rail from Mombasa because the Kenya Railways Corporation and its concessionaire, Rift Valley Railways do not have adequate wagons. However, railway transportation is a much safer mode of transport than road due to the potential risks involved especially in LPG handling coupled with the destruction of the roads. Transport by rail is mostly for fuel oil.

2.2.6.3 Sea and Lake Transport

The discovery of oil in the country, Uganda and the independence of South Sudan provides an opportunity for transportation of both crude and refined petroleum products over the water bodies in the region. There is need to enhance sea and lake transport by acquiring the necessary tankers and the development of the necessary loading infrastructure.

2.2.6.4 Road Transport

1. Road transport is used to move petroleum products from various depots that are located in Mombasa, Nairobi, Nakuru, Eldoret and Kisumu to their environs and other towns. Transportation of products from Mombasa to the hinterland is also undertaken by road since the pipeline system experiences challenges in meeting the demand for petroleum products upcountry.
2. The use of road transport for petroleum fuels is expected to go down drastically once the pipeline system capacity is enhanced as planned. However, road transport will continue to play

a key role in distribution of the products from the KPC depots to the consumers hence the need to have an efficient road system.

2.2.7 Oil Marketing Companies

1. As at September 2011 there were 53 OMCs licensed to import petroleum products and 167 companies licensed to market petroleum products in Kenya, and more are expected to join. The licensing criteria have been simplified to facilitate the entry of indigenous traders in the oil business. However, the market is still largely oligopolistic with 80% being controlled by the big four OMCs.
2. Government plans to put in place a strategy to encourage the growth of indigenous OMCs by establishing more infrastructure for storage and sourcing. Establishment of open access storage facilities by investors who are not necessarily OMCs should be encouraged as a matter of policy to further facilitate the operations of OMCs which might not have individual storage facilities. Incentives on land, levies and taxes should be put in place to attract private sector investment in storage facilities.

2.2.8 Open Tender System (OTS)

1. Importation of petroleum products is through OTS. The crude imports meet about 45% of national demand. The rest (55%) is imported as refined products of which 70% is also imported through OTS. Importation of petroleum products through the OTS allows all the OMCs to access petroleum products at the same price and therefore ensures competition in the petroleum market. Since OTS is run through monthly tenders, it entails sourcing of petroleum predominantly from the spot market whereby petroleum is sourced from the open market without any prior contracts.
2. The industry recognizes that OTS is an effective supply system that creates a competitive, transparent means of availing the product for the Kenyan economy, employing economies of scale. This is demonstrated by the fact that the duty free landed cost of fuel in Kenya is among the lowest in Africa.

2.2.9 Price Comparison with other Countries

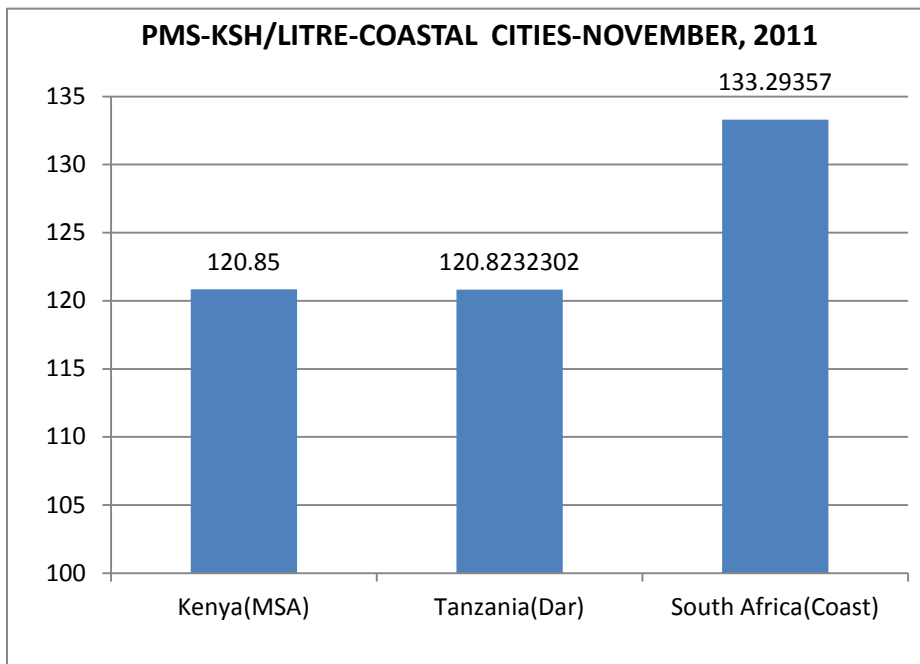
1. The prices published by the ERC in Kenya are competitive compared to the prices in the region and other countries like South Africa as shown in the Figure 2.3.
2. In addition, the economies of scale benefit the smaller OMCs, which are mostly local entrepreneurs. However all parties must abide by the terms and conditions of the agreement which stipulates equal participation without favouritism in the spirit of creating/promoting a level playing field.

2.2.10 Global Geo-Political Issues

1. On the international scene, petroleum prices have been on a continuous but gradual increase. There are a number of geo-political issues that affect the oil prices in the international scene. These include the unrest in the Middle East countries, reduction in production by OPEC, piracy

in the Indian Ocean, increased demand for petroleum products worldwide, foreign exchange fluctuations and fluctuations in the USA strategic reserves.

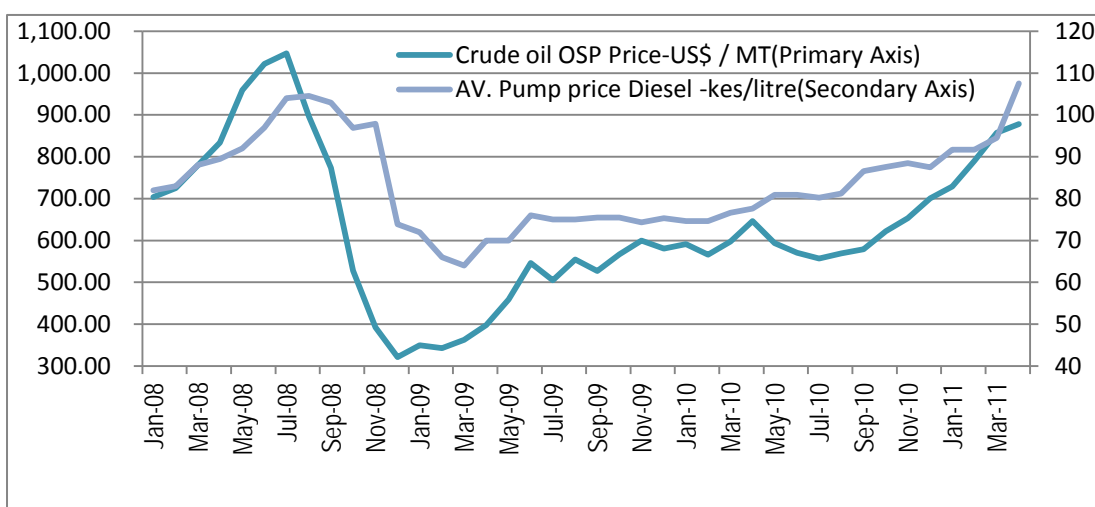
Figure 2.3 - Prices for different countries converted to Kenya shillings per litre



Source: ERC, December, 2011

- This fluctuation of the international prices has been causing a shock to the domestic oil prices. Figure 2.4 shows the time series of the average pump prices in Nairobi and the movement in murban crude oil prices between January 2008 and May 2011. In particular, over the period November 2010 to April 2011, the increases in pump prices were 23% for super petrol, 24% for diesel and 22% for kerosene.

Figure 2.4 - Evolution of crude and pump prices since 2008

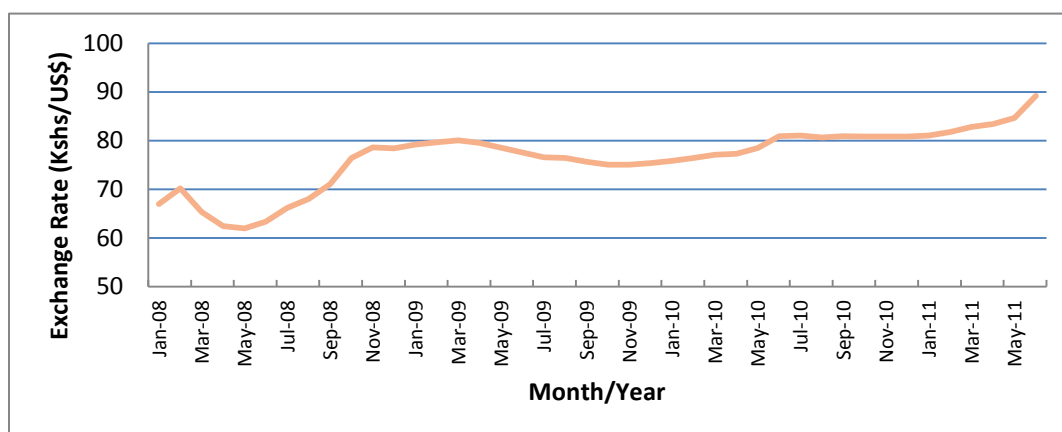


- The imported petroleum products are paid for in US Dollars. Figure 2.5 shows the fluctuation of the exchange rate against the US dollar for the period January 2008 to June 2011 which shows an overall gradual depreciation. In particular, there has been a marked depreciation over the

period November 2010 to June 2011. The depreciation of the Kenya Shilling against US Dollar negates any drop in international crude oil prices as witnessed in the month of June 2011 and makes imports more expensive.

4. The discovery of commercial deposits of oil in Kenya will mitigate the effects of global geopolitical issues and fluctuation of exchange rates in the supply of petroleum products in the country.

Figure 2.5 – Fluctuation of the Exchange Rate



5. Other major costs that impact consumer prices are taxes and levies on petroleum products. These do not vary with the cost of products and have remained unchanged for the last several years. Table 2.3 shows the taxation rates for petroleum products as at June, 2011.

Table 2.3 - Taxation regime for the sector as at June 2011

	Super	Kerosene	Diesel
Excise Tax	19.90	0	8.24
Road Maintenance Levy	9.00	-	9.00
Petroleum Development Levy	0.40	0	0.40
Petroleum Regulation Levy	0.05	0	0.04
Total: Taxes & Levies	29.35	0	17.68

Source: KIPPRA 2011 Survey

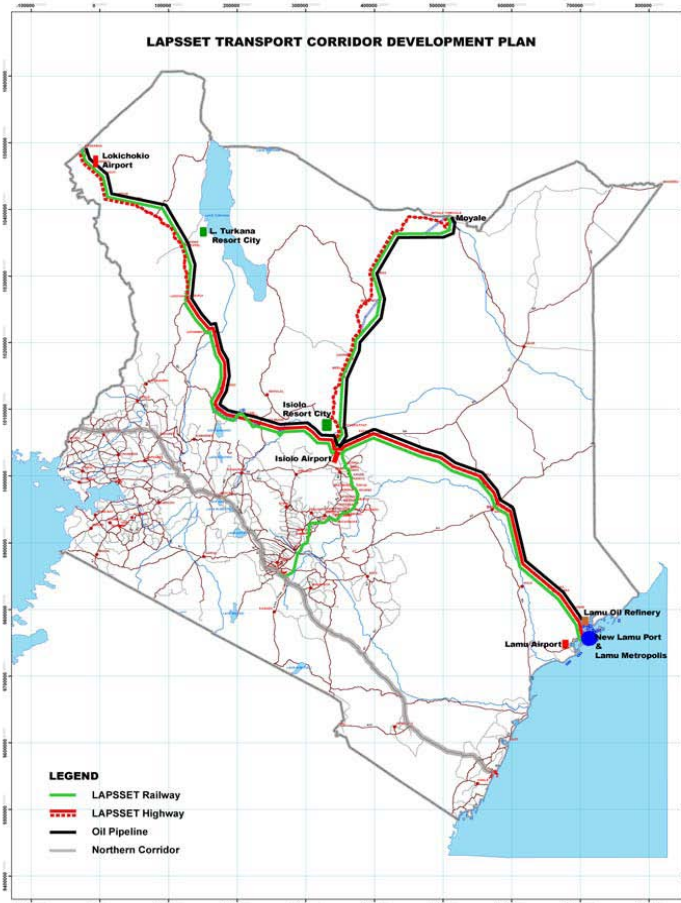
6. Other costs which have increased are the transportation and distribution costs and the allowed marketer's margin to cover overheads and profit.

2.2.11 Lamu Port and Lamu-South Sudan-Ethiopia Transport Corridor (LAPSSET)

1. The Government is at an advanced stage of development of the LAPSSET project.
2. The Government will construct a 1400 kilometre oil pipeline stretching from Lamu to Juba, in South Sudan.

3. The Government will set up a merchant oil refinery in Lamu with a capacity to process 120,000 barrels of oil per day to meet the growing demand for oil products in the region. It will largely refine local crude oil, from South Sudan and other parts of the world to serve the larger Eastern Africa market.

Figure 2.6 – The LAPSSET Project



4. A modern oil terminal will be put up to facilitate oil tanker loading and offloading in the high seas.
5. The Government will also construct a second pipeline from the Lamu refinery to Addis Ababa to deliver refined oil products to Ethiopia.
6. The Government also intends to construct a spur pipeline to join Lamu to the existing Mombasa-Kampala pipeline.

2.2.12 Natural Gas

In order to evaluate the possibility of the use of natural gas in industries including power generation, the Government has been engaged in various initiatives to facilitate adoption of the technology. Two options considered were importation of Liquefied Natural Gas (LNG) and construction of a natural gas pipeline from Tanzania to Mombasa.

2.2.13 Challenges in Petroleum

2.2.13.1 Petroleum Upstream Activities

1. Attraction of capital for petroleum exploration and production activities.
2. High cost of acquisition of new technology.
3. Manpower and technical capacity.
4. Inability to access potential exploration sites/blocks which are located on private land or cultural heritage and conservancy areas as well as game parks/reserves.
5. Limited primary technical data in most of the country's exploration blocks.
6. Inherent weaknesses in the Petroleum (Exploration and Production) Act Cap 308 and Model Production Sharing Contract (PSC) which include lack of provisions for:
 - (a) Compensation regime
 - (b) Licensing rounds
 - (c) Community awareness and participation
 - (d) Windfall profits
 - (e) Gas sharing terms
 - (f) Corporate Social responsibility requirements
 - (g) Mechanism for working out Government Share out of monetary gains from transfer of a PSC
 - (h) Defined criteria for evaluation of terms provided in PSC applications for prudence and competitive bidding for blocks
 - (i) Environmental protection, conservation and management
7. Inadequate policy in petroleum revenue management.

2.2.13.2 Petroleum Mid and Downstream

1. Reliance on a single jetty for off-loading petroleum imports
2. Offshore and onshore access to the port: The maximum draught at the entrance to the Mombasa port is 13.5 meters which limits Kenya's ability to import cargoes bigger than 84,000 MT to KOT. For SOT the maximum ship size is 30,000 MT. The use of many small vessels results in higher freight and demurrage costs. The access road to Shimanzi depot is narrow and leads to serious congestion of tankers.
3. Outdated refinery:
 - (a) Higher than normal fuel and loss performance because of Tops recirculation,
 - (b) Programme yield is based on test run conditions (i.e. under controlled condition for a day, neat crude processing and without any upsets) which may not ordinarily be achieved.

- (c) High sulphur levels have adverse impacts on the environment and health. Diesel sulphur specification is becoming stringent world-wide for cleaner environment.
- 4. Frequent power interruptions.
- 5. Inadequate capacity to store and evacuate petroleum products.
- 6. High initial cost of acquiring the necessary infrastructure.
- 7. Whereas spot buying has various advantages, it exposes the country to price volatility and unreliability as opposed to long term supply contracts which come with price stability and reliability.
- 8. Inadequate storage infrastructure and strategic reserves.
- 9. High petroleum fuel prices.
- 10. Lack of proper planning and coordination of petroleum infrastructure.

2.2.14 Policies and Strategies in Petroleum

2.2.14.1 Petroleum Exploration Policy

- 1. The Government shall continue to promote, through funding, petroleum exploration activities and support private and public investments.
- 2. Adopt the Extractive Industries Transparency Initiative (EITI) Treaty to enhance transparency.
- 3. Establishment of the National Data Centre and laboratory by the Government.
- 4. Review Petroleum (Exploration and Production) Act (Cap. 308).
- 5. The Government shall enhance manpower, technical capacity and local content in petroleum exploration activities.
- 6. The Government shall develop mechanisms for sharing and management of petroleum revenue.
- 7. The Government will undertake measures to fast track commercial petroleum discovery.

2.2.14.2 Petroleum Supply and Distribution Policy

- 1. The Government shall enhance and support modernisation of the refinery.
- 2. The Government shall facilitate and support off-loading, storage, transportation and evacuation infrastructure for adequate supply and distribution of petroleum products in all parts of the country at least cost.
- 3. The Government shall facilitate the procurement of petroleum strategic reserves and storage infrastructure.
- 4. The Government to ensure stable power supply.
- 5. Government to cushion Kenyan consumers from the negative effect of high petroleum pump prices.

6. Introduce measures to increase consumption of LPG for example zero rating tax and duty on LPG appliances.
7. Provide for management of regulated contracts in legislation.

2.2.15 AGENDA FOR ACTION – IMPLEMENTATION ACTION PLAN

2.2.15.1 Short Term 2012 – 2016

Petroleum Upstream

1. Reconstitution of the National Fossil Fuels Advisory Committee (NAFFAC) to widen its composition to include seven core inter-ministerial members plus five co-opted members as follows: – Cabinet Secretary in Charge of Energy, NOCK, Attorney General, NEMA, Kenya Revenue Authority (KRA) or its successor and Cabinet Secretary in Charge of Mineral Resources as well as co-opted members from PIEA, University of Nairobi (UoN), Directorate of Personnel Management (DPM) and Cabinet Secretary in Charge of Finance. Further undertake the expansion of its mandate to include:
 - (a) Negotiation with investors on the terms of the license of the Petroleum and Coal Blocks for Exploration, Production and Development.
 - (b) Advising the Cabinet Secretary in Charge of Energy on Petroleum and Coal Exploration Matters.
2. Sub-divide and create new petroleum exploration blocks, based on technical data.
3. Establish a national petroleum data centre.
4. Enhance local expertise in petroleum exploration and production through training, technical collaboration with exploration companies and universities and research.
5. Enhance primary data acquisition, analysis and interpretation in the open blocks so as to make them attractive to investors.
6. Enhance partnership in data exchange so as to reduce cost in exploration and access to new technology.
7. Enforce all the terms in the Petroleum Production Sharing Contracts.
8. Review the Petroleum (Exploration and Production) Act (Cap. 308) and formulate guidelines in the new legislation to provide for:
 - (a) Gas Sharing Terms
 - (b) Compensation, windfall profits, royalties and corporate social responsibility.
 - (c) Terms of assignment and change of control and transfer of PSCs and charge of royalties on revenues earned as a result of the assignment or transfer of PSCs to 3rd parties by licensees.
 - (d) Develop a policy on management of commercial discoveries of petroleum resources.
9. Enhance corporate governance in the Government institutions charged with petroleum exploration and development.

10. Restructure and enhance NOCK's financial capacity to conduct upstream business.

Petroleum Midstream

1. Enter into MoU with Kenya Railways Corporation and its concessionaire to maximise the utilisation of rail transport for petroleum products.
2. KPC to replace the Mombasa-Nairobi Pipeline by 2014.
3. KPC to construct a common user truck loading facility in Mombasa by 2016.
4. Construct a spur line from Nakuru to Nanyuki/Isiolo.
5. Extend the oil pipeline from Eldoret to Kampala.
6. Review the conditions for minimum crude oil processing and line fill.
7. KPRL to modernize the refinery by 2016.
8. KPRL to develop additional storage and common truck loading facility at its premises in Mombasa.
9. Commence development of the Lamu Port and Lamu-South Sudan-Ethiopia Transport Corridor (LAPSSSET).

Petroleum Downstream

1. Government to co-ordinate energy infrastructure development which are interlinked to facilitate efficient utilization of petroleum resources.
2. NOCK to be the importer of at least 30% of the country's demand of petroleum products.
3. Further upgrade NOCK's truck loading facility in Nairobi.
4. Construction of NOCK's storage and loading facility in Mombasa.
5. Restructure NOCK's capacity to undertake downstream business.
6. Introduce incentives to attract investment in retail networks in the remote areas of the country.
7. Establish a one-stop shop for petroleum licensing.
8. Continue engaging private inspecting companies in combating petroleum products adulteration and dumping.
9. Enhance and enforce penalties for petroleum products adulteration, dumping and under dispensing.
10. The Government through the monetary policy to effectively control foreign exchange rate
11. Construct LPG import handling, storage and distribution facilities.
12. Enforce minimum construction standards for retail and wholesale dispensing sites.
13. Reduce taxes on LPG and related appliances.
14. Enhancing security of supply of petroleum products by raising the operational stock level from 21 to 30 days consumption after construction of additional storage tanks.

15. The Government to invest in NOCK to develop an offshore Single Buoy Mooring (SBM) facility including additional storage facility linked to the SBM in Mombasa through public private partnership (PPP).
16. The Government to provide incentives for private investors to develop petroleum loading terminals, gas filling terminals, petroleum jetties and storage facilities.
17. Construction of storage facilities by KPC at Mtito Andei and Konza and expand facilities at Nakuru and Eldoret capable of meeting the 120 days of demand.
18. Private sector to be encouraged to establish additional storage facilities.
19. Government to facilitate private sector investors' involvement in the development of a private port with a container terminal, gas terminal and oil jetty with a storage facility in Mombasa.
20. Removal of non- tariff barriers to market entry by abolishing requirements for minimum crude oil processing and contribution to pipeline line fill. KPC will procure the entire pipeline line fill and dead stock to facilitate this.
21. Petroleum products quality to be reviewed occasionally to align them with international standards once modernisation of KPRL is completed.
22. Enhancement of institutional capacity in Kenya Bureau of Standards (KEBS) and ERC to enforce compliance with fuel quality specifications for both domestic and export market.

2.2.15.2 Medium Term 2012 – 2022

Upstream

1. Intensify exploration activities.
2. Intensify the utilisation of local capacity in oil exploration.
3. Upgrade the local exploration technology.
4. Commence commercial production of petroleum.

Midstream

1. Put in place incentives to attract investments in additional petroleum refining facilities.
2. Encourage private sector investment in additional capacity for handling and storage of LPG.
3. Commission Lamu Port and Lamu-South Sudan-Ethiopia Transport Corridor (LAPSSSET).
4. The Government shall operationalize the 90 days strategic stocks in the country by construction of the infrastructure and procurement of the stocks as part of the supply security strategy.

2.2.15.3 Long Term 2012 – 2030

Upstream

1. Intensify exploration activities.
2. Intensify petroleum production activities
3. Intensify the utilisation of local capacity in oil production.

4. Develop local capacities in petroleum production.

2.3 COAL RESOURCES

2.3.1 Overview

1. Coal is a readily combustible rock containing more than 50% by weight and more than 70% by volume of carbonaceous material formed from compaction of variously altered plant remains. It is used as a source of energy, including electricity generation. It is the most affordable fuel worldwide and has a potential to become the most reliable and easily accessible energy source.
2. The introduction of clean coal technology (CCTs) in coal fired power plants reduces emissions and extracts sulphur for other applications such as chemical and fertilizer production. The current world coal energy consumption by sector is 42% electricity, 25% industrial and 33% other uses.
3. The Ministry of Energy identified coal as one of the indigenous sources of energy that will drive the development of strategic initiatives for Vision 2030. It was recognized that the key to increased development lay in early identification of indigenous energy sources, exploiting these resources and establishing an appropriate institutional framework for delivery to the consumers.
4. The country has adequate coal deposits for commercial exploitation and the Government is fast tracking exploration and development of the resource for power generation and industrial use.

2.3.2 Demand for Coal

1. In Kenya, coal is mainly used by cement manufacturers to complement heavy fuel oil for process heat. As at 2011, all coal utilised in Kenya was imported. Between 2006 and 2011 consumption of coal averaged 130,000 metric tonnes per annum. This constitutes less than 1% of the total primary energy consumed in the country.
2. Coal consumption is expected to increase with the discovery and mining of coal deposits in Mui Basin in Kitui County.

2.3.3 Coal Supply

As at December 2011 Kenya was a net importer of coal. Table 2.4 shows the cost and quantities of coal imports.

Table 2.4 Coal Imports 2004 to 2009

YEAR	2004	2005	2006	2007	2008	2009
KSHS. '000	1,083,769	731,607	820,773	934,578	1,491,007	1,356,343
TONNES	155,000	128,000	171,000	156,000	159,000	138,000

Source: Statistical Abstract, 2010, Kenya National Bureau of Statistics

2.3.4 Coal Reserves

1. There are commercially viable coal reserves in the Mui Basin situated in Kitui County as shown in Figure 2.7. The basin is sub-divided into four blocks, namely; A, B, C and D as depicted in Figure 2.8.

Figure 2.7 - Location of the Mui Basin

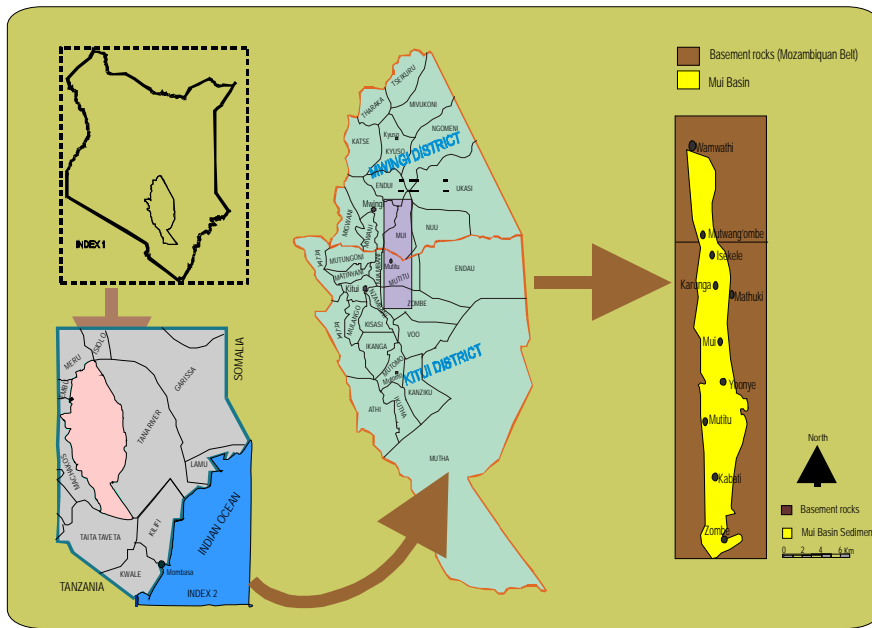
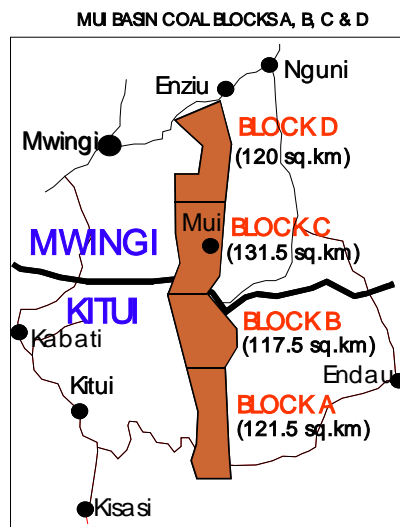


Figure 2.8 - The Four Blocks in the Mui Basin



Source: MoE 2011

- In 2010 four hundred million tonnes of coal reserves were confirmed in Block C. The coal has been analyzed and found to range in ranking from lignite to sub-bituminous with calorific values ranging from 16 to 27 MJ/kg. Further exploration work is on going in the other three blocks as shown in Table 2.5.

Table 2.5 - Blocks in Mui Basin and the Wells Drilled

Block	Area (km ²)	Drilled Wells	Coal Intercepted
A (Zombe – Kabati)	121.5	5	4 Wells
B (Itiko – Mutito)	117.5	7	2 wells
C (Yoonye – Kateiko)	131.5	54	32 wells
D (Isekele – Karunga)	120.0	4	2 wells

Source: MoE

3. The Government is also carrying out exploration for coal at the Coastal Region in Taru Basin in Kwale and Kilifi Counties and will extend the activities to other parts of the country. The purpose of this exploration is to establish coal potential and delineate more coal blocks for concessioning.
4. The Government through KenGen, is working with a strategic investor to build a Coal fired power plant in Kilifi County in the coastal region. Phase 1 of the plant will have a capacity of 600MW. Construction of the plant is expected to commence in 2012 with a commissioning date of 2014. However, there is need to develop adequate and appropriate coal handling and storage facilities onshore.
5. As per the 2011 least cost power development plan (LCPDP), coal is projected to provide 2,400MW of electricity by 2030.

2.3.5 Challenges in Coal exploration

1. Limited skills and expertise in core drilling disciplines.
2. Limited coal reserve data due to low intensity of exploration.
3. Poor infrastructure; coal resources are mostly situated in remote areas where there is lack of developed road, water, communication and electricity.
4. Lack of interest by major coal exploration companies due to limited technical data.
5. Absence of a legal, fiscal and regulatory framework for coal exploration, exploitation and development.

2.3.6 POLICIES AND STRATEGIES

1. Undertake intensive coal exploration.
2. Promote coal industry opportunities to potential investors in coal exploration, mining, development and utilisation in domestic industry.
3. Resource mobilization for coal exploratory drilling.
4. Enhance human and technical capacity for coal exploration, mining and development.
5. Improve infrastructure facilities in the country to facilitate coal development.
6. Create appropriate legal, fiscal and regulatory framework for coal exploration, exploitation and development.
7. Encourage market adaptation of efficient clean coal technology.
8. Promote the integrated “multiplying effect” of coal resources.
9. The Government shall develop mechanisms for sharing of revenue.

2.4 AGENDA FOR ACTION – IMPLEMENTATION ACTION PLAN

2.4.1 Short Term 2012 – 2016

1. Develop local expertise in coal exploration and production through training.

2. Technical collaboration with exploration companies, universities and research institutes.
3. Establish an institute capable of handling coal analysis and other related studies
4. Introduce tax concessions to encourage adoption of clean and efficient coal technologies.
5. Sub-divide and create new coal exploration blocks based on technical data.
6. Enhance regional co-operation in data and information exchange for coal exploration.
7. Pursue an arrangement with Kenya Railways Corporation and its concessionaires to maximise the utilisation of rail transport for coal products.
8. Establish a one-stop shop for coal licensing.
9. Enhance budgetary support for exploration and development of coal resources.
10. Encourage private sector participation in coal exploration, mining and development through PPP.
11. Construction of necessary infrastructure to support coal industry.
12. Ensure that the local community through the counties benefits from the development of the resource.
13. Adapt clean coal technology

2.4.2 Medium Term 2012 - 2022

1. Intensify exploration activities.
2. Upgrade the exploration technology.
3. Put in place incentives to attract investments in exploration and development of coal resources.
4. Build local capacity in coal exploration and management skills.
5. Develop an integrated infrastructure on coal storage and transportation.
6. Put in place mechanisms to benefit the local community from the development of the resource.
7. Establish a special purpose company for coal resource assessment and development to accelerate electricity generation using coal.

2.4.3 Long Term 2012 - 2030

1. Adapt new clean coal technology.
2. Enhance infrastructure development to maximize exploitation of the coal resource
3. Promote coal resource products diversification
4. Ensure compliance with the best coal industry practice in exploration, mining, processing, development and rehabilitation.
5. Provide incentives to investors to develop the coal resources using the best industry practices.
6. Ensure that the local community through counties benefits from the development of the resource.

3.0 – RENEWABLE ENERGY

3.1 BACKGROUND

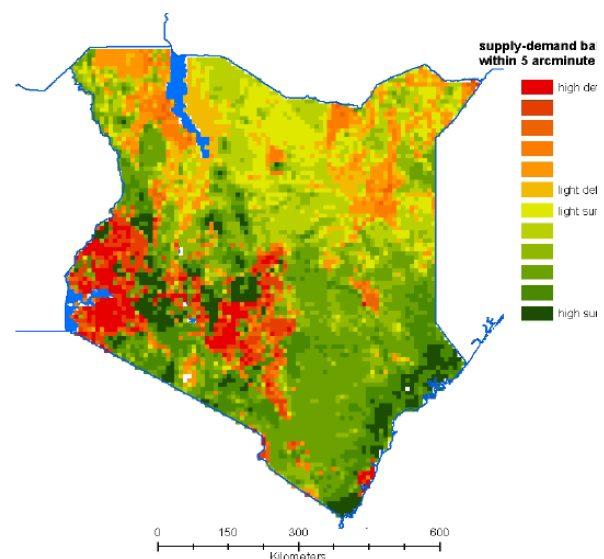
1. Renewable energy is derived from naturally occurring resources mainly solar, biomass, hydro, geothermal, and wind. Other renewable energy resources include tidal waves and municipal waste. These resources, which are abundant in Kenya, are regenerative and can therefore provide continuous and unlimited supply of energy.
2. According to the Economic Survey 2011 renewable energy accounts for 69% of the country's overall energy mix while petroleum accounts for about 22% and electricity 9%. 67.5% of the electricity component is generated using renewable energy sources, and the balance of 32.5% is from fossil fuels.
3. Renewable energy has the potential to enhance energy security, mitigate climate change, generate income, create employment and enable the country to make substantial foreign exchange savings.

3.2 BIOMASS

3.2.1 Background

1. Biomass is organic matter that can be used to provide heat, make fuel and generate electricity. Wood-fuel, the largest source of biomass has been used to provide heat for thousands of years. Many other types of biomass are also used as an energy source such as plant residue from agriculture or forestry and the organic component of municipal and industrial wastes. Landfill gas is also considered a biomass source. Biomass resources can be replenished through cultivation of crops such as fast growing trees and grass.
2. Biomass fuels are the most important source of primary energy in Kenya with wood-fuel (firewood and charcoal) accounting for over 68% of the total primary energy consumption. About 55% of this is derived from farmlands in the form of woody biomass as well as crop residue and animal waste and the remaining 45% is derived from forests.
3. Studies on biomass energy point to a widening gap between supply and demand for wood-fuel, a challenge that requires dedicated policy interventions to redress. Wood-fuel supply does not match demand over various parts of the country (see Figure 3.1 across).

Figure 3.1 Wood Fuel Supply-Demand Balance



Source: Food and Agriculture Organization (FAO) 2010

4. In spite of past efforts to promote wood fuel substitutes, the number of people relying on wood fuel is not decreasing. Consequently, wood fuel will continue to be the primary source of energy for the majority of the rural population and urban poor for as long as it takes to transform the rural economy from subsistence to a highly productive economy.
5. Wood fuel supply management is crucial to ensure sustainable supply to meet the growing demand. Key issues here include: competing land use activities, the growing imbalance between supply and demand and the attendant adverse environmental as well as related land and tree tenure issues, among others.
6. The Government has promoted Agro forestry and social forestry programmes to increase the stock of woody biomass on farms to make up for the loss of forest trees as forestland is converted into agricultural and settlement land. This is a multidisciplinary effort involving the Ministries of Energy, Agriculture and Environment and Natural Resources.

3.2.2 Challenges

1. Unsustainable use of biomass with attendant negative impacts on the environment, leading to serious climate variability and unpredictability in rainfall patterns.
2. Emissions from wood fuel in poorly ventilated houses leading to health hazards among users.
3. Lack of appropriate legal and regulatory framework for sustainable production, distribution and marketing of biomass.
4. Insufficient awareness of fast maturing tree growing for fuel as a commercially viable business.
5. Inadequate data on biomass production and consumption.
6. Disjointed approach in policy implementation by the various ministries and organizations responsible for biomass energy use.
7. Inadequate recognition of biomass as a source of energy, despite its predominance in the energy mix.
8. Use of inefficient technologies in production, conversion and consumption of biomass energy
9. Limited awareness of the FiTs aimed at encouraging investment in renewable energy.
10. Competing interests over land use between biomass plantations, food production and other commercial uses.
11. There is a gap between the existing tree cover vis-a-vis the minimum constitutional requirement of 10%.

3.2.3 Policies and Strategies

1. Develop and maintain a database on biomass energy resources and potential in the country.
2. Formulate and implement a national strategy for coordinating commercial biomass production.
3. Promote efficient conversion and cleaner utilization of biomass including cleaner wood burning and charcoal stoves.

4. Promote implementation of sustainable production and efficient utilization of biomass such as efficient charcoal kilns and energy saving institutional stoves.
5. Promote Research, Development and Dissemination (R,D&D) of biomass energy technologies.
6. Undertake capacity building for biomass energy technologies.
7. Provide incentives for private sector participation in generation, exploitation, production, distribution, supply and use of biomass energy.
8. Enhance public participation in the management, protection and conservation of the environment in relation to biomass energy as provided for in Article 69 of the Constitution.
9. Promote appropriate technologies for the use of alternative sources of energy.
10. Collaborate with other relevant ministries and other stakeholders to grow and sustain tree cover to above 10%.
11. Collaborate with other stakeholders to ensure efficient use of land resource to minimize the adverse effects arising from competition for land use between biomass energy and food production.

3.2.4 Implementation Agenda

Short Term 2012 to 2016

1. Undertake a comprehensive base line study on biomass energy resources and potential, and establish the status of tree cover in the country.
2. Identify and reserve land for use in biomass energy production and undertake awareness programmes to sensitize the public on the importance of the various land uses such as for biomass, food production and other human needs.
3. Facilitate private sector participation in production, conversion, distribution, supply and use of biomass energy through public private partnerships and other initiatives.
4. Enhance public participation in the management, protection and conservation of the environment in relation to biomass energy as provided for in Article 69 of the Constitution.
5. Undertake studies to identify the most appropriate biomass energy conversion technologies.
6. Promote inter-fuel substitution to reduce the over reliance on wood fuel.
7. Strengthen existing Energy Centres and establish others to cover all counties with a view to promote efficient biomass energy use.
8. Promote the use of biomass briquettes as alternatives to woodfuel and kerosene in cooking, water heating and steam generation.
9. Prepare biomass energy development plans.

Mid Term 2016-2022

1. Implement the results of the studies undertaken to establish biomass potential and conversion technologies.
2. Undertake a comprehensive study on the viability of use of renewable sources with a view to eliminating use of kerosene for commercial purposes.
3. Implement the results of the study on the viability of use of renewable sources.
4. Review and update biomass energy development plans.
5. Update biomass energy databases.

Long Term 2022-2030

1. Continue to implement the results of the study on the viability of use of renewable sources.
2. Eliminate the use of kerosene as an energy source.
3. Review and update biomass energy development plans.
4. Update biomass energy databases.

3.3 BIO FUELS

3.3.1 Background

1. Unlike other renewable sources, biomass can be converted directly into liquid fuels called bio-fuels (ethanol and bio-diesel) to meet transportation needs.
2. The use of bio-fuels would reduce vehicle emissions and save on foreign exchange required for importing petroleum fuel, improve on the balance of trade and create employment.
3. A strategy for introduction of bio-fuel blends in the market was developed by the government in 2010. Facilities for ethanol-gasoline blending have been completed in Kisumu to be followed by Eldoret and Nakuru. However, commercial extraction of biodiesel for blending has yet to be initiated.
4. Land will need to be set aside for the production of energy crops as feedstock for bio-fuels. This calls for the formulation of strategies to optimise land use, as well as to harmonise land use policies with the energy policy. Most bio-fuel projects underway or being planned involve sugarcane and sweet sorghum as the main feedstock for ethanol; and jatropha, castor and other vegetable oil crops such as, coconut, croton and cotton seed for biodiesel.

3.3.2 Challenges

1. Insufficient feed-stocks to produce bio-fuels.
2. Limited research data/information for the use and production of bio-fuel.
3. Insufficient legal and institutional framework to support sustainable generation, exploitation, production, distribution, supply and use of liquid bio-fuels.
4. Insufficient supply of bio-fuels for blending due to competing uses.
5. Threat of competition over land use that could lead to food insecurity.

6. Reliance on slow maturing crops and dependence on rain fed agriculture.
7. Inadequate RD&D on alternative bio-fuel feed-stocks and technologies.
8. Lack of knowledge among the public on the viability of growing crops for bio-fuel as a business.

3.3.3 Policies and Strategies

1. Support RD&D for the cultivation of high yielding and fast maturing feedstock so as to enhance the production and use of liquid bio-fuels.
2. Review the existing legal, regulatory and institutional framework to enhance the sustainable generation, exploitation, production, distribution, supply and use of liquid bio-fuels.
3. The Government to grant appropriate tax holidays and duty waivers for bio-fuel production projects, plant and equipment in so far as such products are used to meet energy demands.
4. Collaborate with other stakeholders to ensure efficient use of land resource to minimize the adverse effects arising from competition for land use between liquid bio-fuel feedstock and food production.
5. Work with County Governments on how to increase economic development through bio-fuel programmes.
6. Create awareness on the importance and viability of growing bio-fuel feedstock among the public.
7. Encourage small scale initiatives on the production and use of bio-fuels around the country.
8. Invest in research on the production chain and sustainability of biofuels particularly biodiesel.

3.3.3 Implementation Agenda

Short Term 2012 to 2016

1. Facilitate the farmers to access cheap farm inputs and high yielding fast maturing bio-fuel feedstock.
2. Undertake a comprehensive study on the viability of bio-fuels and map out potential bio-fuels production feedstock and locations nationally and across counties.
3. Enact the necessary legal and regulatory framework to enhance the sustainable generation, exploitation, production, distribution, supply and use of liquid bio-fuels.
4. Government to grant a 3 year tax holiday for bio-fuel production projects in so far as such entities are marketing the products solely for blending.
5. The Government to facilitate duty waiver on bio-fuel production plant and equipment in so far as such entities are marketing the products solely for blending.
6. Government to identify and set aside land in potential locations for piloting of bio-fuel feedstock production.
7. Review the feasibility of gasohol and biodiesel production.
8. Pilot a 10% ethanol-gasoline (E-10 Mandate) blend in government vehicles and in public transport vehicles.

9. Pilot 1% biodiesel blend in government vehicles and in different blending ratios for use as hybrid fuel at isolated power generation plants.
10. Develop a blueprint and road map for national bio-fuel implementation programme.
11. Use public barazas, Agricultural Society of Kenya (ASK) trade fairs, workshops seminars and energy centres to demonstrate and disseminate information on the importance and viability of growing bio-fuel feedstock among the public.

Medium Term 2012 to 2022

1. The National and County Governments to allocate land for growing bio-fuel feedstock.
2. The National and County Governments to enter into PPP arrangements with the private sector entities to accelerate the development of bio-fuels.
3. All vehicles in the country to be using at least 10% ethanol-gasoline (E-10 Mandate) blend.
4. National and County Governments' vehicles to use at least 5% biodiesel blend and use 100% biodiesel at all isolated power generation plants.

Long Term 2012-2030

1. All vehicles in the country to use at least 30% ethanol-gasoline (E-30 Mandate) blend.
2. All vehicles in the country to use at least 5% biodiesel blend.

3.4 BIOGAS

3.4.1 Background

1. Large-scale biogas plants using waste from slaughter houses, agro-processing or municipal waste present good opportunities for electricity generation. A number of pilot and small commercial biogas facilities for heat and electricity generation have been identified (Biopower Limited in Kilifi County generates 150 kW from a mixture of sisal waste and cattle dung, while banana leaves have been used to generate 10 kW at Kamahuha in Muranga County). An example of a large biogas facility using industrial organic waste is the Agro-Chemical & Food Company's bulk volume fermenter (BVf) at Muhoroni, generating 23,000 m³ of gas per day from the distillery effluent. This biogas has been used to substitute fuel oil in running two medium-size boilers.
2. Out of a crop of a cut flower 80% constitutes waste which acts as a source of biomass the remaining 20% is what is commercially marketable. Assuming the same biogas production rates as the waste from gardens or parks, a daily power generation of roughly 200kWh/ton could be realised. Total power that could be generated from members of the Kenya Flower Council is estimated at 87 GWh/yr, corresponding to an installed capacity of about 20MW (depending on usage and design load factor). The highest potential for energy generation from cut flower waste is found in Nakuru County.
3. In 2011 the Ministry of Energy initiated pilot projects for electricity generation from cut flower wastes in Kiambu and Kajado counties with a view to scaling up the generation of electricity from other biogas sources.

4. It is estimated that the potential electricity generation capacity from the floriculture industry could be 20MW. Table 10.1 in **10.0 - Annexure** indicates the energy generation potential in the Kenyan floriculture industry by district (Source REA Master-plan 2009).
5. It is estimated that the potential electricity generation capacity from the sisal industry could be 10MW. Table 10.2 in **10.0 - Annexure** indicates the energy generation potential in the Kenyan sisal industry by company with large plantations (Source REA Master-plan 2009).
6. The Government is involved in the "Biogas for Better Life" which offers business opportunities as well as improved livelihood and aims at providing 2million households in Africa with biogas digesters by 2020. A feasibility study carried out under this initiative established that it is possible to construct 6,500 biogas digesters in Kenya every 5 years.
7. Several biogas projects are being undertaken by MoE and REA in public institutions. The private sector is also implementing a number of similar initiatives all over the country.

3.4.2 Challenges

1. Lack of information on the benefits and potential of biogas technology.
2. Lack of RD&D on biogas emerging technologies.
3. High upfront costs of domestic and commercial biogas plant and equipment.
4. Inadequate skilled installation contractors in the country.
5. Lack of post installation operation and maintenance service for plant, equipment and appliances.
6. Lack of clear registration and regulation guidelines for biogas installation contractors.

3.4.3 Policies and Strategies

1. Create awareness on the benefits and potential of biogas technology
2. Promote RD&D of biogas energy technologies.
3. Introduce rebates and waivers and promote local manufacture of biogas plant and equipment.
4. National and County Governments to initiate capacity building programmes in institutions such as village polytechnics on biogas installation, operation and maintenance skills.
5. Develop guidelines for registration and regulation of biogas contractors/technicians.

3.4.4 Implementation Agenda

Short term 2012 to 2016

1. Use public barazas, ASK trade fairs, workshops seminars and energy centres to demonstrate and disseminate information on the importance and viability of growing bio-fuel feedstock among the public.
2. Promote the use of biogas as an alternative to woodfuel and kerosene for domestic and commercial energy needs.
3. Undertake RD&D through the National Energy Institute in collaboration with other institutions of higher learning.

4. Zero rate VAT and reduce customs duty on biogas plant and equipment.
5. Develop training programmes for biogas technologies in collaboration with relevant training institutions and through the energy centres.
6. Prepare guidelines and regulations for biogas installations contractors/technicians.
7. Undertake a comprehensive study on the viability of bottling biogas for rural development.
8. Start a pilot biogas bottling plant.
9. The Government to facilitate the construction of at least 5000 bio-digesters in Kenya under the "Biogas for Better Life" programme.

Mid Term 2012-2022

1. The Government to facilitate the construction of at least 6500 bio-digesters in Kenya under the "Biogas for Better Life" initiative.
2. Roll out biogas bottling plants across the country in conjunction with the counties

Long Term 2012 to 2030

1. The Government to facilitate the construction of at least 10000 bio-digesters in Kenya under the "Biogas for Better Life" initiative.
2. Continue the roll out of biogas bottling plants across the country in conjunction with the counties.

3.5 SOLAR ENERGY

3.5.1 Background

1. Solar energy can be used for lighting, heating, drying and generating electricity. Kenya's geographical location astride the equator gives it unique opportunity for a vibrant solar energy market. The country receives good solar insolation all year round coupled with moderate to high temperatures estimated at 4-6 kWh/m²/day. Solar energy is widely used for drying coffee, cereals, vegetables, fish, hides and skins; for water heating; and for electricity generation using photovoltaic systems.
2. Solar water heating systems are mainly used in homes, hotels, hospitals and learning institutions. The demand for solar water heating (SWH) is projected to grow to more than 800,000 SWH units by 2020 equivalent to 300,000 TOE. This represents a growth rate of 20% per annum. This demand will mainly be from domestic, institutional and small commercial consumers spurred by the operationalization of the Energy (Solar Water Heating) Regulations, 2009.
3. Kenya is well known for a large-scale market-driven penetration of small PV systems with capacity of 12 – 50 watts power (Wp) consisting of low cost amorphous silicon modules and both mono- and polycrystalline silicon modules. It is projected that by 2020, the installed capacity of solar photovoltaic systems will reach 10MWe generating 22 GWh annually.

4. The Government initiated a programme for electrification of institutions far from grid using solar PV systems. As at 2011 solar PV systems had been installed in 945 institutions including primary and secondary schools, dispensaries, health and administrative centres.
5. The Government has also embarked on a programme to provide solar/diesel and solar / wind hybrid generation capacity to off-grid stations including the following:
 - (a) 60 kW solar / diesel at Lodwar.
 - (b) 30 kW solar / wind at Habaswein.
 - (c) 10 kW solar / diesel at Merti in Isiol.
 - (d) 60 kW solar / diesel at Hola.
 - (e) 50 kW solar / diesel at El Wak in Wajir.
6. As at 2011 the following eleven diesel plants were being converted to hybrid stations:
 - (a) 9 x 230 kVA at Laisamis, North Horr, Eldas (Wajir), Takaba (Mandera), Rhamu (Mandera), Hulugho, Kiunga (Lamu), Lokichogio, Lokitaung, and Lokori (Turkana).
 - (b) 450 kVA at Faza Island.
 - (c) 800 kVA at Lokichogio.

3.5.2 Challenges

1. Disjointed approach in policy implementation and promotion of solar energy projects by the various ministries and organizations
2. The percentage of solar energy harnessed for commercial and domestic applications is insignificant relative to the potential.
3. The cost of solar home systems has remained beyond the reach of many potential consumers despite favourable tax incentives.
4. Erosion of consumer confidence because of inappropriate system standards, faulty installations, importation of sub-standard systems and poor after sales service.
5. Rampant theft of solar photovoltaic panels, which discourages their installation.
6. Lack of awareness on the potential, opportunities and economic benefits offered by solar technologies.
7. Lack of appropriate credit and financing mechanisms to facilitate acquisition of solar technology.

3.5.3 Policies and Strategies

1. Promote the wide spread use of solar energy while enforcing the existing regulations and standards.
2. Provide incentives to promote the local production and use of efficient solar systems.
3. Provide a framework for connection of electricity generated from solar energy to national and isolated grids, through direct sale or net metering.

4. Promote the use of hybrid power generation systems involving solar and other energy sources to manage the effects caused by the intermittent nature and availability of solar energy.
5. Formulate and enforce minimum standards for solar energy technologies.
6. Provide for offences and enhance penalties for theft and vandalism of solar systems.
7. Create awareness on the potential opportunities and economic benefits offered by solar energy technologies.
8. Partnering with financiers to enable the public access credits schemes.
9. Provide Tax rebates on solar panels and equipment.

3.5.4 Implementation Agenda

Short Term 2012 to 2016

1. Designate a specific entity to promote use of solar energy.
2. Formulate regulations and standards for solar energy technologies.
3. Install 50% of all the remaining public facilities with solar PV systems in off grid areas.
4. Promote installation of at least 100,000 units of solar PV home solar systems.
5. Roll out a programme to distribute solar lanterns as substitute for kerosene in lighting rural areas, poor peri-urban and urban settlements.
6. Develop a programme to convert Diesel stations to hybrid power generation systems involving solar energy sources.
7. Develop a programme for raising awareness on requirements for conformity with mandatory regulations for solar water heating systems and ensure installation of at least 350,000 SWH units.
8. Provide incentives to promote the local production and use of solar systems.
9. Create awareness on the potential opportunities and economic benefits offered by solar power technologies.
10. Undertake Research, Development and Dissemination (RD&D) on solar technologies.
11. Zero rate taxes and duties on solar energy equipment.
12. Facilitate generation of at least 100MW electricity from solar.

Medium Term 2012 to 2022

1. Install 100% of all the remaining public facilities with solar PV systems in off grid areas.
2. Promote installation of at least 200,000 units of solar PV home systems.
3. Facilitate generation of at least 200MW electricity from solar by among others, funding, setting aside land, fast-tracking issuance of permits and licences, as well as acquisition of data and information.
4. Develop a programme for raising awareness on requirements for conformity with mandatory regulations for solar water heating systems and ensure installation at least 450,000 SWH units.

Long Term 2012-2030

1. Promote installation of at least 300,000 units of solar PV home systems.
2. Facilitate generation of 500MW electricity from solar.
3. Develop a programme for raising awareness on requirements for conformity with mandatory regulations for solar water heating systems and ensure installation at least 700,000 units.

3.6 WIND ENERGY

3.6.1 Background

1. Wind energy uses naturally occurring energy of the wind for practical purposes like generating electricity, charging batteries, or pumping water. Large, modern wind turbines operate together in wind farms to produce electricity for utilities.
2. Kenya has a proven wind energy potential of as high as 346 W/m² and speeds of over 6m/s in parts of Marsabit, Kajiado, Laikipia, Meru, Nyandarua, Kilifi, Lamu, Isiolo Turkana, Samburu, Uasin Gishu Narok, Kiambu Counties among others. Confirmed wind energy potential for selected areas are given in the Table 3.1.

Table. 3.1: Average wind speed data for selected sites

No.	Site	Average wind speeds in m/s			
		May 2011	June 2011	July 2011	LTA*
1	Malindi	6.2	6.6	-	5.7
2	Oloitoktok	5.8	5.3	5.5	5.1
3	Kinangop	8.3	5.4	5.5	7.3
4	Narok	5.8	4.5	4.9	5.6
5	Isiolo	10.4	9.6	10.4	8.0
6	Bubisa West	-	-	-	10.4
7	Bubisa East	-	-	-	9.1
8	Kerio Valley	5.0	3.9	3.8	5.6
9	New Marsabit	-	-	-	9.7

Source: KenGen, 2011

*Long Term Average

3. The Ministry of Energy developed a Wind Atlas in 2008 with indicative data. To augment the information contained in the Wind Atlas, MoE, with the assistance of Development Partners has installed 55 Wind Masts and Data Loggers (as at 2011) to collect site specific data.
4. With the rising cost of oil, exploitation of wind energy has become more attractive. Substitution of thermal generation with wind power plants will cut down on the large amounts of foreign exchange required to import fossil fuels for the thermal power plants.
5. Further, partial substitution or combining wind with gen-sets (wind–diesel hybrid) and some form of renewable energy storage such as pumped storage in hydropower could cut down on running or overall costs by substituting renewable energy sources for significant amounts of diesel.

6. Using wind energy to substitute thermal generation will also lead to less CO₂ emissions thus contributing to reduction in global warming. The carbon credits associated with the reduction of the emissions can be sold as certificates of emission reduction.
7. The installed wind energy capacity to the grid is 5.45MW as at December 2011 and a further 20MW is expected to be commissioned by end of 2012. The 300MW Lake Turkana Wind power project is expected to be commissioned in 2014. Other committed projects include 110MW at Kinangop and Ngong.
8. As of 2011, proposals for development of 650MW have been received for wind energy capacity at Marsabit, Isiolo and Ngong.
9. Local production and marketing of small wind generators has started and few pilot projects are under consideration. However, only a few small and isolated wind generators are in operation so far.

3.6.2 Challenges

1. High upfront costs.
2. Most potential areas for wind energy generation are far away from the grid and load centres requiring high capital investment for transmission lines
3. Inadequate wind regime data.
4. Limited after sales service.
5. Inadequate wind energy industry standards due to fast changing technologies and enhanced capacities of turbines.
6. Competing interest in land use with other commercial activities.
7. Lack of RD&D in wind technologies

3.6.3 Policies and Strategies

1. Enhance the institutional capacity to promote wide spread use of wind energy while enforcing the existing regulations and standards.
2. Designate an entity to promote, undertake data acquisition, accelerate exploitation of wind energy and provide a one stop shop for information and guidance to investors in wind energy projects.
3. Provide incentives to promote the local production and use of efficient wind systems.
4. Promote the use of hybrid power generation systems involving wind and other energy sources.
5. Provide a framework for connection of electricity generated from wind energy to national and isolated grids, through direct sale or net metering.
6. Formulate and enforce minimum standards for wind energy technologies.
7. Plan transmission lines to facilitate evacuation of power from areas with high wind potential to major load centres.

8. Undertake Research Development and Dissemination (RD&D) through the National Energy Institute
9. Enhance capacity building on wind technologies to provide support services.
10. Provide tax rebates on wind energy equipment;

3.6.3 Implementation Agenda

Short Term 2012 to 2016

1. Collect and compile wind energy data and update the wind atlas.
2. Develop a programme to convert diesel stations to hybrid power generation systems in high potential wind resource areas.
3. Plan transmission lines to facilitate evacuation of power from areas with high wind potential to major load centres.
4. Facilitate development of at least 1,000MW wind energy generation capacity
5. Provide incentives to promote the local production and use of wind energy systems.
6. Zero rate taxes on wind energy equipment.

Medium Term 2012 to 2022

1. Collect and compile wind energy data and update the wind atlas.
2. Facilitate development of 2000MW wind energy generation capacity.

Long Term 2012 to 2030

1. Collect and compile wind energy data and update the wind atlas.
2. Facilitate development of 3,000MW wind energy generation capacity

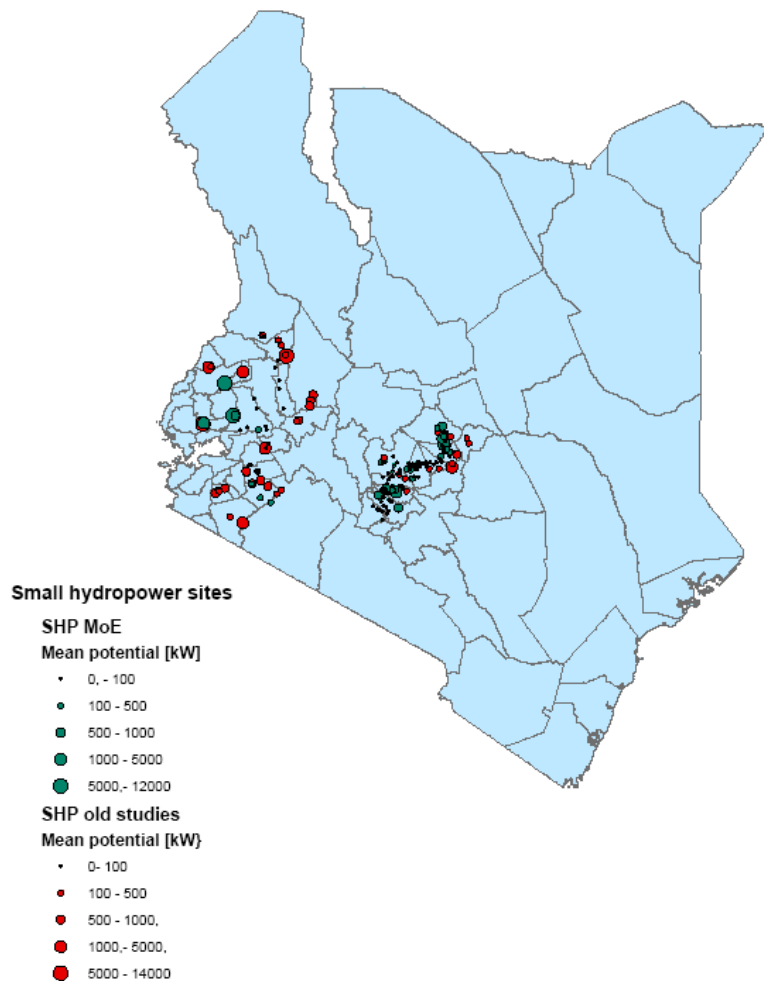
3.7 SMALL HYDROS

3.7.1 Background

1. Kenya has considerable hydropower potential consisting of large hydros (sites with capacity of more than 10MW) and small hydros. Of the large hydros, 750MW has been exploited and accounts for about 50% of installed electric power generation capacity as at 2011 while about 1,450MW remains unexploited. Potential for small hydros is about 3,000MW, 45% of which is located in the Lake Victoria Drainage basin. Only about 30MW had been developed. Chapter Four of this policy document deals with, among others, electric power generation from large hydros, while small hydros are considered in this Chapter Three.
2. With the introduction of the Feed-in-Tariff (FiT) policy in 2008 small-scale candidate sites are expected to be developed for supply of villages, small businesses or farms, as well as grid supply. The Ministry of Energy has carried out feasibility studies for small hydros in tea growing areas covering twelve sites with an estimated combined potential generation capacity of 33MW. Feasibility studies are on-going at 14 other sites and will be expanded to cover other areas and the results used for capital mobilization for development of the sites. As at 2011, only a few schemes have been developed as stand-alone systems or to feed to the national grid.

3. By the end of 2011, more than 260 small hydropower sites have been identified. but the largest number of sites are found in the Tana River drainage basin, mainly in the counties of Kirinyaga, Muranga, Meru and Tharaka Nithi.
4. The map in Figure 3.2 shows the locations of the small hydropower sites as appraised by MoE (dots in green colour) as well as a summary compilation from various studies (dots in red colour).

Figure 3.2: Small Hydropower Schemes



5. As can be seen, the potential for small hydropower sites is mainly located in counties that have high population density and high energy demand.

3.7.2 Challenges

1. The upsurge in demand for electrical energy from 2004 has revealed an exciting potential for growth in and exploitation of the small hydros subsector. This has led to emerging challenges such as:
 - (a) Destruction of catchment areas threatens long term viability of small hydro power projects.
 - (b) Inadequate financial resources and technical personnel for carrying out feasibility studies and development of sites.

- (c) Inadequate hydrological data.
- (d) Competing interests between developing the sites and usage of land and water resources by the affected communities and institutions.
- (e) Inadequate technical capacity to design, construct, operate and maintain the projects.
- (f) Lack of facilities to match load demand with the electrical output.
- (g) Vandalism of electric power infrastructure.
- (h) Tariffs charged do not generate sufficient revenues to cover capital as well as operation and maintenance costs of the projects.
- (i) Inappropriate standards, legal and regulatory regime.

3.7.3 Policies and Strategies

1. Promote protection of the environment, catchment areas and water towers.
2. Provide incentives for public private partnerships and increase funding.
3. Collect hydrological data on small hydros.
4. Create awareness and disseminate information on the benefits of small hydros and its coexistence with other usages of the resource.
5. Promote development of capacity and knowledge upon the youth, on usage of appropriate technologies.
6. Provide incentives to promote the local production and use of efficient small hydro power systems.
7. Formulate and enforce standards, legal and regulatory regimes for small hydros.

3.7.3 Implementation Plan

1. Develop small, mini, micro- and pico-hydropower capacities totalling 50MW from various sites in the short term, 100MW in the medium term and 300MW in the long term.

3.8 MUNICIPAL WASTE

3.8.1 Background

1. Municipal waste consists of solid waste including durable and nondurable goods, containers, food scraps, yard waste and inorganic waste from homes, institutions and businesses, wastes generated by manufacturing, agriculture, mining and construction and demolition debris, as well as sludge and liquid waste from water and wastewater treatment facilities, septic tanks, sewerage systems, slaughter houses.
2. In order of preference, municipal waste can be managed by reduction of its production at source; reuse and/or recycling; treatment to destroy or reprocess waste to recover energy or other beneficial resources if the treatment does not threaten public health, safety, or the environment; or dumping and disposal.

3. Most of the municipal waste in Kenya as at 2011 is disposed in poorly managed dump sites, such as the Dandora dumpsite, located 8 km from Nairobi's Central Business ranked as the largest waste disposal pit in the East African region as at 2011. With appropriate waste-to-energy technologies, municipal can be used to provide energy while helping to clean the environment.

3.8.2 Challenges

1. Lack of legal, regulatory and institutional framework for exploitation.
2. Inadequate data and information on potential of municipal waste.
3. Lack of incentives for exploitation

3.8.3 Policies and Strategies

1. Develop legal, regulatory and institutional framework for exploitation.
2. Acquire adequate data and information on potential of municipal waste.
3. Provide incentives for exploitation

3.9 BIOMASS CO-GENERATION

3.9.1 Background

1. Co-generation refers to the simultaneous production of heat and power from one single fuel source. It is common where plant processes require both heat and power such as sugar processing and offers opportunity for improved plant energy efficiency besides reducing energy costs and providing additional revenue stream through surplus power export to the national grid.
2. A pre-feasibility study on cogeneration by the Ministry of Energy completed in 2007 established that there is potential for generating up to 120MW of electricity for export to the national grid without major investments and about 200MW with modest investments in terms of expanding cane fields and cane crushing capacity.
3. Mumias Sugar Company took advantage of its cogeneration potential from sugarcane bagasse by generating 38MW out of which 26MW is exported to the national grid. Other sugar companies are expected to diversify into the use of sugar processing by-product value addition through co-generation and bioethanol production. The planned generation from all sugar companies is estimated to be 90MW by 2013

3.9.2 Challenges

1. Use of obsolete, inefficient plant and equipment in the cogeneration industry.
2. Limited technical, human and financial resources for cogeneration development.
3. Lack of technical capacity in commercial and emerging cogeneration technologies.
4. Lack of awareness in cogeneration potential in areas where the agro-wastes are available.
5. Inadequate data and documented assessment of resources and potential.
6. Lack of model Power Purchase Agreement (PPA) for cogenerated power in the country.

7. Poor governance in the sugar sub-sector.
8. Insufficient information to investors on issues relating to licensing, taxation and feed in tariff policy.

3.9.3 Policies and Strategies

1. Accelerate investment in efficient and emerging technologies.
2. Undertake capacity building programmes in cogeneration technologies.
3. Carry out awareness programmes in cogeneration potential areas.
4. Carry out a comprehensive study on cogeneration potential.
5. Develop a model Power Purchase Agreement (PPA) for cogenerated power.
6. Provide incentives to promote cogeneration from biomass.
7. Formulate and implement a national strategy for coordinating development of co-generation
8. Undertake RD&D in co-generation technologies.
9. Develop a certification scheme for co-generation projects.
10. Collaborate with the players in the sugar industry to address governance issues.

3.9.4 Implementation plan

Short Term 2012 to 2016

1. Reduce start-up costs by providing tax rebates.
2. Promote local manufacturing/maintenance of cogeneration technologies capability.
3. The national and County Governments to promote the utilization of municipal and industrial waste as sources of energy.
4. Prepare integrated solid waste management plans and roadmaps.
5. Undertake RD&D through the National Energy Institute.
6. Government to enter into PPP arrangements with the private sector entities to accelerate co-generation to realise at least 200MW.
7. Develop a criteria for certification schemes for cogeneration projects.
8. Undertake Pilot programmes to generate at least 50MW of electricity using municipal/industrial solid waste.

Medium Term 2012-2022

1. Promote the utilization of municipal and industrial waste as sources of energy in municipalities across counties.
2. Implement integrated solid waste management plans and roadmaps jointly with County Governments.
3. Roll out electricity generation projects from municipal/industrial solid waste in municipalities and generate at least 100MW of electricity using municipal/industrial solid waste.

4. Facilitate 800MW of co-generation capacity from bagasse and agro-residues.

Long Term 2012 to 2030

1. Promote the utilization of municipal and industrial waste as sources of energy in municipalities across counties.
2. Implement integrated solid waste management plans and roadmaps jointly with County Governments.
3. Implement electricity generation projects from municipal/industrial solid waste in municipalities and generate at least 300MW of electricity using municipal/industrial solid waste.
4. Facilitate at least 1200MW of co-generation capacity from bagasse and agro-residues.

3.10 FEED IN TARIFFS

3.10.1 Background

1. A FiT is an instrument of promoting electricity generation from renewable energy sources. It enables power producers to generate and sell Renewable Energy Sources Generated Electricity (RES-E) to a distributor at a pre-determined fixed tariff for a given period of time.
2. The FiT Policy was launched in April 2008 and applied to three technologies namely wind, small hydro power and biomass (municipal waste and cane bagasse). Since then, submissions from potential investors point to generation tariffs higher than the FiTs due to increases in the cost of generation equipment and financing. To attract private sector investment, a realistic review of the tariffs has to be undertaken, while also widening the scope to cover other renewable energy sources.
3. The objectives of the FiT Policy are to:
 - (a) Facilitate resource mobilization by providing investment security and market stability for investors in electricity generation from Renewable Energy Sources.
 - (b) Reduce transaction and administrative costs and delays by eliminating the conventional bidding process.
 - (c) Encourage private sector investors to operate their plants prudently and efficiently so as to maximize returns.
4. The advantages of Renewable Energy Resource Generated Electricity are:
 - (a) Minimal adverse effects to the environment
 - (b) Enhancement of energy supply security, reducing the country's dependence on imported fuels and coping with the global scarcity of fossil fuels and its attendant price volatility.
 - (c) Enhancement of economic competitiveness and job creation.
5. As at 2011 a number of investors had expressed interest to develop projects under the FiT policy as follows:
 - (a) 20 small hydropower projects with total capacity of 84MW
 - (b) 23 wind power projects with total capacity of 1327MW

- (c) 6 biomass energy projects with total capacity of 270MW
 - (d) 1 sea wave energy projects with total capacity of 100MW
6. The existing FiT structure for each technology is as shown in the Table 3.2:

Table 3.2: Feed-in-Tariff Structure

Technology Type	Plant Capacity (MW)	Maximum Tariff US cents / kWh	
		Firm Power	Non-Firm Power
Geothermal	Up to 75	8.5	-
Wind	0.5 - 100	12	12
Biomass	0.5 - 100	8	6
Small Hydro	0.5 – 0.99	12	10
	1 – 5	10	8
	5.1 - 10	8	6
Biogas	0.5 - 100	8	6
Solar	0.5 - 10	20	10

Source: MoE FiT Policy 2010

3.10.2 Challenges

1. Insufficient data to inform the level of tariffs for different technologies;
2. Lack of awareness on FiT among the potential investors;
3. No clear guidelines on PPA negotiations which results in lengthy negotiations;
4. Inadequate technical and financial capacity of some community based projects;

3.10.3 Policies and Strategies

1. Undertake a study on the capital expenditures and the operating costs on the different types of technologies.
2. Initiate promotion campaigns to reach potential investors.
3. Develop model Power Purchase Agreements.
4. Provide capacity building and financial assistance to community based projects
5. Expand the scope of FiT to include the emerging technologies.

3.10.4 Implementation Agenda

Short Term 2012-2016

1. Develop an investment guide
2. Set minimum and maximum tariffs to guide the negotiations for PPA.
3. Review the FiT Policy to include operations and maintenance escalation components.
4. Expand the scope of FiT to include the emerging technologies.
5. Provide capacity building and financial assistance to community based projects.

3.11 OTHER RENEWABLES

3.11.1 Background

1. Other renewable energy sources and technologies are not yet widely demonstrated or commercialised. These include ocean energy, biomass gasification, bio-refinery technologies and concentrating solar power. Of particular interest is ocean energy, owing to the long coastline that Kenya is endowed with.
2. The oceans contain huge amounts of power that can be drawn from different sources and exploited for generating useful energy. The most developed conversion systems use tidal energy, thermal energy, marine currents and ocean waves. A private investor has expressed interest to develop a 100MW electric power plant utilising tidal waves.

3.11.2 Challenges

1. Lack of legal, regulatory and institutional framework for exploitation of emerging renewable energies.
2. Inadequate data and information on potential of renewable energies.
3. Lack of incentives for exploitation.

3.11.3 Policies and Strategies

1. Develop legal, regulatory and institutional framework for exploitation.
2. Acquire adequate data and information on potential of other renewable energies.
3. Provide incentives for exploitation.

3.12 CROSS CUTTING ISSUES

3.12.1 Challenges

1. Lack of a lead agency to spearhead renewable energy development.
2. Absence of local credit schemes and financing mechanisms.
3. Inadequate public awareness on the economic opportunities offered by renewable energy and renewable energy technologies.

3.12.2 Action Plans

1. The Government recognizes that renewable energy has potential to enhance energy security, mitigate climate change, generate income, create employment and generate foreign exchange savings. Consistent with this recognition, the Government shall:
 - (a) Designate a Renewable Energy Lead Agency to promote and accelerate the exploitation of this resource. The Lead Agency shall provide a one stop shop for information and guidance to investors for renewable energy projects.
 - (b) Develop a tariff for net metering for electricity generated from renewable energy sources by electricity consumers.

- (c) Revitalize the existing Energy Centres and establish others to cover all counties with a view to promote renewable energy use.
- 2. Partner with financiers to enable the public to access credits schemes
- 3. Develop capacity building programmes for players in renewable energy technologies in collaboration with training institutions and the energy centres.
- 4. Introduce net metering policy to encourage consumers sell excess power generated from the renewable energy systems.
- 5. Prepare a master plan for renewable energy.

4.0 - ELECTRICITY

4.1 BACKGROUND

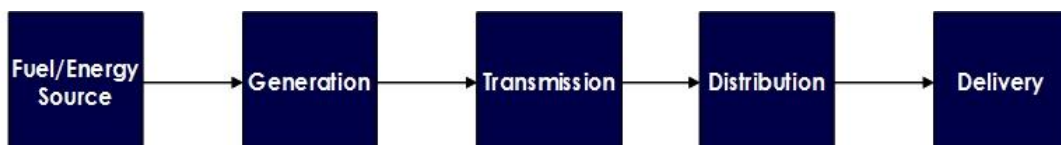
1. Electricity is a secondary source of energy generated through the consumption of primary energy sources namely renewable energy, fossil fuels and nuclear energy. By virtue of its versatility in application, it is crucial to economic growth and is the most sought after energy service by society. Access to electricity is associated with rising or high quality of life.
2. As at 2011 electricity provided 9% of overall energy requirements in Kenya, while fossil fuels and renewable energy provided 22% and 69%, respectively. In the FY ended 30th June 2011, 68.7% of the electrical energy was generated using renewable energy sources while 31.3% was generated using fossil fuels as detailed in Table 4.1.

Table 4.1 - Electric Power Generation Sources and Energy Generated in FY 2010/11

Sources of Electric Power Generation		Installed Capacity		Annual Generation	
		(MW)	Percentage	(GWHrs)	Percentage
Renewable Energy	Hydro	762	47.8%	3,427	46.9%
	Geothermal	198	12.4%	1,453	19.9%
	Wind	5	0.3%	18	0.2%
	Cogeneration	38	2.4%	87	1.2%
	Imports			30	0.4%
	Total	1,003	63.0%	5,015	68.7%
Fossil Fuels	MSD	452	28.4%	1,976	27.1%
	Gas Turbines	60	3.8%	1	0.0%
	HSD	18	1.1%	44	0.6%
	Emergency Power Plants	60	3.8%	267	3.7%
	Total	590	37.0%	2,288	31.3%
Installed Capacity and Units Generated		1,593	MW	7,303	GWhs

3. The electricity supply industry (ESI) value chain consists of four elements, as shown below.

Figure 4.1 – The Electricity Industry Value Chain



4. First, there is generation, requiring both a fuel source (e.g., hydro, geothermal, petroleum or wind energy) and a power plant to convert the fuel source into electrical energy.
5. Second, the generated electricity is transformed (stepped up) for transmission over high voltage power lines; and matching end user requirements (demand) with energy availability (supply), referred to as system operations.

6. The third element is distribution where electricity is transformed again (stepped down) to enable delivery or supply of electrical energy to end users or consumers via a vast network of power lines and substations.
7. Finally, there is delivery or supply which entails retailing of electrical energy to consumers through a series of commercial functions – procuring, pricing, selling, metering, billing and revenue collection.
8. Generation, transmission, system operations and distribution are physical functions, while wholesaling and delivery/retailing are merchant or commercial functions.
9. Competition in the industry generally means competition in the generation of electricity, as well as in the commercial functions. The transportation (transmission and distribution) as well as system operation functions are natural monopolies as it does not make economic, environmental or aesthetic sense to build multiple sets of competing systems in any one area. System operations is also non-competitive, since the system operator has to control all the plants in a control area, otherwise the system would not function efficiently or safely.
10. The electricity supply industry (ESI) in Kenya has been undergoing reforms and restructuring since the mid-90s with the aims of, *inter alia*:
 - (a) Creating appropriate legal, regulatory and institutional framework for the ESI.
 - (b) Ensuring provision of reliable, efficient and sustainable electric power supplies.
 - (c) Increasing the population's access to electricity as a means of stimulating economic growth.
 - (d) Improving the efficiency of power distribution and supply through reductions in technical losses and collection of revenues.
 - (e) Creating a more competitive market structure with clear definition of roles for public and private sector players in generation, transmission, distribution and retail functions.

4.2 DEMAND FOR ELECTRICITY

1. Demand for electricity has shown an upward trend since the year 2004 due to accelerated economic growth. Peak demand increased from 899MW in 2004/05 to 1,194MW in 2010/11, while the number of electricity consumers more than doubled from 735,144 in 2004/05 to 1,753,348 in June 2011 as detailed in the Table 4.2.

Table 4.2. - Demand and Consumer Statistics

	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Energy Generated (GWh)	5,347	5,697	6,169	6,385	6,489	6,692	7,303
Energy Sold (GWh)	4,379	4,580	5,065	5,322	5,432	5,624	6,123
Peak Demand (MW)	899	920	987	1,044	1,072	1,107	1,194
Number of Consumers	735,144	802,249	924,329	1,060,383	1,267,198	1,463,639	1,753,348

Source: KPLC Annual Report and Financial Statements, 2011.

2. The peak load is projected to grow to 2,511MW by 2015 and 15,026MW by 2030. To meet this demand, the projected installed capacity should increase gradually to 19,199MW by 2030.
3. As at 30th June 2011, 28.9 % of the population was connected to electricity compared to only 15% as at 30th June 2004. The population of Kenya in 2004 was estimated at 33.6million and the population census of 2009 posted a figure of 38.6million. The estimated population in 2011 stood at 40million.
4. The reference scenario of historical and forecast electricity demand indicates a consistent annual increase in electricity demand, as shown in Table 10.3 in **10.0 Annexure**.
5. To meet the projected demand, the system expansion over the Vision 2030 period indicates that the total installed capacity will be obtained from geothermal - 26%, nuclear plants - 19%, coal plants - 13%, hydro plants - 5%, thermal plants (MSD) - 9%, gas turbines (LNG) - 11%, wind plants - 9%, while imports will provide up to 8%.

4.3 ELECTRICITY GENERATION

1. Electricity generation in Kenya is liberalised with several licensed electric power producers whose combined installed capacity was 1,533MW as of December 2011. These include KenGen which accounts for approximately 76% of the installed capacity, and six (6) Independent Power Producers (IPPs) which account for the balance.
2. Generation capacities from hydro, geothermal, baggase (cogeneration) and wind plants were 47.8%, 12.4%, 2.4% and 0.3% respectively while fossil fuel based thermal (inclusive of emergency power) plants contributed 37%.
3. Several generation projects are under development that will lead to a capacity addition of 1,534MW by 2016.

4.3.1 Hydro Electric Power

4.3.1.1 Background

1. As of December 2011 the installed capacity of hydropower generation was 767MW equivalent to 47.8% of total installed capacity. It is estimated that the undeveloped hydroelectric power potential of economic significance is 1,449MW out of which 1,249MW is for projects of above 30MW. Average energy production from these potential projects is estimated to be at least 5,605 GWh per annum. This hydropower potential is located in five geographical regions, representing Kenya's major drainage basins: Lake Victoria (295MW), Rift Valley (345MW), Athi River (84MW), Tana River (570MW) and Ewaso Ng'iro North River (146MW).
2. By December 2011, a feasibility study for a multi-purpose hydropower project on Tana River after Kiambere hydropower plant (HPP), High Grand Falls Power Project, revealed a capacity of 700MW of power together with water storage capacity of 6million cubic metres. A further study in the same area also showed potential for 100MW at the Karura HPP.

3. In order to increase generation capacity, the Government has upgraded some of the existing hydro power plants.
4. Feasibility studies have also been carried out for three projects on Ewaso Ng'iro South River in the Rift Valley basin with a total capacity of 220MW. In the North Rift Valley basin, a feasibility study for a high head hydropower plant (Arror HPP) was completed in 2011 and revealed a potential of about 70MW.
5. Small hydros are hydropower schemes whose potential does not exceed 10MW of installed capacity. The total estimated potential of small, mini, micro and pico hydro systems is 3,000MW. Most of this potential is situated within the country's five main drainage basins. The implementation of some of these schemes is undertaken by both the Government and private investors. As of 2011 Government run schemes were a total of 15MW while those by private developers were 10MW.

4.3.1.2 Challenges

1. Hydropower is vulnerable to variations in hydrology and climate. This is a big challenge as poor rains results in power and energy shortfalls, reducing the contribution of hydro power in the energy mix.
2. The economic risk in hydropower projects is relatively higher than other modes of electricity generation because they are capital intensive and wholly dependent on hydrology.
3. A major challenge for hydro power projects is relocation and resettlement of affected persons. This is key among reasons why the Magwagwa hydro project on river Kipsonoi in Kericho, a densely populated area, has not been implemented to date. This project would have greatly improved the performance of the 60MW Sondu Miriu and 21MW Sangoro HPPs.
4. Long lead time of between 7-10 years.
5. Inadequate hydrological data throughout the East African region that does not capture quality nor cover required periods of at least 50 years.
6. Conflicting and competing land and water uses between various sub-sectors of the economy with regard to development and utilization of the same for electricity generation.

4.3.1.3 Policies and Strategies

1. A hydro risk mitigation fund shall be set up by the Government under the proposed Consolidated Energy Fund to cater for risks such as prolonged droughts cushion generators, transmitters, distributors and consumers against effects of adverse hydrology. This fund will reduce spikes in electricity prices from thermal power plants.
2. There is need to address competing water requirements between hydropower generation and other uses. The Government will establish an inter-ministerial committee comprising of relevant stakeholders to ensure coordination at policy, regulatory and operational levels of competing and conflicting water uses.

3. Energy conservation will be promoted in the hydropower plants by environmental conservation of catchment areas that will further stop soil erosion that results in siltation of dams. The hydro generator shall be responsible for funding of the initiative.
4. The Government shall implement hydro power projects as multi-purpose projects. Consideration will also be given to leasing of such projects for operation through long-term concessions.
5. The private sector will be encouraged through FiT to develop potential sites, for projects whose sizes are within the definition, to generate electricity for their own consumption and for export of surplus electrical energy to the national grid. In recognition of efforts expended, the National Government will provide letters of comfort to investors which guarantee purchase of electrical energy on just and reasonable terms.

4.3.1.4 Agenda for Action

Short Term 2012-2016

1. Formulate mechanism to establish and operationalize the hydro risk mitigation fund.
2. Establish an inter-ministerial committee comprising relevant stakeholders to address conflicting water uses.
3. Preserve the catchment areas through the energy sector environment conservation programmes.
4. Implement High Grand Falls project (700MW) and other viable hydropower projects.
5. Undertake pre-investment studies on hydro resources to define their technical and economic viability.

Medium Term 2012-2022

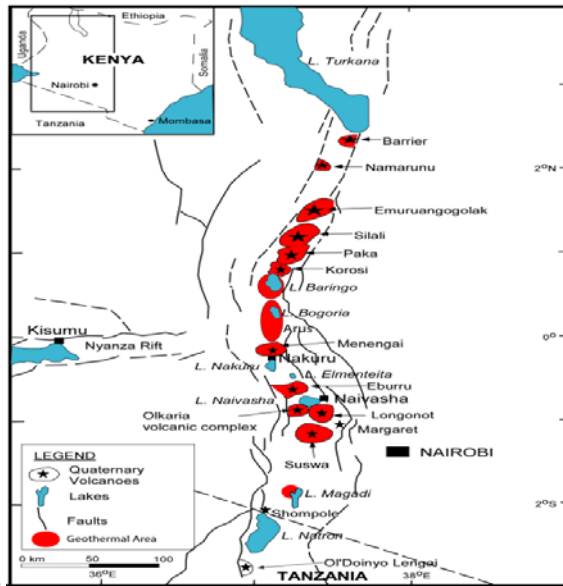
Implement High Grand Falls project (700MW) and other viable hydropower projects.

4.3.2 Geothermal Electric Power

4.3.2.1 Background

1. Kenya is endowed with vast geothermal resources within the Rift Valley with an estimated potential between 7,000MWe and 10,000MWe. Figure 4.2 shows the location of the geothermal resource areas in Kenya.

Figure 4.2 - Location of Geothermal Areas.



2. As of December 2011 the installed capacity of geothermal energy generation stood at 198MW, an equivalent of 13% of the total installed capacity as detailed in Table 4.3.

Table 4.3- Existing Geothermal Power Plants

Station	Entity	Location	No. of Units	Rating per Unit	Installed Capacity(MW)	Year Installed
Olkaria I	KenGen	Olkaria	3	15	45	1981
Olkaria II	KenGen	Olkaria	2	35	70	2003
Olkaria II	KenGen	Olkaria	1	35	35	2010
Olkaria III	Orpower 4	Olkaria	3	4-5	13	2000
Olkaria III	Orpower 4	Olkaria	1	35	35	2009
Total					198	

4.3.2.1 Advantages

Geothermal electric power is;

1. Suitable energy source for base load electricity generation.
2. Not directly affected by climate variability.
3. Indigenous and readily available in Kenya.
4. A renewable and sustainable source of energy.
5. Green clean energy that is environmentally friendly.
6. A high utilization and conversion form of energy of up to 95% and 90% respectively.
7. Comparatively low operational and maintenance form of energy.

4.3.2.2 Challenges

1. Relatively long lead time of between 5-7 years from conception to production of electricity.
2. High upfront investment costs. Geothermal projects typically progress through stages of reconnaissance, surface exploration, feasibility study, exploratory drilling, appraisal drilling and production drilling stages which normally involve high investment costs.
3. High cost of drilling equipment. On average, a drilling rig costs approximately US\$ 30 million (2011 prices).
4. Expensive risks including sinking dry wells, contamination and possible collapse of wells.
5. Lack of pre-drilling feasibility data due to lack of human and capital resource to undertake the studies.
6. Remote location, siting restrictions and long distances to existing load centres necessitating heavy investment in transmission and other support infrastructure.
7. Competing and conflicting interests in use of natural resources.

4.3.2.3 Policies and Strategies

1. The Government shall support and fund the Geothermal Development Company (GDC) so as to manage the geothermal exploration risk and attract investors
2. GDC will develop and implement a rigorous monitoring and evaluation framework for the Geothermal Development Plan of drilling an estimated 1,130 wells to provide steam for the planned 5,530MW to meet projected capacity by 2030. After the exploratory wells, public private partnership will be encouraged to do further exploration and production through concessions. Conditions will be spelt out to guard against hoarding of wells.
3. The National Government will continue to encourage the private sector to invest in geothermal energy so as to achieve the projected supply of 5,530MW by the year 2030.

4.3.2.4 Agenda for Action

Short Term 2012-2016

1. Increase Government allocation of funds for geothermal programme and support GDC in sourcing more funds from development partners.
2. Develop a mechanism for public private partnership in geothermal exploration production
3. GDC shall develop and implement a monitoring and evaluation programme for the geothermal development plan of drilling 100 wells by 2016

Medium Term 2012-2022

1. Undertake further geothermal resource assessments to define additional economically viable geothermal power plants.
2. Develop 1,500MW of geothermal power by 2019.

Long Term 2012-2022

1. Develop 5530MW of planned Geothermal Energy

4.3.3 Thermal Electric Power

4.3.3.1 Background

1. Thermal electric power is generated from petroleum fuels or natural gas.
2. Thermal generation accounts for approximately 33% of installed capacity and its contribution to the actual energy mix as at 2011 stood at approximately 37%. The installed capacity on the interconnected system is comprised as follows;
 - (a) 452MW of medium speed diesel (MSD) generators.
 - (b) 60MW of gas turbines.
 - (c) A further 60MW of Emergency Power Plants are in service to bridge the capacity shortfall.
3. All thermal generating plants are run on imported fuels which are subject to volatile international oil market prices which are borne by the consumers. Consumption of heavy fuel oil is expected to increase as projected in the 2011 LCPDP with the installed capacity of petroleum fired generation rising to 705MW by 2013 and to 1,025MW by 2018. This increase in generation capacity is to boost reliability and security of supply.

4.3.3.2 Advantages

1. Thermal power generation:
 - (a) Requires a relatively shorter period of between 12 to 18 months.
 - (b) Requires smaller physical space compared to hydro and geothermal power plants.
 - (c) Lower capital cost compared to hydro power and geothermal power plants.
 - (d) Can be installed in any part of the country as compared to hydro power and geothermal plants which are site specific.
 - (e) Attractive to private investment due to faster return on investment.

4.3.3.3 Challenges

- (a) High recurrent cost due to use of petroleum fuel leading to higher electricity costs.
- (b) Petroleum fuel is not renewable.
- (c) Causes environmental pollution which requires costly mitigation measures.
- (d) Kenya imports all her petroleum products which are subject to high price volatility.
- (e) Thermal power plants have a relatively shorter life span of about 20 to 25 years compared to hydropower plants which have a lifespan of over 50 years.

- (f) Thermal power has relatively lower conversion efficiency of less than 50% compared to hydropower plants which have over 90% efficiency.

4.3.3.4 Policies and Strategies

1. High recurrent cost due to use of petroleum fuel, leads to high pass through costs in the tariff. To mitigate against this challenge, the Government will zero-rate all taxes on petroleum products, coal and natural gas imported for use in thermal electricity generation. Further the Government should accelerate efforts in petroleum exploration.
2. The National Government will encourage electricity generation using natural gas and coal.
3. The Government will ensure that all equipment procured for thermal power plants shall be designed and constructed to minimise the environmental impact while giving consideration to visual impact, wildlife and temporary disturbance during construction, maintenance and operation.
4. In order to maintain a clean environment, the Government will ensure that operators of thermal plants comply with environmental regulations and all other relevant local and international standards and guidelines.

4.3.3.5 Agenda for Action

Short Term 2012-2016

1. Establish a liquefied natural gas (LNG) handling and storage facility in Mombasa
2. Enforce compliance for pollution prevention and reduction in thermal power plants
3. The Government will enhance coal resource assessment and development to accelerate electricity generation using coal by end of 2014.
4. The ministry responsible for Energy shall continue exploration and subsequent mining of coal to meet the increasing demand for electricity.
5. Promote bagasse based cogeneration and implement the identified projects based on least cost and efficiency criteria.

Medium Term 2012-2022

1. Undertake development of the coal resource and generate 620MW of electrical power by 2018
2. Complete a Liquefied Natural Gas (LNG) power plant of 600MW together with a storage and reticulation facility.

Long Term 2012-2022

2. Develop 4,490MW coal power plants.

4.3.4 Nuclear Electric Power

4.3.4.1 Background

1. A nuclear power plant is a facility at which energy released by fission (splitting) of atoms is converted to electrical energy under strictly regulated operating conditions. Nuclear reactors produce, contain and control the release of energy from splitting of Uranium 235 atoms. In electric power plants this energy heats water to make steam which in turn drives turbine generators to make electricity. The various activities associated with production of electricity from nuclear reaction are referred to collectively as the nuclear fuel cycle which starts with the mining of uranium and ends with disposal of nuclear waste.
2. To develop nuclear electricity, Kenya shall be guided by the International Atomic Energy Agency (IAEA) Milestone Approach which prescribes the 19 infrastructure issues to be addressed at every phase of development of the nuclear power programme.
3. The milestone approach is a progressive development framework comprising 3 phases. Completion of infrastructure conditions of each of these phases is marked by a specific milestone at which the progress and success of the development effort can be assessed and a decision made whether to move to the next phase. The milestones are:
 - (a) Milestone 1- The country is ready to make a knowledgeable commitment to a nuclear programme;
 - (b) Milestone 2 – the country is ready to invite bids for the first nuclear power plant.
 - (c) Milestone 3 – The country is ready to commission and operate the first nuclear power plant.Figure 10.1 in **10.0 - Annexures** illustrates the activities under each milestone.
4. The uptake of nuclear power technology has been growing over time across different countries and regions. Various countries without existing nuclear power technology in their power systems have expressed interest in investing in nuclear electricity production, while developed countries with existing nuclear plants have been expanding their capacities. All over the world, as of September 2011, there were 435 nuclear power plants in operation, 28 under construction and 222 in the planning stage.
5. Vision 2030, both in its medium and long term plan points to development of nuclear energy as a viable means of providing the much needed reliable and affordable electricity for the ever increasing commercial, industrial and household use. Further Sessional Paper No 4 of 2004 identified the role of nuclear energy in generating electricity and acknowledge that the country requires additional technical expertise and financial resources to harness this energy resource.
6. The Government established a Nuclear Electricity Project Committee (NEPC) mandated with the objective of spearheading and fast tracking the development of nuclear energy for electricity generation.
7. The critical need for nuclear energy is premised on the fact that, with the rising demand for power in the country due to the accelerated investment in the economy, it is one of the forms of

energy that can produce enormous amounts of electricity at a relatively economical cost. The LCPDP projects that the total installed capacity in 2030 will be 19,199MW, out of which nuclear plants are expected to contribute 19%.

8. The first nuclear plant of 1,000MW is expected to be commissioned in 2022 when the peak demand is projected to be 6,048MW. Additional units of 1,000MW each are expected to be commissioned in 2026, 2029 and 2031 when the respective demands will be 9,556MW, 13,435MW and 16,905MW. It is further noted that the introduction of nuclear plants into the grid is justified by the demand for electricity within the Eastern Africa Power Pool (EAPP).

4.3.4.2 Advantages

1. Nuclear plants are some of the most cost effective sources of power.
2. It is a clean non- pollutant way to produce energy as it does not produce any GHG emissions.
3. The fuel for nuclear power plants is uranium which is abundantly available in its resource areas. Uranium deposits are not exhaustible for an estimated 1,000 years worldwide.
4. Nuclear power is a reliable source of power with an economic life of 70 years with an option of extension of up to 20 years.
5. Nuclear power is suitable for base load operation.
6. Nuclear fuel can be recycled and re- used. This approach would capture the vast amount of energy still remaining in the spent nuclear fuel and reduce on radioactive waste.
7. Nuclear power plants have one of the highest conversion factors with a sustained plant efficiency of up to 98%.
8. In comparison with other forms of energy such as solar and wind, nuclear energy utilizes less land. A site area comparison of the various forms of energy reveals that for a 1,000MW capacity plant, nuclear energy requires 330,000m², solar 33,000,000m² and wind 165,000,000m².

4.3.4.3 Challenges

1. Nuclear plants require a relatively higher upfront capital cost investment compared to other energy sources.
2. Proliferation concerns since breeder reactors yield products that could potentially be diverted and turned into atomic weapons.
3. The spent fuel waste is highly radioactive and has to be carefully stored for many years or decades after use. This adds to the costs of operation and maintenance of the plants. Globally, there is currently no disposal mechanism for radioactive and chemical materials.
4. There are increased global safety concerns especially after nuclear accidents of Chernobyl, Ukraine (1986) and Fukushima, Japan (2011). The same is even higher within the Kenyan public which is not adequately informed about nuclear energy.

4.3.4.4 Mitigating factors

1. It is important to note that the international nuclear industry through comprehensive RD&D has substantially addressed most of the concerns and challenges that traditionally undermined nuclear energy as a form of economical and safe energy. This can be evidenced in the fact that in 2005, the IAEA was awarded the prestigious Nobel Peace Prize for *'its efforts in preventing nuclear energy from being used for military purposes and most importantly for ensuring that nuclear energy for peaceful purposes is used in the safest possible way'*.
2. Some of the measures to mitigate the challenges include:
 - (a) Comprehensive nuclear laws, regulations and treaties, in reactor designs, operator training, public awareness, emergency preparedness, enhanced safety, additional safeguards and security standards, all which have greatly reduced probability of occurrence of nuclear accidents and negative impact on public environment, health and safety.
 - (b) New reactor types have been designed to make it physically impossible to melt down. This is due to elaborate regulations on safety and security safeguards, in design, setting up and operating nuclear plants.
 - (c) Development of small and medium sized reactors (SMRs) provides an attractive and affordable nuclear power option for many developing countries with small electrical grids, insufficient infrastructure and limited investment capability. Multi-module power plants with SMRs may offer energy production flexibility that energy market deregulation might call for in future in many countries. SMRs are also of particular interest for co-generation and many advanced future process heat applications. Some SMRs designs reduce obligations of the user for spent fuel and waste management and offer greater non-proliferation assurances to the international community.
 - (d) Heightened vigilance by the IAEA and the international community has ensured recent nuclear energy research, development and use are increasingly for peaceful purposes and not military use.

4.3.4.5 Policies and Strategies

The National Government shall:

1. Transform Nuclear Electricity Project Committee into a Nuclear Electricity Board to promote and implement a nuclear electricity generation programme;
2. Develop the nuclear electricity legal and regulatory framework.
3. Establish the Atomic Energy Commission which shall perform regulatory and other related functions;
4. Establish Nuclear Energy Research Center within the proposed National Energy Institute, which shall be responsible for RD&D of nuclear energy technology and application;
5. Identify an operator

6. Establish any other body required for the development and operation of nuclear electricity programme;
7. Provide funds for establishment and operation of nuclear electricity programme.

4.3.4.6 Agenda for Action

Short Term 2012-2016

The Government Shall:

1. Transform through a primary legislation, the NEPC to the Nuclear Electricity Board charged with the core mandate of fast tracking and promoting nuclear electricity generation.
2. Carry out pre-feasibility and feasibility studies to address all requisite infrastructure issues for the development of a nuclear power programme.
3. Develop the nuclear electricity legal and regulatory framework.
4. Commence on human capacity building programme for recruitment of highly knowledgeable and skilled human resource in nuclear energy and ensure continuous training in all relevant specializations required for the support of the nuclear power programme.
5. Develop comprehensive legal and regulatory framework addressing all requisite infrastructure issues towards the realization of nuclear electricity.
6. Ensure the country accedes and domesticates to key Conventions to meet her international obligations necessary for the establishment of a nuclear power programme.
7. Establish the Atomic Energy Commission.
8. Establish Nuclear Energy Research Centre under the proposed National Energy Institute.
9. Establish or designate any other body as the circumstances may require for the realization of a comprehensive Nuclear Electricity Program .
10. Development of a funding and financing plan for nuclear power programme.
11. Undertake extensive public awareness on the need for nuclear energy, engage stakeholders for support of nuclear power and also draw a comprehensive communication strategy.
12. Identification of several nuclear candidate sites followed by site evaluation, characterization and selection of feasible sites to be communicated to IAEA.
13. Identification of vendor's in nuclear energy technology, engagement in bilateral agreements and MOU with vendor countries.
14. Attainment of IAEA Milestone 1 (Ready to make a knowledgeable commitment to a nuclear programme and Milestone 2 (Ready to invite bids for the first nuclear power plant).
15. Bid for the first 2,000MW nuclear power plant(s).
16. The nuclear regulator to issue the siting and construction license

Medium Term 2012-2022

1. Nuclear regulator to issue construction and operating license.
2. Attainment of Milestone 3 (Ready to commission and operate the first nuclear power plant).
3. To commission the first 1,000MW nuclear plant(s) by 2022.
4. Embark on the implementation of the next 2,000MW nuclear power plant(s).

Long Term 2012-2030

Commission 4,000MW of nuclear electricity power.

4.4 ELECTRIC POWER TRANSMISSION

4.4.1 Background

1. The existing transmission network comprises 1,331 km of 220 kV and 2,343 km of 132 kV lines, and is interconnected with Uganda through a 132 kV double circuit line.
2. As of June 2011, there were nine generation substations with a transformation capacity of 1846 MVA and forty-five transmission substations with a capacity of 2,954 MVA.
3. The existing transmission system capacity is severely constrained particularly during peak hours. The problem is partly due to inadequate reactive power in major load centres and also transmission constraints particularly in the Western and Nairobi regions.
4. One of the recommendations under Sessional Paper No. 4 of 2004 was to unbundle transmission and distribution functions. This began in 2008 with the establishment of KETRACO as a transmission entity which will also be responsible for system operations.
5. As part of its mandate, KETRACO is currently undertaking new transmission line projects aimed at developing a robust grid system to:-
 - (a) Improve quality and reliability of electricity supply throughout the country by ensuring adequate evacuation capacity.
 - (b) Reduce the cost of electricity to the consumer by absorbing the capital cost of transmission lines since they will be fully funded by the National Government.
 - (c) Provide interconnection links with the neighbouring countries in order to facilitate power exchange and develop electricity trade in the region.
 - (d) Reduce transmission losses that as of 2011 cost the country about US\$ 17million per year.
 - (e) Open up off-grid areas in order to ease connectivity to electricity by constructing transmission lines to link them up to the national grid.

4.4.2 Extension of the National Transmission Network

1. The rise in electricity consumption requires a corresponding increase in generation capacity and transmission network. Consequently, the number of transmission lines projected for construction in the next 5 years needs to be substantial to meet this need.

- Through the LCPDP process and feasibility studies, KETRACO has identified priority projects for implementation, constituting a total of about 1,400 km of 132 kV lines, 900 km of 220 kV lines, 1,250 km of 400 kV lines and 700 km of 500 kV HVDC lines.

4.4.3 Regional Interconnection

4.4.3.1 Imports and Exports

- The Kenyan transmission network is interconnected with Uganda's system through a 132 kV double circuit transmission line. The arrangement allows for electrical energy exchange between the two systems. Kenya also has cross-border agreements with Tanzania.
- Quantities of imports and exports of electrical energy (in kWhs) between Kenya and Uganda as well as between Kenya and Tanzania are detailed in the table 4.4:

Table 4.4 - Imports and Exports of Electrical Energy

Year ended 30 th June	Kenya – Uganda (kWhs)		Kenya – Tanzania (kWhs)	
	Imports	Exports	Imports	Exports
2005	105,627,168	19,894,364	267,733	n/a
2006	14,600,888	23,936,088	443,157	n/a
2007	12,684,112	73,479,000	434,946	n/a
2008	24,665,248	46,359,936	1,036,864	n/a
2009	28,570,508	26,557,446	1,220,868	n/a
2010	37,135,529	26,291,418	1,101,026	526,740
2011	29,946,605	30,265,350	860,527	838,800

- Resulting from the ongoing regional integration under the EAPP initiative and the need to build synergies in the region in power development, the government has committed to enter into mutually beneficial regional interconnections with other African countries. As a result, the regional power market is progressively evolving into a power pool with the anticipated interconnections with Ethiopia, Tanzania and the Southern African Power Pool (SAPP) countries and strengthening of the interconnection with Uganda. Table 4.5 details planned regional inter-connectors.

Table 4.5 – Planned Regional Inter-connectors

No	Transmission Line	Distance (km)	Voltage	Transfer Capacity (MW)	Status
1.	Lessos (Kenya) –Tororo (Uganda)	127	220 kV	250	In progress
2.	Ethiopia-Kenya	700	500kV HVDC	2000	In progress
3.	Isinya (Kenya) - Singida (Tanzania)	500	400kV	1,300	Proposed

4.4.3.2 Benefits of Regional Interconnectivity

1. Security of supply and system stability due to increased generation mix.
2. Increasing national economic efficiency by operating on lower reserve margins
3. Expanded power market sizes and reduced country specific risks
4. Capital saving as the country need not invest in new stations
5. Increases competition by providing options for cheaper power
6. Electricity access to remote areas
7. Shared reserve margin
8. The transmission infrastructure acts as a catalyst for investment in non-conventional renewable energy sources.

4.4.4 Transmission Plan

The LCPDP includes a section on transmission development plan to be developed for the period 2011-2031. The plan provides for development of an estimated 16,064 km of new lines at a cost of US\$ 3.116billion.

4.4.5 Challenges

1. Weak, inadequate and poorly -integrated transmission infrastructure capacity.
2. Displacement, environmental, health and safety issues.
3. Vandalism on transmission network - Between 2002 and 2008 the direct loss to KPLC from vandalism of transmission assets was KShs 2.414billion while the economic loss to the country as a whole was KShs 4.171billion
4. Inadequate local technical skills especially in HVDC systems.
5. Land and wayleaves acquisition.
6. Insufficient framework for private participation in development of transmission infrastructure.
7. Inadequate policy, legal and institutional framework for the operationalization of the independent system operator.

4.4.6 Policies and Strategies

1. The National Government shall support open access of the transmission network through an independent system operator taking into account existing contractual commitments.
2. The National Government will encourage regional integration of the power system to enhance regional power trade.
3. The Government will continue to fund the development of the transmission system through KETRACO to enhance affordability. The Government will continue to assist transmission licensees access credit to enhance capacity, improve reliability and reduce losses in the networks.

4.4.7 Agenda for Action

Short Term 2012-2016

1. Ensure adequate and timely national transmission infrastructure is put in place.
2. Transfer of system operation functions from KPLC to an independent system operator.
3. Accelerate regional inter-connection of transmission networks.
4. Continue funding of transmission system(s) expansion.
5. Implement power transmission projects to reach 3,900 km of new transmission lines by 2016.

Medium Term 2012-2022

Implement regional power interconnection project.

Long Term 2012-30

Increase national and regional transmission network for full regional inter-connection.

4.5 ELECTRIC POWER DISTRIBUTION

4.5.1 Background

1. The distribution network entails receipt of bulk supply of electrical energy from generation or transmission network and transfer of this energy through distribution lines and distribution substations to consumers. The capacities of the distribution substations and distribution transformers as at 30th June 2011 were 2,244 MVA and 5,069 MVA respectively. The distribution lines comprised of 655 km of 66 kV lines, 15,271 km of 33 kV lines, 26,250 km of 11 kV lines and low voltage lines. The distribution assets are owned by GoK, KPLC and REA.
2. Customer Average Interruption Duration Index (CAIDI) deteriorated from 4.4 hours in 2009/10 to 4.6 hours in 2010/11. KPLC aims to improve this to 3hours by 2013/14. The sharp increase in vandalism considerably contributed to this worsening situation leading to a number of transformer failures and consequential power outages.
3. The technical and commercial losses arising during the transmission and distribution of electricity are as provided in Table 4.6.

Table 4.6 - Targeted Power System Loss Reduction Path

	2007/08 (%)	2008/09 (%)	2009/10 (%)	2010/11 (%)	2011/12 (%)	2012/13 (%)	2013/14 (%)
Total Losses	16.60	16.30	15.90	15.50	15.00	14.50	14.50
Transmission losses	3.60	3.40	3.50	3.50	3.50	3.50	3.50
Distribution losses	13.00	12.90	12.40	12.00	11.50	11.00	11.00
Technical Losses	13.20	13.10	12.90	12.80	12.50	12.00	12.00
Non-technical losses	3.40	3.20	3.00	2.80	2.50	2.50	2.50
Projected Incremental Loss Reduction	1.30	0.30	0.40	0.40	0.50	0.50	0.00

Source: KPLC Strategic Plan 2010/11 - 2014/15

4.5.2 Distribution Expansion Plan

1. The objective of the ongoing Energy Access Scale-Up is to increase connectivity from 22% to 30% by the year 2014. It involves expansion of the national power distribution grid to connect one million new customers in 5 years starting from 2009. The number of electricity consumers increased by 196,441 in 2009/10 and 289,709 in 2010/11.
2. In addition, more projects have been initiated to enhance capacity, quality of supply and reduce power losses. These projects are expected to be completed during the medium term and cover among others the following key areas:
 - (a) Refurbishment of existing distribution network, establishment of new substations, installations of new distribution transformer, construction of new lines, implementation of pilot distribution automation project.
 - (b) Upgrade of Supervisory Control and Data Acquisition/Energy Management System (SCADA/EMS).
 - (c) Improvement of the Geographical Information System (GIS) utility database by completing the digitizing and mapping of the grid network.
 - (d) Implementation of customer service improvement programs including roll out of Automatic Meter Reading (AMR) for large customers and pre-paid meters for small to medium customers.

4.5.3 Distribution Plan 2015-2030

1. Programme to supply the forecast LCPDP demand and improve reliability involves sub-transmission at 132 kV and 66 kV and the discontinuation of 33 kV sub-transmission. Distribution to urban and rural areas will largely continue at 11 kV and 33 kV respectively.
2. By the year 2020, capacities of primary and distribution substations, HV lines and MV lines estimates are 11,888MVA, 190,204MVA, 7,925 km and 118,875 km respectively. In the year 2030 the estimates of the distribution substation capacity, distribution transformer capacity, HV lines and MV lines will be 37,565MVA, 60,104MVA, 25,043 km and 187,825 km respectively.

Table 4.7: Vision 2030 Distribution Expansion Plan

Year	Peak Demand	Primary Substation Capacity	Distribution Substation Capacity	Sub-Transmission Lines	MV Distribution Lines
	MW	MVA	MVA	km	km
2010	1,227	2,241	4,688	655	31,145
2020	4,755	11,888	19,020	7,925	118,875
2030	15,026	37,565	60,104	25,043	187,825

Source: KPLC Strategic Plan 2010/11-2014/15

- Notes:
1. Distribution substation capacity estimated at 2.5 times the demand,
 2. Distribution transformer capacity estimated at 4 times the demand,
 3. The lines estimate based on projection of the existing lines.

4.5.4 Challenges in Distribution

1. High end-user electricity tariffs.
2. High electricity connection charges. Despite efforts to subsidize the cost of connection to between Kshs.17,000/- to KShs.35,000/-, this amount is still beyond the reach of majority of rural consumers.
3. Vandalism of electric power infrastructure.
4. Lengthy process of way-leaves acquisition
5. Encroachment of way-leaves trace
6. Weak distribution network characterized by limited redundancy and aging installations leading to frequent and prolonged supply interruptions.
7. Most of the distribution networks in major cities, urban areas and the coastal strip are overhead and therefore prone to frequent interruptions due to corrosion and climatic changes.
8. High system losses.
9. Illegal power line connections and theft of electricity.
10. Physical plans in most cases do not provide an infrastructure corridor for electricity reticulation.
11. High arbitrary levies charged by the Local Authorities on power infrastructures.

4.5.5 Policies and Strategies

1. The National Government shall ensure that distribution services are provided efficiently by duly licensed network service providers.
2. The County Government may plan and develop distribution services in line with national policy.
3. The National Government will assist distribution licensees to access credit to enhance capacity, improve reliability and reduce losses in the distribution networks.
4. The National Government will continue funding the development of distribution network through REA.
5. The Government will continue to support strengthening of distribution network through licensed distributors.
6. Clarification of assets ownership between REA and KPLC shall be done.

4.5.6 Agenda for Action

Short Term 2012-2016

1. Support open access of the distribution network to enable purchase and sale of electricity by licensees and consumers.
2. County Governments to plan and develop distribution services in line with national policy.

3. Reinforce the transmission and distribution system to improve quality of electricity services and reduce system losses to 15% with a view to put licensees on a sustainable path to reduction of consumer tariffs by 2016.
4. Continue to implement a prudent financially sustainable customer connection policy to accelerate consumer connections by at least 250,000 annually.
5. Expand the distribution network additional 16,000 km of medium voltage, 1,000 MVA of distribution substations, 50,000 km of low voltage lines and 3,000 MVA of distribution transformers so as to connect 1.5million new customers by 2016.

Medium Term 2012-2022

Increase HV lines, primary substation capacity, MV lines, distribution transformers and LV lines

Long Term 2012-2022

Increase distribution substation capacity HV lines, MV lines and distribution transformers to 38,000MVA, 25,000 km, 190,000 km and 60,000MVA respectively.

4.5.7 Rural Electrification

4.5.7.1 Background

1. The Government established the Rural Electrification Authority (REA) under section 66 of the Energy Act, No.12 of 2006 to accelerate the pace of rural electrification in the country. The objective was to streamline the implementation of the rural electrification programme so as to facilitate the achievement of the aforementioned national development goals. In addition, GoK targets as set out in the Vision 2030 is to achieve 100% connectivity to all.
2. As at June 2011 the Government through KPLC and REA had provided electricity supply to 13,757 out of the existing 21,122 public facilities in the country as per 2009 Rural Electrification Master Plan.
3. The cumulative capital expenditure since inception of Rural Electrification Programme (REP) in 1973 was Kshs.45billion of which Kshs 36billion was generated from internal sources and the balance of Kshs 9billion was from Development Partners.
4. The number of customers connected under the rural electrification programme (REP) rose significantly by 23.2% to stand at 309,287 as at June 2011 from 251,056 customers as at June 2010. Units of electricity sold increased by 22.8% from 250million in 2009/10 to 307million kWh in 2010/11.

4.5.7.2 Challenges in Rural Electrification

1. High costs of connection. Despite efforts to subsidize the cost of connection to KShs. 35,000/-, this amount is still beyond the reach of majority of rural consumers.
2. Scattered population settlements in the rural areas leading to long distribution lines. The non-controlled sub-division of arable land has escalated this problem.

3. Harsh terrains and inaccessibility due to under developed infrastructure leads to high cost of REP Projects.
4. High operating costs of grids in rural areas due to low population density.
5. Acquisition of wayleaves due to high compensation demand by Government organizations and land owners.
6. Vandalism of power infrastructure.

4.5.7.3 Policies and Strategies

To achieve this objective the Government shall:

1. Undertake to fund rural electrification programmes.
2. Seek funding from development partners for specific programmes especially in areas less attractive to the private sector.
3. Complement self-help groups and private sector efforts in rural electrification projects.
4. Build appropriate local capacity for manufacture, installation, maintenance and operation of appropriate energy technologies in rural areas.
5. Provide incentives to both users and producers of energy technologies in rural areas.
6. Package and disseminate information on energy systems in rural areas to create investor and consumer awareness on economic potential offered by these systems.
7. Support the activities of organizations and bodies that deal with rural electrification initiatives.
8. Further subsidise the electricity connection charges to make them more affordable.
9. Rural Electrification Authority will formulate co-operation arrangements with County Governments for implementation of rural electrification programmes.

4.5.7.4 Agenda for Action

Short Term 2012-2016

1. Provide electricity to all public facilities including trading centres, schools, polytechnics, health centres, community water works and administrative offices by 2012.
2. Continue funding the development of distribution network through REA.
3. Reduction of connection charges.
4. Increase rural electrification connectivity to at least 27%.
5. Clarify asset ownership between REA and KPLC.
6. Formulation of co-operation arrangements with County Governments for implementation of rural electrification programme.

7. Package and disseminate information on energy systems in rural areas to create investor and consumer awareness.

Medium Term 2012-2022

Expand rural electrification connectivity to 50%.

Long Term 2012-2030

Expand rural electrification penetration to 100%.

4.6 CROSS CUTTING ISSUES

4.6.1 Challenges

1. As at 2011 the average tariff was approximately KShs.15 per kWh, while most Kenyans lived below an average income of KShs.100 a day. For a domestic user who would need 3 kWh per day, the cost of electricity at approximately 50% of their income is untenable.
2. Since most of the sector players are public institutions they are required to adhere to lengthy and bureaucratic public procurement processes and procedures. The delay is further exacerbated by the appeals process which allows any party to interfere with the procurement process without necessarily being required to face stringent initial vetting by the Public Procurement Appeals Tribunal.
3. Outdated or lack of land use master plans which has made it difficult and expensive to acquire land and way-leaves for power infrastructure development.
4. The policy and decision making processes in public energy sector players are complicated by their corporate governance structures which are influenced by government policy, board appointments, existing laws and regulations.
5. High cost of financing energy infrastructure projects.
6. Insufficient fiscal and other incentives for private sector investment.
7. Lack of adequate port facilities for handling cheaper energy resources including coal and natural gas to support power generation.
8. The re-organization of existing contracts in light of restructuring the sector creates challenges due to existing commitments including Power Purchase Agreements (PPAs) and asset ownership.
9. Demand for power in some areas is low due to lack of economic activities as well as poor infrastructure rendering some of the electrification projects unsustainable.

4.6.2 Policies and Strategies

1. Article 66(2) of the Constitution, establishes the principle that investment in property must benefit the local communities and their economies. Therefore, all generation, transmission and distribution entities must ensure that energy infrastructure investments benefit local

communities. Accordingly, a formula assigning County Governments as trustees of local communities and other devolved units shall be devised.

2. The National Government shall provide funds for energy projects' pre-feasibility and feasibility studies.
3. The National Government shall enact or amend laws that enhance penalties for existing offences affecting the sector and provide for additional offences while also classifying these offences as economic crimes.
4. The Government shall acquire land, wayleaves and coordinate resettlement activities where necessary to pave way for energy infrastructure development.
5. The Government shall determine levies charged by County Governments, urban areas and cities on power infrastructure as provided under Article 209 (5) of the Constitution.
6. The Government through the ministry in charge of energy will establish directorates for electrical energy, geothermal resources, coal resources and nuclear energy.
7. The County Government shall plan for energy facilities in line with the existing National Energy Policy.
8. The National Government will provide fiscal incentives to encourage investors to acquire and develop energy development technologies.
9. ERC shall ensure that during the energy purchase process, regulated asset base composition, return on equity for energy entities and the process of electricity tariff design is properly defined, scheduled, documented and provided for under regulations formulated under the Energy Act.
10. Incorporation of clean development mechanisms for all renewable energy developments.
11. The Government will encourage development of energy from renewable sources so as to benefit from carbon credits under the 1997 Kyoto Protocol.

4.6.3 Agenda for Action

Short Term 2012-2016

The Government shall:

1. Ensure implementation of committed power generation projects in order to attain an additional capacity of at least 1,534MW by 2016.
2. Establish a National Energy Institute by 2013 to enhance local capacity for research, manufacture, installation, maintenance and operation of appropriate energy technologies.
3. Enhance a competitive power market structure for generation, supply and distribution of electricity.
4. Enhance financial resources mobilisation and efficiency.
5. Undertake prefeasibility and feasibility studies on geothermal hydro power, wind and other sources of energy and make the reports available to investors.

6. Concession or privatise the off-grid (isolated) power stations within the framework of the Privatisation Act.
7. Develop resettlement action plan framework policy for energy related projects.
8. Direct funds earned from carbon credit under the 1997 Kyoto Protocol to further develop green energy sources and corporate social activities.
9. Active participation in the regional power pool initiatives to enhance regional trade.
10. Review FiT to be more attractive to investors in electricity sub-sector.
11. Provide letters of comfort to investors in electricity sub-sector.
12. Provide incentives for local manufacturing of energy infrastructure equipment and their use.
13. Make periodic offers of recommended projects to power generation companies based on merit economic ranking.

5.0 - ENERGY EFFICIENCY AND CONSERVATION

5.1 BACKGROUND

1. Energy efficiency and conservation refers to measures aimed at reducing energy consumption without sacrificing productivity or increasing costs. Energy efficiency and conservation measures have the potential to scale down capital investments needed to provide additional supplies and reduce overall resource use. It also has the potential of reducing cost of production at the end user level.
2. Energy efficiency and conservation reduces energy demand, improves energy security, improves competitiveness and helps to mitigate climate change by lowering GHG emissions.
3. A number of factors have highlighted the importance of, and urgency for, energy efficiency and conservation:
 - (a) High energy prices – the continuing increase in the price of energy has significantly contributed to increased interest in energy efficiency and conservation
 - (b) Insecurity of supply – expressed in the growing discomfort about the vulnerability and uncertainty of future energy supplies as well as the volatility of their prices.
 - (c) Adverse environmental and health impacts – there is increasing concern about spiralling degradation of the environment as exemplified by increased local air pollution and acid precipitation from ever growing fossil fuel combustion. Associated with this are global issues such as climate change as a result of GHG emissions.
 - (d) Depletion of energy resources – there is growing unease at the rate of depletion of major energy resources. The most used energy resources such as fuel wood and fossil fuels are becoming scarce as demand rises.
4. From the consumer's point of view, energy efficiency and conservation measures yield direct savings on the energy bill. From the national stand point, adoption of such measures would significantly reduce the foreign exchange costs of oil imports. It would also serve to defer additional investment in power generation capacity. Ultimately, improved energy efficiency would boost the competitiveness of Kenyan products owing to reduced input costs.
5. A survey of Kenyan industries revealed that wastage of primary energy input ranged from 10% to 30%. This was attributed to lack of information, motivation and know-how. Among other contributing factors was financial restrictions.⁶At the end of the initial phase of the Global Environmental Fund-Kenya Association of Manufacturers (GEF-KAM) Industrial Energy Efficiency Project, cumulative energy savings to the tune of 1,800 GWh had been attained.
6. It is expected that with continued efforts through the CEEC and the private sector, it is possible to avoid emissions of CO₂ to the tune of 5.2million tonnes by the year 2015. This corresponds to energy savings of about 16,130 GWh.

7. The energy policy and the Energy Act 2006 (Part V Sections 104-106) provide the policy and legal framework for energy efficiency and conservation programmes and strategies in the country.

5.2 CHALLENGES

1. Inadequate awareness of the potential benefits from efficient use and utilization of energy efficiency and conservation practices, technology and appliances.
2. Consumer apathy. There is a tendency for consumers not to embrace energy efficiency and conservation best practices as long as there is good supply of energy for current use.
3. Limited use of available conservation tools / new technology with increased efficiency leads to energy wastage.
4. Limited technical capacity, training and expertise in energy management and conservation to operationalize requirements of sections 104, 105 and 106 of the Energy Act, 2006.
5. Lack of comprehensive, reliable energy audit data and information covering various sectors and sub-sectors.
6. Slow adoption of conservation opportunities and measures due to socio-economic factors.
7. Inadequate financing owing to challenges in sourcing funds and credit mobilization for energy efficiency and conservation projects are impediments to investment in this area
8. Insufficiency of standardized equipment and appliances that would benefit from tax rebates and fiscal incentives.
9. Low awareness of existing fiscal, legal, regulatory incentives, frameworks and mechanisms such as tax holidays, generation plant and equipment tax rebates, emerging credit facilities such as green energy facility grants and loans and carbon credit from the Clean Development Mechanism (CDM).

5.3 POLICIES AND STRATEGIES

1. Recognize energy efficiency and conservation as a high-priority energy resource.
2. Promote energy efficiency and conservation initiatives in all sectors.
3. Enhance the provision of energy audits and advisory services.
4. Promote establishment of laboratories for energy efficiency testing.
5. Disseminate energy efficiency and conservation information to consumers.
6. Develop standards and codes of practice on cost effective and efficient energy use.
7. Provide appropriate fiscal and other incentives to exploit energy efficiency and conservation opportunities.
8. Review energy intensity in all sectors and international best practices so as to enable process improvement.

9. Transform the Centre for Energy Efficiency and Conservation (CEEC) into a fully-fledged national public entity to continue promoting energy efficiency and conservation.
10. Require buildings to incorporate energy efficiency and conservation measures.
11. Introduce the concept of green design in buildings which includes solar water heating, natural lighting, ventilation, and open office design among others.
12. Promote development of standards and codes of practice on energy efficiency and conservation.
13. Develop and enforce standards for fuel economy through speed limits, efficiency of motor vehicle engines, adopting good driving and maintenance practices.
14. Raise awareness on opportunities to conserve fuel.
15. Promote mass transportation of passengers and cargo to encourage economies of scale and the attendant fuel efficiency.
16. Promote the introduction of new and efficient technologies such as hybrid engines, compressed natural gas (CNG), liquefied petroleum gas (LPG), fuel cell and electric vehicles through demonstration, research and training.
17. Prepare a National Energy Efficiency and Conservation Plan in consultation with relevant stakeholders.
18. Promote efficiency in oil refining to be in line with modern practices which minimize wastage and encourage heat recovery.
19. Promote efficiency and improvement in generation, transmission and distribution of electricity.

5.4 AGENDA FOR ACTION

5.4.1 Short Term 2012 – 2016

1. Put in place mechanism to recognize energy efficiency and conservation as a high priority energy resource and promote energy efficiency and conservation initiatives in all sectors;
2. Enhance the provision of energy audits and advisory services.
3. Develop mechanism for establishment of laboratories for energy efficiency testing.
4. Disseminate energy efficiency and conservation information to consumers.
5. Develop standards and codes of practice on cost-effective, efficient energy use.
6. Undertake necessary amendments to relevant tax legislation to provide for appropriate fiscal and other incentives to exploit energy efficiency and conservation opportunities.
7. Enact necessary legislation to require buildings to incorporate energy efficiency and conservation and introduce the concept of green design in buildings which includes solar water heating, natural lighting, ventilation and open office design among others.
8. Undertake awareness raising programmes on opportunities to conserve fuel.

9. Prepare a national energy efficiency and conservation plan in consultation with relevant stakeholders.
10. Promote efficiency in oil refining to be in line with modern practices which minimize wastage and encourage heat recovery including modernization of the refinery.
11. Framework for co-operation between regional partner states, the National and County Governments be developed to ensure that energy planning is carried out in a co-ordinated, efficient and participatory manner.
12. Develop reliable databases for all energy forms.

5.4.2 Medium Term 2012 - 2022

1. Develop and enforce standards for fuel economy through speed limits, efficiency of motor vehicle engines, adopting good driving and maintenance practices.
2. Promote mass transportation of passengers and cargo to encourage economies of scale and the attendant fuel efficiency.
3. Promote energy efficient means of transport of fuels, taking advantage of bulk transport where appropriate.
4. Promote efficiency improvement in generation, transmission and distribution of electricity.

5.4.3 Long Term 2012 - 2030

Promote the introduction of new and efficient technologies such as hybrid, compressed natural gas (CNG), liquefied petroleum gas (LPG), fuel cell and electric vehicles through demonstration, research and training.

6.0 – LAND, ENVIRONMENT, HEALTH AND SAFETY

6.1 BACKGROUND

1. Land is a critical resource in the development of energy infrastructure. However, due to competing interest in land utilization, the sector faces challenges in developing its infrastructure.
2. Environmental Management in the energy sector is key to ensuring sustainability in the energy chain. Energy production, transportation and use pose various dangers to human life and the environment. The challenge for players in energy sector is the provision of affordable, reliable and sustainable energy whilst upholding people's rights to land, environment, health and safety.
3. The Environmental Management and Co-ordination Act, No. 8 of 1999 (EMCA, 1999) is the umbrella legal framework in respect to environmental management in Kenya. Its implementing agency is the National Environmental Management Authority (NEMA). It recognises "Lead Agencies" as any Government institution in which any law vests functions of control or management of any element of the environment or natural resource. Lead Agencies therefore play an important role in enforcing compliance with its provisions.
4. The Energy Regulatory Commission is a key "Lead Agency" in the energy sector, drawing its powers from the Energy Act No. 12 of 2006 to "... formulate, enforce and review environmental, health, safety and quality standards for the energy sector, in coordination with other statutory authorities". The Act also requires that while reviewing applications for licences in the energy sector, ERC to consider, among others, the environmental and social impacts, and compliance with EMCA 1999.
5. Environmental Impact Assessment Regulations require that mitigating measures be put in place to minimise the adverse impact of energy projects. The regulations also seek to establish operations, equipment and products standards and prohibit deliberate acts of pollution in order to reduce or eliminate the human element in pollution. Therefore, comprehensive environmental impact assessments are conducted for all projects prior to their implementation to ascertain the level of potential environmental damage, the required mitigation measures as well as the associated costs.
6. Other authorities that are involved in the energy sector in terms of environment, health and safety are the Directorate of Occupational Safety and Health Services (DOSHS) under the Occupational Safety and Health Act of 2007 and the Water Resources Management Authority (WRMA) under the Water Act of 2002.
7. Vision 2030 acknowledges that land is a vital factor of production in the economy together with its aesthetic, cultural and traditional values. Some key initiatives envisioned to address environmental problems which relate to the energy sector are;
 - (a) Sustainable management of natural resources.
 - (b) Pollution and waste management.
 - (c) Disaster risk management.

- (d) Use of incentives for environmental compliance.
8. The Constitution offers protection of right to property. Energy sector players, to whom land access and utilization is critical in their operations, must be alive to this fact. In addition, Article 42 of the Constitution provides for every person's right to a clean and healthy environment. The Constitution also declares that Sustainable Development among the values and principles of governance which bind all State organs, officials and any person implementing public policy.
 9. The trans-boundary impact of environmental pollutants has necessitated international cooperation in order to prevent, minimise and mitigate pollution. A substantial portion of the risk arise from operations in the energy sector, amongst them transportation of petroleum products, disposal of hazardous waste, handling and management of radioactive materials. Several Multilateral Environmental Agreements/Treaties have been developed globally with Kenya ratifying and domesticating a number of them. The Constitution states that any treaty or convention ratified by Kenya forms part of the Laws of Kenya.
 10. Guidelines shall be developed to ensure the application and compliance of the relevant conventions in the energy sector.

6.2 ENERGY SUPPLY SIDE ENVIRONMENTAL CONCERNS

6.2.1 Electricity

The construction and operation of electricity projects have a direct impact on the quality of the environment either by the emission or discharge of pollutants, poor waste handling, or by changing the ecological systems. The degree of pollution and other ecological impacts are dependent upon the nature of the technology in use as well as the size and the general location of the plant.

6.2-2 Fossil Fuels

6.2.2.1 Exploration and Production

1. Exploration and production activities can have negative environmental impacts and therefore should be conducted in a way that protects the environment. Offshore and onshore exploration effects can be minimized by limiting the exploration duration and activities as well as employing newer technologies.

6.2.2.2 Petroleum

1. Major environment, health and safety concerns in the petroleum industry are fire outbreaks and oil spills. The country has witnessed a number of incidents involving petroleum products which have led to loss of life and property. However, these can be addressed through adoption of international best practices in handling safety concerns in the sub-sector and ensuring strict compliance and enforcement of the regulations.

2. Personnel handling petroleum products are exposed to the risks associated with inhalation of product fumes and dermal contact. These concerns can be addressed through use of high standard equipment and repeated use of personal protective equipment.

6.2.2.3 Coal

Concerns in the coal industry include emissions which contribute to global warming and acid rain. However, modern technologies among them the Clean Coal Technology (CCT) can be applied to reduce pollution significantly.

6.2.3 Renewable Energy

1. Generally, renewable energy is considered as an environmentally friendly option for energy development. However, some concerns exist raising the need for mitigation measures to be incorporated in projects to ensure minimal impact and also ensure sustainability.

6-2-3.1 Geothermal

2. Geothermal power generation involves drawing fluids at high temperature from deep in the earth. These fluids carry a mixture of gases which contribute to global warming, acid rain, and noxious smells if released. To mitigate these, the plants are equipped with emission control systems to reduce the exhaust. In addition, the practice of re-injecting these fluids into the earth in order to stimulate production helps to reduce the environmental risk.

6-2-3.2 Large Hydro

3. The major concern for hydros is the displacement of people and wildlife where a reservoir is located. Large reservoirs result in submersion of extensive areas upstream, destroying ecologically rich and productive land, riverine valley forests, marshland and grass land. Dams also have an impact on aquatic ecosystems both upstream and downstream by disrupting the reproductive cycle, e.g., fish whose spawning grounds are normally upstream. Submerged vegetation - decomposes anaerobically producing methane, a potent greenhouse gas. Other risks of hydros include dam failure which may be caused by sabotage, or structural failures, and siltation.
4. A health and safety concern with electricity grid systems and consumer installations is the danger of electrocution and electric shocks.

6-2-3.3 Biomass

5. A supply-demand imbalance in the use of biomass has negative environmental impact in the form of deforestation. It has been established that charcoal production leads to the depletion of woodlands in Kenya at the rate of 0.5 ha per annum. This is mainly because of the inefficient charcoal kilns used. In addition, the cost of the raw material (e.g. tree replacement) is generally not considered and the wood is regarded as a free good.

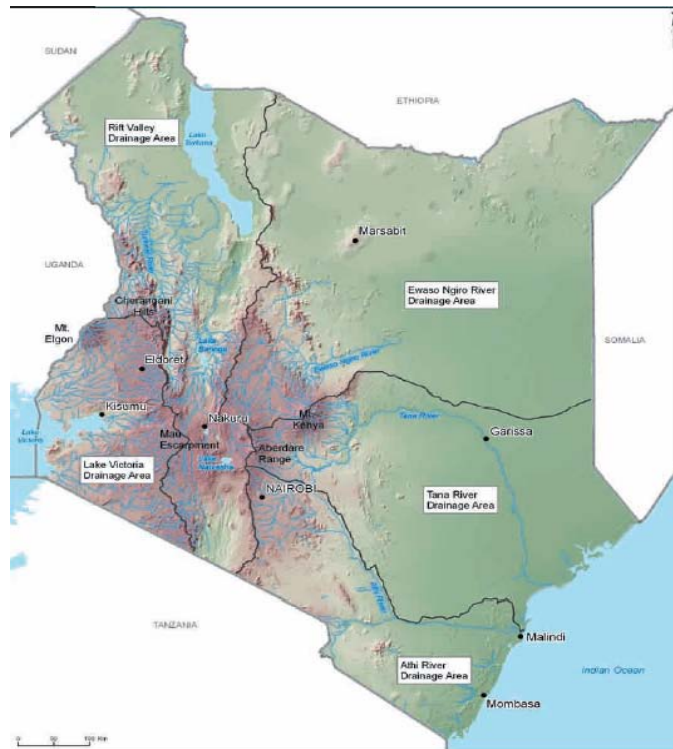
6.2.4 Nuclear Energy

1. The global, traditional challenge of nuclear energy remains the management of radioactive waste however, as a result of continued research in the area, radioactive waste management is now well within manageable levels. Spent fuel rods can either be safely stored until the radioactive levels reduce to non-toxic levels or be reprocessed and reused in generation of nuclear energy. The waste also requires special handling and storage facilities to reduce the risk of exposure to employees, the public and the environment.
2. A nuclear meltdown, or an explosion, may cause release of radioactive materials which can have a negative impact to environment, health and safety of persons. However, recent advancement in research has developed reactors that cannot melt and have an enhanced and advanced security and safety mechanisms that reduce greatly the possibility of a nuclear accident.

6.3 CONSERVATION OF CATCHMENT AREAS

1. There are five major 'water towers' in Kenya, namely: Mt Kenya, Aberdare Ranges, Mau Complex, the Cherangani Hills and Mt. Elgon as depicted in Figure 6.1, across. These water towers give rise to five drainage basins which are critical to the country's socio economic well being. Tana River and the Lake Victoria are the major basins

Figure 6.1 - The 5 Water Towers and their drainage basins



2. About 50% of Kenya's total electricity generation is from hydro power stations. Hydro power is among the cheapest and most environmental friendly sources of energy. Destruction of catchments causes heavy siltation of dams and the irregular flow of water resources which in turn leads to reduced performance of dams for hydropower generation. There is therefore an increased need to conserve the water catchment areas.

3. The Kenya Energy-Sector Environment and Social Responsibility Programme is tasked to manage and finance activities related to growing of trees in order to conserve soil and preserve catchment areas of hydropower dams.

6.4 DEMAND SIDE ENVIRONMENTAL CONCERNS

1. Solid fuels or biomass fuels are less efficient than oil, natural gas or propane. It takes larger quantities of peat, wood, or coal to do the job and they will produce larger quantities of smoke when they are burned. Solid fuels produce less heat for the amount of fuel consumed and produce more pollution. This is described as the energy ladder.

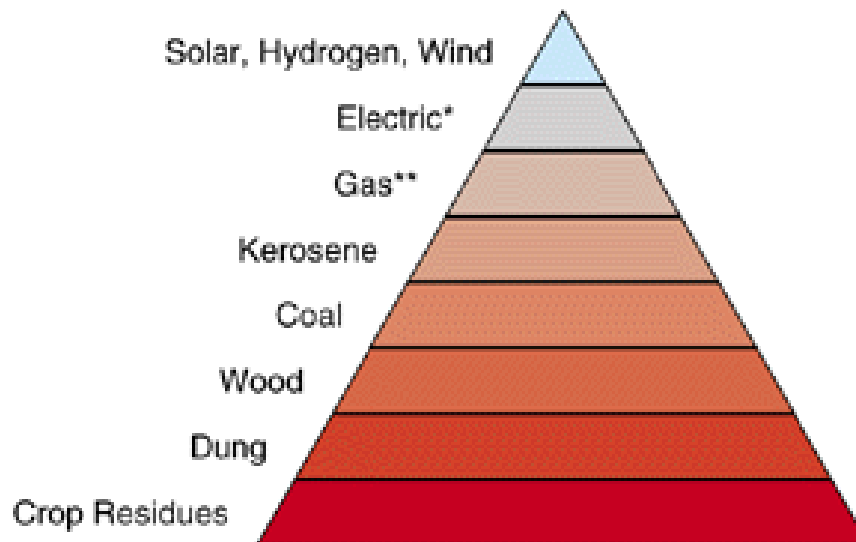


Figure: 6.2 - The Energy Pyramid² - Efficiency of Solid Fuel compared to other fuels

2. The solid fuels lead to increased indoor air pollution which leads to Upper Respiratory Tract Infections. The challenge is to move consumers up the energy ladder. Biomass which is at the bottom of energy ladder provides 60% of cooking energy needs in Kenya.

6.5 CLIMATE CHANGE ISSUES

1. Kenya is a signatory of the Kyoto Protocol, a treaty signed in 1997, to lower anthropogenic emissions of Carbon Dioxide (CO₂). However, Kenya is not among the Annex I countries which have emission reduction targets since its emissions are low as seen in Table 6.1 which compares emissions from developed (Annex I) countries and MDCs and LDCs. However, under the protocol, there are opportunities to benefit by selling Certified Emission Reductions (CERs) through the Clean Development Mechanism (CDM). Kenya has developed a National Strategy on Climate Change.

² <http://www.burningissues.org/car-www/science/Energy-ladder.html>

Table 6.1 - Comparative Energy Indicators Energy Consumption and Emissions

Category	Country	TPES/pop (toe/capita)	TPES/GDP toe/000 2000 USD	Elec. Cons./pop Kwh/capita	CO2/TPES tCO ₂ /toe	CO2/pop tCO ₂ /capita	CO2/GDP kgCO ₂ /2000 USD
Developed	USA	7.50	0.19	13,647	2.45	18.38	0.48
	UK	3.40	0.12	6,067	2.45	8.32	0.29
	Norway	6.22	0.15	24,868	1.27	7.89	0.19
	France	4.16	0.18	7,703	1.38	5.74	0.24
MDC	China	1.6	0.81	2,453	3.08	4.91	2.50
	India	0.54	0.75	566	2.30	1.25	1.73
	Malaysia	2.70	0.52	3,493	2.49	6.70	1.30
	Indonesia	4.67	0.30	589	1.94	1.69	1.56
Africa/MDC/ LDC	South Africa	2.76	0.73	4,770	2.51	6.93	1.84
	Egypt	0.87	0.49	1,425	2.46	2.13	1.20
	Ghana	0.41	1.24	268	0.78	0.31	0.96
	Kenya	0.47	1.01	156	0.48	0.22	0.48

- ✓ TPES – Total Primary Energy Supply
- ✓ Pop – Population
- ✓ MDCs – Middle Developing Countries
- ✓ LDCs – Least Developed Countries

Source: Key World Energy Statistics, 2010, International Energy Agency

2. Although Kenya has ratified the Kyoto Protocol, it has not benefited much from the Clean Development Mechanism (CDM) since potential projects have not been developed or fully made operational. Table 6.2 shows projects developed and submitted for consideration under CDM.

Table 6.2 - Projects developed and submitted for consideration under CDM in Kenya

Project Type	Investor/Buyer	Company	Estimated Annual Emission Reductions ('000 t CO2e)
35 Bagasse based Cogeneration Project	Japan Carbon Finance	Mumias Sugar Company Ltd	96.000
Sondu Miriu Hydro Power Project	Danish Carbon Fund (World Bank)	KenGen	211.068
Large scale Geothermal grid connected project	To be identified	Orpower 4	177.600
Olkaria II Geothermal Expansion Project	Community Development Fund (World Bank)	KenGen	171.026
Conversion of the Kipevu Open Cycle Gas Turbine to Combined Cycle Operation	Development Carbon Fund (World Bank)	KenGen	44.808
Redevelopment of Tana Hydro Power Station	Development Carbon Fund (World Bank)	KenGen	38.376
Optimisation of Kiambere Hydro	Development Carbon Fund (World Bank)	KenGen	38.758
6 Bagasse Cogeneration Project	Pioneer Carbon (UK)	Muhoroni Sugar Company Ltd	16.758

Source: NEMA, KFW, ERC 2011

3. With these investments, on a scale of between 100 points (highest) and 0 points (lowest) Kenya is rated to have an 'adequate' climate for CDM investment. It however needs to move from 'Satisfactory' to 'Good' categories to improve opportunities to attract investments Table 6.3 - Projects developed in Kenya for CDM investment climate index which compares the investment climate for CDM projects in Africa.

Table 6.3 - Projects developed in Kenya for CDM investment climate index (CDM ICI), Africa October 2007 (excerpt)

Position	Country	Climate Rating	Assessment
1	Tunisia	78.5	Good climate
2	South Africa	77.8	Good climate
9	Kenya	51.7	Adequate Climate
54	Somalia	4.4	Unsatisfactory climate

Source: excerpt (CDM ICI), Africa October 2007 kFW

6.6 DISASTER PREPAREDNESS AND MITIGATION

1. Natural disasters may be triggered by adverse weather and climate conditions, whereas man-made disasters may be due to sabotage, human error or technological failure. Government therefore recognises the need to establish appropriate disaster preparedness and mitigation mechanism within the energy sector.
2. The following hazards are a constant threat that must be taken into consideration in planning and management of the energy sector:

- (a) Climate and weather hazards including floods and droughts,
 - (b) Geophysical hazards including, landslides and mudflows.
 - (c) Environmental hazards including soil erosion, siltation and desertification.
 - (d) Industrial accidents, human negligence, sabotage through terrorism and other deliberate acts and infrastructural systems failure.
3. The challenges are mainly in setting up and making operational capacity for disaster preparedness, management and mitigation. However, this can be addressed through proper disaster preparedness and management mechanisms and practices.

6.7 LAND AND SOCIO-ECONOMIC IMPACTS

1. Energy development projects have various impacts on communities where the projects are implemented. Key among these is the displacement of persons in projects such as hydro power plants requiring water reservoirs, acquisition of way leaves during construction of transmission lines and pipelines. Others include the concern by local communities that they will not benefit from these projects.
2. The challenges are :
 - (a) Absence of a Resettlement Action Plan Framework. Currently, all projects receiving support by World Bank or IFC are required to develop RAPs. These should be replicated for all projects and a national framework developed.
 - (b) Absence of a proper compensation mechanism for local communities in line with the requirement of the Constitution of Kenya 2010.
 - (c) Acquisition of land: difficulty in the acquisition of way leaves, rights of way and easements to facilitate energy infrastructure development is an impediment to fast tracking the improvement and upgrading of the energy systems.
 - (d) Vandalism of energy sector infrastructure continues to cause immense losses as well as energy supply interruption.
 - (e) The need to enhance regional, gender and environmental considerations in energy planning and development.
 - (f) Land access and permit where exploration blocks fall on private land or cultural heritage areas including game parks/reserves.

6.8 POLICIES AND STRATEGIES

6.8.1 Land and Socio-Economic Issues

1. The National Government shall ensure that planning for utility services and public/private infrastructure under Article 60(2), Article 66 (1) and the Fourth Schedule of the Constitution include planning for energy utility services namely way-leaves, infrastructure development, transmission, distribution and pipeline corridors.

2. The Proposed Energy Bill shall make provision for waivers in respect to any charges for utilization of resources owned by other public bodies critical to the development of energy infrastructure and service provision such as way-leaves, easements and rights of way. Any compensation for interest in land under Article 40 of the Constitution shall be at market rate as determined by a registered land valuer where there is no dispute. However, where there is a dispute, the Government valuer(s) shall provide opinion to ensure uniformity and fairness.
3. The proposed Bill shall make provision for the National Government to determine rates payable for compensation in respect of damage caused by the energy sector players including clearing way leaves among others.
4. The Cabinet Secretary in charge of energy shall seek for amendment/repeal any legislation that impacts negatively on the energy sector.
5. The Proposed Bill shall allow the right of access to survey and use of land for energy infrastructure development purposes including but not limited to prospecting for petroleum, gas and coal production, storage, transmission, laying of petroleum pipelines and electricity distribution infrastructure, dams and geothermal development.
6. Where energy infrastructure and ancillary apparatus are removed, the surface of the land shall forthwith be restored to its former condition as far as possible and in default thereof restoration may be carried out by the owner of the land, and the costs thereof shall be recoverable from the licensee. This provision currently covers the electricity sub sector and it is proposed that it is expanded to cover all other sub sectors.
7. Make a provision for repairing damage or loss caused by a licensee's operations in respect to laying of energy infrastructure in accordance with Article 70. This provision currently covers the electricity sub sector and should now be expanded to cover all other sub sectors.
8. A provision be made for gazettelement/de-gazettelement of all land held by public entities utilized/owned for energy infrastructure by Cabinet Secretary.
9. Introduce a section that allows a licensee to erect, install, break up or lay energy infrastructure and ancillary apparatus upon, under, over or across any public streets, road, railways, tramways, rivers, canals, harbours, game parks, water ways, forests or Government property, in the manner and on the conditions as will be provided and may, from time to time. A licensee should repair, alter or remove any such infrastructure and ancillary apparatus so erected, laid or constructed, provided that the person having the control of such street shall have a prior right to break up and repair such street with reasonable dispatch upon payment to him of a reasonable charge by the licensee.
10. The Proposed Bill shall provide that whenever a licensee carries out any work authorized by this section, he shall comply with the regulations or by-laws, if any, of the County Government or local authority concerned and shall complete that work within reasonable time and reinstate the street broken up and remove any debris or rubbish occasioned thereby and shall, while the street is broken up or obstructed, cause the works to be, at all times, fenced and guarded and

during the night, adequately lit. This provision currently covers the electricity sub sector and should now be expanded to cover all other sub sectors.

11. The Proposed Bill shall provide that where a public institution in the energy sector requires the compulsory acquisition of land for use, the public institution may apply to the Cabinet Secretary in charge of Energy to acquire the land on its behalf.
12. The Proposed Bill shall provide for the right in cases of emergency to clear obstructions to energy infrastructure installations by any licensee in the energy sector. Where necessary, the entity can obtain an order from the Energy Tribunal allowing for access to the area under Kenya Police Service supervision. This provision currently covers the electricity sub sector and shall be expanded to cover all other sub sectors.
13. The Proposed Bill shall provide that all County Governments shall set aside suitable land for energy infrastructure development purposes, including but not limited to projects recommended in the indicative National Energy plans.
14. The proposed Energy Bill shall provide for the following offenses:
 - (a) Illegal acquisition of interest in public land set aside for energy infrastructure projects from encroachment/grabbing and includes punitive penalties for either offence;
 - (b) Trespass on or encroachment of energy installations, infrastructure and wayleaves, wayleaves trace infringement in respect of blasting, quarrying, dumping of materials, structures erection and any other activity that compromise distribution services.
15. The Government shall develop a Resettlement Action Plan Framework for energy related projects.
16. The proposed Bill shall provide for access to land where exploration blocks fall on private land or cultural heritage areas including game parks/reserves;

6.8.2 Environment Health and Safety

1. The Proposed Energy Bill shall provide for procedure for enforcement of environmental rights under Article 70 and specifically provide for notification of breach and giving time to remedy the breach.
2. The Principle of sustainable development as provided for under Article 10 (2)d of the Constitution be incorporated in the Proposed Energy Bill;
3. The Government shall support the development and implementation of Environmental Impact Assessment (EIA) guidelines for the energy sector.
4. The Government shall facilitate the development of standards for equipment, products, protective equipment, facilities and operating practices in the energy sector to ensure safe operations in the sector. Where local standards are lacking, international standards shall apply.

5. The proposed Bill shall provide for measures aimed at facilitating consumers to move up the energy ladder including zero rating tax on LPG appliances, construction of import handling facilities for LPG, and introduction of cleaner fuels and technologies.

6.8.3 Climate Change

The National Government shall;

1. Ensure that the energy sector is well represented in international climate change negotiations to improve the investment climate for CDM projects.
2. Ensure that the proposed National Energy Institute undertake research in the energy areas that advance clean energy technologies and invest in RD&D in renewable technologies such as cogeneration, geothermal, wind, solar, small hydro and biomass.

6.8.4 Electricity

1. The National Government shall put in place mechanisms to mitigate negative effects of generation, transmission and distribution of electricity.
2. The National Government will encourage the use of electric trains, trams and cars.

6.8.5 Fossil Fuels

1. The Government shall ensure the modernisation of the refinery to ensure it produces petroleum product specifications that meet international standards.
2. For coal development, the Government shall require the use of Clean Coal Technology (CCTs) which reduces pollution significantly.
3. The Government shall implement an integrated road/rail transport network that facilitates efficient and safe mobility and promote efficient mass transport systems.
4. The Government shall carry out rapid urban air quality assessments. These are cost effective and shall identify key problem sectors/areas that need to be prioritized in tackling air pollution.
5. The Government shall develop strategies to reduce transport emission. These will include:
 - (a) The adoption of low sulphur fuels and clean vehicles programs within the timelines agreed by Ministers at the Better Air Quality Regional Meetings. This means AFRI-2 or better immediately and AFRI-4 or better by 2020.
 - (b) Setting up/revamping their vehicle emission inspection and maintenance programs for the existing vehicle fleet.
 - (c) Banning the importation of two stroke motorcycles.
6. Enforcement of supply of clean fuels in accordance with specifications in the Standards.
7. The Government shall ensure dissemination of standards, provide public sensitization on dangers of vehicle emissions and promote choice towards clean fuels and vehicles, public transport and non-motorized transport.

6.8.6 Renewable Energy

1. The Government shall actively support and promote the uptake of renewable energy technologies.
2. To ensure sustainable production and use of wood fuel resources, the Government shall ensure promotion of modern production technologies, introduce a regulatory framework for wood fuel and support commercial woodlots. In addition, the Government shall support forest policy aimed at increasing the tree cover to 10% and above.

6.8.7 Nuclear Electricity

For nuclear development, the Government shall ensure compliance with international standards for plant siting, construction, operation and decommissioning and waste management, to ensure proactive preventive approach to managing the environment, health and safety risks.

6.8.8 Conservation of Catchment Areas

The Government shall support conservation initiatives and ensure proper coordination. In addition, it shall ensure effective management of the catchment areas to safeguard both the installed capacity and potential power generation sites.

6.8.9 Disaster Prevention and Management

1. The general safety approach and design philosophy based on risk reduction and mitigation of adverse climate effects shall be the long-term basis for development and investment criteria in the energy sector. Using climate, weather information and data, the maximisation of safety factor for hydro dams, power stations, geothermal power stations, fuel oils depots, and petroleum production areas should be taken on board in all future developments especially in areas considered of high risk and high hazard rating.
2. The concept of resilience: that is the ability at every relevant level to detect, prevent, and, if necessary, to handle disruptive challenges while minimising damage to infrastructure, the environment and loss of life. In view of the above, the following broad policy measures will be undertaken by all the energy sector entities:
 - (a) Incorporation of disaster preparedness and mitigation into energy policy and management planning.
 - (b) Establishment of early warning systems in all energy production and delivery systems and networks.
3. The proposed Energy Bill shall provide for the:
 - (a) Disaster Response Unit at the Ministry of Energy to coordinate with the National Disaster Operations Centre (NDOC) on disasters in the energy sector.
 - (b) Disaster prevention and mitigation units in the energy entities. The ERC shall enforce this requirement through licensing and other regulatory tools.

- (c) Creation of a Disaster Prevention and Management Fund in coordination with other relevant government agencies to be managed by the ERC to cater for compensation arising out of environmental damage.
 - (d) Mandatory taking out of an environmental liability policy by entities in the sector.
 - (e) County Governments to set up disaster management units to coordinate disaster management in co-ordination with the National Disaster Operations Centre and the ministry responsible for energy on disaster prevention and response.
 - (f) Establishment of functional hazard monitoring systems for feedback purposes.
 - (g) Mainstreaming weather and climate data and information to the sector's core activities.
 - (h) Undertaking of deliberate and coordinated training and education programmes to develop the capacity to understand the relationships between climate early warning products and services and be able to relate the same to disaster preparedness activities.
 - (i) Supporting the development and operationalization of a Control of Major Hazard Facilities Framework.
 - (j) A section be introduced that enhances petroleum depots safety by prohibiting the parking of a petroleum tanker in an oil terminal/depot for more than one hour after loading.
 - (k) All County Governments to designate parking lots for petroleum tankers and prescribing a fine for non-compliance by a County of one million shillings.
 - (l) Full clearance of all way leaves to prevent occupation and potential disaster including reallocation of existing occupants to prevent encroachment.
4. In instituting the above measures and strategies, emphasis will be focused in specific measures that will enhance risk reduction and vulnerability. Consequently, the following strategies will be used for risk reduction and vulnerability:
- (a) Information Base: The sector will develop information and a database on weather and climate factors at national level and at specific site levels. Specific sites here refer to sites that continually understudy the interaction between weather and climate on the system and other stress monitors that relay vulnerability. One important factor here is accuracy of information and reliability.
 - (b) Risk zoning: Zoning and mapping of the risky areas help in enhancement of evaluation of risk and vulnerability. Risk mapping shall be a continuous exercise updating risk assessment results in the maps and subsequent zoning of the risk levels.
 - (c) Disaster response plans: Using the information on climate and weather and risk prone points of a system, detailed disaster response plans are a vital link in reduction of risk and vulnerability. The plans shall include rapid reaction activity plans and initial attack or emergency steps.

(d) Disaster plans and costing centres: Updated and well-maintained disaster management plans are necessary as a strategy for reduction of risk and vulnerability

5. The Government shall develop mechanism for security of energy installations.

6.9 AGENDA FOR ACTION

6.9.1 Short Term 2012- 2016

Land

1. Align all energy projects with the National Land Policy which provides a framework for access to planning and administration of land in the country. National Land Commission to ensure that planning for utility services and public/private infrastructure under Article 60(2), Article 66 (1) and the Fourth Schedule of the Constitution includes planning for energy utility services including way-leaves, infrastructure development corridors.
2. Develop a Resettlement Action Plan Framework for energy related projects.
3. Develop a proper mechanism for benefits sharing and compensation for local communities in line with the requirement of the Constitution of Kenya 2010.
4. The Government shall support the ongoing conservation initiatives. In addition, efforts to improve, ensure accountability, and improve on synergies shall be initiated to ensure effective management of the catchment areas so as to safeguard both the installed capacity and potential power sites of power generation.
5. Full acquisition of all way leaves to prevent occupation and potential disaster including reallocation of existing occupants to prevent encroachment.

Environment

1. Enhance sectoral, regional, gender and environmental considerations in energy planning and development.
2. Develop and implement Environmental Impact Assessment (EIAs) guidelines for the energy sector. In addition, the Environmental Management Plans developed through EIAs should be enforced.
3. Promote the development, commercialization and widespread utilization of renewable energy technologies.
4. The Government shall support database development, impact analysis and cost-benefits analysis through research and other related institutions that shall input into policy development.
5. The Government shall actively support and promote the uptake of renewable energy technologies which are more environmental friendly. However, the appropriate mitigation measures shall be put in place to ensure minimal impact where this may arise, e.g., siting, collection of data, and improvements of design of the generators and rotors for wind projects.
6. Provide for the mandatory environmental liability policy by entities in the sector.

7. Mainstream weather and climate data and information to the sector's core activities.
8. Promote the information base for energy sector about weather and climate factors at national level and at specific site levels. Specific sites here refer to sites that continually understudy the interaction between weather and climate on systems and other stress monitors that relay vulnerability.
9. Promote disaster response plans using the information on climate and weather and risk prone points of systems. The plans shall include rapid reaction activity plans and initial attack or emergency steps.

Health

1. Implement measures aimed at facilitating consumers to move up the energy ladder, e.g., zero rating tax on LPG appliances, construction of import handling facilities for LPG, introduction of cleaner fuels and technologies, including Liquefied Natural Gas, biogas, and Compressed Natural Gas.
2. Support the implementation of Environment Health and Safety Management Systems (EHSMS) in all energy related facilities.
3. Promote the development of appropriate local capacity in the manufacture, installation, maintenance and operation of basic renewable technologies such as biodigesters, solar water heating systems and hydro-turbines.
4. Support the modernisation of the refinery to ensure it produces petroleum product specifications that meet international standards. This includes the current plan to reduce the sulphur level in diesel from 5000 ppm to 50 ppm.
5. The Government shall carry out rapid urban air quality assessments. These are cost effective and shall point policy makers to the key problem sectors/areas that need to be prioritized in tackling air pollution. The link between the use of high sulphur fuels and impact on health shall be established and appropriate measures undertaken.
6. The Government shall develop short and long term strategies/road maps to reducing transport emission. These will include:
 - (a) Enforce supply of clean fuels in accordance to specifications in Standards.
 - (b) Support the role of civil society in dissemination of standards, providing public sensitization on dangers of vehicle emissions and to promoting choice towards clean fuels and vehicles, public transport and non-motorized transport.
7. Promote the concept of resilience: that is the ability at every relevant level to detect, prevent, and, if necessary, to handle disruptive challenges while minimizing damage to humans, infrastructure and the environment is to be instituted into the energy production and delivery systems. In lieu of the above this, the following broad policy measures will be undertaken by all the energy sector investments:
 - (a) Establish functional hazard monitoring systems for feedback purposes

(b) Support the development and operationalization of a Control of Major Hazard Facilities Framework.

Safety

1. Enhance and strictly enforce penalties for vandalism of energy sector infrastructure which continue to cause immense losses as well as energy supply interruption.
2. Support the development of standards for equipment, products, protective equipment and operating practices, and facilities, in the energy sector etc to ensure safe operations in the sector. Where local standards are lacking, international standards shall apply.
3. The general safety approach and design philosophy based on risk reduction and mitigation of adverse climate effects shall be the long-term basis for development and investment criteria in the energy sector. Using climate and weather data and information the maximisation of safety factor for energy infrastructure such as dams, power stations, geothermal power stations, fuel oils depots and petroleum production areas should be taken on board in all future developments especially in areas considered high risk and for high hazard rating.
4. Incorporate disaster preparedness and mitigation into energy policy and management planning.
5. Establish early warning systems in all energy production and delivery systems and networks.
6. Create disaster management and response units.
7. Put in place a well-coordinated central command linked to all vulnerable areas of the sub-sectors systems and networks.
8. Undertake deliberate and coordinated training programmes to develop capacity to understand the relationship between climate early warning systems and how they relate to disaster preparedness activities.
9. Amend section 99 of the Energy Act to require all County Governments to designate parking lots for petroleum tankers and prescribing a fine for non-compliance by a County of one million shillings for failure to designate such parking.
10. Promote risk zoning and mapping of the risk areas to help in enhancement of evaluation of risk and vulnerability. Risk mapping be a continuous exercise for updating risk assessment results in the maps and subsequent zoning of the risk levels.

6.9.2 Medium Term 2012-2022

Land

1. Promote research into efficient methods of conversion of wood and agricultural waste (coffee husks and used tea leaves).
2. Invest in research on the production chain and sustainability of biofuels particularly biodiesel.

Environment

1. Recognize and/or Ratify all treaties and international conventions affecting the energy sector under Article 2(6) of the Constitution in the proposed Bill.
2. Invest in RD&D in renewable technologies such as cogeneration, geothermal, wind, solar, small hydro and biomass including conversion of wood and agricultural waste into energy.
3. Promote energy efficiency and conservation measures.
4. Initiate measures to increase carbon sinks, for example through afforestation.

Health

1. The Government shall support the role of civil society in dissemination of standards, providing public sensitization on dangers of vehicle emissions and promoting choice towards clean fuels and vehicles, public transport and non-motorized transport
2. Promote non-motorised transport.

Safety

Promote risk zoning and mapping of the risk areas to help in enhancement of evaluation of risk and vulnerability. Risk mapping be a continuous exercise for updating risk assessment results in the maps and subsequent zoning of the risk levels.

6.9.3 Long Term 2012 -2030

Environment

1. Undertake research in energy research areas that together with the transfer from and absorption of the advanced and clean energy technologies of developed, industrialized countries, will enable it avoid a high-emissions path:
2. Invest in RD&D in renewable technologies such as cogeneration, geothermal, wind, solar, small hydro and biomass.
3. Invest in research on the production chain and sustainability of biofuels particularly biodiesel.
4. Promote energy efficiency and conservation measures.
5. Educate the public and entities/industry to reduce their carbon foot print.
6. The Government shall support the practice of re-injecting geothermal fluids into the earth in order to stimulate production helps to reduce the environmental risk in geothermal projects. Geothermal power plants should also be equipped with emission control systems to reduce exhausts such as carbon dioxide, hydrogen sulphide, methane and ammonia.
7. Enforce adoption of low sulphur fuels and clean vehicles programs within the timelines agreed by Ministers at the Better Air Quality Regional Meetings. This means AFRI-2 or better immediately and AFRI-4.

8. The Government shall ensure promotion of modern production and use of new technologies, introduction of a regulatory framework for wood fuel including charcoal and also support commercial woodlots. In addition, the Government shall support forest policy aimed at increasing the tree cover to 10% and above.

Health

1. Enforce the use of modern technology dubbed the Clean Coal Technology (CCT) which reduces pollutants significantly. Other measures shall include the adoption of cleaner production methods.
2. Set up/revamping their vehicle emission inspection and maintenance programs for the existing vehicle fleet.
3. Ban the importation of two stroke motorcycles.

Safety

1. Encourage research to establish the risk of Electromagnetic Radiation associated with transmission lines.
2. Implement an integrated road transport network that facilitates efficient and safe mobility.
3. For nuclear development, the Government shall ensure compliance with international standards for plant siting, construction, operation, decommissioning and waste management, to ensure proactive preventive approach to managing the environment, health and safety risks.

7.0 - DEVOLUTION AND ACCESS TO ENERGY SERVICES

7.1 BACKGROUND

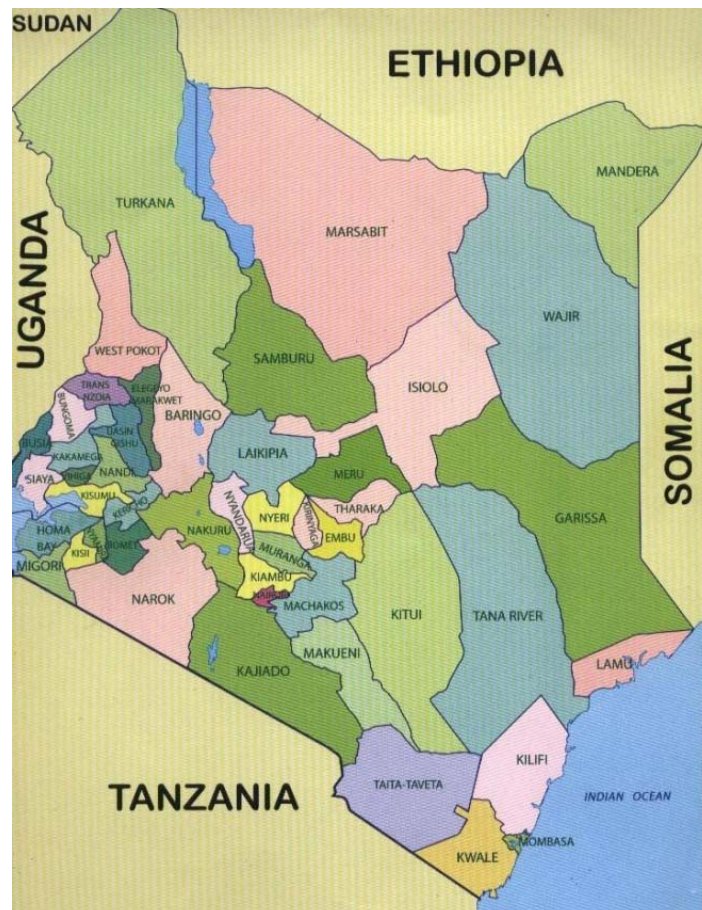
- 1 The Constitution has created significant changes in governance structures within the country especially in relation to administrative, resource allocation and service delivery functions. It has introduced two levels of government i.e. the National and County Governments and further provided for the distribution of functions and powers between the two levels, *inter alia*, under Articles 185(2), 186(1) and 187(2).
- 2 Each County government will have a Legislature and an Executive. It is noted under Article 6, that although the two levels of government are distinct and inter-dependent, they are required to conduct their mutual relations on the basis of consultation and co-operation.
- 3 In the energy sector, the National Government will be responsible for energy policy whereas the County Governments will be responsible for planning and development within their jurisdictions. These functions include electricity and gas reticulation and energy regulation.
- 4 As set out under Article 174 of the Constitution, the objects of devolution of government are to:
 - (a) Promote democratic and accountable exercise of power.
 - (b) Foster national unity by recognising diversity.
 - (c) Give powers of self-governance to the people and enhance the participation of the people in the exercise of the powers of the State and in making decisions affecting them.
 - (d) Recognise the right of communities to manage their own affairs and to further their development.
 - (e) Protect and promote the interests and rights of minorities and marginalised communities.
 - (f) Promote social and economic development and the provision of proximate, easily accessible services throughout Kenya.
 - (g) Ensure equitable sharing of national and local resources throughout Kenya.
 - (h) Facilitate the decentralisation of State organs, their functions and services, from the capital of Kenya.
 - (i) Enhance checks and balances and the separation of powers.
- 5 Further, under Article 175, County Governments established under the Constitution shall reflect the following main governance principles:
 - (a) County Governments shall be based on democratic principles and the separation of powers.
 - (b) County Governments shall have reliable sources of revenue to enable them to govern and deliver services effectively.
 - (c) No more than two-thirds of the members of representative bodies in each county government shall be of the same gender.

- 6 It is a further requirement under Article 176 (2) that every County government decentralise its functions and the provision of its services to the extent that it is efficient and practicable to do so.
- 7 Under Article 202 (1), the Constitution further requires that Revenue raised nationally be shared equitably among the national and county governments. Under Article 202 (2): County governments may be given additional allocations from the national government's share of the revenue, either conditionally or unconditionally.
- 8 Article 191 provides for the resolution mechanisms and co-operation arrangements where there are conflicts between national and county laws in respect of matters falling within the concurrent jurisdiction of both levels of government. The proposed sharing of activities between the national and County Governments is discussed in section 7.5.

7.2 KENYA AND ITS 47 COUNTIES

- 1 Under the Constitution, Kenya has been divided into 47 counties as detailed in Figure 7.1.

Figure 7.1 – Kenya and its 47 Counties



- 2 The status and challenges of energy services in the 47 counties are very diverse and are summarized Table 10.2 in 10.0 - Annextures.

7.3 ACCESS TO ENERGY SERVICES BY COUNTY

It is estimated that worldwide, 1.456 billion people do not have access to electricity, out of which 83% live in rural areas. In Sub-Saharan Africa only 12% of the rural populations have access to electricity compared to the average of 35% - 40% for the developing world. In Kenya, it was estimated by 2003 that about 4% of the population had electricity connection in their homes; and this figure was estimated to have risen to about 22% by 2010.

7.4 CHALLENGES

- 1 Despite the fact that the Fourth Schedule of the Constitution provides for the various roles of the two levels of the government, there is a possibility of operational uncertainty as to the extent of responsibility between the two levels of governments.
- 2 There is no framework for devolution of functions within the energy sector to ensure service continuity nor standards to guide County governments on devolved responsibility.

7.5 POLICIES AND STRATEGIES

- 1 A framework on the functional devolution of roles between the two levels of government will be developed in consultation with all stakeholders to avoid the uncertainty/overlap of responsibilities.
- 2 Fifteen percent of royalty due to the National government from specific county resources developed by energy sector players be paid to the specific County government and five percent to the specific local community.
- 3 Minimum standards shall be developed to guide County governments on devolved responsibilities in the energy sector.
- 4 Some of the licensing services will be systematically devolved to the County governments as detailed in Table 10.3 in **10.0 - Annexure**.

8.0 - ENERGY FINANCING, PRICING AND SOCIO-ECONOMIC ISSUES

8.1. BACKGROUND

1. The funding required for the energy sector is substantial. New investments are needed for exploration, exploitation, generation, transmission and distribution activities. Long-term financing options that involve both foreign and domestic financing resources are required. However, foreign investment capital and national foreign earnings provide the greater proportion of needed funds.
2. The government shall continue to encourage private sector investments in the energy sector.
3. To attract foreign investment in the energy sector, certain necessary conditions would have to be met. Experience has shown that Independent Power Producers (IPPs) require incentives to mitigate the perceived political and economic risks.

8.2. CHALLENGES

1. Inadequate funding for the energy sector.
2. Lack of continuity in the funding of projects in the energy sector.
3. Low foreign investment from a highly competitive international finance market.
4. Partial adoption of the most cost- effective energy supply options for the country.
5. Low foreign exchange earnings through export of energy products.
6. Inadequate local development of energy technologies.

8.3. POLICIES AND STRATEGIES

1. The Government shall explore and adopt all viable financing options from local and international sources for cost effective exploitation of its energy resources.
2. Investments in the energy sector shall be accorded high priority within the economy.
3. The Government shall continue to provide financial support for energy infrastructure development.
4. Provision of incentives for renewable energy projects so as to reduce the cost of expensive petroleum based energy in the long term.
5. The National government will grant the following tax incentives for energy expansion projects:
 - (a) Fifteen (15) year income tax holiday for hydroelectric projects whose installed capacity will not be less than 50MW ; 10 years for projects of between 20MW and 49MW , and 7 years for those below 20MW but not less than 1MW.
 - (b) Fifteen (15) year tax holiday for geothermal plants.

- (c) Ten (10) year tax holiday for fossil fuel power plants of at least 50MW, 7 years for plants of between 30MW and 49MW and 5 years for plants between 10MW and 29MW.
 - (d) Ten (10) year tax holiday for power plants using renewable energy including biomass.
 - (e) Seven (7) year tax holiday on dividend income from investments made from domestic sources.
6. Income tax exemption on interest incomes to domestic creditors with repayment periods of at least seven (7) years, to entities engaged in energy production, transmission and distribution for the duration of their loans.
 7. Exemption of withholding tax on interest incomes to foreign creditor with repayment periods of at least seven (7) years, to entities engaged in energy production, transmission and distribution for the duration of their loans
 8. Provide for high import duty for non efficient energy technology while zero-rating efficient technologies.
 9. Allow procurement of plant, equipment and related accessories for generation and transmission projects free of duty and taxes during project implementation. Procurement of major parts for the power plants, transmission and distribution systems and materials shall also be exempted from duty and taxes.
 10. Become a joint venture partner in situations where the IPPs will be unwilling to participate in hydropower development without Government participation due to perceived project risks.
 11. Exempt public electricity suppliers from income tax subject to expanding the network at a cost equivalent to foregone income tax in the preceding year on annual basis. The ERC will monitor compliance and report back to the cabinet secretary in-charge of Finance on the amounts spent annually. In the event that such amounts are less than the foregone income taxes the same will be liable for collection as income tax and treated as late payment attracting appropriate penalties under the Income Tax Act, (Cap 470).
 12. Grant income tax holiday to investors in new refining facilities for a period of between 5 and 10 years depending on size of investment.
 13. Dedicating a certain percentage of the nation's income from conventional energy sub-sector to support training, research, development demonstration and technology acquisition in the energy sector.
 14. Providing fiscal incentives for prospective investors in the energy sector.
 15. Reviewing the existing laws and regulations for the operation of energy sector industries so as to increase private sector participation in the industries.
 16. Ensuring a reasonable return on investments through cost-effective energy pricing.

17. Establishing guaranteed and dependable repayment schemes for loans invested in energy projects.

8.4. ENERGY FINANCING OPTIONS

1. Establishing a favourable investment climate to attract investments in the energy sector.
2. Providing adequate infrastructural facilities to enterprises involved in the development of the energy sector.
3. Encouraging energy firms to source development funds from the capital market, Retirement Benefits Schemes (RBS), Savings and Credit Cooperative Societies (SACCOs) etc.
4. Furthering the internationalization of Kenya's Capital Market by encouraging financial instruments and stocks of Kenya's energy corporate units to be quoted in international financial markets to attract foreign portfolio investment capital.
5. Expanding the scope of venture capital financing to embrace investments in the energy sector.
6. Establish a fund under the Exchequer and Audit Act, (Cap 412) to finance pre-development studies including geothermal resource, hydro power, petroleum, coal and other sources of energy.
7. Review the Income Tax Act, (Cap 470), the Customs and Excise Act, (Cap 472) and the Value Added Tax Act (Cap 476) to provide fiscal incentives in the energy sector.
8. Provision of letters of comfort to Independent Power Producers (IPPs) and letters of guarantee to state corporations covering political risks.
9. Encourage development partners to establish facilities for financing energy related projects especially renewable energy and energy efficiency projects.
10. Waive duty on renewable energy power generation equipment such as solar equipment.
11. Introduce tax concessions to encourage adoption of clean and efficient coal technologies.
12. Provide incentives to attract investment in oil retail networks in the remote areas of the country.
13. Seek financing of clean energy projects through carbon credits under clean development mechanism (green energy) and other financing associated with clean energy.
14. The Government to provide incentives for private investors intending to develop private ports with container terminals, gas terminals and oil jetties with storage facilities.
15. Package attractive investment instruments which will be appealing to other investors such as pension schemes and investment co-operative societies.

8.4.1 Consolidated Energy Fund

1. The Government shall set up a consolidated Energy Fund to cater for the following:-

- (a) Establishment and operations of the proposed National Energy Institute.
 - (b) Acquisition of strategic petroleum reserves and the construction of the appropriate infrastructure.
 - (c) Assist in energy sector environmental disaster mitigation and response.
 - (d) Hydro risk mitigation during times of prolonged drought.
 - (e) Geothermal risk mitigation fund for underwriting risks in geothermal power development including dry wells, well and plant contamination and platform collapse.
 - (f) Water towers conservation programmes.
 - (g) Energy efficiency and conservation programmes.
 - (h) Promotion of renewable energy initiatives.
2. The sources of the money for this energy fund will be as below:
- (a) Levies and license fees in the energy sector.
 - (b) Penalties and fines relating to offences in the energy sector as levied by ERC and the Energy Tribunal.
 - (c) Contribution from energy sector players.
 - (d) Contribution from Treasury.
 - (e) Raising funds through the stock market (bonds and bills).
 - (f) Recovered assets from proceeds of corruption and economic crimes in the energy sector.
 - (g) Allocation from levies charged by various statutory bodies including WRMA, TARDA, KVDA etc.

8.4.2 Agenda for Action

1. Establish a Consolidated Energy Fund to be administered by Trustee comprised of representatives from the industry players.
2. Establish eligibility criteria for the access to and utilization of the Consolidated Energy Fund.
3. Create an Environmental Disaster Response Fund in coordination with other relevant government agencies and industry players to be managed by the ERC to cater for compensation arising out of environmental damage.
4. Establish a fund under the Exchequer and Audit Act, (Cap 412) to finance pre-development studies including geothermal resource assessment, hydro power, nuclear energy, petroleum, coal and other sources of energy.
5. Review the Income Tax Act, (Cap 470), the Customs and Excise Act, (Cap 472) and the Value Added Tax Act, (Cap 476) to provide the following fiscal incentives:

- (a) Fifteen (15) year income tax holiday for hydroelectric projects whose installed capacity will not be less than 50MW; 10 years for projects of between 20 and 49, and 7 years for those below 20MW but not less than 1MW.
 - (b) Ten (10) year tax holiday for geothermal and fossil fuel power plants of at least 50MW, 7 years for plants of between 30 and 49MW and 5 years for plants between 29 and 10MW.
 - (c) Ten (10) year tax holiday for power plants using renewable energy including biomass.
 - (d) Seven (7) year tax holiday on dividend income from investments made from domestic sources.
 - (e) Income tax exemption on interest incomes to domestic creditors including commercial banks and institutional investors extending loans, with repayment periods of at least seven (7) years, to companies engaged in power generation, transmission and distribution for the duration of their loans.
 - (f) Allow procurement of plant, equipment and related accessories and spare parts for generation transmission and distribution projects free of duty and taxes during project implementation.
6. Access rural energy global fund under United Nations Framework convention on climate change.

8.5. ENERGY PRICING AND SOCIAL ECONOMIC ISSUES

Net domestic sales and consumption of petroleum fuels by consumer category have witnessed a gradual increase in the last five years. The sales recorded an increase of 4.3 percent between 2009 and 2010. A similar trend was observed over the same period for electricity for which consumption grew by 6%.

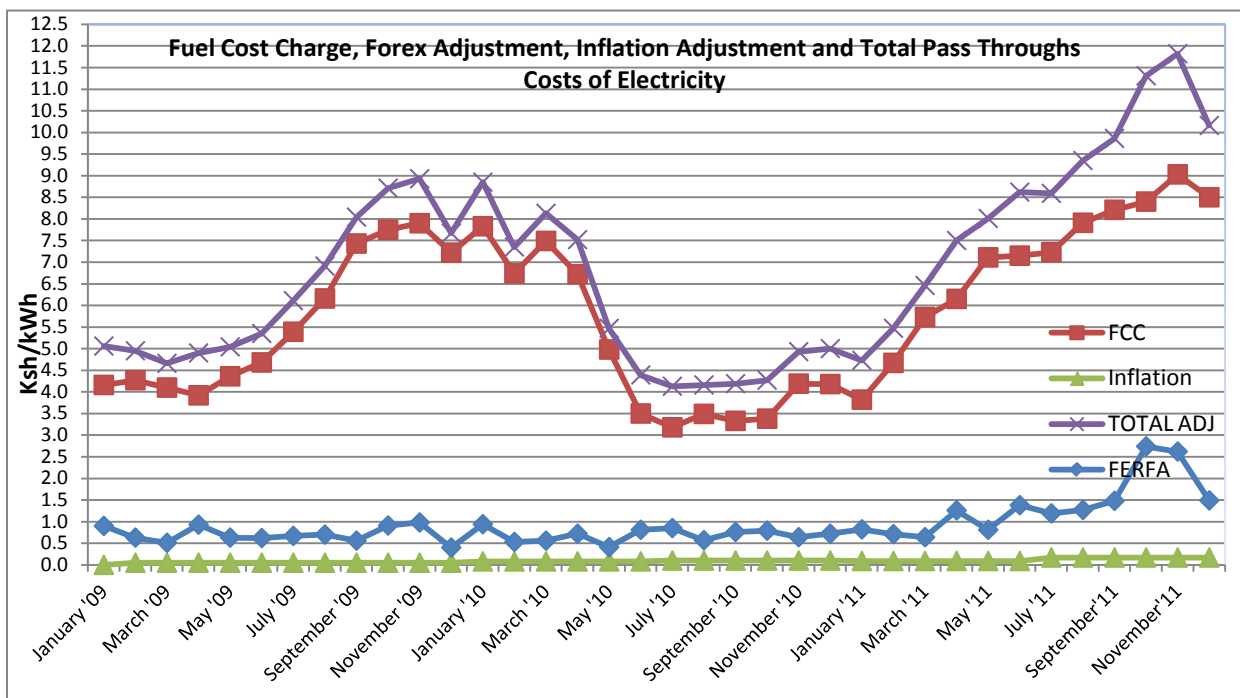
8.5.1 Energy Pricing

Electricity

1. Electricity Pricing in Kenya is based on a Long Run Marginal Cost (LRMC) of supply principle. The consumer tariffs contain a component of power generation investment requirements in the short and medium term.
2. The power tariffs are regulated by ERC and managed through PPA's between generators and the offtaker (Bulk Tariff). Consumer tariffs on the other hand are approved and regulated by ERC for all customer categories. Tariffs provide for prudent investment and operation costs as well as a return on investment for both generators and distributors. A provision exists for review of the tariffs every three years to cater for changes in the operating environment.
3. Fuel costs and exchange rates gains/losses are pass-through costs in the current regime. These account for power cost variations in the event of fluctuation in the international crude oil prices as well as volatility for the Kenya shilling against foreign currencies, mainly the US dollar.

4. Thermal generation in 2011 accounted for 35% of power supply thus increasing the exposure of power price volatility due to the use of imported petroleum.
5. The increase in cost of petroleum products also leads to an increase in the cost of electricity. Figure 8.1 shows the trend of total pass through costs of electricity tariffs mainly which are Fuel Cost Charge adjustment (FCC), Foreign Exchange Fluctuation Rate (FERFA) and Inflation adjustment. These are directly or indirectly affected by crude oil price fluctuation. The total pass-through costs have often been above the Non-fuel tariff which range between 2.00 to 8.96 kshs/kwh. The increase in Fuel Cost Charge has been fuelled by the increase in international prices of petroleum products coupled with enhanced use of emergency power as a result of poor hydrology which reduced hydro electric power capacity.

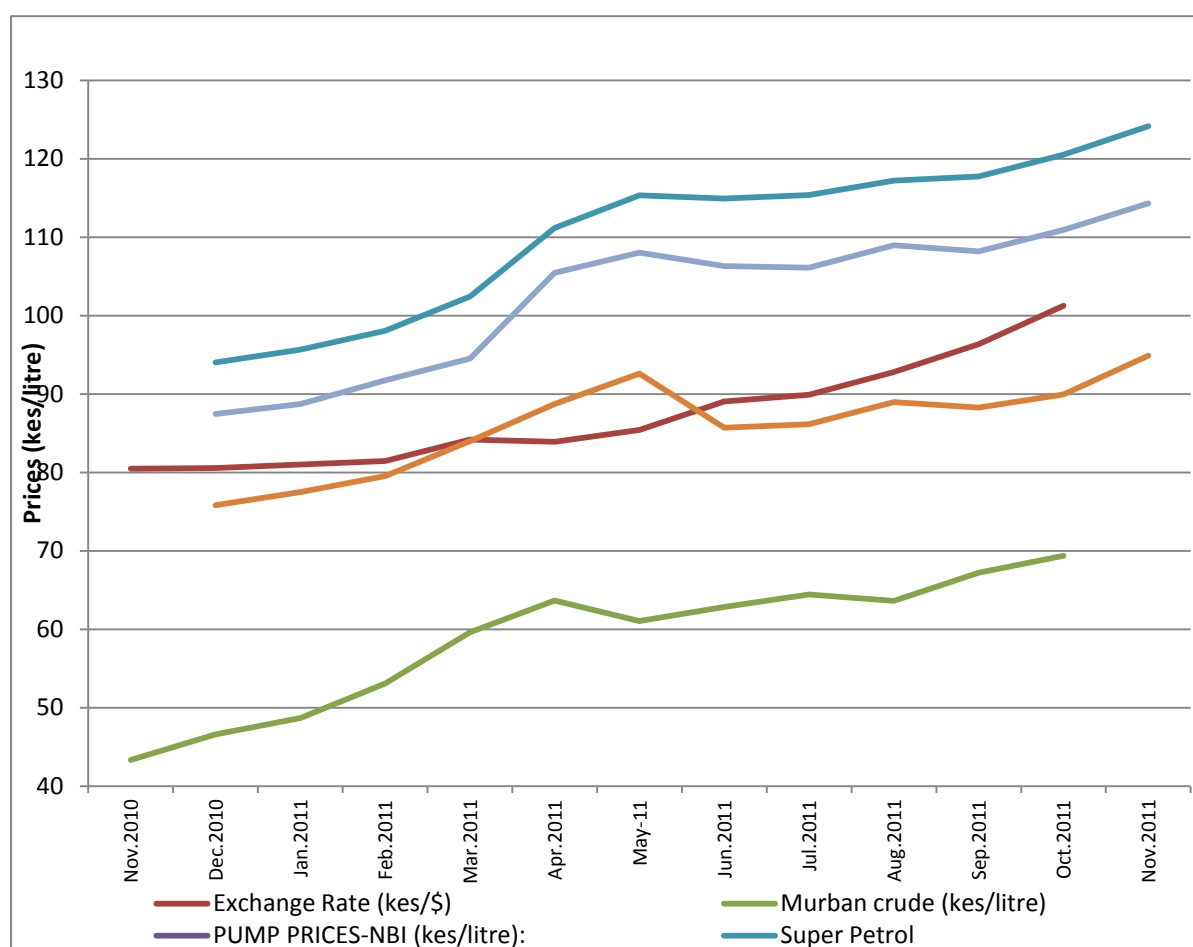
Figure 8.1 – Pass-Through Costs in the Electricity Tariffs



Petroleum

1. Kenya imports all her petroleum products requirements mostly from the Middle East. The international price of crude oil and petroleum products has been on a steady increase and has had an impact on the cost of petroleum and associated products. Figure 8.2 illustrates the continuous increase in crude oil and the attendant rise in local pump prices between November 2010 and November 2011. Over this period, the local pump prices for petroleum products regulated by the Energy Regulatory Commission have increased by about 35%.

Figure 8.2 – Trend of Crude Oil Prices and Pump Prices



Other Costs

1. The water charges imposed by the Water Resources Management Authority (WRMA) have an impact on the ultimate price of electricity. These charges were imposed without adequate consultation with concerned utilities and ERC which is mandated by the Energy Act to set and review tariffs.
2. Other government agencies, e.g., Kenya Wildlife Service (KWS), Kenya Forest Service (KFS), and Local Authorities have also been imposing charges on energy utilities for land leases for wind and geothermal project developments. This is also likely to happen with the formation of counties.
3. The end result is the cost of energy for the end consumer is likely to go up significantly.

8.6.2 Implications of High Energy Prices

1. The impact of crude oil price increases lead to inflationary pressure in the economy which is translated to increases in prices of goods and services. This tends to depreciate the exchange rate and increase interest rates. An increase in diesel prices leads to an increase in farming

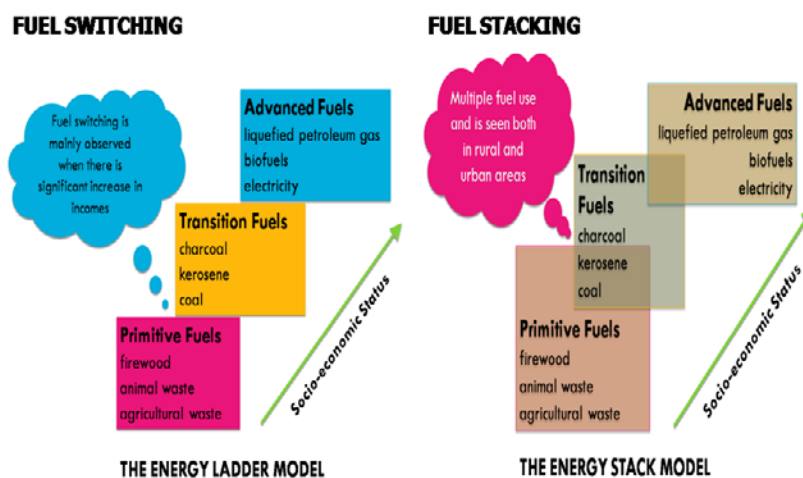
costs, the cost of inputs in the manufacturing and transport sectors and subsequently an increase in consumer prices making Kenyan products uncompetitive. With the income of consumers remaining relatively constant, these increases lead to erosion of purchasing power of the consumers in addition to reducing monies for other needs.

2. Due to the upward trend in international pricing of petroleum products, and the deterioration of the Kenya shilling against the dollar, the Government in 2010 introduced a petroleum price capping mechanism.

8.6.3 Household Energy Consumption Patterns

1. In a survey on consumption patterns in Kenya, it was revealed that in Kenya, consumers engage in Fuel stacking rather than Fuel switching (KIPPRA, 2009).
2. The studies reveal that there are two main models used to explain household energy allocation behaviour. These are the fuel stacking and fuel ladder models (see Figure 8.3). The fuel stacking model shows that as people become richer, they may be expected to move from traditional biomass fuels to more advanced and less polluting fuels (e.g. from wood to charcoal, kerosene, and then to gas). The fuel ladder model postulates that fuel switching is mainly observed when there is significant increase in income. The fuel stacking model is where a household use multiple fuels. In this model, households continue to use more than one fuel as income increases.

Figure 8.3 Fuel Stacking and Fuel Ladder Models



Source: Sclag and Zuzarte (2008)

3. The challenge is to move consumers up the energy ladder. Biomass which is at the bottom of energy ladder provides 60% of cooking energy needs in Kenya. The Table 8.1 shows comparison of fuel cost.

Table 8.1 - Energy Tariffs and Costs

Energy Resource	Unit Cost (Wholesale)		Unit Cost (Sale)		Duty	VAT	Other Taxes (specify)		
	Kshs	US\$	Kshs	US\$			%	%	%
Electricity/kWh	2.4	0.03	1.55-13.80	0.02-0.2		16	5% RE levy	0.03 Kshs/kWh ERC Levy	Fuel and Forex adjustment
Firewood/ kg	1.0	0.01	1.5(rural) 15(urban)	0.02- 0.22					
Charcoal/kg	11.0	0.16	14-16	0.2-0.23					
Diesel/lt	63.9	0.94	71	1.04	0.45 Kshs/l itre		10.31 Kshs/lt	5.8 Kshs/lt Road levy	0.4 Kshs/lt Petroleum Development Levy
Petrol/lt	72.9	1.07	81	1.19	0.45 Kshs/l itre		19.89 Kshs/lt Excise	5.8 Kshs/lt Road levy	0.4 Kshs/lt Petroleum Development Levy
Biogas/m3	2,400.0	35.29	3000- 4500	44-66					
LPG/kg	106.3	1.56	125	1.84	25%	-	7.2 Kshs/kg Excise		0.4 Kshs/kg Petroleum Development Levy

Source: GTZ – East African Energy Resource Base, 2007

4. Although price is a major influence in the choice taken, other factors that also influence the preferred type of energy include income, fuel quality, convenience, accessibility and availability. The prices of conventional energy resources, which are subject to structured commercial supply/demand markets, include the cost of production plus profit margins and an array of taxes. Traditional energy resources such as wood fuel are often priced in an informal, less structured market. Thus, prices may only reflect the cost of extraction (labour) and transportation. The cost of the raw material (e.g. tree replacement) is generally not considered and the wood is regarded as a free good.

8.6.4 Policies and Strategies

- 1 The National Government shall ensure that energy charges are prudent, cost effective and imposed in a coordinated manner in consultation with relevant stakeholders.
- 2 The National Government shall direct that regulatory agencies, County governments and local authorities, include in any regulatory action that could significantly affect energy supplies, distribution, use or pricing, a detailed statement on:
 - (a) The impact on energy pricing of the proposed action.

- (b) Any adverse impact on energy that cannot be avoided should the proposal be implemented.
- (c) Alternatives to the proposed action.

These shall be included in all regulations and orders submitted for legislation.

- 3 Through the Monetary Policy, institute measures that ensure stability of the foreign currency exchange rates.
- 4 Monitor projects to ensure projects identified are implemented on time to ensure security of supply and increased access by consumers. This will reduce high prices resulting from constrained supply (emergency power and gas currently).
- 5 Due to the impact of energy pricing on the cost of living and national economic development, the Government shall link the economic policy with the energy policy.
- 6 The Government shall encourage users to shift to modern energy sources by encouraging marketers as well as providing incentives to increase production and use. Further, by creating an enabling environment to achieve low and affordable prices for fuels, appliances and equipment, gadgets and apparatus among the majority of the citizens.

8.6.5 Agenda for Action

SHORT TERM 2012 – 2016

- 1 The Government shall regularly inform the public on the process of energy development, procurement and the prudently incurred costs.
- 2 Through the Monetary Policy, institute measures that ensure stability of the foreign currency exchange rates.
- 3 Due to the impact of energy pricing on the cost of living and national economic development, the Government shall link the economic policy with the energy policy.

MEDIUM TERM 2012 - 2022

- 1 The Government shall ensure that energy charges are prudent, cost effective and imposed in a coordinated manner in consultation with relevant stakeholders.
- 2 The Government shall direct that regulatory agencies, County Governments and local authorities should include in any regulatory action that could significantly affect energy supplies, distribution, use or pricing, a detailed statement on:
 - (a) The energy impact of the proposed action.
 - (b) Any adverse energy effects that cannot be avoided should the proposal be implemented.
 - (c) Alternatives to the proposed action.

These shall be included in all regulations and orders submitted for legislation.

- 3 Monitor projects to ensure projects identified are implemented on time to ensure security of supply and increased access by consumers. This will reduce high prices resulting from constrained supply (emergency power and gas currently).
- 4 Due to the impact of energy pricing on the cost of living and national economic development, the Government shall link the economic policy with the energy policy.
- 5 The Government shall encourage users to shift to modern energy sources by encouraging marketers as well as providing incentives to increase production and use and further by creating an enabling environment to achieve low and affordable prices for fuels, appliances and equipment, gadgets and apparatus among the majority of the citizens.

LONG TERM 2012 – 2030

- 1 Monitor projects to ensure projects identified are implemented on time to ensure security of supply and increased access by consumers. This will reduce high prices resulting from constrained supply (emergency power and gas currently).

9.0 –CROSS CUTTING ISSUES

9.1 LEGAL AND REGULATORY FRAMEWORK

9.1.1 Challenges

1. Legal and regulatory framework for the energy sector that is not aligned to the Constitution.
2. Outdated and fragmented sectoral laws governing the energy sector.
3. Overlap of roles and functions of institutions in the energy sector.
4. Lack of legal and regulatory framework in coal exploration and development.
5. Revenue sharing and management of energy resources.
6. Inadequate penalties to energy related offences.
7. Disjointed legal and regulatory frameworks governing operation of government institutions that impact the operations of institutions within the energy sector.
8. Inadequate powers of the Energy Tribunal due to contradictions in the Energy Act.
9. Inadequate legal and regulatory provisions in the energy sector governing land acquisition and access.
10. Lack of legal framework governing transmission system operations.
11. Lack of a designated lead agency to spearhead promotion and development of renewable energy resources.

9.1.2 Policies and Strategies

1. Review and align the energy sector's legal and regulatory framework with the Constitution and amalgamate them into one statute.
2. Provide for demarcation of roles between the national and County Governments as far as the energy sector is concerned.
3. Review the institutional mandates of the various public institutions under the energy sector to streamline their respective mandates, businesses and operations.
4. Incorporate provisions in the proposed energy legislation that will ensure that:
 - (a) Energy sector investments in property benefit local communities and their economies as provided for under Article 66 (2) of the Constitution.
 - (b) Sharing of royalties arising from the exploitation of the natural resources equitably between the national and County Governments.
 - (c) All the public institutions under the energy sector adopt the Constitutional requirements on national values and principles under Article 10.

- (d) Recognition of all general rules of international law affecting the energy sector under Article 2(5) of the Constitution.
 - (e) Recognition of all ratified treaties and international conventions affecting the energy sector under Article 2(6) of the Constitution.
 - (f) Protection of consumer rights as is provided for under Article 46 of the Constitution.
 - (g) County Governments shall provide for adequate street lighting (installation and maintenance).
 - (h) County Governments shall provide adequate designated parking places for petroleum tankers.
 - (i) Where serviceable alternative cheaper modes of transportation with adequate carrying capacity exist, long distance road transport shall not be allowed.
 - (j) Government shall develop and manage a prudent national energy efficiency and conservation programme.
5. Establish a National Energy Institute to undertake training, research, development, dissemination, nurture talent, innovation and to enhance capacity building in the sector.
 6. Provide for Directorates in the Ministry responsible for energy for purposes of streamlining operations in issues of policy.
 7. Enhance the jurisdiction of the Energy Tribunal within the amalgamated legislation.
 8. Enhance penalties for existing offences in the energy sector; by providing minimum sentences. Also provide for additional offences and classify these offences as economic crimes.
 9. Provide and create additional safeguards on utilization of land, environment and natural resources critical to the development of energy infrastructure and service provisions
 10. Provide appropriate procedures for access to information that also protects the principle of confidentiality as provided under Articles 33 and 35 of the Constitution.
 11. Make appropriate provisions for compulsory acquisition of property for energy infrastructure in accordance with Article 40 of the Constitution.
 12. KENGEN to provide the scope and components of Regulated Asset Base used in tariff formulation.
 13. Provide that the system operations function be undertaken by an Independent System Operator (ISO).
 14. Provide a framework for open access to transmission and distribution networks.
 15. Provide that transmission to be at national level while generation and distribution to be at both national and county levels.

16. Provide for the criteria to access funds for electrification of marginalized areas from the Equalization Fund under Article 204 of the Constitution. REA shall continue to finance cross-county rural electrification connections.
17. Rural Electrification Authority shall spearhead promotion and development of renewable energy.

9.2 INTEGRATED ENERGY PLANNING

9.2.1 Background

1. Sessional Paper No 4 of 2004 identified the need to integrate energy planning with the national economic, social and environmental policies, as energy is a critical input in the social economic progress of any economy. At the sector level, there are close linkages between the various forms of energy, which necessitates integrated energy planning.
2. The Energy Act, No 12 of 2006 assigned the responsibility for development of indicative national energy plans to the Energy Regulatory Commission (ERC). To fulfil this mandate ERC established three sub-sector specific planning committees for electricity, fossil fuels and renewable energy. This was with a view of institutionalizing energy planning and improving coordination so as ensure projects were implemented timely and within budget. As a result, energy masterplans will be developed to cover the energy sub-sectors and updated regularly.
3. In 2009, ERC established a committee charged with the responsibility of planning of the electricity sub-sector. The Committee comprised technocrats from Ministry of Energy (MoE), ERC, Kenya Power and Lighting Company (KPLC), Kenya Electricity Generating Company (KenGen), Geothermal Development Company (GDC), Kenya Electricity Transmission Company (KETRACO), Rural Electrification Authority (REA), Nuclear Electricity Project Committee (NEPC), Kenya National Bureau of Statistics (KNBS) and the Ministry of State for Planning, National Development and Vision 2030 Secretariat, to be responsible for preparation of the Least Cost Power Development Plan (LCPDP).

9.2.2 Challenges

1. The main challenges facing integrated energy planning include;
 - (a) Inadequate structures and systems for integrated energy planning and monitoring of the implementation of planned projects.
 - (b) Inadequate capacity to carry out integrated energy planning.
 - (c) Lack of petroleum and renewable energy masterplans.
 - (d) Lack of reliable databases for all energy forms.
 - (e) Inadequate linkages with other sectors of the economy.
2. Lack of integrated energy planning has led to an array of setbacks including:
 - (a) Occasional shortages or disruptions in supply of fossil fuels.

- (b) Occasional power rationing and poor quality of supply, as well as frequent power interruptions.
- (c) Conflicting and competing interests between various sub-sectors of the economy with regard to development and utilization of energy resources.

9.2.3 Policies and Strategies

1. Establish structures and systems for integrated energy planning and monitoring of the implementation of planned projects.
2. Develop adequate capacity to carry out integrated energy planning.
3. Develop petroleum and renewable energy masterplans.
4. Create reliable databases for all energy forms.
5. Create linkages with other sectors of the economy.

9.2.4 Agenda for Action

Short Term 2012-2016

Establish the least cost development planning committees for fossil fuels and renewable energy.

9.3 RESEARCH AND HUMAN RESOURCE DEVELOPMENT

9.3.1 Background

Research, Development and Dissemination (RD&D) as well as human resource capacity development enhancement are key to the development of the energy sector.

9.3.2 Challenges

1. Absence of a National Energy Institute for research and human resource development.
2. Inadequate funding for RD&D.
3. Limited research activities.
4. Inadequate promotion of local content in energy technologies.
5. Inadequate linkage between local industries and academia.

9.3.3 Policies and Strategies

1. Establish a National Energy Institute.
2. Allocate adequate resources for research and human resource development.
3. Put in place mechanism to attract private sector funding in Research and Human Resource Development.
4. Promote local, regional and international participation in research activities, particularly in technology-oriented research.

5. Undertake a National Research and Human Resource Development road-mapping to assess the status of research in key energy technologies.
6. Promote local production of energy technologies.
7. Form an inter-agency Committee that will ensure close collaboration with institutions that collect, analyze and prepare policy papers i.e. Kenya Bureau of Standards (KEBS), Kenya Institute for Public Policy, Research and Analysis (KIPPRA) in order to access energy sector specific information.
8. Enhance research linkages between industries and academia.
9. Allocate adequate resources for Research and Human Resource Development.
10. Continuously train and upgrade human resource capacity to keep up with the changing technological issues in collaboration with training institutions and the proposed National Energy Institute to develop appropriate training curriculum targeting key areas in the energy sector.

9.4 GENDER

9.4.1 Challenges

1. Gender imbalances in various positions in institutions.
2. Inadequate implementation of policy on gender mainstreaming.
3. Inadequate public awareness on the adverse health effects of use of woodfuel and kerosene on women and children.

9.4.2 Policies and Strategies

1. The Government shall take measures to implement the one-third gender principle in the energy sector institutions as provided for under Article 27(8) of the constitution.
2. In order to address the challenges faced by women and children in the use of woodfuel and kerosene Government shall:
 - (a) mainstream gender issues in policy formulation and in energy planning, production and use.
 - (b) undertake public education and awareness creation on the cultural structures and practices hindering the access by women to alternative sources of energy.
 - (c) undertake public health education on the efficient use of bio-energy and promote the use of fuel efficient bio-energy appliances.
 - (d) enhance regional, gender and environmental considerations in energy planning and development.

9.5 POLICY IMPLEMENTATION, MONITORING AND EVALUATION

Set up an appropriate mechanism to monitor and evaluate the implementation process so as to ensure that the gains in this policy benefit all Kenyans.

9.6 DATA

The Government shall establish a mechanism for energy data collection, management and dissemination under an integrated energy sector management system covering the Ministry in charge of energy and the parastatals under it to facilitate online transmission of data and information.

9.7 AGENDA FOR ACTION

9.7.1 Short Term 2012 – 2016

9.7.1.1 Institutional Arrangements

1. Establish Directorates within the Ministry of Energy to be responsible for:
 - (a) Electrical Energy.
 - (b) Geothermal Resources.
 - (c) Petroleum Energy.
 - (d) Coal Resources.
 - (e) Renewable Energy.
 - (f) Nuclear Energy.
 - (g) Energy Efficiency and Conservation.
2. Strategic parastatals should not be privatised.

9.7.1.2 Legal and Regulatory Framework

1. Amalgamate all energy sectoral laws into one statute and repeal the Energy Act, 2006 by 2012.
2. The new Energy Act to, *inter alia*, provide for:
 - (a) Enhanced mandate for ERC and the Energy Tribunal.
 - (b) All proposals regarding land and environment as outlined in this Policy.
 - (c) New offences.
 - (d) Enhancement of penalties for existing offences by providing minimum sentences.
 - (e) Classification of all offences as economic crimes.
 - (f) Monetary sanctions to be imposed by ERC or the Energy Tribunal in the event of default by licensees, proceeds of which shall be paid into the Consolidated Energy Fund.

- (g) Recognition and/or ratification of all treaties and international conventions affecting the energy sector under Article 2(6) of the Constitution.
- (h) Enhancement of safety at petroleum depots by prohibiting the parking of a petroleum tanker in an oil terminal/depot for more than one hour after loading.
- (i) County Governments to provide street lighting and designated parking places for petroleum tankers.
- (j) That fossil fuels be included in the National Energy Masterplan.
- (k) Provide for reduction of connection charges to accelerate connectivity in rural areas.
- (l) Provide for new sections and regulations to cover coal exploration, exploitation and environmental issues.

9.7.1.3 Energy Pricing

1. Develop mechanism to ensure energy tariffs are affordable.
2. Develop necessary legislation to meter for net-metering.
3. Develop guidelines to cater for lower tariffs during off-peak hours.

9.7.1.4 Research, Development and Dissemination

1. Establish a National Energy Institute.
2. Transform the Centre for Energy Efficiency and Conservation (CEEC) into a fully fledged national public entity to continue promoting energy efficiency and conservation.
3. Build appropriate local capacity for manufacture, installation, maintenance and operation of appropriate energy technologies.
4. Develop mechanisms for private sector funding for research and development.
5. Human Resource Development and Capacity Building.
6. Develop a comprehensive capacity building programme for the energy sector.

9.7.1.5 Gender

1. Undertake an audit in all public sector institutions to establish the gender component in the work force.
2. Work closely with the Public Service Commission and Boards of the various parastatals to enhance affirmative action in their recruitment processes in order to attain the one-third gender rule.
3. Ensure representation of gender in key energy sector planning and implementation committees.
4. Undertake public meetings, and barazas through the Energy Centres to create awareness for efficient utilization of bio-energy resources and appliances.

5. Develop and distribute education, communication and training materials on gender issues relating to the efficient utilization of bio-energy appliances and public health issues.

9.7.2 Medium Term 2012 – 2022

9.7.2.1 Research, Development and Dissemination

Undertake a National RD&D road-mapping to access the status of research in key energy technologies.

9.7.2.2 Human Resource Development and Capacity Building

1. Build local Human resource capacity to undertake specialized research and consultancy services in the energy sector which has in the past been sourced internationally.
2. Develop programmes in local institution of higher learning for drilling of geothermal wells, coal and oil wells, nuclear power development and high voltage transmission systems.
3. Introduce a certification system for qualified energy practitioners in various energy sub-sectors.

9.7.3 Long Term 2012 - 2030

9.7.3.1 Research, Development and Dissemination

1. Promote local, regional and international participation in research activities, particularly in technology-oriented research.
2. Promote local production of energy technologies.

10.0 ANNEXURES

Annex 10.1 - The PSC Model Fiscal Structure

- (a) **Area:** Specified Block size is provided with its coordinates.
- (b) **Exploration:** Phases – Initial Exploration –2yrs, First Additional –2yrs; Second Additional 2yrs; Total 6 years.
- (c) **Production:** 20 to 30 years, (typically at least 25 years).
- (d) **Relinquishment:** 25% of original area, after 1st Phase, 25% of remaining area after 2nd Phase (Negotiable).
- (e) **Exploration Obligations:** Includes geological and geochemical surveys, reinterpretation of available data, technical data acquisition and well drilling with a minimum exploratory depth of 3000m and minimum negotiable expenditure.
- (f) **Training Fees:** this is based on an agreed *lump sum* amount payable annually during *exploration, development and production periods*
- (g) **Surface Fees Rental:** this is based on an agreed amount *per sq km for the block size basis* and divided into *exploration, development and production*.
- (h) **Taxation:** Under the Kenya Model, taxes are paid “*in lieu*” – “*for and on behalf of the Contractor*” out of the Government share of profit.
- (i) **Corporate Income Tax:** this in Kenya is at 30% while the world wide *average is between 30-35%*.
- (j) **Depreciation:** the model uses a *5 year Straight Line Depreciation* method for capital costs. The depreciation begins “*when production starts.*”
- (k) **Ring fencing:** It does not allow costs from one block to be recovered from another.
- (l) **Government Participation:** The Kenya Model PSC requires a minimum Government participation of 10%. The Government share is carried through exploration and paid in full during production.
- (m) **Profit Oil Split:** Based upon a *production-based* sliding scale system. Applicable Tranches are Negotiable.
- (n) **Cost Recovery Limit:** this is *based* on negotiated *gross revenues* and lies well within the *World Average of 60%*.

Table 10.1 - Energy Generation Potential in Floriculture Industry

District	Potential Energy Generation (h/yr)	Capacity (kW)
Nakuru	35,741	8,160
Thika	8,935	2,040
Kiambu	7,148	1,632
Kajiado	6,552	1,496
Laikipia	4,170	952
Nyandarua	4,170	952
Meru	3,574	816
Gatundu	2,383	544
Machakos	2,383	544
Nyeri	2,383	544
Trans Nzoia	2,383	544
Athi River	1,787	408
Other	7,150	1,220
Total	88,758	19,852

Source: *Updated Rural Electrification Master Plan, 2009*

Table 10.2 - Biogas Potential from Sisal Production

Company	Generation Potential (h / yr)	Capacity*
Rea Vipingo	8,750	1500-2000
DWA Estate Ltd.	10,500	1800-2400
Taita Estate	12,600	2150-2870
Mogotio Plantations	6,300	1080-
Kilifi Plantations	1,750	300-400
Tabu Estate Ltd.	1,750	300-400
Voi Sisal Estate	700	120-160

Note: *Assuming 12 to 16 hours full load

Source: *Updated Rural Electrification Master Plan*

Table 10.3 - Historical and Forecast Electricity Demand for 2010 - 2031

YEAR	INSTALLED MW	PEAK MW	GWh	GROWTH RATE (GWh)
2010	1,363	1,227	7,296	13.00%
2011	1,503	1,302	7,775	7.63%
2012	1,531	1,520	9,084	16.75%
2013	1,979	1,765	10,560	16.08%
2014	2,852	2,064	12,376	16.98%
2015	3,132	2,511	15,155	21.64%
2016	3,832	2,866	17,300	14.13%
2017	4,337	3,292	19,902	14.87%
2018	5,077	3,751	22,685	13.94%
2019	5,591	4,216	25,512	12.40%
2020	6,431	4,755	28,795	12.79%
2021	7,217	5,388	32,651	13.31%
2022	8,217	6,048	36,652	12.25%
2023	8,837	6,784	41,130	12.18%
2024	9,957	7,608	46,147	12.13%
2025	11,097	8,528	51,771	12.10%
2026	13,117	9,556	58,069	12.06%
2027	13,737	10,706	65,133	12.03%
2028	15,389	11,994	73,065	12.03%
2029	17,199	13,435	81,964	12.01%
2030	19,199	15,026	91,946	11.85%
2031	21,599	16,905	103,518	12.51%

Figure 10.1 Nuclear Power Programme Milestones, adapted from IAEA Publications, September 2011

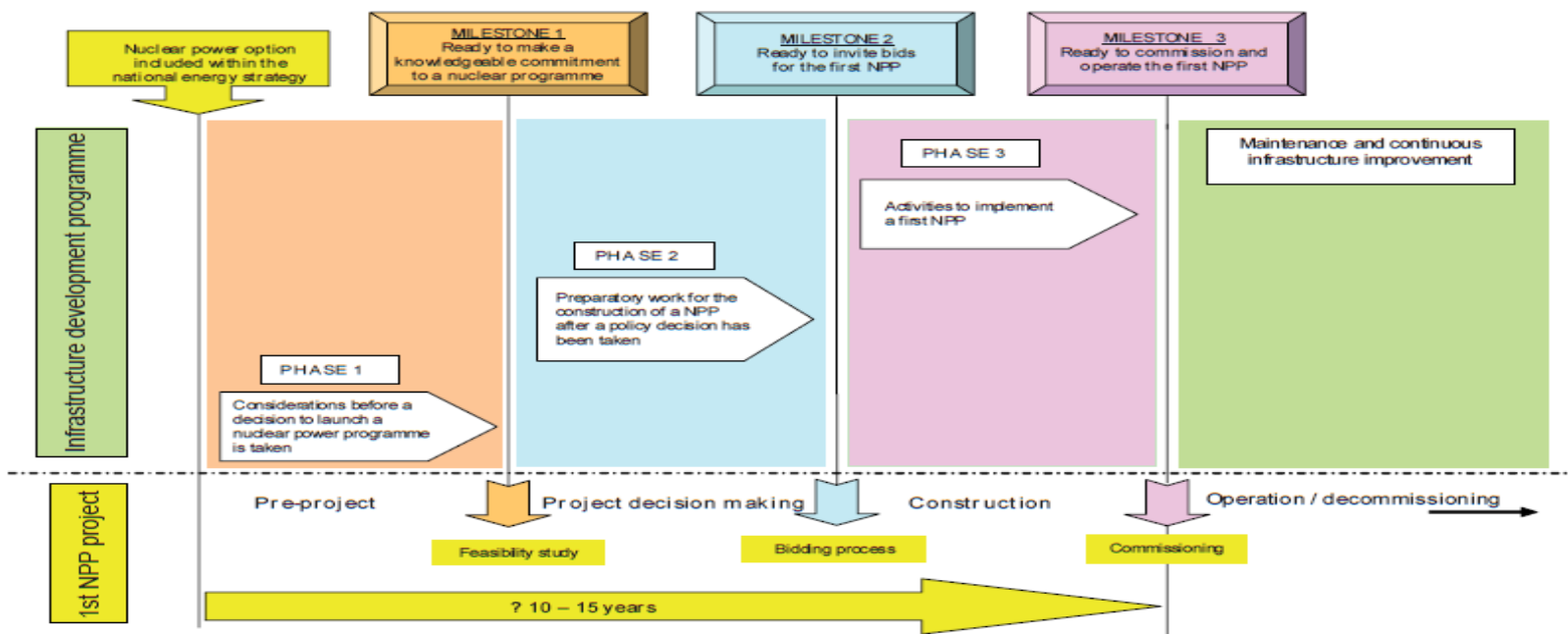


Table 10.2

SUMMARY OF THE ENERGY STATUS IN THE COUNTIES

County	Population	Area (km ²)	Fossil Fuels	Electricity	Renewable Energy
Mombasa	939,370	219	All petroleum products are imported into the country through the Port of Mombasa. Home of the only refinery in the country. Well developed infrastructure for distribution of petroleum products. County with lowest cost of petroleum products.	Three thermal power plants with capacity of 254MW located in the county. 600MW coal power plant planned. No. of households connected with electricity are 158588 or 59.02% connectivity.	Requirements for woodfuel and charcoal met from other counties. Municipal waste, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.2%
Kwale	649,931	8,270	Receives bulk of its petroleum products by truck through Likoni Ferry.	No power plant in the county. No. of households connected with electricity are 12888 or 10.56% connectivity.	Good supply of woodfuel and charcoal. Cogeneration, solar, wind, small hydro and tidal wave largely unexploited. Percentage of Solar utilisation stands at 1.25%
Kilifi	1,109,735	12,610	Well developed infrastructure for distribution of petroleum products with connectivity levels of 16.73%.	1 x 90MW thermal power plant. No. of households connected with electricity is 33,423 or 16.73% connectivity.	Good supply of wood fuels and charcoal. Solar, wind, small hydro and tidal wave largely unexploited. Solar utilisation stands at 1.74%
Tana River	240,075	38,437	Limited infrastructure for distribution of petroleum products	Small section of county with national grid; An isolated grid supplying Hola. No. of households connected with electricity is 1184 or 2.5% connectivity.	Good supply of woodfuel and charcoal. Cogeneration, solar, wind, small hydro and tidal wave largely unexploited. Solar utilisation stands at 5.87%
Lamu	101,539	6,273	Limited infrastructure for distribution of petroleum products	2 isolated grids at Lamu and Mpeketoni. No. of households connected with electricity is 3,767 or 16.98% connectivity.	Good supply of woodfuel and charcoal. Cogeneration, solar, wind, small hydro and tidal wave largely unexploited. Solar utilisation stands at 2.52%

County	Population	Area (km ²)	Fossil Fuels	Electricity	Renewable Energy
Taita/Taveta	284,657	17,084	Well developed infrastructure for distribution of petroleum products.	No power plant in the county. No. of households connected with electricity is 10,653 or 14.99% connectivity.	Good supply of woodfuel and charcoal. Cogeneration, solar, wind, small hydro and tidal wave largely unexploited. Solar utilisation stands at 0.58%
Garissa	623,060	44,175	Limited infrastructure for distribution of petroleum products	No. of households connected with electricity is 11,405 or 11.57% connectivity.	Supply of woodfuel and charcoal from unsustainable sources. Solar, and wind largely unexploited. Solar utilisation stands at 10.4%
Wajir	661,941	56,686	Poor infrastructure for distribution of petroleum products. County with one of the highest costs of petroleum products.	2 isolated grids supply Wajir and Habaswein. No. of households connected with electricity are 3,039 or 3.43% connectivity.	Supply of woodfuel and charcoal from unsustainable sources. Solar, and wind largely unexploited. Solar utilisation stands at 29.69%
Mandera	1,025,756	25,991	Poor infrastructure for distribution of petroleum products. County with the highest costs of petroleum products.	Isolated grid supplies Mandera Town. No. of households connected with electricity are 3,198 or 2.55% connectivity.	Good supply of woodfuel and charcoal. Solar, wind, cogeneration and tidal wave largely unexploited. Solar utilisation stands at 36.05%
Marsabit	291,166	70,961	Poor infrastructure for distribution of petroleum products. County with one of the highest costs of petroleum products.	2 isolated grids supplying Marsabit and Moyale. No. of households connected with electricity is 4,258 or 7.48% connectivity.	Supply of woodfuel and charcoal from unsustainable sources. Has best wind regime in the country. Solar largely unexploited. Solar utilisation stands at 48.04%
Isiolo	143,294	25,336	Limited infrastructure for distribution of petroleum products	Small section of county with national grid; and an isolated grid supplying Merti. No. of households connected with electricity is 5,800 or 18.51% connectivity.	Supply of woodfuel and charcoal from unsustainable sources. Solar, and wind largely unexploited. Solar utilisation stands at 23.25%

County	Population	Area (km ²)	Fossil Fuels	Electricity	Renewable Energy
Meru	1,356,301	6,933	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity is 50,004 or 13.12% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Solar utilisation stands at 1.84%.
Tharaka-Nithi	365,330	2,639	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity is 826 or 3.02% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Solar utilisation stands at 6.03%.
Embu	516,212	2,818	Well developed infrastructure for distribution of petroleum products	No. of households with electricity is 19,611 or 14.89% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Solar utilisation stands at 0.85%.
Kitui	1,012,709	30,497	Reasonable infrastructure for distribution of petroleum products	No. of households with electricity is 9,850 or 4.79% connectivity.	Supply of woodfuel and charcoal from unsustainable sources. Wind and solar largely unexploited. Solar utilisation stands at 5.02%.
Machakos	1,098,584	6,208	Well developed infrastructure for distribution of petroleum products	No. of households electricity with 45,067 or 5.85% connectivity.	Supply of woodfuel and charcoal from unsustainable sources. Wind and solar largely unexploited. Percentage of Solar utilisation stands at 0.21%
Makueni	884,527	8,009	Well developed infrastructure for distribution of petroleum products	No. of households electricity with 10,912 or 5.85% connectivity.	Supply of woodfuel and charcoal from unsustainable sources. Wind and solar largely unexploited. Percentage of Solar utilisation stands at 0.61%
Nyandarua	596,268	3,245	Well developed infrastructure for distribution of petroleum products	No. of households electricity with 15,086 or 10.49% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.27%

County	Population	Area (km ²)	Fossil Fuels	Electricity	Renewable Energy
Nyeri	693,558	3,337	Well developed infrastructure for distribution of petroleum products	No. of households electricity with 53,086 or 26.32% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.5%
Kirinyaga	528,054	1,497	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 25,353 households or 16.44% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.27%.
Murang'a	942,581	2,559	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 33,847 households or 13.96% connectivity	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.23%.
Kiambu	1,623,282	2,543	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 255,704 households or 53% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.15%.
Turkana	855,399	68,680	Poor infrastructure for distribution of petroleum products. County with one of the highest costs of petroleum products.	An isolated grid supplying Lodwar. No. of households connected with electricity are 3,017 households or 2.45% connectivity.	Supply of woodfuel and charcoal from unsustainable sources. Has best wind regime in the country. Solar largely unexploited. Percentage of Solar utilisation stands at 72.97%
West Pokot	512,690	9,169	Limited infrastructure for distribution of petroleum products.	106MW HPP at Turkwel. Small section of county with national grid. No. of households connected with electricity are 2,456 households or 2.62% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 50.1%

County	Population	Area (km ²)	Fossil Fuels	Electricity	Renewable Energy
Samburu	223,947	21,022	Limited infrastructure for distribution of petroleum products.	Small section of county with national grid; and isolated grid supplying Bargo Township. No. of households connected with electricity are 2,949 households or 6.23% connectivity.	Supply of woodfuel and charcoal from unsustainable sources. Wind and solar largely unexploited. Percentage of Solar utilisation stands at 60.08%
Trans Nzoia	818,757	2,496	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 15,121 households or 8.89% connectivity.	Good supply of woodfuel and charcoal. Agricultural waste, small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.58%
Uasin Gishu	894,179	3,345	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 56,534 households or 27.95% connectivity.	Good supply of woodfuel and charcoal. Agricultural waste, small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.31%
Elgeyo-Marakwet	369,998	3,030	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 5,547 households or 7.15% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 15.14%
Nandi	752,965	2,884	Well developed	No. of households connected with electricity are 9,788 households or 6.35% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.21%
Baringo	555,561	11,015	Reasonable infrastructure for distribution of petroleum products	No. of households connected with electricity are 10,583 households or 9.56% connectivity.	Good supply of woodfuel and charcoal. Huge potential for geothermal, small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 27.78%

County	Population	Area (km ²)	Fossil Fuels	Electricity	Renewable Energy
Laikipia	399,227	9,462	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 18,222 households or 17.67% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 5.12%
Nakuru	1,603,325	7,495	Well developed infrastructure for distribution of petroleum products	Home of all existing geothermal power plants in the country, No. of households connected with electricity are 69,098 households or 34.02% connectivity.	Good supply of woodfuel and charcoal. Huge potential for geothermal, small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.83%
Narok	850,920	17,933	Reasonable infrastructure for distribution of petroleum products	No. of households connected with electricity are 9903 households, 5.85% connectivity.	Good supply of woodfuel and charcoal. Solar and wind largely unexploited. Percentage of Solar utilisation stands at 7.67%
Kajiado	687,312	21,901	Reasonable infrastructure for distribution of petroleum products	Much of existing wind power plant capacity in the country is in this county. No. of households connected with electricity are 69098 households or 39.83% connectivity.	Supply of woodfuel and charcoal from unsustainable sources. Huge potential for wind, small hydros and solar, largely unexploited. Percentage of Solar utilisation stands at 2.19%
Kericho	590,690	2,158	Well developed infrastructure for distribution of petroleum products	Major tea producing companies generate own electricity using small hydros. No. of households connected with electricity are 15005 households or 11.76% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.28%
Bomet	891,835	2,792	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 7552 households or 4.32% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.83%

County	Population	Area (km ²)	Fossil Fuels	Electricity	Renewable Energy
Kakamega	1,660,651	3,018	Well developed infrastructure for distribution of petroleum products	Has the only sugar factory that exports excess electrical energy from its cogeneration plant to the grid. No. of households connected with electricity are 19959 households or 5.61% connectivity.	Good supply of woodfuel and charcoal. Bagasse cogeneration, small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.38%
Vihiga	554,622	564	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 8678 households or 7.04% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.47%
Bungoma	1,375,063	3,032	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 12219 households or 4.51% connectivity.	Good supply of woodfuel and charcoal. Agricultural waste, small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.55%
Busia	743,946	1,695	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 9253 households or 6% connectivity.	Good supply of woodfuel and charcoal. Agricultural waste, small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.37%
Siaya	842,304	2,530	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 8615 households or 4.33% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.22%
Kisumu	968,909	2,086	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 4155 households or 18.33% connectivity.	Good supply of woodfuel and charcoal. Municipal waste, small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.23%
Homa Bay	963,794	3,183	Well developed infrastructure for distribution of petroleum products	An isolated grid supplying Mfangano Island. No. of households connected with electricity are 6850 households or 3.32% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.4%

County	Population	Area (km ²)	Fossil Fuels	Electricity	Renewable Energy
Migori	917,170	2,596	Reasonable infrastructure for distribution of petroleum products	No. of households connected with electricity are 9551 households or 5.3% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.58%
Kisii	1,152,282	1,318	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 20965 households or 7.77% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.26%
Nyamira	598,252	899	Well developed infrastructure for distribution of petroleum products	No. of households connected with electricity are 6486 households or 6.1% connectivity.	Good supply of woodfuel and charcoal. Small hydros, solar and wind largely unexploited. Percentage of Solar utilisation stands at 0.28%
Nairobi	3,138,369	695	Well developed infrastructure for distribution of petroleum products. County with highest consumption of petroleum products.	1 x 106 MW thermal power plant. No. of households connected with electricity are 712,859 households or 72.37% connectivity.	Requirements for woodfuel and charcoal met from other counties. Solar, wind and municipal waste largely unexploited. Percentage of Solar utilisation stands at 0.06%

Table 10.3

Sharing of licensing activities between national and County Governments

National	County
Petroleum, Gas and Coal.	
Licensing of :- <ul style="list-style-type: none"> • Exploration and production • Refining • Importation • Exportation • Wholesale • Transit • Storage • Transport – Road, rail, pipeline Issuing of Construction Permits for- <ul style="list-style-type: none"> • Storage • Service Stations • Transport 	Licensing of petroleum trade- <ul style="list-style-type: none"> • Retail • Designated parking
Electricity	
Licensing of- <ul style="list-style-type: none"> • Electric power generation. • Electric power transmission. • Electric power distribution. • Electric power supply (inter-county). • Examination of Electricians and electrical contractors. • Electric power import and export. • Appoint, register and oversee the operations of electricity service providers. 	Licensing of- <ul style="list-style-type: none"> • Electric power generation (upto 3MW) • Electric power distribution (upto 3MW) • Electric power supply (intra-county) Issuance of licences for- <ul style="list-style-type: none"> • Electricians • Electrical contractors
Renewable Energy	
(i) Licensing of- <ul style="list-style-type: none"> • Large Scale generation of electricity using Solar and Wind • Large scale charcoal producers • Large scale biomass producers • Cross boundary Charcoal/biomass transportation. (ii) Registration of Energy auditors and keeping an updated register of the same.	Licensing of- <ul style="list-style-type: none"> • Small Scale Generation of Electricity using Solar and Wind (upto 3 87) • Solar Water Heater and Photo Voltaic Contractors • Solar System installation Technicians Licensing/issuance of permits for- <ul style="list-style-type: none"> • Small scale charcoal/biomass producers.