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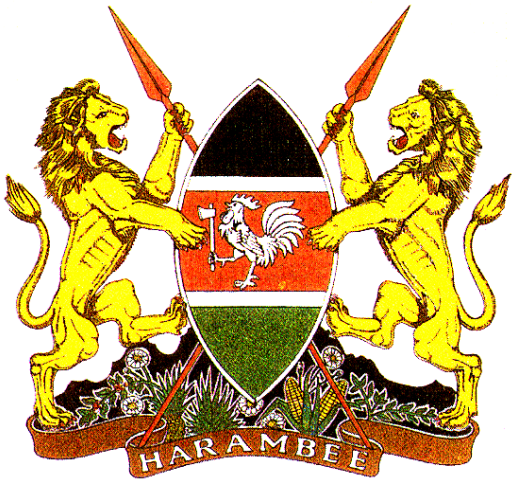

REPUBLIC OF KENYA

Ministry of Energy
and Petroleum

NATIONAL ENERGY POLICY

NOVEMBER, 2013

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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 CABINET SECRETARY FOR ENERGY AND PETROLEUM

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. Davis Chirchir
Cabinet Secretary
Ministry of Energy and Petroleum

PREFACE BY PRINCIPAL SECRETARY

In the past nine 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 a section 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 vision 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.

Eng. Joseph K. Njoroge, MBS
Principal Secretary, Ministry of Energy and Petroleum

EXECUTIVE SUMMARY

1. This policy document is organised into nine substantive chapters, starting with the Introduction in Chapter 1. Chapters 2 and 3 deal with the primary energy sources, namely Fossil Fuels and Renewable Energy, including electricity generation from geothermal and hydro resources. Chapter 4 deals with the secondary energy source, Electricity, followed by Chapter 5 on Energy Efficiency and Conservation then Chapter 6 on Land, Environment, Health and Safety. Chapters 7, 8 and 9 deal with Devolution and Access to Energy Services; Energy Financing, Pricing and Socio-Economic Issues; and Cross Cutting Issues, respectively. At the end of this document are the Acronyms and Glossary of Terms used herein.

Introduction

2. The overall objective of the energy policy is to ensure affordable, sustainable and reliable supply of energy to meet national and county development needs, while protecting and conserving the environment.

3. The energy sector is guided the policy set out in Sessional Paper No. 4 of 2004 and governed by a number of statutes, principally the Energy Act, No. 12 of 2006, the Geothermal Resources Act No. 12, of 1982 and the Petroleum (Exploration and Production) Act, Cap 308. With adoption of the Kenya Vision 2030 and the promulgation of the Constitution of Kenya 2010, there is need to review both the policy and all these statutes so as to align them with the Vision and the Constitution; the statutes shall be reviewed and amalgamated into one.

Fossil Fuels

4. Kenya has had no known commercial reserves of petroleum until March 2012 when oil was discovered in Northern Kenya, leading to a lot of interest in the sector. 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.

5. There is therefore need to develop adequate petroleum production capacity in the country, and also 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 setting up a new refinery at Lamu or Isiolo or other appropriate location. This will make oil and gas products more competitive in the region, enable creation of wealth, ensure supply security and stability of their prices.

6. The Government will ensure that there are strategic petroleum reserves in the country. The increased use of LPG shall be encouraged so as to eliminate the use of kerosene in households and reduce over-reliance on bio-mass. The Government is also evaluating the possibility of using natural gas to support commercial and industrial activities including transportation.

7. The average consumption of petroleum products in Kenya has been increasing over the years. To ensure security of supply of petroleum products, the Government will facilitate construction

of adequate import/off-loading, storage distribution and fuel dispensing facilities through public private partnerships as appropriate.

8. The quality of petroleum products will be constantly reviewed to conform to international standards. To this end the institutional capacity will be enhanced to enforce fuel quality specifications for both domestic and export market.

9. Coal has the potential of providing affordable, reliable and easily accessible energy source, for electricity generation. Extensive coal exploration has taken place in the Mui Basin situated in Kitui County where a total of 76 wells have been drilled with 42 wells intercepting coal seams of various thicknesses at different depths. More wells are being drilled to appraise the coal reserves in the basin of which Block C has been appraised to have 400 million tonnes. More coal exploration is going on in other parts of the country. These resources are expected to provide about 4,500MW of electricity generation by 2030.

10. 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 and 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.

11. Following the discovery of petroleum and coal deposits, the Government shall:
    (a) Adopt and implement the Extractive Industries Transparency Initiative (EITI) Treaty as a demonstration of its commitment to good governance, increasing scrutiny over revenue collection from these resources, and improving the country's investment climate;
    (b) Reconstitute the National Fossil Fuels Advisory Committee (NAFFAC) and anchor it in law.
    (c) Develop mechanisms for sharing of benefits between the National and County Governments as well the local communities in accordance with Article 69 of the Constitution.
    (d) establish a one stop shop for licensing of fossil fuel operations and undertakings with a view to enhancing development of the requisite infrastructure for fossil fuels

12. Kenya recently discovered natural gas at Mbawa in Lamu. The commercial viability is yet to be ascertained.

Renewable Energy

13. Renewable energy, derived from the naturally occurring resources including geothermal, hydro, solar, wind and ocean energy, biomass, biofuels, biogas and municipal waste can supply our needs and those of future generations in a sustainable way if effectively harnessed through careful planning and advanced technology. In addition, renewable energy has potential to enhance energy security, mitigate climate change, generate income, create employment and generate foreign exchange savings.

14. To enhance exploitation of the vast geothermal resources that Kenya is endowed with, the Government will continue to fund the Geothermal Development Company (GDC) so as to manage the geothermal exploration risk and attract investors. Further, the Government will encourage investment in the geothermal subsector so as to ensure that Kenya achieves at least 5,500MW of geothermal electric power generation by 2030, as well as enhancing direct uses of the resource.

15. Kenya has an estimated hydropower potential of about 6,000MW comprising of large hydros (sites with capacity of more than 10MW) and small hydros. Of the large hydros, 807MW has been exploited and accounts for close to 50% of installed generation capacity as at 2012 while about 1,450MW remains unexploited. Potential for small hydros is over 3,000MW, of which, less than 25MW has been developed.

16. In view of the fact that hydropower is vulnerable to variations in hydrology and climate, it will be necessary to put in place a mechanism to cushion generators, transmitters, distributors and consumers against the effects of adverse hydrology.

17. The Government shall establish an inter-ministerial Renewable Energy Resources Advisory Committee (RERAC) to advise the cabinet secretary on, *inter alia:*
    (a) Criteria for allocation to investors of energy resource areas.
    (b) Licensing of Renewable Energy resource areas
    (c) Management of water towers and catchment areas.
    (d) Development of multi-purpose projects such as dams and reservoirs for power generation, portable water, flood control and irrigation with a view to ensuring proper coordination at policy, regulatory and operational levels on matters relating to the various uses of water resources.
    (e) Management and development of other energy resources such agricultural and municipal waste, forests, and areas with good wind regimes, tidal and wave energy.

18. The Government shall transform the Rural Electrification Authority into the National Electrification and Renewable Energy Authority (NERA) to be the lead agency for development of renewable energy resources other than geothermal and large hydros.

Electricity Sub-Sector

19. Electricity is a secondary source of energy generated through the consumption of primary energy sources namely fossil fuels, renewable energy and nuclear energy. By virtue of its versatility in application, electricity is crucial to the socio-economic development of the country and is the most sought after energy service, access to which is associated with rising or high quality of life.

20. Reform and restructuring of the Kenyan electricity supply industry (ESI) has been going on 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 affordable 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.

21. In order to provide affordable electricity to transform the Kenyan economy, a roadmap to raise the generation capacity by at least 5000MW from the current 1,664MW to slightly over 6,700 MW by 2016 is proposed. Through this road map the generation cost is projected to reduce from US¢ 11.30 to 7.41, while end-user tariffs are projected to reduce from US¢ 14.14 to 9 for commercial/industrial customers and from US¢ 19.78 to 10.45 for domestic customers.

22. The National Government shall:-

(a) Transform the Kenya Nuclear Electricity Board into a Nuclear Electricity Corporation to promote and implement a nuclear electricity generation programme.

(b) Develop and monitor implementation of electricity master plans for the country and the Eastern African Region.

(c) Support the development by KETRACO of new transmission lines, comprising of about 5,000 km in the short term and 16,000 km by 2031 to enhance security, reliability and affordability of electricity supply.

(d) Facilitate open access to the transmission and distribution networks, designate a system operator and encourage regional interconnections to enhance regional electricity trade.

(e) Provide incentives for development of robust distribution networks, including gradual elimination of overhead distribution systems to ensure efficient and safe provision of distribution services by duly licensed network service providers, so as to reduce power supply interruptions and improve the quality of supply and service.

(f) Put in place mechanisms to facilitate reduction in cost of new connections to supply.

(g) Continue funding the development of distribution networks through NERA.

Energy Efficiency and Conservation

23. The importance of energy efficiency and conservation measures in the Kenyan economy cannot be overemphasized, with possible annual energy savings in excess of KShs 2.5 billion in the industrial sector. Challenges to implementation of energy efficiency and conservation initiatives include lack of awareness of the benefits and methods of conservation, apathy, limited technical capacity and inadequate data.

24. The Government shall establish the Energy Efficiency and Conservation Agency (EECA) as a fully-fledged national public entity to promote energy efficiency and conservation.

25. EECA shall spearhead energy efficiency and conservation activities to improve the energy security and mitigate the effects of climate change by lowering Green House Gas 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.

Land, Environment, Health and Safety

26. In carrying out its planning and development mandate pursuant to the Fourth Schedule, Part 2, paragraph 8 (e) regarding electricity and gas reticulation and energy regulation, every county government shall set aside suitable land for energy infrastructure development purposes, including but not limited to projects recommended in the indicative national energy plans.

27. The Government shall facilitate:

    (a) Development of a Resettlement Action Plan Framework for energy related projects; including livelihood restoration in the event of physical displacement of communities.

    (b) Access to land where exploration blocks fall on private land, community land and cultural heritage areas including game parks/reserves.

28. The Government shall:

    (a) Put in place mechanisms to eliminate kerosene as a household energy source by 2022.

    (b) Ensure the creation of disaster response units in each county and in relevant energy sector entities.

Devolution and Access to Energy Services

29. The National Government will be responsible for energy policy while the County Governments will be responsible for planning and development, including electricity and gas reticulation and energy regulation within their jurisdictions.

30. 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. Amongst the roles to be addressed in the framework include:

    (a) Electricity and gas reticulation as well as energy regulation.

    (b) Establishment of energy disaster management centres in all the counties.

31. NERA shall formulate cooperation arrangements with County Governments for implementation of rural electrification and renewable energy programmes.

Energy Financing, Pricing and Socio-Economic Issues

32. The Government shall:

    (a) Explore and adopt all viable financing options from local and international sources for cost effective utilization of all its energy resources, and in so doing shall endeavour to maintain a competitive fiscal investment climate in the country.

    (b) Support Public Private Partnerships in the development, operation and maintenance of energy infrastructure and delivery systems.

33. The Government shall set up a Consolidated Energy Fund to cater for funding of the proposed National Energy Institute, infrastructure development; acquisition of strategic petroleum reserves; energy sector environmental disaster mitigation, response and recovery; hydro risk mitigation; water towers conservation programmes; energy efficiency and conservation programmes as well as promotion of renewable energy initiatives.

Cross Cutting Issues

34. The Cabinet Secretary responsible for energy may establish directorates with responsibility for policy development as well integrated national planning in the areas of oil and gas, coal resources, renewable energy, electricity, nuclear energy for electricity generation as well as energy efficiency and conservation.

35. Research, Development and Dissemination as well as human resource development are key in achieving the objectives of this policy. It is therefore necessary to establish a National Energy Institute to undertake training, research, development, dissemination, nurture talent, innovation and to enhance capacity building in the sector.

36. The Government is committed to promoting a climate that would be conducive to sustained investments in the energy sector taking into account the needs and ability of the people of Kenya.

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. Since 2008 the Kenyan economy has remained resilient, growing at 4.6% in 2012 up from 4.4% in 2011. This is as a result of implementing appropriate broad-based policies leading to high growth momentum. Despite this outcome, low productivity in agriculture, weak manufacturing sector and weak transport system in the face of rising imports and stagnating exports and high electricity cost remain major concerns.

3. The Government has since then been addressing these challenges brought about by high inflationary pressures through tightening of fiscal and monetary policies and containing of the depreciation of the shilling. These efforts have yielded positive results as experienced by easing of food prices, declining inflation rate and relatively stable exchange rate.

4. Other factors responsible for this positive momentum include falling international oil prices, the new Constitution, East Africa Community (EAC) integration, Information Communication Technology (ICT) innovations, strong macroeconomic management and recent investments in infrastructure

5. Real GDP is expected to continue to improve, largely because of expansion in tourism, telecommunications, transport, construction, investments in the energy sector and recovery in agriculture.

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.

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.

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 and petroleum products, accounting for about 25% of the national import bill. By 2012 the value of imported petroleum products increased by 19.3% from 2011. This increase was partly explained by a 45.1% decline in the value of crude petroleum imports in 2012.

10. 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.

11. 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 adequate secure, affordable, sustainable and reliable supply of energy 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 an environment conducive for the development and provision of energy services.

   (d) Prioritise and promote development of indigenous primary and secondary energy resources

   (e) Prioritise and promote the development of local technologies in energy development and delivery.

   (f) Promote energy efficiency and conservation.

   (g) Ensure that prudent environmental, social, health and safety considerations are factored in energy sector developments.

   (h) Ensure that a comprehensive, integrated and well informed energy sector plan is put in place for effective development.

   (i) Foster international co-operation in energy trade, investments and development.

   (j) Promote capacity building in the sector through energy research, development, training and local manufacture of energy plant, equipment, appliances and materials.

(k) Promote appropriate standards, codes of practice and specifications for equipment, systems and processes in the energy sector.

(l) Promote diversification of energy supply sources to ensure supply security

(m) Promote healthy competition in the sector.

(n) Promote cost effective and equitable pricing of energy

(o) Protect producer, supplier and consumer interests.

(p) Promote both local and international investments in the energy sector.

(q) Ensure foreign investments in the energy sector have a minimum local equity participation of 30%.

(r) Promote indigenous investments in the energy sector through incentives.

(s) Promote and develop Government owned agencies in the development of energy resources

(t) Promote an elaborate response strategy in energy related disaster management.

(u) Generate at least 70% of electricity from renewable resources and build the necessary transmission infrastructure.

(v) Provide for the phased transfer of provision of energy services to the Counties in accordance with Article 174 of the Constitution.

(w) Foster cooperation arrangements between county governments and the relevant public institutions.

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; and

   (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, the Energy Tribunal and the Rural Electrification Authority.

   (b) The Geothermal Resources Act No. 12, enacted in 1982 to control the exploitation and use of geothermal resources and vests 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, 2011

(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 connected therewith or incidental thereto.

(r) The National Construction Authority Act that provides the establishment, powers and functions of the National Construction Authority and 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 achieve 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 and Petroleum (MoEP)

   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 mandated to generate electric power, currently producing 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 of 2006 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 100% 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, maintenance and operation 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 4 million tonnes per annum but processes 1.6 million 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. Kenya Nuclear Electricity Board (KNEB)

KNEB 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.

14. 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.

15. Oil Marketing Companies (OMCs)

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

16. 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 sub-sector.

17. Oil Exploration and Production Companies (OIEPs)

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

18. 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), Kenya Maritime Authority (KMA) 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 restrictive regulations such as procurement laws, inadequate investments framework for PPP's, JVA's etc. 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, 2012 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 manufacturers[1].
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).

2.2PETROLEUM (OIL)

2.2.1 Petroleum Exploration

1. Kenya has had no known commercial reserves of petroleum until January 2012 when Tullow Oil, spudded Ngamia I Well located at Lokichar in Turkana County. By November 2013, Tullow had drilled four more exploration wells (Etuko, Twiga, Ekales and Paipai) three of which had oil. The API gravity of the oil was estimated at between 30^0 and 35^0, indicating high quality oil.
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. Between 2012 and November 2013, three exploration wells (Mbawa, Kiboko and Kubwa) were drilled in the off-shore.

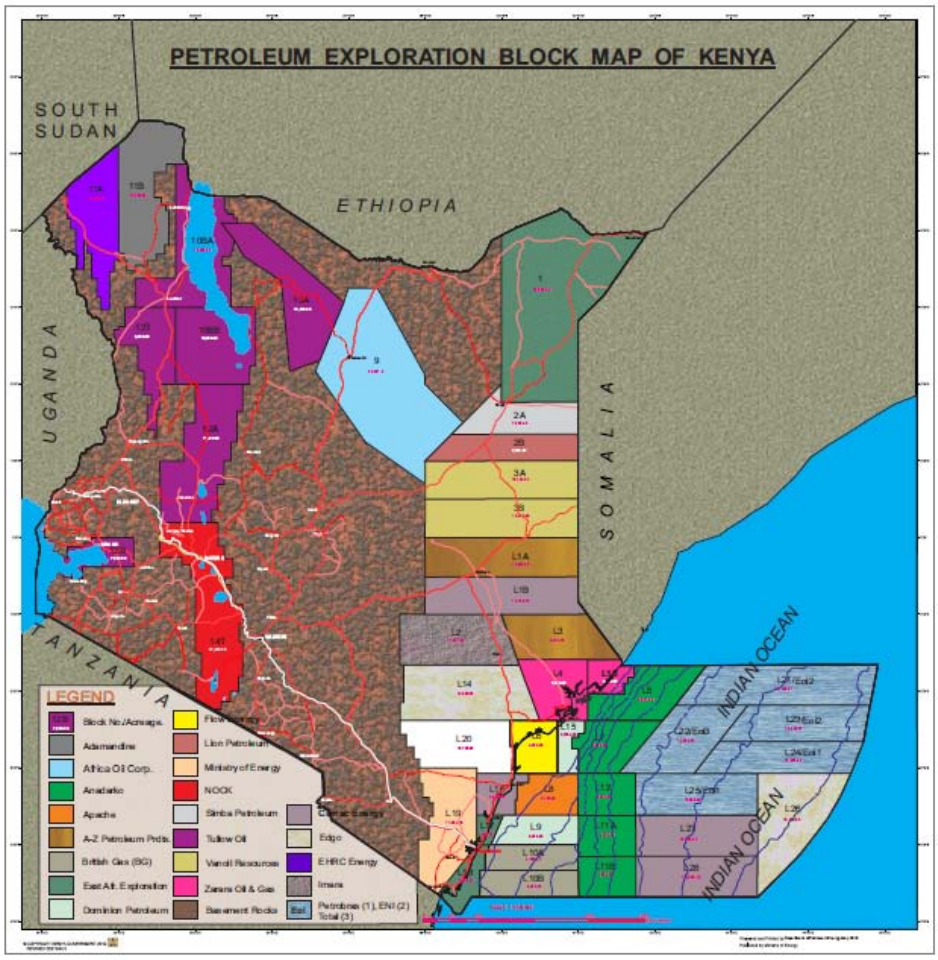
   Table: 2.1 Summary of the Basins and Wells Drilled

Basin	Area (km^2)	Wells drilled	Average Sediment thickness (m)
Lamu	261,000	19	12,000
Mandera	43,404	2	10,000
Anza	81,319	11	10,000
Tertiary Rift	105,673	7	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 November 2013 there were a total of 39 exploratory wells, more than 80,000 km of two dimensional (2D) and 6,300 km^2 of three dimensional (3D) seismic data.
4. As at November 2012, Kenya had a total of 46 exploration blocks, as shown in Figure 2.1 below.

[1]Economic Survey, 2011

Figure 2.1 – Petroleum Exploration Blocks, December 2012



5. The marked increase in petroleum exploration interest is attributed to:

   (a) The discovery of oil in Turkana County in 2012.
   (b) Creation of basin by basin data packages by the Government.
   (c) The existence of an attractive legal, regulatory framework, fiscal and acceptable risk-reward balance.
   (d) Intensive promotion activities by the Government.
   (e) Discoveries of commercial quantities of petroleum in neighbouring Uganda
   (f) Major discoveries of natural gas offshore Mozambique and Tanzania which have similar geological setup as offshore Kenya.
   (g) Rising world crude oil prices.
   (h) Increased world demand in natural gas.

6. As at November 2013 out of the 46 gazetted blocks, 44 had been licensed to oil exploration and production companies (OIEPs) as detailed in Table 2.2 below. The entry of major foreign OIEPs has been a major boost for Kenya's petroleum exploration activities. Their entry will add

immense value through acquisition of high quality data due to the deployment of new data acquisition technologies such as 3D Seismic and Full Tensor Gradiometry (FTG).

Table 2.2: Licensed Petroleum Exploration Companies as at December 2012

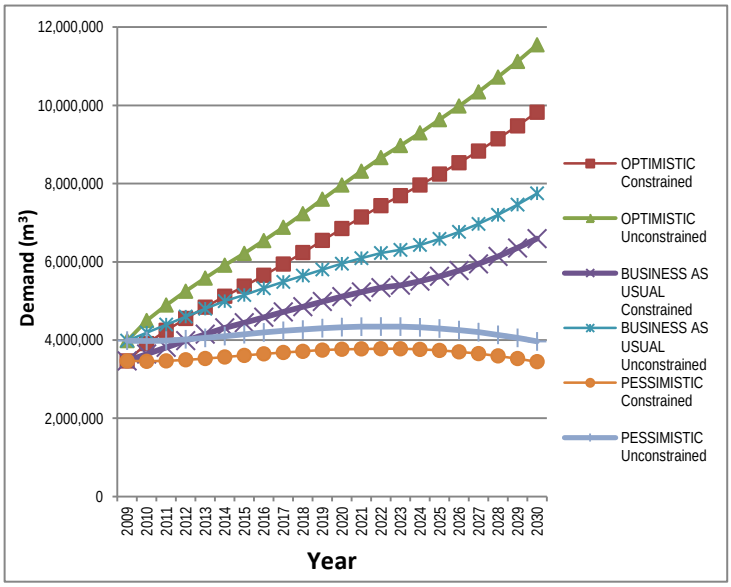
No	Exploration Companies	Exploration Block Nos.	Total No. of Blocks
1.	Tullow Oil Corporation	10A, 10BB, 10BA, 13T, 12A,and 12B	6
2.	Anadarko	L-5, L-7, L-12, L-11A, L-11B	5
3.	BG Group	L-10A, L-10B	2
4.	Ophir/Dominion	L-9, L-15	2
5.	Apache	L-8	1
6.	Vanoil Resources	3A, 3B	2
7.	Africa Oil Corporation	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, 1	3
14.	A-Z Petroleum	L-1A & L-3	2
15	CAMAC Energy	L-1B, L-16, L-27, L-28	4
16	Rift Energy	L-19	1
17	Imara Energy Corp.	L-2	1
18	Adamantine Energy Ltd	11A	1
19	Pacific Seaboard Investments Ltd	L-20	1
20	ERHC Energy Inc.	11B	1
21	Lamu Oil Exploration	L-14	1
22	Total Exploration & Production Kenya B. V.	L-22	1
23	ENI Spa	L-21, L-23, L-24	3

7. Licensing of Petroleum Blocks is currently governed by the Petroleum (Exploration and Production) Act (Cap. 308). All Production Sharing Contracts (PSC) are based on a model PSC and Heads of Agreement (HoA). Cap. 308 and the model PSC has no provisions on gas terms.
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.

2.2.2 Petroleum Demand and Consumption

1. According to the Economic Survey 2013, consumption of petroleum fuels in Kenya rose from 3.1 million Tons of Oil Equivalent (TOE) in 2007 to 3.9 million TOE in 2011 and fell to 3.6 million TOE in 2012. 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 79.7% of petroleum consumption, industrial and commercial sectors accounted for 11.4% while power generation accounted for 8%.
3. A study by the Kenya Institute of Public Policy Research and Analysis (KIPPRA) of August 2010, estimated that unconstrained demand of Liquefied Petroleum Gas (LPG) was 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.
4. The average consumption of petroleum products in Kenya has been increasing over the years. In 2004, actual consumption was 2.9 million TOE, rising to 3.6 million TOE in 2009 and 3.77 million TOE in 2010. 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.
5. Demand for petroleum products (in m^3) is projected to rise by 3.1% on average per annum from 2009 to 2030. The projections under different scenarios are given in Figure 2.2.

Fig 2.2 National Demand Forecast for petroleum products



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 2011 oil prices fluctuated rapidly with the lowest at US$ 95.6 in January, peaking in April at US$ 120 per barrel

and averaging at more than US$110 per barrel most of the year. In 2012 the average price went up by 3.1% to US$112.97 per barrel. The rapid prices changes were mainly attributed to strong global demand, appreciation of the dollar and the unrest in the Middle East and North Africa. High international oil prices and a weak Kenyan Shilling have led to spikes in prices of petroleum products in the domestic market.

2. The total quantity of petroleum products imported into the country grew by 11.5% from 3,844,600 tonnes in 2010 to 4,285,700 tonnes in 2011 and declined by 3.3% to 4,142,500 tonnes in 2012. During the same period, the total value of petroleum products exported, including re-exports, increased by 47.1% while the total import bill increased by 68.2% to KShs. 337,749.2 million in 2011 and declined to KShs. 326,921.6 million in 2012. Total domestic demand for petroleum products rose by 1.9% in 2011 and declined by 6.9% in 2012.

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 the Kenya Ports Authority is to cease using SOT for handling petroleum products and to relocate KOT to pave way for construction of a Container Terminal at Kipevu.

2.2.4.3 Storage Facilities in Mombasa

1. KOSF has a storage capacity of 326 million litres while its operational capacity is 269 million litres. This comprises 58, 108 and 103 million litres of petrol, diesel and dual-purpose kerosene, respectively. This capacity is not adequate for regional demand of petroleum products estimated at 450 million litres per month.

2. Further, the capacity is constrained by low product evacuations at Nairobi. 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

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. Therefore the Government shall set up a Consolidated Energy Fund to among others cater for the acquisition of the stocks and the development of the appropriate infrastructure for the strategic petroleum reserve.

2.2.4.5 Common User Truck and Rail Loading Facilities in Mombasa

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 has been refining 1.6 million 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 there was an attempt to modernize the refinery and for this reason the Government entered into an agreement with Essar Energy Overseas Limited. 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. The modernization was intended result to competitive refined petroleum products, increase employment and wealth creation opportunities and with the discovery of oil in the region, the refinery would become strategic asset for processing of such oil. Essar Energy Overseas Limited has since opted out from KPRL
3. The Government plans to build another petroleum refinery in Isiolo or other suitable location under the Lamu Port and Lamu-South Sudan Ethiopia Transport Corridor (LAPSSET) 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 Company Ltd. (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 450 million 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. There are also plans to extend the pipeline to Kigali Rwanda and Goma in eastern DRC.
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 450 km long. It is a 14 inch diameter pipe and has 8 pumping stations with enhanced operational pumping capacity of 830 m^3 per hour, up from 440 m^3 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 70 OMCs. The product transfers from the KPC Nairobi Terminal to the OMCs' depots are currently at an average of 5,000m^3 per day based on requests by the OMCs. This is against handling capacity of approximately 10,000m^3 per day.

2.2.6.2 Rail Transport

As at 2013 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 capacity. 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. With the construction of the standard gauge railway line, transportation of petroleum products by rail is likely to increase.

2.2.6.3 Sea and Lake Transport

The discovery of oil in the country and Uganda as well as 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 to 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

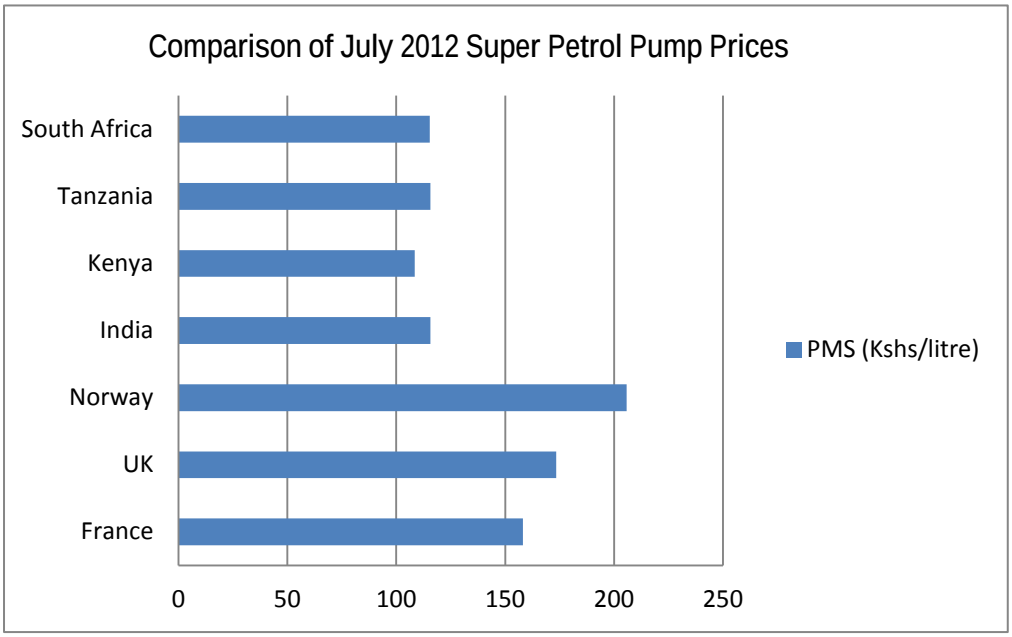
1. As at June 2013 there were 88 OMCs licensed to import petroleum products and 176 companies licensed to market petroleum products in Kenya, and more are expected to join. The licensing criteria have been simplified to facilitate the entry of indigenous traders in the oil business. However, the market 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

1. Importation of petroleum products is through the Open Tender System (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.

3. The prices in Kenya as published by the ERC are competitive compared to the prices in the region and other countries like South Africa as shown in Figure 2.3.

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



Source: *ERC, AIT/FIA Information Centre-OTA, July, 2012*

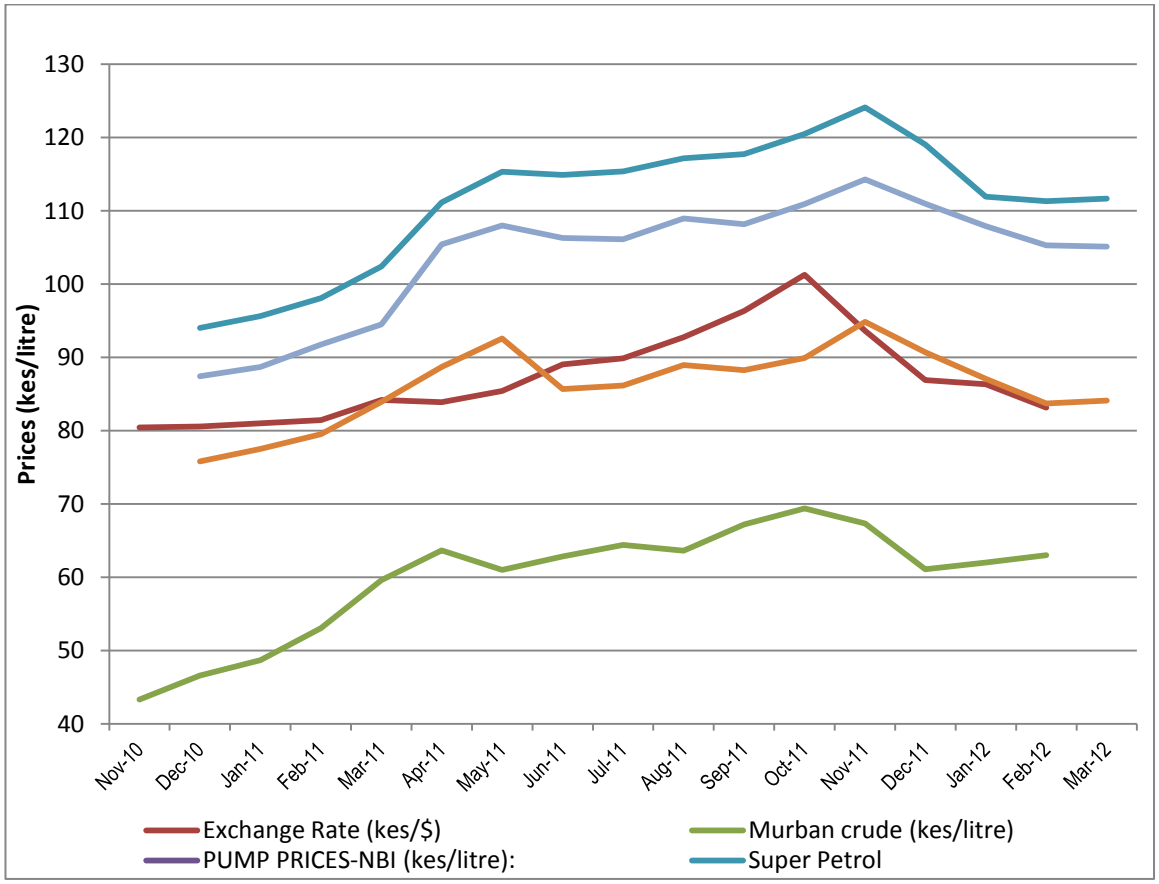
4. In addition, the economies of scale benefit the smaller OMCs, which are mostly local entrepreneurs. However all parties must abide by the terms and conditions of the agreement which stipulates equal participation without favouritism in the spirit of creating/promoting a level playing field.

2.2.9 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.
2. 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.
3. The imported petroleum products are paid for in US Dollars. Figure 2.4 also shows the fluctuation of the exchange rate against the US dollar for the period November 2010 to March 2012 which shows an overall gradual depreciation. In particular, there was 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.

Figure 2.4 - Trend of Crude Oil Prices, Pump Prices and Exchange Rates



4. 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 November 2013

	Super	Kerosene	Diesel
Excise Tax	19.90	0	8.24
Road Maintenance Levy	9.00	-	9.00
Petroleum Development Levy	0.40	0.40	0.40
Petroleum Regulation Levy	0.05	0.05	0.04
Total: Taxes & Levies	29.35	0.45	17.68

Source: *KIPPRA 2011 Survey*

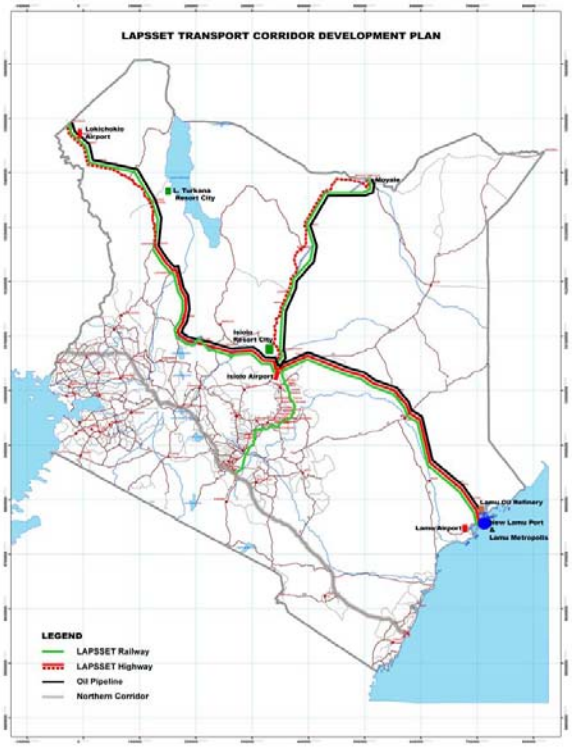
5. Other costs which have increased are the transportation and distribution costs and the allowed marketer's margin to cover overheads and profit.

6. It is hoped that 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.

2.2.10 Lamu Port and Lamu-South Sudan-Ethiopia Transport Corridor

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 facilitate the setting up of merchant oil refineries to process crude oil to meet the growing demand for oil products in the region. The refineries will process crude oil from within and the region.
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 the Lamu – Juba pipeline to the existing Mombasa-Kampala pipeline.

Figure 2.6 – The LAPSSET Project



2.2.11 Challenges in Petroleum

2.2.11.1 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 Cap. 308 and in the model 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.
   (j) Mechanism for working out national government, county government and local community benefits sharing.
   (k) Payment of royalty on gross oil produced.

   The model PSC is at Annex 10.1 in 10.0 Annexures.
7. Petroleum resource is finite.
8. Inadequate policy for sustainable utilization of petroleum revenue and its management.

2.2.11.2 Petroleum Mid and Downstream

1. Reliance on a single jetty for off-loading petroleum imports.
2. Offshore and onshore access to the port:
   (a) 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. It is to be noted that the maximum draught at the entrance to the Mombasa port is 16 meters after dredging.
   (b) 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 infrastructure for storage and evacuation of petroleum products.
6. High initial cost of acquiring the necessary infrastructure.
7. Lack of proper planning and coordination of petroleum infrastructure.
8. Lack a petroleum (oil and gas) master plan.
9. 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.
10. High prices of petroleum products.
11. Adulteration of petroleum products.
12. Lack of centralized gas reticulation infrastructure to homes.

2.2.12 Policies and Strategies - Petroleum (Upstream, Midstream and Downstream)

2.2.12.1 Petroleum Exploration and Production

Policies and Strategies Petroleum Exploration and Production	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Develop a policy on management of commercial discoveries of petroleum resources.	✓	✓	
2. The Government shall continue to promote, petroleum exploration activities and support private and public investments.	✓	✓	
3. An inter-ministerial committee, called National Fossil Fuels Advisory Committee (NAFFAC) shall be re-constituted under legislation to advise the Cabinet Secretary on all petroleum and coal exploration matters. members drawn from the Ministry in-charge of Energy, NOCK, Attorney General, NEMA, KRA and Ministry in-charge of Mineral Resources, National Treasury and the concerned County Government:.	✓		
(a) ;			
(b) to prepare and review standard licensing terms of each petroleum block;			
(c) to negotiate with investors on the terms of the license of the petroleum and coal blocks for exploration, production and development;			

	Policies and Strategies Petroleum Exploration and Production	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
	(d)			
4.	Government to establish a National Data Centre and laboratory to enhance primary data acquisition, analysis and interpretation in open blocks and to enhance partnership in data exchange so as to reduce cost in exploration and access to new technologies	✓		
5.	Sub-divide and create new petroleum exploration blocks, based on technical data and negotiate favourable work programmes that will see investors with requisite capacity assist in data acquisition.	✓		
6.	Review Cap. 308 to incorporate industry best practice adapted to fit local conditions. The revised Act shall provide for gas sharing terms, compensation, windfall profits, royalties and Corporate Social Responsibility.	✓		
7.	Government shall enhance manpower, technical capacity and local content in petroleum exploration activities by establishing programmes in conjunction with local industry associations, local training institutions and international institutions.	✓	✓	✓
8.	The Government shall develop legal mechanisms for sharing and management of petroleum benefits, in line with the Extractive Industries Transparency Initiative.	✓		
9.	Review the model PSC to ensure that it is adequate to support dynamic, competitive, well managed exploration activities inclusive of but not limited to: compensation regime; licensing rounds; community awareness and participation; windfall profits; gas sharing terms; Corporate Social Responsibility requirements; government share out of monetary gains from transfer of a PSC; defined criteria for evaluation of terms provided in PSC applications for prudence and competitive bidding for blocks; environmental protection, conservation and management; sharing of benefits mechanism between the national government, county government and local community; payment of royalty on gross oil produced; local content requirement.	✓	✓	
10.	Enhance corporate governance in the Government institutions charged with petroleum exploration and development.	✓	✓	✓
11.	Restructure and enhance NOCK's financial capacity to conduct upstream business.	✓	✓	
12.	Establish a one-stop shop for petroleum upstream licensing and operations.	✓		
13.	Strengthen monetary and fiscal regimes to maximize the government take on petroleum exploitation while taking into account the investors interests.	✓	✓	

Policies and Strategies Petroleum Exploration and Production	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
14. Provide incentives for investments in marginal oil and gas discoveries that could have the potential to deliver much financial and socio-economic value.	✓	✓	✓
15. Investment in petroleum exploration and production activities shall include technology transfer and development of local manpower including engaging qualified local personnel as a priority.	✓	✓	✓
16. The Government will support local investors that have the capacity and interest to participate in and/or undertake petroleum exploration and production.	✓	✓	✓
17. The Government will support collaboration and synergy by any government owned agencies keen to jointly participate and undertake petroleum exploration and production	✓	✓	✓
18. The Government to facilitate KPC to develop petroleum and natural gas infrastructure i.e. crude oil pipelines and storage tanks and that it will be the Government's lead agency in the development of such facilities in public private partnership (PPP) arrangement.	✓	✓	✓
19. Enforce all terms in the PSCs.	✓	✓	✓
20. The Government shall develop an Oil and Gas Master Plan; intensify exploration activities; enhance the utilisation of local capacity in oil exploration; upgrade the local exploration technology; commence commercial production of petroleum.		✓	✓

2.2.12.2 Petroleum Supply and Distribution (Midstream and Downstream)

Policies and Strategies Petroleum Supply and Distribution	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Collaborate with the Kenya Railways Corporation and its concessionaire to maximise the utilisation of rail transport for petroleum products.	✓		
2. KPC to replace the Mombasa-Nairobi pipeline, extend the oil pipeline to enhance regional inter-connection, construct common user truck loading facilities and spur lines as necessary.	✓	✓	✓
3. Develop petroleum pipeline infrastructure along the LAPSSET project.	✓		
4. Government shall provide security for petroleum installations.	✓	✓	✓
5. Provide a legal and regulatory framework for midstream petroleum and gas infrastructure including third party access at reasonable terms and conditions	✓	✓	
6. Government to co-ordinate energy infrastructure development which are interlinked to facilitate efficient utilization of petroleum resources.	✓	✓	

Policies and Strategies Petroleum Supply and Distribution	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
7. Facilitate NOCK's role of stabilizing the market/prices by using appropriate measures including increased market presence and importation of at least 30% of the country's demand.	✓	✓	
8. Introduce incentives to attract investment in retail networks in the remote areas of the country	✓	✓	
9. Establish a one-stop shop for petroleum licensing.	✓		
10. Combat malpractices in the petroleum industry such as adulteration, dumping and under dispensing through compliance monitoring and by enhancing penalties.	✓	✓	
11. Enhance consumption of LPG, being an environmentally friendly and economic modern fuel by:	✓		
(a) Constructing import handling, storage, and distribution facilities.	✓	✓	
(b) Providing fiscal incentives on LPG and related appliances.	✓	✓	
(c) Encouraging private sector investment in additional capacity for handling and storage of LPG.		✓	✓
12. Enforce minimum construction and operation standards for retail and wholesale dispensing sites.	✓	✓	
13. 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.	✓	✓	
14. 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 PPP.	✓		
15. Develop additional storage and common truck loading facilities in Mombasa and Nairobi.	✓		
16. Provide appropriate incentives to facilitate and support public and private investments in the development of petroleum infrastructure including petroleum jetties, gas filling terminals, loading and storage facilities in all parts of the country at least cost.	✓	✓	✓
17. Construct petroleum storage facilities at appropriate locations to meet 30 days of operational stocks and 90 days of strategic reserve stocks.		✓	
18. Government to facilitate private sector investors' involvement in the development of a landlord port with a container terminal, gas terminal and oil jetty with a storage facility in Mombasa.		✓	
19. Petroleum products quality to be reviewed occasionally to align them with international standards by enhancing institutional capacity in Kenya Bureau of Standards (KEBS) and NERC to enforce compliance with fuel quality specifications for both domestic import and export market..	✓	✓	✓

Policies and Strategies Petroleum Supply and Distribution	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
20. The Government shall facilitate NOCK to procure the ninety days petroleum strategic reserve stock.		✓	
21. The Government shall enhance and support modernisation of the existing refinery and fast track the development of new refineries to enhance petroleum refinery capacity in the region.	✓	✓	
22. The Government shall facilitate and support public and private investments in off-loading, storage, transportation and evacuation infrastructure for adequate supply and distribution of petroleum products.	✓	✓	
23. The Government shall establish mechanisms to ensure stable power supply to support petroleum business.			
24. Government shall where necessary cushion Kenyan consumers from the negative effect of high petroleum prices.	✓	✓	
25. Assess the continuing feasibility of pump price regulation.	✓		
26. Introduce measures to increase consumption of LPG.	✓	✓	
27. Provide for management of regulated contracts in legislation.			
28. Provide incentives for investment in centralized gas reticulation systems.		✓	
29. Transportation of petroleum products by road to be restricted where other cheaper and safer modes of transportation are available.		✓	
30. Encourage private sector investment in the construction of common user truck and rail loading facilities.	✓	✓	
31. The government shall put enabling mechanisms to allow KPC apply its expertise regionally in petroleum infrastructure development.		✓	✓

2.3 NATURAL GAS

2.3.1 Background

1. Natural gas accumulations can be found as pure methane or in conjunction with higher hydrocarbons. Natural gas is categorized as being one of three types:

   (a) Oil and associated gas,

   (b) Rich condensate and gas,

   (c) Dry gas.

2. Conventional natural gas is typically found in sandstone reservoirs and can either be in the form of associated or non-associated gas. Associated gas is found together with crude oil, either as free gas or dissolved in the oil. Non-associated gas is found without significant quantities of oil.

Both associated and non-associated gas may contain heavier hydrocarbons such as ethane, propane, and butane.

3. Unconventional gas types include coal bed methane and shale gas. Methane produced from coal seams is called coal bed methane (CBM), coal seam methane, or coal seam gas (CSG). Once produced, it is transported and marketed like conventional natural gas.
4. Gas contained within layers of fine-grain clay and siltstone rocks commonly known as 'shale' is called shale gas. Shale is the earth's most common sedimentary rock, rich in organic carbon but having very low permeability.
5. Natural gas has the potential of meeting future energy needs of the country and offers a number of significant environmental benefits over other fossil fuels mainly due to its chemical simplicity and burns cleaner than all other fossil fuels.
6. Kenya had no known reserves of natural gas until September, 2012 when gas discoveries were made offshore at Mbawa 1 near Malindi. The commercial viability is yet to be established.

2.3.2 Natural Gas Exploration

1. As of 2013, Kenya has no infrastructure for exploitation of natural gas. If commercial quantities are found, field development will need to include drilling of production wells, installation of offshore and onshore production facilities, and LNG liquefaction plants for export. Drilling and construction activities, particularly in deep water developments, are highly capital intensive.
2. With increased petroleum exploration being undertaken both on-shore and off-shore in the country's four major sedimentary basins there is now the possibility that indigenous natural gas may be discovered in commercial quantities. If natural gas is discovered in sufficient quantities the country could harness some of the indigenous gas to meet the growing energy requirements of the country and would seek to reduce reliance on imports.
3. The monetization of natural gas is frequently more complex than the commercialization of hydrocarbon liquid reserves. Frequently investments will be required in interrelated links in the supply chain, including upstream, midstream, downstream and consumption facilities.

2.3.3 Importation of Natural Gas

The options available for importation are either through natural gas pipelines from producing fields in neighbouring countries or by Liquefied Natural Gas (LNG) ships supplying LNG to onshore regasification plants.

2.3.4 Utilization

The following options shall be explored upon discovery of commercial quantities of natural gas or importation of the same.

2.3.4.1 Electric Power Generation

The main use of natural gas is through gas-fired power generation, preferably Combined Cycle Gas Turbines (CCGT) to ensure maximum efficiency. Generation of power through gas fired

plants has several advantages over other fossil fuelled power plants in that it has much lower environmental impact. Natural gas pipeline would need to be constructed from the field to the power plant or from the LNG import handling facility or import pipeline.

2.3.4.2 Industrial

The following industries are feasible when sufficient quantities of natural gas are available at reasonable cost:

(a) Manufacture of ammonia for fertilizer production. More than 97% of the worlds strategic fertilizer is produced from synthetically produced ammonia derived from natural gas. The natural gas is both a feedstock and fuel.

(b) Manufacture of fuel additives, plastics detergents, formaldehyde, among others.

(c) Manufacture of steel through the modern Direct Reduced Iron method which directly removes oxygen by reacting the ore with a hydrogen-rich and CO-rich gas produced by catalyzing methane derived from natural gas. The natural gas is both a feedstock and fuel.

2.3.4.3 Gas to Liquids

This application is used to produce diesel and other fuels. However the technology for Gas to Liquids (GTL) has not yet been commercially proven and therefore shall not be an option until such technologies are well developed and available at reasonable cost.

2.3.4.4 Transport (Compressed Natural Gas)

Compressed Natural Gas (CNG) is methane pressured at 200 to 250 bars (2900 to 3,500 psi) at which it is stored and distributed. In this case, Methane is compressed to less than 1% of the volume it occupies at standard atmospheric pressure. CNG technology shall be applied in Kenya for transport.

2.3.4.5 Commercial and Domestic use

The Government shall initiate pilot projects for residential domestic and commercial purposes for space heating, water heating, cooking, and street lighting. Networks shall be developed for supplying residential and commercial consumers with clean and reliable natural gas.

2.3.5 Challenges

2.3.6.1 Challenges in Upstream Gas Activities

1. The lower wellhead price of natural gas, be it caused either by having to compete with lower cost alternative fuels in the domestic market or as a result of lower netback prices into the export markets, and longer project lead times, makes it extremely challenging to economically develop a natural gas industry based on oil-based fiscal terms. The government will recognize these facts and offer more favourable fiscal terms for natural gas including more favourable profit splits as an incentive for natural gas exploration and development.

2. Exploration and production of natural gas is highly capital intensive.
3. Inexistence of gas infrastructure to support gas discovery and development.
4. High cost of gas infrastructure both offshore and onshore.
5. Inability to disaggregate into component elements of supply chain e.g cost of wholesale Gas, transportation and distribution in order to price the gas.
6. Inherent weaknesses in Cap. 308 and the model PSC which include lack of provisions for:
   (a) Gas sharing terms.
   (b) Environmental protection, conservation and management.
   (c) Inadequate policy in profit gas revenue sharing and management.
7. There is no world gas price like in the case of oil.
8. Inadequate manpower, technical capacity and local content in gas exploration and production activities.
9. Lack of gas master plan.
10. Potential for Gas flaring especially from oil producing fields. Gas flaring is a practice that is most often linked with the simultaneous production of oil and natural gas where there is no ready market for the gas. This is performed by safely burning off the associated gas. This approach was historically accepted as industry standard; however the increasing focus on the impact of oil and gas production on the environment, combined with the increasing value of gas, makes indiscriminate flaring untenable. However, there are instances when it is necessary to flare associated gas production. This is normally in relation to preventing excessive pipeline pressure and/or in response to a specific emergency (such as equipment failure).

2.3.6.2 Challenges in Natural Gas

1. Lack of a regulatory framework for natural gas development and production.
2. Lack of infrastructure for exploitation and use of natural gas, such as LNG liquefaction plants, natural gas pipelines, etc.
3. Lack of legal regulatory and fiscal framework to facilitate the export options as the easiest and quickest option to monetize natural gas discoveries.
4. Lack of facilities to exploit natural gas reserves, e.g., power plants, petrochemical plants, and fertilizer plants.
5. Lack of infrastructure for supply to commercial, industrial and residential consumers.
6. Lack of gas master plan.

2.3.6 Policies and Strategies - Natural Gas

Policies and Strategies	Implementation Plan

	Natural Gas	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	Develop a Gas Master Plan and a policy that identifies priority domestic sectors for gas utilization and, provided sufficient volumes are discovered, will allow gas to be separated and exported at international market prices.	✓	✓	
2.	Develop the gas sector by: ensuring the safe supply of gas to end users; attracting investment in the sector by establishing a transparent and efficient legislative framework that encourages upstream and downstream development and enables long term investment; promoting private sector participation in all parts of the gas chain and establishing a regulatory framework (Economic Regulation, Negotiated Access and Operational Regulation) according to international norms.	✓	✓	
3.	Enhance local expertise in gas exploration and production through training, technical collaboration with exploration companies and universities and research institutions.	✓	✓	
4.	Promote gas exploration both onshore and offshore and support private and public investments through provision of requisite fiscal, legal and regulatory framework.	✓	✓	
5.	Put in place mechanism for gas infrastructure development in under PPP arrangements to promote exploration and development.	✓	✓	
6.	The Government shall develop prior plan to support drilling of production wells, re-injection wells, and the necessary infrastructure such as gas processing plants, pipelines and storage facilities.	✓		
7.	To facilitate efficient use of capital and Government oversight, a segmented fiscal structure covering the upstream, midstream and downstream shall be adopted. The upstream shall be subject to the PSC regime while the midstream and downstream activities shall be held in separate entities outside the PSC and subject to general Corporate Income Tax.	✓	✓	
8.	Adopt a transfer pricing mechanism to address the possibility of tax avoidance by affiliated parties in the gas value chain, based on international best practice guidelines for transfer pricing. Commercialization of gas requires mechanisms to be provided to take into account elements of supply chain which shall consider the value of natural gas upon discovery, development, processing and the market for end products in order to determine the pricing.	✓	✓	
9.	Facilitate industries to exploit supplies of natural gas based on market studies of priority markets.			✓
10.	Initiate networks to supply residential and commercial consumers with clean and reliable natural gas.			✓
11.	For Gas to liquids (GTL) the policy shall be to allow the technology to be commercially proven before adoption locally.			✓

Policies and Strategies Natural Gas	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
12. CNG technology shall be applied for transport starting with public transport initially on pilot basis in areas with supply of natural gas.			✓
13. The Government shall promote studies for overall gas demand in the country to facilitate planning.		✓	✓
14. Review Cap 308 and the model PSC to address gaps and provide for: gas sharing terms, environmental protection, conservation and management; and profit-gas revenue sharing and management.	✓		
15. Enhance manpower, technical capacity and local content in all aspects of petroleum activities.	✓	✓	
16. Develop mechanisms for sharing and management of gas revenue.	✓		
17. Undertake measures to fast track commercial gas discovery including CBM and Shale Gas.		✓	✓
18. In the event of discovery of crude oil together with natural gas, companies should endeavour to ensure that secondary measures are instituted to exhaustively produce from such wells.		✓	✓
19. Flaring of the natural gas shall not be allowed except for safety and testing purposes. Where flaring is done, it shall be under a regulated regime and monitoring and reporting of the same shall be required.		✓	✓
20. NOCK in partnership with the private sector to construct an LNG import and export terminal. Where natural gas is available within a distance of 2000 km, the preferred option is to use a gas pipeline.			✓
21. Upon discovery of commercial quantities of natural gas, empower KPC to construct and operate a natural gas pipeline.		✓	✓
22. Establish a regulatory framework for the Midstream and Downstream Natural Gas sector by the National Energy Regulatory Commission.		✓	✓

2.4 COAL RESOURCES

2.4.1 Overview

1. 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.
2. 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.

3. 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 while capturing carbon for storage (CCS). Current world coal energy consumption by sector is 42% electricity, 25% industrial and 33% other uses.
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.

2.4.2 Demand for Coal

1. In Kenya, coal is mainly used by cement manufacturers to complement heavy fuel oil for process heat. As at 2013, all coal utilised in Kenya was imported. Between 2006 and 2013 consumption of coal averaged 140,000 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 and other parts of the country.

2.4.3 Coal Supply

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	2010	2011
KSHS. '000	1,083,769	731,607	820,773	934,578	1,491,007	1,356,343	1,623,680	2,322,491
TONNES	155,000	128,000	171,000	156,000	159,000	138,000	165,200	236,300

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

2.4.4 Coal Upstream Development

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.
2. 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 Blocks A and B. Blocks C and D are under concession. The blocks are shown in Table 2.5.

Figure 2.7 - Location of the Mui Basin

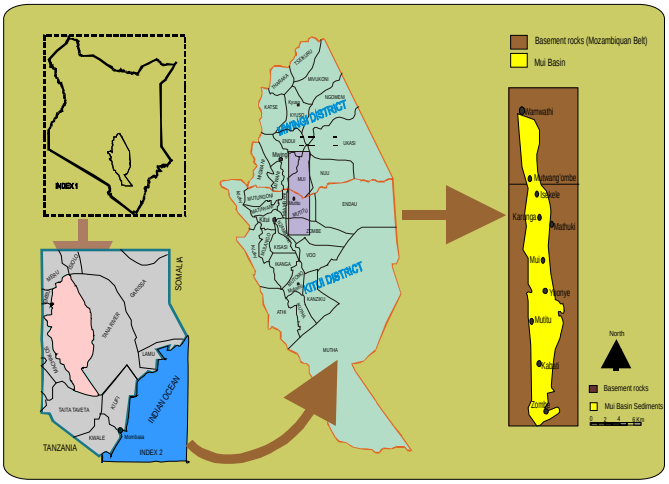


Figure 2.8 - The Four Blocks in the Mui Basin

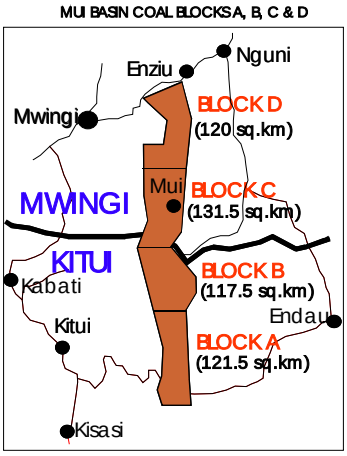


Table 2.5 - Blocks in Mui Basin and the Wells Drilled

Block	Area (km^2)	Drilled Wells	Coal Intercepted
A (Zombe – Kabati)	121.5	8	4 Wells
B (Itiko – Mutito)	117.5	8	4 wells
C (Yoonye – Kateiko)	131.5	56	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 has extended the activities to other parts of the country and in this it has established 31 more coal blocks for the purpose of establishing coal potential and delineating the blocks for concessioning.
4. The Government has concessioned Blocks C and D in the Mui Basin for coal resource development with the objective of generating 960MW from a coal fired plant in Kitui County.
5. As per the 2013 least cost power development plan (LCPDP), coal is projected to provide 4,500MW of electricity by 2030.

2.4.4.1 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.

6. Lack of a special purpose vehicle to spearhead exploration, assessment and development of coal resources.

2.4.5 Coal Mid and Downstream Development

The Government is working with a strategic investor to build a coal fired power plant in Lamu County in the coastal region. Phase 1 of the plant will have a capacity of 960MW. Construction of the plant is expected to commence in 2014 with a commissioning date of 2016. However, there is need to develop adequate and appropriate coal handling and storage facilities onshore.

2.4.5.1 Challenges in Coal Mid and Downstream

1. Inadequate technical capacity for coal mid and downstream activities.
2. Absence of a standard import and export coal handling facilities.
3. Underdeveloped road and railway transportation system.
4. Undeveloped processing facilities for coal.
5. Insufficient power supply in the coal field.
6. Undeveloped capacity to store and evacuate coal products.
7. High initial cost of acquiring the necessary infrastructure.
8. High transportation cost from the processor to end user.

2.4.6 Policies and Strategies - Coal (Upstream, Midstream and Downstream)

Policies and Strategies Coal	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Develop local expertise and enhance local content in coal exploration and production through training and collaboration with exploration companies, training and research institutions.	✓		
2. Create appropriate legal, fiscal and regulatory framework for coal exploration, exploitation and development	✓		
3. Establish coal energy research centre within the national energy institute capable of handling coal analysis and other related studies.	✓		
4. Adapt clean coal technology and provide appropriate fiscal incentives.	✓		
5. Create new coal exploration blocks based on technical data.	✓		
6. Enhance regional co-operation in data and information exchange for coal exploration.	✓		
7. Kenya Railways Corporation and its concessionaires shall 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.	✓		

Policies and Strategies Coal		Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
10.	Encourage private sector participation in coal exploration, mining, development and use through PPP and other investors by providing appropriate incentives.	✓		
11.	Construction of necessary infrastructure to support coal industry including for import and export of coal.	✓		
12.	Intensify coal exploration activities by upgrading exploration technology and mobilizing resources.	✓	✓	✓
13.	Government to facilitate development of 960MW coal generation power plant within the Mui Basin (Kitui County) and in other viable sites in the country.	✓	✓	✓
14.	Establish a special purpose company for coal resource assessment and development to accelerate electricity generation using coal.		✓	
15.	Develop an integrated infrastructure for coal storage, transportation and utilization to facilitate development of the coal industry..		✓	✓
16.	Incentivize county Government with coal deposits to develop infrastructure to potential coal mining sites to encourage investments in coal mining		✓	✓
17.	Put in place mechanisms of sharing of revenue to ensure that the local community benefit from the development of the resource.		✓	
18.	Ensure compliance with the best coal industry practice in exploration, mining, processing, development and rehabilitation.	✓	✓	

2.4.7 Cross Cutting Policies and Strategies in Fossil Fuels

Policies and Strategies Fossil Fuels		Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	The Government shall create a Sovereign Wealth Fund from a portion of the proceeds from indigenous coal and petroleum resources whose role, source and management shall be provided for in the Law.		✓	
2.	The Government shall adopt and implement the Extractive Industries Transparency Initiative (EITI) Principles as a demonstration of its commitment to good governance, increasing scrutiny over revenue collection from oil and gas as well coal resources, and improving the country's investment climate.	✓		
3.	Establish a Sectoral Planning Committee under the Integrated Energy Planning including the Fossil Fuels Development and Planning Committee.	✓		
4.	Enhance infrastructure development for fossil fuels.	✓	✓	
5.	Adopt clean technologies in exploration, exploitation and development of fossil fuels.	✓	✓	✓
6.	The government shall develop a framework and methodology for		✓	✓

	Policies and Strategies Fossil Fuels	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
	determining the oil, gas and coal resource reserves.			
7.	The Government shall develop a framework and methodology for reporting petroleum discoveries and provide penalties for falsification of data.		✓	✓

3.0 – RENEWABLE ENERGY

3.1 BACKGROUND

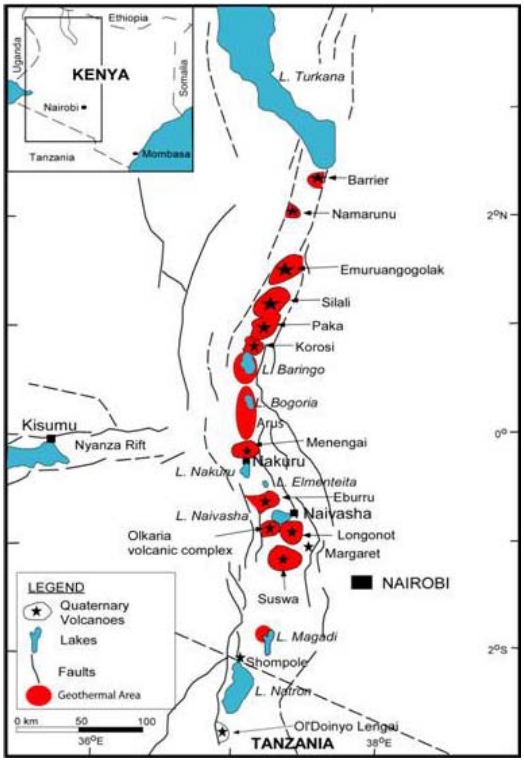
1. Renewable energy is derived from naturally occurring resources, principally the movement of wind and water, the heat and light of the sun, plant material and animal waste, and geothermal (the heat in the earth's crust). All these resources can supply our needs and those of future generations in a sustainable way. Effectively harnessing these renewable resources requires careful planning and advanced technology.
2. Renewable energy has the potential to enhance energy security and reliability; generate income and create employment; enable the country to make substantial foreign exchange savings by reducing dependence on imported fuels and its attendant price volatility, and mitigate climate change as it has minimal adverse effects on the environment.
3. According to the Economic Survey 2013 biomass provides 69% of the country's overall energy requirements while petroleum accounts for about 22% and electricity 9%. 74.5% of the electricity component is generated using renewable energy sources with fossil fuels providing the balance of 25.5%.

3.2 GEOTHERMAL ENERGY

3.2.1 Background

1. Below the earth's crust, there is a layer of hot and molten rock called magma. Heat is continually produced there, mostly from the decay of naturally radioactive materials such as uranium and potassium. The amount of heat within 10,000 metres of the earth's surface contains 50,000 times more energy than all the oil and natural gas resources in the world.
2. The areas with the highest underground temperatures are in regions with active or geologically young volcanoes. These occur at plate boundaries or at places where the crust is thin enough to let the heat through.
3. In Kenya, more than 14 high temperature potential sites occur along Rift Valley with an estimated potential of more than 10,000 MWe. Other locations include Homa Hills in Nyanza, Mwananyamala at the Coast and Nyambene Ridges. These are shown in Figure 3.1 across.

Figure 3.1 - Location of Geothermal Resource Areas in Kenya



4. Geothermal power plants use steam or hot water from a natural underground reservoir to generate electrical energy. Other uses of geothermal energy include:

   (a) Dairy industry - refrigeration and pasteurization of milk products;

   (b) Grain Silos - drying of grains (wheat & maize) and other farm products e.g. pyrethrum;

   (c) Space heating and cooling - green houses, residential houses, hotels and other buildings;

   (d) Industry - production of industrial sulphur, treatment of hides and skins and honey processing, and

   (e) Water heating for fish and crocodile farming, and spas/swimming pool.

3.2.2 Challenges

1. Relatively long lead time of between 5-7 years from conception to production of electricity.
2. Geothermal projects typically progress through stages of reconnaissance, surface exploration, feasibility study, exploratory drilling, appraisal drilling, production drilling, steam field development and power plant construction stages which normally involve high upfront investment costs.
3. High resource development risks.
4. Inadequate geothermal expertise and expensive external technology.
5. Remote location, siting restrictions and long distances to existing load centres necessitating heavy investment in transmission and other support infrastructure.
6. Competing and conflicting interests in use of land and natural energy resources by various sectors of the economy.
7. Relocation and resettlement of affected persons during geothermal development.

3.2.3 Policies and Strategies - Geothermal Energy

	Policies and Strategies Geothermal Energy	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	The Government shall support and fund the Geothermal Development Company (GDC) so as to manage the geothermal exploration risk and attract investors.	✓	✓	✓
2.	The Government will continue to support and facilitate the public sector as well as encourage the private sector to invest in geothermal subsector through various means including PPP and joint venture arrangements so as to achieve the projected capacity of 1,887MW by 2017 and at least 5,500MW by 2030.	✓	✓	
3.	The government will promote research development and dissemination and capacity building for geothermal development through provision of fiscal and other incentives.	✓	✓	✓
4.	The government shall streamline licensing and allocations of geothermal	✓	✓	

	Policies and Strategies Geothermal Energy	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
	blocks with incentives and sanctions in order to accelerate geothermal development.			
5.	Promote and encourage direct uses of geothermal resources such as utilization of heat, water, gases and minerals.	✓		
6.	Utilize the best available technologies that optimise the resource and conserve the reservoir such as binary generation and bottoming cycles.	✓		
7.	The developer of a geothermal field shall guarantee geothermal steam supply for the contract term of the plant.	✓		
8.	Promote early geothermal generation through implementation of efficient modular geothermal wellhead technologies.	✓		
9.	Undertake further geothermal resource assessments to determine additional economically viable geothermal resources.	✓	✓	
10.	Increase Government allocation of funds for the geothermal programme and support GDC in sourcing more funds.	✓		

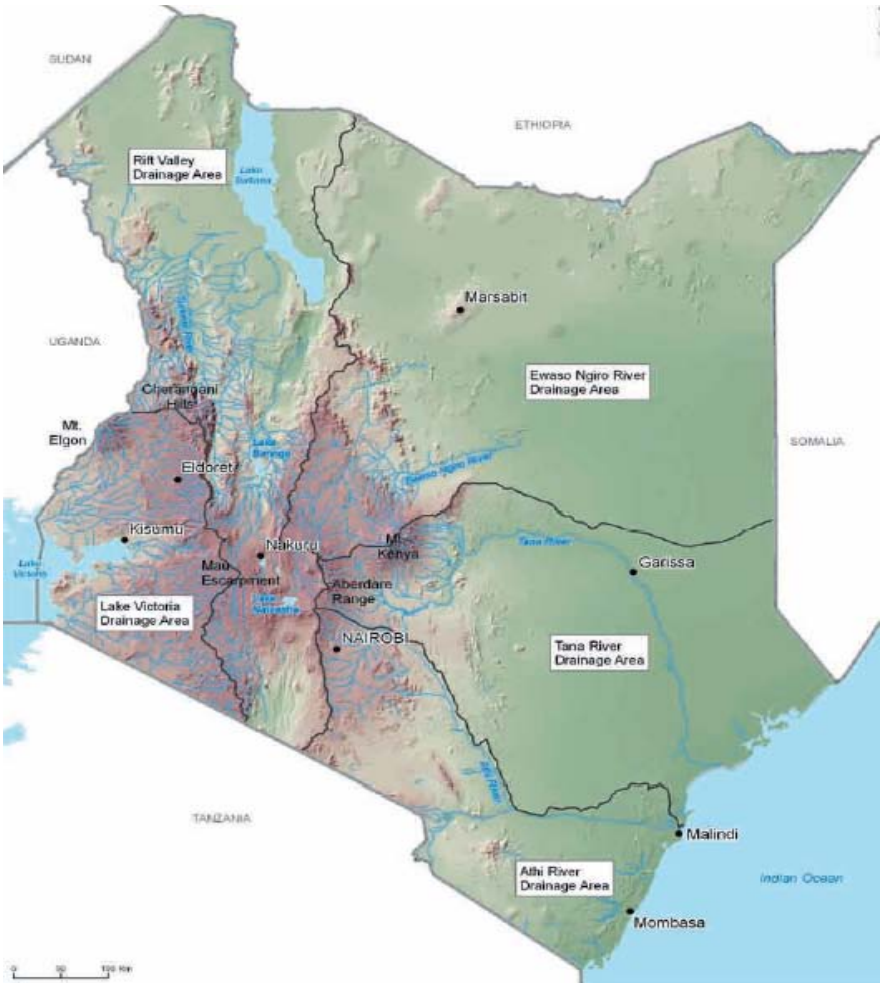
3.3 HYDRO ENERGY

1. Hydropower is electricity generated using the energy of moving water. Rain or melted snow, usually originating in hills and mountains, create streams and rivers that eventually run to lakes, seas or oceans. This energy has been exploited for centuries. In the late 19th century, hydropower became a source for generating electricity.
2. A typical hydro plant is a system with three parts: an electric plant where the electricity is produced; a dam that can be opened or closed to control water flow; and a reservoir where water can be stored. The amount of electricity that can be generated depends on how far the water drops and how much water moves through the system.
3. Hydropower is also readily available; engineers can control the flow of water through the turbines to produce electricity on demand. In addition, reservoirs may offer recreational opportunities, such as swimming and boating. But damming rivers may destroy or disrupt wildlife and other natural resources.
4. Hydropower is, to date, the most successful form of renewable energy. The amount of electrical energy generated depends upon the quantity of available water. Adverse hydrology can have a devastating effect on an economy that is heavily dependent on hydropower such as Kenya at present.
5. Kenya has an estimated hydropower potential of about 6,000MW comprising of large hydros (sites with capacity of more than 10MW) and small hydros. Of the large hydros, 807MW has been exploited and accounts for about 50% of installed generation capacity as at 2013 while

about 1,450MW remains unexploited. Potential for small hydros is over 3,000MW, of which less than 25MW has been developed.

6. 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 3.2 below. These water towers give rise to five drainage basins which are critical to the country's socio economic well being. The major drainage basins are those of Tana River and Lake Victoria.

Figure 3.2 - The 5 Water Towers and Drainage Basins



3.3.1 Large Hydros

3.3.1.1 Background

1. As of June, 2013 the installed capacity of hydropower generation was 807MW equivalent to 49% 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 (800MW) 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. These upgrades include Tana, Kiambere and Kindaruma adding a total of 72MW in the system.
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 2013 Government run schemes were a total of 15MW while those by private developers were 10MW.

3.3.1.2 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. However, during the rain season the water is lost due to inadequate storage capacity in the existing Masinga reservoir. This loss is about 100 GWh per year in power generation and also flooding and associated hardship downstream.
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. Water charges that have an effect of increasing the cost of hydro generated electricity.
7. 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.

8. Ownership of physical dam reservoirs which have stifled redevelopment.
9. Competing interests in the management of hydropower generating infrastructure leading to delays in implementation of viable energy projects e.g. raising of the Masinga dam. This delay has resulted in lost opportunity to generate additional 100 GWh per year.

3.3.1.3 Policies and Strategies and Implementation Plan – Large Hydro

	Policies and Strategies Large Hydro	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	Develop a hydro risk mitigation to address risks such as prolonged droughts so as to cushion generators, transmitters, distributors and consumers against effects of adverse hydrology.	✓		
2.	Address competing interests in the use of water resources for hydropower generation and other purposes.	✓		
3.	Establish an inter-ministerial committee comprising of relevant stakeholders to advise policy direction on ownership and management of dams.	✓		
4.	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.	✓		
5.	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.		✓	
6.	The private sector will be encouraged through Feed-in-Tariff to develop potential sites to generate electricity for their own consumption and for export of any surplus to the national grid. Government will provide letters of comfort to investors which guarantee purchase of electrical energy on just and reasonable terms.		✓	
7.	To provide necessary support for raising of Masinga dam, development of High Grand Falls (700MW) and other viable hydropower projects.		✓	
8.	Undertake pre-investment studies on hydro resources to define their technical and economic viability.		✓	

3.3.2 Small Hydros

3.3.2.1 Background

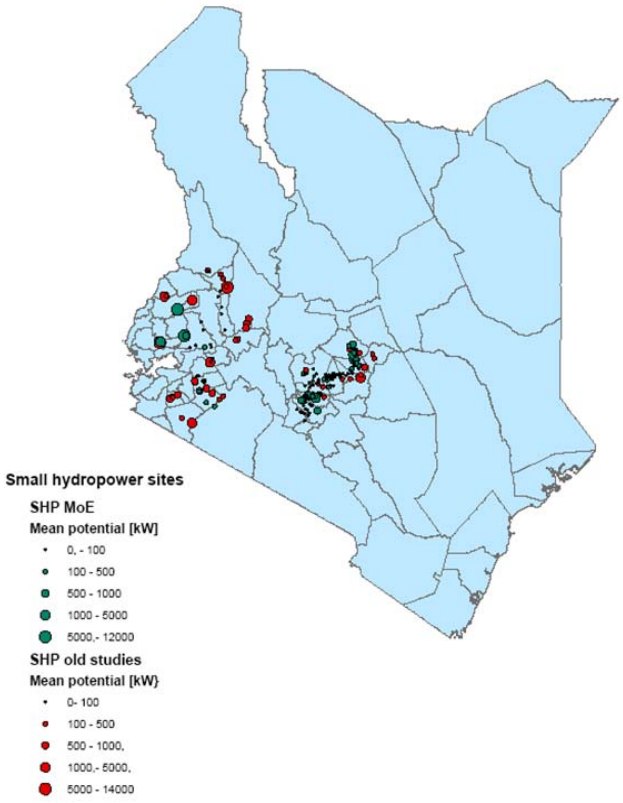
1. Of the more than 3,000MW small hydro potential, only about 30MW has been developed. With the introduction of the Feed-in-Tariff (FiT) policy in 2008 small-scale candidate sites are expected to be developed to supply villages, small businesses or farms, as well as grid supply.
2. The Ministry of Energy and Petroleum 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 2013, only a few schemes had been developed as stand-alone systems or to feed to the national grid.

3. By the end of 2013, more than 260 small hydropower sites had 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. Figure 3.2 is a map showing the locations of small hydropower sites as appraised by MoE (dots in green colour) as well as a summary compilation from various studies (dots in red colour). As can be seen, the potential for small hydropower sites is mainly located in counties that have high population density and high energy demand.

Figure 3.2: Small Hydropower Schemes



3.3.2.2 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 concerned 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.

3.3.2.3 Policies and Strategies and Implementation Plan – Small Hydros

	Policies and Strategies Small Hydros	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	Promote protection of the environment, catchment areas and water towers.	✓	✓	✓
2.	Provide incentives for public private partnerships and increase funding.	✓		
3.	Promote small micro-enterprises through fiscal incentives to reduce small hydro's start up costs.		✓	
4.	The Renewable Energy Research Centre in the National Energy Institute to collect hydrological data on small hydros.		✓	
5.	Create awareness and disseminate information on the benefits of small hydros and its coexistence with other usages of the resource.	✓		
6.	Promote development of capacity and knowledge upon the youth, on usage of appropriate technologies.		✓	
7.	Provide incentives to promote the local production and use of efficient small hydro power systems.		✓	
8.	Formulate and enforce standards, legal and regulatory regimes for small hydros.		✓	
9.	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.	✓	✓	✓

3.4 BIOMASS

3.4.1 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

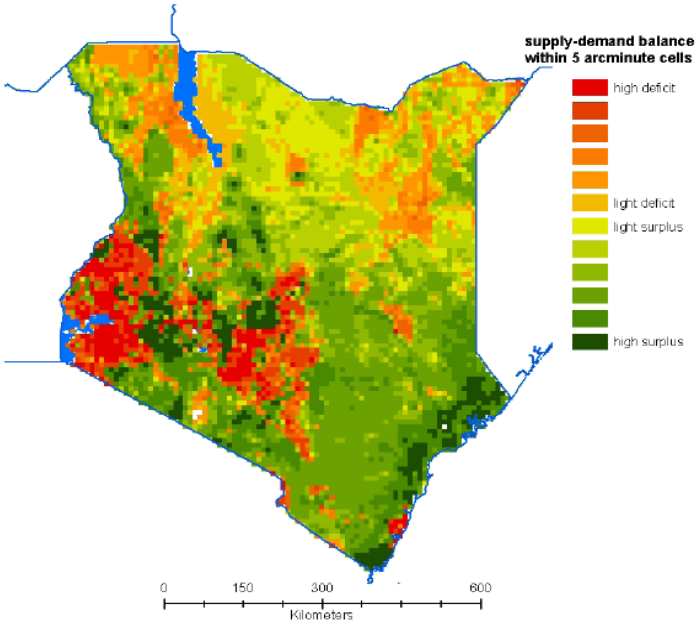
gas is also considered a biomass source. Biomass resources can be replenished through cultivation of crops such as fast growing trees and grass.

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 below).

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.

Figure 3.1 Wood Fuel Supply-Demand Balance



***Source**: Food and Agriculture Organization (FAO) 2010*

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.

3.4.2 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%.

3.4.3 Policies and Strategies and Implementation Plan - Biomass

	Policies and Strategies Biomass	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	Undertake a comprehensive base line study on biomass energy resources and potential, and establish status of tree cover in the country.	✓		
2.	Develop and maintain a database on biomass energy resources and potential in the country.	✓		
3.	Formulate and implement a national strategy for coordinating subsistence and commercial biomass production.	✓		
4.	Promote and update standards for efficient conversion and cleaner utilization of biomass including cleaner charcoal and wood burning stoves.	✓		
5.	Promote Research, Development and Dissemination (RD&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.		✓	

Policies and Strategies Biomass		Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
8.	Enhance public participation in the management, protection and conservation of the environment as provided for in Article 69 of the Constitution.	✓	✓	✓
9.	Promote alternative sources of energy and technologies such as biogas and solar as a substitute for biomass.	✓	✓	
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.	✓	✓	
12.	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.	✓		
13.	Undertake studies to identify and promote the most appropriate biomass energy conversion technologies and implement the recommendations.	✓	✓	✓
14.	Promote inter-fuel substitution to reduce the over reliance on wood fuel.	✓	✓	
15.	Strengthen existing Energy Centres and establish others to cover all counties with a view to promote efficient biomass energy use.	✓	✓	
16.	Promote the use of biomass briquettes as alternatives to woodfuel and kerosene in cooking, water heating and steam generation	✓		
17.	Undertake a comprehensive study on the viability of use of renewable sources with a view to eliminating use of kerosene in households.		✓	
18.	Prepare, review and update biomass energy development plans.	✓	✓	✓

3.5 BIO FUELS

3.5.1 Background

1. Unlike other renewable sources, biomass can be converted directly into liquid fuels called bio-fuels to meet energy 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.

3.5.2 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, utilisation, 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.
9. Illegal export and illicit use of ethanol.

3.5.3 Policies and Strategies and Implementation Plan - Biofuels

Policies and Strategies Biofuels	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
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, production, distribution, supply and use of liquid bio-fuels.	✓		
3. Provide fiscal incentives 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 resources to minimize the adverse effects arising from competition for land use between liquid bio-fuel feedstock and food production.	✓	✓	
5. Work with county governments 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. Promote joint venturing between Government agencies and private sector on the development and utilisation of bio fuels.		✓	

Policies and Strategies Biofuels	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
8. Invest in research on the production chain and sustainability of biofuels particularly biodiesel.		✓	✓
9. Harmonize the taxation regime in the region to discourage diversion of ethanol to export markets and illicit use.		✓	
10. Facilitate farmers to access cheap farm inputs and high yielding fast maturing bio-fuel feedstock.	✓		
11. Undertake a comprehensive study on the viability of bio-fuels and map out potential bio-fuels production feedstock across all counties.	✓		
12. Provide fiscal incentives for bio-fuel production plant and equipment in so far as such entities are marketing the products solely for blending.	✓		
13. Government to identify and set aside land in potential locations for piloting of bio-fuel feedstock production.	✓		
14. Review the feasibility of gasohol and biodiesel production.	✓		
15. Pilot a 10% ethanol-gasoline (E-10 Mandate) blend in Government vehicles and in public transport vehicles.	✓		
16. Pilot 1% biodiesel blend in Government vehicles and in different blending ratios for use as hybrid fuel at isolated power generation plants.	✓		
17. Develop a blueprint and road map for national bio-fuel implementation programme.	✓		
18. 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.	✓	✓	
19. The Government to enter into PPP arrangements with the private sector entities to accelerate the development of bio-fuels.		✓	
20. All gasoline vehicles in the country to be using at least 10% ethanol-gasoline (E-10 Mandate) blend.			✓
21. Provide incentives to encourage all diesel vehicles in the country to use at least 5% biodiesel			✓
22. Government vehicles to use at least 5% biodiesel blend and all isolated power generation plants to use 100% biodiesel.			✓

3.6 BIOGAS

3.6.1 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 m^3 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 Kajiado 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 2 million 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. Various prisons including Embu GK prison and schools in the country currently utilize biogas for their cooking and lighting requirements.

3.6.2 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.

3.6.3 Policies and Strategies and Implementation Plan - Biogas

	Policies and Strategies Biogas	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	Create awareness on the benefits and potential of biogas technology.	✓		
2.	Promote RD&D of biogas energy technologies through the National Energy Institute, other learning institutions and other entities.		✓	
3.	Provide appropriate fiscal incentives for local manufacture as well as importation of biogas plant and equipment.		✓	
4.	National and County Governments to initiate capacity building programmes in institutions such village polytechnics on biogas installation, operation and maintenance skills.		✓	
5.	Develop guidelines for registration and regulation of biogas contractors and technicians.	✓		
6.	Promote domestic and community based biogas plants to cater for the urban poor.		✓	
7.	Promote large scale production, piping and storage of biogas.			✓
8.	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.	✓		
9.	Promote the use of biogas as an alternative to woodfuel and kerosene for domestic and commercial energy needs.	✓		
10.	Develop training programmes for biogas technologies in collaboration with relevant training institutions and through the energy centres.	✓		
11.	Undertake a comprehensive study on the viability of bottling biogas for rural development.	✓		
12.	The Government to facilitate the construction of at least 5,000 bio-digesters by 2017, at least 6,500 by 2022 and 10,000 by 2030 in Kenya under the “Biogas for Better Life” programme.	✓	✓	✓
13.	Roll out biogas initiatives to supply the remaining public institutions including prisons, schools and hospitals as well as biogas bottling plants across the country	✓	✓	

3.7 SOLAR ENERGY

3.7.1 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, 2012.
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 2012 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 Isiolo.
   (d) 60 kW solar / diesel at Hola.
   (e) 50 kW solar / diesel at El Wak in Wajir.
6. As at 2012 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.

3.7.2 Challenges

1. Disjointed approach in policy implementation and promotion of solar energy projects in the country.
2. The percentage of solar energy harnessed for commercial and domestic applications is insignificant relative to the potential.
3. Prohibitive costs of solar home systems despite favourable fiscal incentives and arising from lack of appropriate credit and financing mechanisms.

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.

3.7.3 Policies and Strategies and Implementation Plan – Solar Energy

Policies and Strategies Solar Energy	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Promote the wide spread use of solar energy while enforcing the existing regulations and standards.	✓		
2. Ensure that all commercial buildings adopt solar and hybrid solar energy sources for water heating and lighting.	✓		
3. Provide incentives to promote the local production and use of efficient solar systems.		✓	
4. Provide a framework for connection of electricity generated from solar energy to national and isolated grids, through direct sale or net metering.		✓	
5. 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.		✓	
6. Formulate and enforce minimum standards for solar energy technologies.	✓	✓	
7. Provide fiscal incentives on solar panels and equipment.	✓		
8. Provide for offences and enhance penalties for theft and vandalism of solar systems.	✓		
9. Create awareness on the potential opportunities and economic benefits offered by solar energy technologies.	✓		
10. Partner with financiers to enable the public access credits schemes.		✓	
11. Install solar PV systems in 50% of all the remaining public facilities in the off grid areas.	✓		
12. Promote installation of at least 100,000 units of solar PV home solar systems by 2017.	✓		
13. Roll out a programme to distribute solar lanterns as substitute for kerosene in lighting rural areas, poor peri-urban and urban settlements.	✓		
14. Develop a programme to convert diesel stations to hybrid power generation systems harnessing solar energy.	✓		
15. 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 by 2017.	✓		

Policies and Strategies Solar Energy	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
16. Provide incentives to promote the local production and use of solar systems.	✓		
17. Undertake RD&D on solar technologies.		✓	✓
18. Facilitate generation of 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 so as to realise at least 100MW from solar by 2017, 200MW by 2022 and 500MW by 2030.	✓	✓	✓
19. Promote installation of at least 200,000 units of solar PV home systems by 2022.		✓	
20. 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 by 2022 and at least 700,000 units by 2030.		✓	✓

3.8 WIND ENERGY

3.8.1 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. The Ministry of Energy developed a Wind Atlas in 2008 with indicative data.

3. To augment the information contained in the Wind Atlas, MoE, with the assistance of Development Partners on the one hand and KenGen have between them installed more than 60 Wind Masts and Data Loggers in various counties across the country to collect site specific data with a view to open up generation electricity from wind. Confirmed wind energy potential for selected areas are given in the Table 3.1.

Table. 3.1: Average wind speed data for selected sites

	Site	Average Wind Speeds in m/s			
		May 2012	June 2012	June 2013	LTA
1.	Malindi*	7.28	7.53	8.92	7.16
2.	Kinangop	6.59	5.99	5.35	7.01
3.	Isiolo (Mugae)	9.12	10.45	10.66	7.73
4.	Isiolo (Mweromalia)	12.73	13.62	13.92	9.21

	Site	Average Wind Speeds in m/s			
		May 2012	June 2012	June 2013	LTA
5.	Isiolo (Kiremu)	-	10.45	10.56	8.23
6.	Isiolo (Matabiti area)	-	11.83	-	12.29
7.	Bubisa West	-	-	13.58	10.92
8.	Bubisa East	-	-	11.84	9.64
9.	New Marsabit	-	-	10.09	9.43
10.	Maralal**	-	-	2.89	4.78
11.	Naromoru**	-	-	7.90	6.01

Source: *KenGen, 2013*
LTA means Long Term Average.

* Being relocated to the shoreline.

** Has just been installed.

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 CO_2 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 June, 2012 and a further 20MW is expected to be commissioned by end of 2013. The 300MW Lake Turkana Wind power project is expected to be commissioned in 2017. Other committed projects include 110MW at Kinangop and Ngong.
8. As of 2012, 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.

3.8.2 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.

3.8.3 Policies and Strategies and Implementation Plan – Wind Energy

Policies and Strategies Wind Energy		Implementation		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
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 fiscal incentives on wind energy equipment.		✓	
11.	Collect and compile wind energy data and update the wind atlas.		✓	
12.	Facilitate development of wind power generation of at least 500MW by 2017 and 1,000 by 2022 and 3,000MW by 2030.	✓	✓	✓

3.9 MUNICIPAL WASTE

3.9.1 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 2013 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 of 2013. With appropriate waste-to-energy technologies, municipal can be used to provide energy while helping to clean the environment.

3.9.2 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.

3.9.3 Policies and Strategies and Implementation Plan – Municipal Waste

	Policies and Strategies Municipal Waste	Implementation Plan		
		Short Term 2014- 2017	Medium Term 2014-2022	Long Term 2014-2030
1.	In collaboration with the relevant line ministries develop legal, regulatory and institutional framework to address management and utilisation of municipal waste by government agencies and counties.	✓		
2.	In collaboration with counties acquire adequate data and information on potential of municipal waste.	✓		
3.	Provide incentives for conversion of municipal waste to energy.		✓	

3.10 BIOMASS CO-GENERATION

3.10.1 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 capacity from all sugar companies is estimated to be 90MW by 2013.

3.10.2 Challenges

1. Use of obsolete, inefficient plant and equipment in the cogeneration industry.
2. Lack of a reliable and continuous supply of bagasse.
3. Limited technical, human and financial resources for cogeneration development.
4. Inadequate technical capacity in commercial and emerging cogeneration technologies.
5. Lack of awareness in cogeneration potential in areas where the agro-wastes are available.
6. Inadequate data and documented assessment of resources and potential.
7. Lack of model Power Purchase Agreement (PPA) for cogenerated power in the country.
8. Poor governance in the sugar sub-sector.
9. Insufficient information to investors on issues relating to licensing, taxation and feed in tariff policy.

3.10.3 Policies and Strategies and Implementation Plan – Biomass Cogeneration

Policies and Strategies Biomass Cogeneration		Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	Accelerate investment in efficient and emerging technologies.		✓	
2.	Promote community programmes and projects in production and supply of raw materials such as bagasse.		✓	
3.	Undertake capacity building programmes in cogeneration technologies.	✓		
4.	Carry out awareness programmes in cogeneration potential areas.	✓		
5.	Carry out a comprehensive study on cogeneration potential.	✓		
6.	Develop a model PPA for cogeneration projects.	✓		
7.	Provide incentives to promote cogeneration from biomass.		✓	
8.	Formulate and implement a national strategy for coordinating development of co-generation.	✓		
9.	Undertake RD&D in co-generation technologies.	✓		
10.	Collaborate with players in the sugar industry to address governance issues.	✓		
11.	Reduce start-up costs by providing appropriate fiscal incentives.	✓		
12.	Promote local manufacture and maintenance of cogeneration technologies.	✓		
13.	The national and County Governments to promote the utilization of municipal and industrial waste as sources of energy.	✓		

Policies and Strategies Biomass Cogeneration	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
14. Prepare integrated solid waste management plans and roadmaps.	✓		
15. Government to enter into PPP arrangements with the private sector entities to accelerate co-generation to realise at least 200MW by 2017.	✓		
16. Develop criteria for certification schemes for cogeneration projects.	✓		
17. Undertake Pilot programmes to generate at least 50MW of electricity using municipal/industrial solid waste by 2017, 100MW by 2022 and 300MW by 2030.	✓	✓	✓
18. Facilitate 800MW of co-generation capacity from bagasse and agro-residues by 2022 and 1,200MW by 2030.	✓	✓	✓

3.11 FEED IN TARIFFS

3.11.1 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 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 and lengthy negotiations of PPA.
   (c) Encourage private sector investors to operate their plants prudently and efficiently so as to maximize returns.
3. 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.
4. As at 2012 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.

5. The existing FiT structure for each technology is as shown in the Table 3.2:

3.11.2 Challenges

1. Insufficient data and analytical tools 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.

Table 3.2 (a): Feed-in-Tariff Structure for projects upto 10MW

Technology	Installed Capacity (MW)	Standard FiT (US$/kWhr)	Percentage escalable portion of the tariff	Min. Capacity (MW)	Max. Capacity (MW)
Wind	0.5-10	0.11	12	0.5	10
Hydro	0.5	0.105	8	0.5	10
	10	0.0825			
Biomass	0.5-10	0.10	15	0.5	10
Biogas	0.2-10	0.10	15	0.2	10
Solar (Grid)	0.5-10	0.12	8	0.5	10
Solar (Off-Grid)	0.5-10	0.20	8	0.5	10

Table 3.2 (b): Feed-in-Tariff Structure for projects above 10MW

Technology	Installed Capacity (MW)	Standard FiT (US$/kWhr)	Percentage escalable portion of the tariff	Min. Capacity (MW)	Max. Capacity (MW)	Max. Cumulative Capacity (MW)
Wind	10.1-50	0.11	12	10.1	50	500
Geothermal	35-70	0.088	20 for first 12 years and 15 after	35	70	500
Hydro	10.1-20	0.0825	8	10.1	20	200
Biomass	10.1-40	0.10	15	10.1	40	200
Solar (Grid)	10.1-40	0.12	12	10.1	40	100

3.11.3 Policies and Strategies and Implementation Plan – Feed-in-Tariffs

	Policies and Strategies Feed-in-Tariffs	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	Undertake a study on the capital expenditures and the operating costs on the different types of technologies and develop sufficient analytical tools to inform the level of tariffs for different technologies.	✓		
2.	Initiate promotion campaigns to reach potential investors.	✓		
3.	Develop model Power Purchase Agreements for the various modes of generation under FiT.	✓		
4.	Provide capacity building and financial assistance to community based projects.	✓		
5.	Expand the scope of FiT to include the emerging technologies.	✓	✓	
6.	NERC to provide guidelines and timelines for PPA negotiations.	✓		
7.	Develop an investment guide.	✓		
8.	Set minimum and maximum tariffs to guide the negotiations for PPA under the FiT.	✓		
9.	Review the FiT Policy to include operations and maintenance escalation components.		✓	✓

3.12 OTHER RENEWABLES

3.12.1 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 which Kenya is endowed.
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.

3.12.2 Challenges

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

3.12.3 Policies and Strategies and Implementation Plan – Other Renewables

	Policies and Strategies Other Renewables	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	Develop legal, regulatory and institutional framework for utilization.	✓		
2.	Acquire adequate data and information on potential of other renewable energies.		✓	
3.	Provide incentives for exploitation.		✓	✓

3.13 CROSS CUTTING ISSUES

3.13.1 Challenges

1. Inadequate institutional, legal and regulatory framework for management of renewable energy resources including:
   (a) Criteria for allocation to investors of energy resource areas such as geothermal fields.
   (b) Licensing of Renewable energy areas.
   (c) Management of multi-purpose projects such as dams and reservoirs for power generation, portable water, flood control and irrigation.
   (d) Management of energy resource areas such as water towers, catchment areas, forests, municipal waste as well as areas with good wind regimes, tidal and wave energy.
   (e) Corporate Social responsibility requirements.
   (f) Environmental protection, conservation and management.
   (g) Mechanism for working out national government, county government and local community benefits sharing.
   (h) Payment of royalty on proceeds from renewable energy resources.
2. Other than geothermal energy and large hydros, there is no lead agency to spearhead development of other renewable energy resources.
3. Absence of local credit schemes and financing mechanisms.
4. Inadequate public awareness on the economic opportunities offered by renewable energy and renewable energy technologies.

3.13.2 Policies and Strategies and Implementation Plan – Cross cutting Renewable Energy

	Policies and Strategies Cross cutting	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	The Government shall establish an inter-ministerial Renewable Energy Resources Advisory Committee (RERAC) composed of members representing; Ministries in-charge of Energy, Finance, Environment and Natural Resources, NERA, AG, NERC, GDC, KenGen and the relevant	✓		

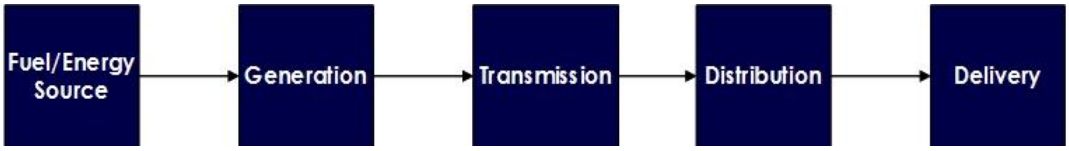
	Policies and Strategies Cross cutting	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
	County Government to advise the Cabinet Secretary on criteria for allocation of renewable energy resource areas and specifically in relation to:			
	(a) Licensing of renewable energy resource areas.	✓		
	(b) Management of multi-purpose projects such as dams and reservoirs for power generation, portable water, flood control and irrigation.	✓		
	(c) Management of energy resource areas such as water towers, catchment areas, forests, municipal waste as well as areas with good wind regimes, tidal and wave energy.	✓		
2.	The Government shall:			
	(a) Transform the Rural Electrification Authority into the National Electrification and Renewable Energy Authority (NERA) to become the lead agency in the development of renewable energy resources excluding geothermal and large hydros. NERA shall be the one stop shop for information and guidance to investors on renewable energy projects.	✓		
	(b) Develop a tariff for net metering for electricity generated from renewable energy sources by electricity consumers.	✓		
	(c) Revitalize the existing MOEP Energy Centres and establish others to cover all 47 counties with a view to promote renewable energy use.	✓		
3.	Partner with financiers to enable the public to access credits schemes.	✓		
4.	Develop capacity building programmes for players in renewable energy technologies in collaboration with training institutions and the energy centres	✓		
5.	Introduce net and smart metering policy to encourage consumers sell excess power generated from the renewable energy systems.		✓	
6.	Prepare a master plan for renewable energy.	✓		
7.	Promote community based power generation.		✓	
8.	Create awareness on the benefits resulting from development of clean energy technologies.		✓	
9.	Establish a Renewable Energy Research Centre within the National Energy Institute for the handling of renewable energy promotion, potential analysis, mapping and other related studies.		✓	
10.	Establish green energy certification schemes.		✓	
11.	Establish energy efficiency/conservation projects certification schemes.		✓	
12.	The government will provide necessary support for the implementation of the renewable energy projects in the populated areas including facilitation of acquisition, relocation and resettlement of project affected persons.		✓	✓

4.0 – ELECTRICITY

4.1 BACKGROUND

1. Electricity is a secondary source of energy generated through the consumption of primary energy sources namely fossil fuels, renewable energy 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. The electricity supply industry (ESI) value chain consists of four elements, as shown below.

Figure 4.1 – The Electricity Industry Value Chain



3. 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.
4. 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.
5. 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.
6. 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.
7. Generation, transmission, system operations and distribution are physical functions, while wholesaling and delivery/retailing are merchant or commercial functions.
8. 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.
9. 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 affordable 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 1,354MW in 2012/13, while the number of electricity consumers more than doubled from 735,144 in 2004/05 to 2,330,962 by June 2013 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	2011/12	2012/13
Energy Generated (GWh)	5,347	5,697	6,169	6,385	6,489	6,692	7,303	7,670	8,087
Energy Sold (GWh)	4,379	4,580	5,065	5,322	5,432	5,624	6,123	6,341	6,581
Peak Demand (MW)	899	920	987	1,044	1,072	1,107	1,194	1,236	1,354
Number of Consumers	735,144	802,249	924,329	1,060,383	1,267,198	1,463,639	1,753,348	2,038,625	2,330,962

Source: *KPLC Annual Report and Financial Statements, 2013.*

2. The peak load is projected to grow to 3,400MW by 2015 and 18,000MW by 2030. To meet this demand, an additional 5,000 MW of new generation is to be developed by 2016 to bring total installed capacity to at least 6,600MW, eventually rising to 24,000MW by 2030.

3. As at 30th June 2013, 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 2013 stood at 40million.

4.3 ELECTRIC POWER GENERATION

4.3.1 Background

1. Electricity generation in Kenya is liberalised with several licensed electric power producers whose combined installed capacity was 1,700MW as of June 2013. These include KenGen which accounts for approximately 76% of the installed capacity, and seven (7) Independent Power Producers (IPPs) which account for the balance.

2. It is estimated that as at 2013, 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 2013, 74.5% of the electrical energy was generated using renewable energy sources while 25.5% was generated using fossil fuels as detailed in Table 4.1.

Table 4.1 - Electric Power Generation Sources and Energy Generated in FY 2012/13

Sources of Electric Power Generation		Installed Capacity		Annual Generation	
		(MW)	Percentage	(GWHrs)	Percentage
Renewable Energy	Hydro	820	49.0%	4,299	53.1
	Geothermal	249	14.9%	1,599	19.8
	Wind	5	0.3%	14	0.2
	Cogeneration	38	2.3%	71	0.9
	Imports			42	0.5
	Total	1,112	66.5%	6,025	74.5
Fossil Fuels	MSD	452	27.0%	1,720	21.3
	Gas Turbines	60	3.6%	27	0.3
	HSD	18	1.1%	53	0.7
	Emergency Power Plants	30	1.8%	261	3.2
	Total	590	33.5%	2,061	25.5
Installed Capacity and Units Generated		1,672MW		8,086 GWhrs	

4.3.2 The 5000+MW by 2016 Project

1. It is anticipated that electricity demand will rise sharply as new county governments take shape and numerous economic activities spring up in the counties. In particular energy intensive activities such as mining, production of iron and steel products from local iron ore deposits, irrigation of large tracts of land for food security and agro-based industry, operation of petroleum pipelines for both crude and refined fuel oils, petrochemicals production including urea, steel products based manufacturing, such as motor vehicle body parts and for earth moving equipment, electrification of designated rail lines, installation of escalators at shopping malls and airports, and new economic zones will require a lot of power.

2. In order to provide affordable electricity for these activities which are expected to transform our economy, a roadmap to raise the generation capacity by at least 5000MW from the current 1664MW to slightly over 6,700 MW by 2016 is proposed. Through this road map the generation cost is projected to reduce from US¢ 11.30 to 7.41, while end-user tariffs are projected to reduce from US¢ 14.14 to 9 for commercial/industrial customers and from US¢ 19.78 to 10.45 for domestic customers.

3. This capacity will mainly be developed from Geothermal 1,646MW, Natural Gas 1,050MW, Wind 630MW and Coal 1,920MW through IPPs under the PPP framework. Tables 4.2 and 4.3 below show the new generation capacity additions and cumulative installed capacities over the 40 month duration of the project, while Figures 4.2 and 4.3 show the evolution of the energy mix and progression of end user tariffs, respectively, over the same period.

Table 4.2 – New Generation Capacity Additions in MW from October 2013

TECHNOLOGY	NEW CAPACITY ADDITIONS (MW) No of Months from start of the Project							
	6	12	18	24	30	36	40	TOTAL
HYDRO	24	0	0	0	0	0	0	24
THERMAL	87	163	0	0	0	0	0	250
GEOTHERMAL	90	176	190	50	205	150	785	1,646
WIND	0	0	20	60	300	250	0	630
COAL	0	0	0	0	960	0	960	1,920
LNG	0	0	0	700	350	0	0	1,050
CO-GENERATION	0	0	18	0	0	0	0	18
TOTAL	201	339	228	810	1,815	400	1,745	5,538

Table 4.3 – Cumulative Installed Capacities in MW from October 2013

TECHNOLOGY	CUMULATIVE INSTALLED CAPACITY (MW) Number of Months from start of the Project							
	0	6	12	18	24	30	36	40
HYDRO	770	794	794	794	794	794	794	794
THERMAL	622	709	782	782	782	432	432	432
GEOTHERMAL	241	331	507	697	747	952	1102	1887
WIND	5	5	5	25	85	385	635	635
COAL	0	0	0	0	0	960	960	1920
LNG	0	0	0	0	700	1050	1050	1050
CO-GENERATION	26	26	26	44	44	44	44	44
RETIREMENTS		90				350		
CUMMULATIVE TOTAL	1,664	1,775	2,114	2,342	3,152	4,617	5,017	6,762
Generation Tariff (US¢/kWh)	11.3	10.14	9.93	8.74	8.07	7.38	7.58	7.41
Industrial/Commercial Tariff (US¢/kWh)	14.14	12.77	12.49	11.03	10.08	9.03	9.32	9
Domestic Tariff Progression (US¢/kWh)	19.78	18.3	17.73	15.85	13.46	11.14	11.19	10.43

Figure 4.2 – Evolution of the Energy Mix from October 2013

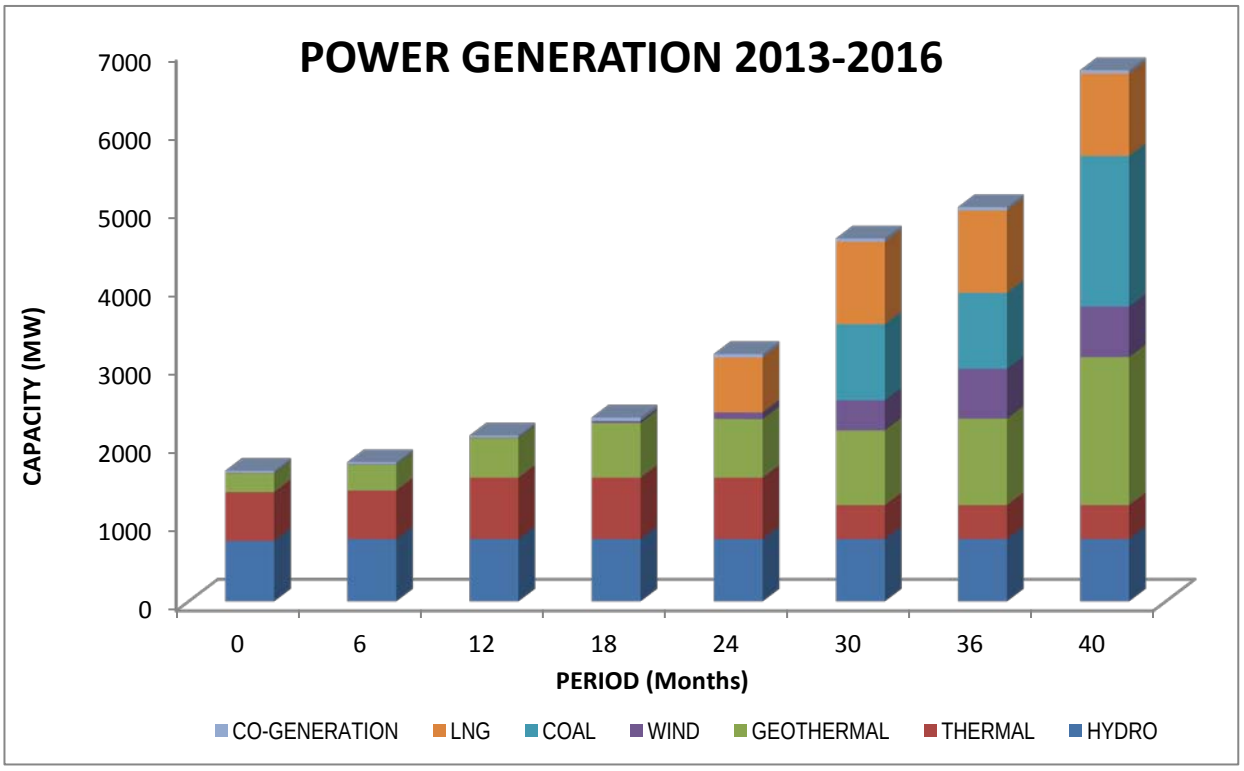
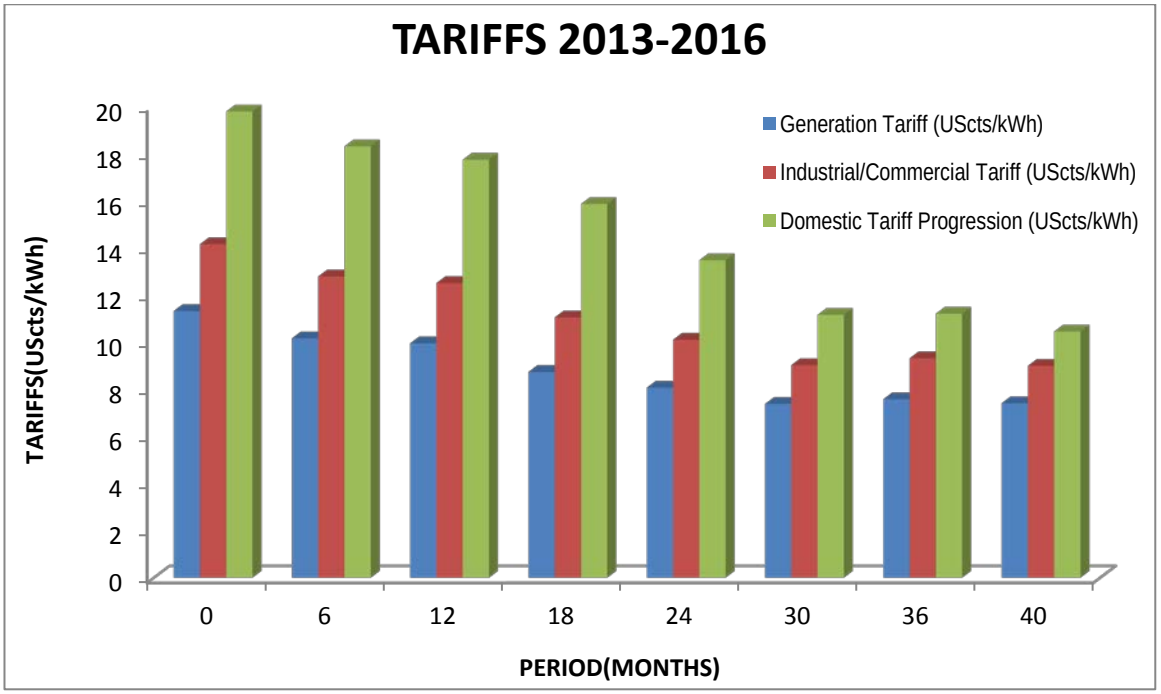


Figure 4.3 – Evolution of Generation and End User Tariffs from October 2013



4. The road map will require the construction of various transmission lines to evacuate power to respective load centres at an estimated cost of KShs 50 billion to be funded by GOK over the 40

month period so as to unlock over KShs 800 billion of new investment in power generation by the private sector. The developers of these power plants will be expected to negotiate and execute power purchase agreements with KPLC which shall remain the single buyer during the project period.

4.3.3 Generation from Renewable Energy Resources

Generation of electrical energy using renewable energy resources is dealt with in Chapter 3.

4.3.4 Generation of Electricity using Fossil Fuels

4.3.4.1 Background

1. Thermal power plants generate electrical energy using fossil fuels, mainly, petroleum, natural gas and coal.
2. Thermal generation accounts for approximately 34.7% of installed capacity and its contribution to the actual energy mix as at June 2013 stood at approximately 37%. The installed capacity on the interconnected system comprises:
   (a) 452MW of medium speed diesel (MSD) generators.
   (b) 60MW of gas turbines.
   (c) 30MW emergency power plant at Muhoroni for voltage support in Western Kenya.
3. All thermal generating plants are run on imported petroleum fuels which are subject to volatile international oil market prices which are passed through to consumers. Consumption of petroleum is projected progressively reduce and be replaced natural gas.

4.3.4.2 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.

4.3.4.3 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.

4.3.4.4 Policies and Strategies and Implementation Plan – Electric Power Generation

	Policies and Strategies Electric Power Generation	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	The Government will provide fiscal incentive on petroleum products, coal and natural gas imported for use in thermal electricity generation.	✓	✓	✓
2.	The Government will encourage electricity generation using indigenous fossil fuels primarily natural gas and coal including facilitating PPPs.	✓		
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.	Implement committed power generation projects in order to attain an additional capacity of at least 5,000MW by 2016 which include two coal plants of up to 1,000MW each in Lamu and Kitui counties and natural gas fired power plants of up to 1,050MW.	✓		
5.	The Government shall promote the utilisation of Combined Cycle Gas Turbine (CCGT) plants to increase efficiency.	✓	✓	
6.	Regulator to develop appropriate standards and mechanisms for consumer protection including but not limited to reliable, and stable, power supply includes repair and maintenance time lines. The regime should include penalties.	✓		
7.	Establish natural gas handling and storage facilities in the country.		✓	
8.	Enforce compliance for pollution prevention and reduction in thermal power plants.	✓	✓	✓
9.	Promote bagasse based cogeneration and implement the identified projects based on least cost and efficiency criteria.	✓		

4.3.5 Generation of Electricity using Nuclear Energy

4.3.5.1 Background

1. 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 2013, there were 435 nuclear power plants in operation, 28 under construction and 222 in the planning stage as detailed in Table 10.3 in 10.0 - Annexures.

2. Vision 2030 notes the need for reliable and affordable electricity for the ever increasing commercial, industrial and household use. 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.
3. In April 2010, the National Economic and Social Council (NESC) proposed the introduction of nuclear electricity into the Kenyan energy mix as a national priority leading to the formation of the 13 member Nuclear Electricity Project Committee (NEPC) under the then Ministry of Energy. In November 2012, the Kenya Nuclear Electricity Board was established vide the State Corporations Act, Cap 446 and it effectively became successor of the NEPC.
4. Nuclear energy across the world elicits varied reactions in relation to plant safety, management or radioactive waste and proliferation concerns in the wake of heightened terrorism. 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 International Atomic Energy Agency (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.*
5. Kenya has adopted the internationally recommended IAEA Milestone Approach in development of its nuclear power programme. The Milestone Approach is a phased, guided and systematic methodology which assesses all nuclear infrastructure issues at every single stage of development. Figure 10.1 in 10.0 - Annexures illustrates the activities under each milestone
6. The first nuclear plant of 1,000MW is expected to be commissioned in 2022. Additional units of 1,000MW each are expected to be commissioned in 2026, 2029 and 2031. 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).

4.3.5.2 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 as it's a natural resource. 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 330,000m^2, solar 33,000,000m^2 and wind 165,000,000m^2.

4.3.5.3 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 concerns are even higher within the Kenyan public who are not adequately informed about nuclear energy.

4.3.5.4 Mitigating factors

1. 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.

4.3.5.5 Policies and Strategies and Implementation Plan – Nuclear Electricity

	Policies and Strategies Nuclear Electricity	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	Transform through a primary legislation, KNEB to a promoter of the nuclear power programme.	✓		
2.	Develop a comprehensive legal and regulatory framework for the development, regulation and utilization of nuclear energy for electricity generation including establishing nuclear energy regulator.	✓		
3.	Identify an operator for the nuclear power plant and establish any other body required for the development and operation of nuclear electricity programme..	✓		
4.	Establish a nuclear energy research centre within the proposed National Energy Institute, which shall be responsible for RD&D of nuclear energy technology and application.	✓		
5.	Provide funds for establishment and operation of nuclear electricity programme.	✓		
6.	Carry out pre-feasibility and feasibility studies to address all requisite infrastructure issues for the development of a nuclear power programme.	✓		
7.	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.	✓		
8.	Ensure the country accedes and domesticates to key conventions, treaties and protocols to meet her international obligations necessary for the establishment of a nuclear power programme.	✓		
9.	Undertake extensive public awareness on the need for nuclear energy, engage stakeholders for support of nuclear power and also draw a comprehensive communication strategy.	✓		
10.	Identification of nuclear candidate sites followed by site evaluation, characterization and selection of feasible sites to be communicated to IAEA.	✓		
11.	Identification of vendors in nuclear energy technology, engagement in bilateral agreements and MOUs with vendor countries.	✓		
12.	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).	✓		

Policies and Strategies Nuclear Electricity	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
13. Bid for the first 2,000MW nuclear power plant(s) by 2017, commission the first 1,000MW nuclear plant(s) by 2022 and 4,000MW by 2030..	✓		
14. The Government in the development of nuclear power shall collaborate with IAEA and countries with nuclear power generation technology. Transform through a primary legislation, the KNEB to the Nuclear Electricity Corporation charged with the core mandate of fast tracking and promoting nuclear electricity generation.	✓		

4.4 ELECTRIC POWER TRANSMISSION

4.4.1 Background

1. The existing transmission network comprises 1,331 km of 220 kV and 2,436 km of 132 kV lines, and is interconnected with Uganda through a 132 kV double circuit line.
2. As of June 2013, there were nine generation substations with a transformation capacity of 1846 MVA and forty-five transmission substations with a capacity of 3,076 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.

4.4.2 Extension of the National Transmission Network

1. As part of its mandate, KETRACO is currently undertaking new transmission projects aimed at developing a robust grid system to:-
   (a) Enable evacuation of the additional 5,000MW by 2016, which entails construction of the 220kV Menengai – Soilo, 400kV Menengai – Rongai, 400kV Silali – Rongai, 400kV Dongo Kundu – Mariakani, 400kV Lamu – Kitui – Nairobi and the 400kV Isinya - Nairobi East transmission lines as well as the 400kV Kitui Substation.
   (b) Improve quality and reliability of electricity supply throughout the country by ensuring adequate evacuation capacity.
   (c) 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.
   (d) Provide interconnection links with the neighbouring countries in order to facilitate power exchange and develop electricity trade in the region.
   (e) Reduce transmission losses that as of 2012 cost the country about US$ 17million per year.

(f) Open up off-grid areas in order to ease connectivity to electricity by constructing transmission lines to link them up to the national grid.

2. 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.

3. Through the LCPDP process and feasibility studies, KETRACO has identified priority projects for implementation totalling about 6,000 km of transmission lines comprising 1,400 km of 132 kV, 2700 km of 220 kV and 1250 km of 400 kV AC lines as well as 650 km of 500 kV HVDC line between 2011 and 2014. It is projected that by 2031 KETRACO will have constructed 16,000 km of transmission lines.

4.4.3 Regional Interconnection

4.4.3.1 Imports and Exports

1. 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.

2. 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 30th 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
2012	35,805,150	41,214,150	1,080,674	1,097,820
2013	41,000,000	30,000,000	1,200,000	1,000,000

3. 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	Capacity (MW)	Status
1.	Lessos (Kenya) –Tororo (Uganda)	127	400 kV	250	In progress
2.	Eastern Africa Electricity Highway	700	500kV HVDC	2000	In progress
3.	Kenya – Tanzania	500	400kV	1,300	Detailed Design

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. In the medium term, it is planned that approximately 5,000 km of new transmission lines will be constructed at an estimated cost of about US$ 2billion. In the long term the LCPDP provides for development of an estimated 16,000 km of new lines at an estimated present value cost of US$ 4.48 billion.

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. Encroachment of the way leaves trace.
7. Insufficient framework for private participation in development of transmission infrastructure.
8. Inadequate policy, legal and institutional framework for the operationalization of the independent system operator.

4.4.6 Policies and Strategies and Implementation Plan – Electricity Transmission

	Policies and Strategies Electricity Transmission	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	The Government shall support open access of the transmission network taking into account existing contractual commitments and provide a mechanism for determination of wheeling charges applicable to transmission lines.			
2.	The Government will establish the legal and regulatory mechanisms for competitive electricity market and further support regional integration of the power system to enhance regional power trade.	✓		
3.	The Government will continue to fund the development of the national transmission system 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.	The Government will designate and provide, legal and institutional framework for an independent system operator (ISO).	✓		
5.	Ensure adequate and timely national transmission infrastructure is put in place including evacuation of electrical energy from early generation geothermal plants.	✓		
6.	The Government to implement at least 3,900 km of new transmission lines by 2016.	✓		
7.	The Government to ensure transmission reliability by establishing redundancies in transmission system.	✓		
8.	Increase national and regional transmission network for full regional inter-connection.			✓
9.	National Government in collaboration with member states to provide infrastructure and finance EAPP power market centre in Nairobi.		✓	

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 2013 were 2,800MVA and 6,195MVA respectively. The distribution lines comprised of 1,097 km of 66 kV lines, 16,136 km of 33 kV lines, 28,818 km of 11kV lines and low voltage lines. The distribution assets are owned by GoK, KPLC and REA.

2. Customer Average Interruption Duration Index (CAIDI) improved from 4.28 hours in 2010/11to 3.03 hours in 2011/12. KPLC aims at improving, this to 3 hours by 2013/14. Emphasis continued to be given to resolving repetitive breakdown cases to reduce the number of incidences and improve repair time. 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 new electricity consumers increased by 285,277 in 2011/12 and 292,337 in 2012/13.

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 2014-2030

1. Programme to supply the forecast LCPDP demand and improve reliability involves sub-transmission at 132kV and 66kV and the discontinuation of 33kV sub-transmission. Distribution to urban and rural areas will largely continue at 11kV and 33kV respectively.

2. By the year 2020, capacities of primary and distribution substations, HV lines and MV lines estimates are 11,888MVA, 190,204MVA, 7,925km and 118,875km 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 including standing charges.
2. High electricity connection charges. Despite efforts to subsidize the cost of connection to between KShs17,000/- to KShs35,000/-, 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 public institutions on power infrastructures.
12. Distribution system largely served by post paid metres.
13. Lack of competition in distribution services leading to inefficiency and high prices.
14. Lack of a legal framework for operationalization of open access.

4.5.5 Policies and Strategies and Implementation Plan - Distribution

	Policies and Strategies Distribution	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	The National Government shall ensure gradual elimination of overhead distribution systems to provide efficient and safe distribution services by duly licensed network service providers, so as to reduce power supply interruptions and improve the quality of supply and service.	✓		
2.	The County Government may plan and develop distribution networks and transfer them to distributor(s) duly licensed to operate and maintain them in line with the national policy of having only one distributor in a given area at any particular time for efficiency and technical effectiveness of the national power network.	✓		
3.	The National Government shall provide a legal framework to support open access of the distribution network taking into account existing contractual commitments and provide mechanism for determination of wheeling charges applicable to distribution lines.	✓		
4.	The Government will continue funding the development of distribution network in rural areas and continue to support strengthening of distribution network in the rest of the areas through licensed distributors.	✓		
5.	Clarification of assets ownership between REA (which is proposed to be renamed NERA) and KPLC shall be done.	✓		
6.	Off-grid networks shall meet the national power grid standards for future inter-connection.	✓		
7.	The Government shall continue to implement a prudent financially sustainable customer connection policy to accelerate consumer connections to 500,000 and 750,000 annually by 2016 and 2022 respectively and shall endeavour to provide affordable electricity to all and eliminate connection charges.	✓	✓	
8.	Reinforce the 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.	✓	✓	✓
9.	Expand the distribution network to an 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 by 2016 and increase distribution substation capacity HV lines, MV lines and distribution transformers to 38,000MVA, 25,000 km, 190,000 km and 60,000MVA respectively by 2030.	✓	✓	✓
10.	Regularly review the electricity market to enhance competition, improve efficiency and increase reliability, security and quality of supply.		✓	
11.	Continue to implement a sustainable customer connection policy to achieve 100% connectivity by 2020.			✓

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. To achieve these objectives, the Authority has the mandate of extending electrification services to rural areas, developing rural electrification master plans, managingthe rural electrification programme fund, mobilizing resources for rural electrification and promoting the development and use of renewable energy. In addition, GoK targets as set out in the Vision 2030 is to achieve 100% connectivity by 2030.
2. As at June 2013 the Government through KPLC and REA had provided electricity supply to 23,167 out of the existing 25,873 public facilities in the country.
3. The cumulative capital expenditure since inception of Rural Electrification Programme (REP) in 1973 was KShs45billion 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 to stand at 453,544 as at June 2013 from 382,631 as at June 2012. Units of electricity sold increased by 5million from 308million kWh in 2011/12 to million 313million kWh in 2012/13.

4.5.7.2 Challenges in Rural Electrification

1. High costs of connection. Despite efforts to subsidize the cost of connection to between KShs 17,000 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 way leaves due to high compensation demand by public institutions and land owners.
6. Vandalism of power infrastructure.

4.5.7.3 Policies and Strategies and Implementation Plan – Rural Electrification

Policies and Strategies Rural Electrification	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Update the rural electrification master plan.	✓		

	Policies and Strategies Rural Electrification	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
2.	Continue funding the development of distribution network through the National Electrification Program Fund to the economically unviable areas.	✓		
3.	Seek funding from development partners for specific programmes especially in areas less attractive to the private sector and 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.	Increase rural electrification connectivity to at least 40% by 2016 and 100% by 2020.	✓	✓	✓
9.	Clarify asset ownership between REA (or NERA) and KPLC.	✓		
10.	Collaborate with other government agencies for provision of basic necessities including energy services to nomadic and pastoral settlements.	✓		
11.	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 implement cross-county rural electrification connections.	✓		
12.	Implement cooperation arrangements with County Governments for accelerated implementation of rural electrification programme.		✓	

4.6 CROSS CUTTING ISSUES

4.6.1 Challenges

1. Kenya's Poverty line is set at 1.46 US$/day in urban areas and at 0.68 US$/day in rural areas. This is equivalent to 124.10 KeS/day and 57.80 KeS/day respectively; or KeS 3,226.60 and KeS 1,502.80 per month respectively. The energy charge for a domestic customer on the Lifeline Tariff is 2.00 KeS/kWh and such a customer consumes, on average, 22 kWh/month. The typical monthly bill for such a consumer in April 2012 is KeS 383.67 which is 12% of the income for the urban consumer on the poverty line and 26% for the rural consumer on the poverty line. These charges exceed 5% and are therefore unsustainable for consumers on or below the poverty line.

2. Outdated or lack of land use master plans which have made it difficult and expensive to acquire land and way-leaves for power infrastructure development.
3. 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.
4. High cost of financing energy infrastructure projects.
5. Insufficient fiscal and other incentives for private sector investment.
6. Lack of adequate port facilities for handling cheaper energy resources including coal and natural gas to support power generation.
7. The restructuring of the sector creates challenges due to existing obligations including Power Purchase Agreements (PPAs), financial covenants and asset ownership.
8. 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 and Implementation Plan – Electricity Cross Cutting Issues

Policies and Strategies Electricity Cross Cutting Issues	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Put in place mechanisms to ensure that the local communities benefit from developments of the electricity supply infrastructure.	✓		
2. The Government shall:			
(a) provide funds for pre-feasibility and feasibility studies for energy projects.	✓		
(b) ensure that integrated plans for the electricity supply system are prepared including the Least Cost Power Development Plan (LCPDP).	✓		
(c) where necessary acquire land and wayleaves for energy infrastructure development.	✓		
(d) develop a resettlement action plan framework policy for energy related projects.	✓		
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 determine levies charged by County Governments, urban areas and cities on power infrastructure as provided under Article 209 (5) of the Constitution.	✓		
5. The Government will provide fiscal incentives to encourage investors to acquire and develop energy development technologies.	✓		

	Policies and Strategies Electricity Cross Cutting Issues	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
6.	NERC shall ensure that during the energy contracting 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 in regulations formulated under the Energy Act so as to also cater for the urban poor and marginalized groups.	✓		
7.	The Government will encourage incorporation of clean development mechanisms in energy projects so as to benefit from carbon credits under the 1997 Kyoto Protocol or any successor mechanism.	✓		
8.	The government shall take adequate measures including introduction of sanctions to ensure that licensees supply quality power.	✓		
9.	Power generators shall, in consultation with distribution and transmission licensees, construct or cause the construction of supply lines to cater for the needs of the local community in their areas of operation.	✓		
10.	Institute appropriate and innovative ways to enhance surveillance and security of energy infrastructure.	✓		
11.	Create awareness on the benefits resulting from development of clean energy technologies.	✓		
12.	The Cabinet Secretary will liaise with the relevant government agencies to provide for efficient dispute resolution mechanisms in the energy sector.	✓		
13.	Enhance financial resources mobilisation and efficiency.	✓		
14.	Concession government owned off-grid (isolated) power stations within the framework of the Privatisation Act.	✓		
15.	Where commercially viable, progressively connect off-grid systems to the national grid.	✓		
16.	Provide incentives for local assembly and manufacture of energy infrastructure equipment.	✓		

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 a lack of information, motivation and know-how. Financial restrictions were among the other factors that contributed to that outcome. At 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 CO_2 to the tune of 5.2 million 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. High technical losses in the generation, transmission and distribution systems.
5. 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.
6. Lack of comprehensive, reliable energy audit data and information covering various sectors and sub-sectors.
7. Slow adoption of conservation opportunities and measures due to socio-economic factors.
8. Inadequate financing owing to challenges in sourcing funds and credit mobilization for energy efficiency and conservation projects are impediments to investment in this area
9. Insufficient standardized equipment and appliances that would benefit from tax rebates and fiscal incentives.
10. 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).
11. High cost of optimisation technologies in energy development and consumption.

Policies and Strategies and Implementation Plan – Energy Efficiency and Conservation

	Policies and Strategies Energy Efficiency and Conservation	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	Recognize efficiency and conservation as a high-priority energy resource.	✓		
2.	Promote energy efficiency and conservation initiatives in all sectors including schools.	✓	✓	✓
3.	Enhance the provision of energy audits and advisory services in the counties.	✓		
4.	Promote the establishment of laboratories for energy efficiency testing.	✓		

	Policies and Strategies Energy Efficiency and Conservation	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
5.	Disseminate information on energy efficiency and conservation to consumers.	✓	✓	✓
6.	Provide for incentives and penalties to reduce high losses in generation, transmission and distribution systems.	✓	✓	✓
7.	Provide appropriate fiscal and other incentives to enhance uptake of energy optimisation technologies.	✓		
8.	Review energy intensity in all sectors and international best practices so as to enable process improvement.	✓		
9.	Establish an energy efficiency and conservation agency as a fully-fledged national public entity.		✓	
10.	Introduce the concept of green design in buildings. This includes solar water heating, natural lighting, ventilation, and open office design among others.		✓	✓
11.	Promote development of standards and codes of practice on energy efficiency and conservation.	✓	✓	
12.	Develop and enforce standards for fuel economy through speed limits, efficiency of motor vehicle engines as well as adopting good driving and maintenance practices.	✓	✓	✓
13.	Promote mass transportation of passengers and cargo so as to encourage economies of scale and the attendant fuel efficiency.	✓	✓	
14.	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.			✓
15.	Prepare a National Energy Efficiency and Conservation Plan in consultation with relevant stakeholders.		✓	
16.	Promote efficiency in oil refining in line with modern practices which minimize wastage and encourage heat recovery.		✓	
17.	Promote efficiency and improvement in conservation, generation, transmission distribution and consumption of energy including incentives to encourage assembly and manufacture of energy efficient equipment.		✓	

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 a "Lead Agency" 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 laws and regulations.
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, NERC 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. 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 and associated costs.
6. Other authorities that have regulatory mandate 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, Water Resources Management Authority (WRMA) under the Water Act of 2002 and the Kenya Maritime Authority (KMA) under the Merchant Shipping Act & Kenya Maritime Authority Act of 2006.
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 risks 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 provides that any treaty or convention ratified by Kenya forms part of the Laws of Kenya. It is necessary to develop guidelines to ensure the application and compliance of the relevant conventions in the energy sector.

6.2 ENERGY SUPPLY SIDE ENVIRONMENTAL CONCERNS

6.2.1 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.

6.2.1.2 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.

6.2.1.3 Coal

1. 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.

1. Clean coal energy can be harnessed chemically without combustion with air by capturing 99% of Carbon Dioxide.

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

1. 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.
2. 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. Other mitigation measures include extraction of excess materials for industrial use.

6.2.3.2 Large Hydro

1. 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.
2. 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. Appropriate mitigation measures should be adopted to counter these and other potential negative effects.

6.2.3.3 Biomass

1. 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 Electricity

1. 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.
2. A health and safety concern with electricity grid systems and consumer installations is the danger of electrocution and electric shocks.

6.2.5 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 may cause release of radioactive materials which can have a negative impact to environment, health and safety of persons. However, further research has led to development of advanced reactors with enhanced security and safety mechanisms that greatly diminish the possibility of a nuclear accident.

6.3 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.

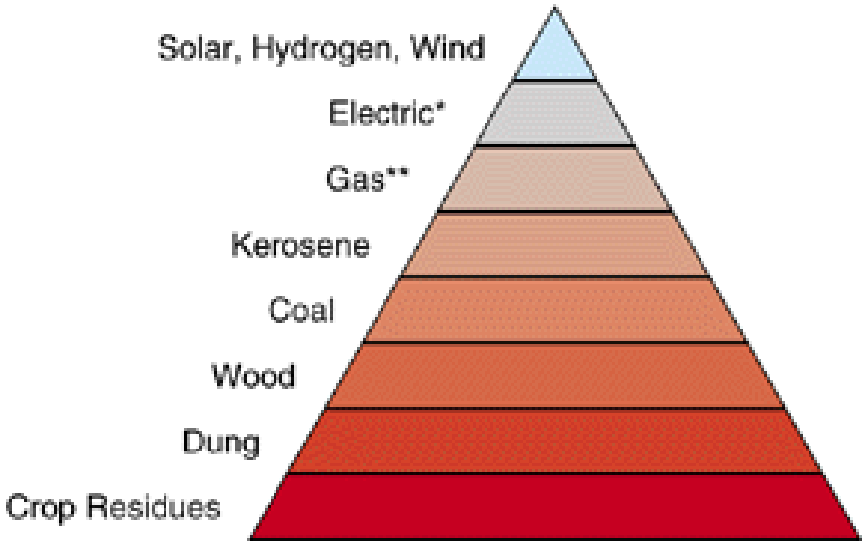


Figure: 6.1 - The Energy Pyramid[2] - Efficiency of Solid Fuel compared to other fuels

2. The solid fuels lead to increased indoor air pollution which leads to Upper Respiratory Tract Infections (URTI). The challenge is to move consumers up the energy ladder recognising that biomass, which is at the bottom of energy ladder provides 60% of cooking energy needs in Kenya.
3. Kerosene is widely used in households for lighting and cooking. In 2008 about 300 thousand cubic metres were used, up from 200 thousand cubic metres consumed in 2003. However, this

[2] http://www.burningissues.org/car-www/science/Energy-ladder.html

causes indoor air pollution leading to cases of URTI, in addition to the risk of explosions of lamps and stoves leading to injuries, loss of lives and property. There is need to move consumers from the consumption of kerosene to LPG and natural gas.

6.4 CLIMATE CHANGE ISSUES

1. Kenya is a signatory of the Kyoto Protocol, a treaty signed in 1997, to lower anthropogenic emissions of Carbon Dioxide (CO_2). 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.

Table 6.1 - Comparative Energy Indicators - Energy Consumption and Emissions

Category	Country	TPES/pop (toe/capita)	TPES/GDP toe/000 2000 US$	Elec. Cons./pop Kwh/capita	CO2/TPES tCO2/toe	CO2/pop tCO2/capita	CO2/GDP kgCO2/2000 US$
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	1.04	146	0.54	0.25	0.56

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

Source: Key World Energy Statistics, 2011, 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)
Bagasse based Cogeneration Project	Japan Carbon Finance	Mumias Sugar Company Ltd	125.591
Sondu Miriu Hydro Power Project	Danish Carbon Fund (World Bank)	KenGen	211.068
Olkaria II Geothermal Expansion Project	Community Development Fund (World Bank)	KenGen	149.632
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	25.680
Optimisation of Kiambere Hydro	Development Carbon Fund (World Bank)	KenGen	38.758
Bagasse Cogeneration Project	Pioneer Carbon (UK)	Muhoroni Sugar Company Ltd	16.758
Olkaria I Expansion (140MW)	World Bank	KenGen	
Olkaria III Phase 2 Geothermal Expansion Project		OrPower4	177.60
Olkaria IV (140MW)	World Bank	KenGen	
Ngong Wind Existing (5.1MW)	KenGen	KenGen	
Ngong Wind II (20MW)	KenGen	KenGen	
Lake Turkana 300 MW Wind Power Project	AFD, Japan, Spain	LTWP	736.615
Songoro (21MW)	KenGen	KenGen	
Aberdare Range/Mt. Kenya Small Scale Reforestation Initiatives	Canada, Italy, Luxembourg		24.778

Source: *NEMA 2012, 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*

6.5 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 earthquakes, faults, volcanic eruptions, subsidence, landslides, blowouts and mud flows.
   (c) Environmental hazards including soil erosion, siltation and desertification.
   (d) Industrial accidents, oil spills, 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.

6.6 LAND AND SOCIO-ECONOMIC IMPACTS

6.6.1 Background

1. Energy development projects have various impacts on communities where the projects are implemented. Key among these is both economic and physical displacement. Physical displacement of project affected people is particularly prevalent 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.

6.6.2 Challenges

1. 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.
2. Access to and acquisition of land: Difficulty in the acquisition of sites, 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. Further, legal and regulatory provisions in the energy sector governing land acquisition and access are inadequate.
3. Absence of a comprehensive and fair compensation mechanism for local communities in line with the requirement of the Constitution (Article 66).

4. Vandalism of energy sector infrastructure continues to cause immense losses as well as supply interruptions.
5. The need to enhance regional, gender and environmental considerations in energy planning and development.
6. Land access and permit where exploration blocks fall on private land or cultural heritage areas including game parks/reserves.

6.7 Policies and Strategies and Implementation Plan – Land, Environment, Health and Safety

6.7.1 Land and Socio-Economic Issues

Policies and Strategies Land and Socio-Economic Issues		Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
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. The 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 include planning for energy utility services namely way-leaves, infrastructure development, transmission, distribution and pipeline corridors.	✓		
2.	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. The Government shall initiate compensation within a reasonable period. However, where there is a dispute, the Government valuer(s) shall provide opinion to ensure uniformity and fairness.	✓		
3.	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.	Seek for amendment/repeal of any legislation that impact negatively on the energy sector.	✓		
5.	Make provision to 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, storage, transmission, laying of petroleum pipelines and electricity supply infrastructure, dams and geothermal development.	✓		
6.	Provide that 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, the owner of the land may carry out the restoration, and the costs thereof shall be recoverable	✓		

Policies and Strategies Land and Socio-Economic Issues	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
from the licensee.			
7. Provide for restoring, repairing damage or making good loss caused by a licensee's operations in respect to laying of energy infrastructure or extraction of energy resources in accordance with Article 70.	✓		
8. The Cabinet Secretary may gazette or de-gazette all land held by public entities for energy infrastructure.	✓		
9. A licensee may 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 from time to time. A licensee may 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. Where a licensee faces constraint in accessing any natural resource including land and water for development of energy infrastructure, the licensee may upon authorization by the national government reclaim portions of existing water bodies for such purposes.	✓		
11. Whenever a licensee carries out any work authorized his licence or permit, 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.	✓		
12. Where a public institution in the energy sector requires the compulsory acquisition of land for use, the institution may apply to the Cabinet Secretary to acquire the land on its behalf.	✓		
13. Provide for the right in cases of emergency to clear obstructions to 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 supervision of the Kenya Police Service.	✓		
14. 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.	✓		
15. Provide for the following offenses:			
(a) Illegal acquisition of interest in public land set aside for energy infrastructure projects through encroachment or grabbing and include punitive penalties for either offence;	✓		
(b) Trespass on or encroachment of energy installations, infrastructure	✓		

Policies and Strategies Land and Socio-Economic Issues	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
and wayleaves, wayleaves trace infringement in respect of blasting, quarrying, dumping of materials, structures erection and any other activity that compromise distribution services.			
16. Develop a Resettlement Action Plan Framework for energy related projects; including livelihood restoration in the event of physical displacement of communities.	✓		
17. Provide for access to land where exploration blocks fall on private land, community land and cultural heritage areas including game parks/reserves.	✓		
18. Full acquisition of all project sites and way leaves to prevent occupation and potential disaster including relocation of existing occupants to prevent encroachment.		✓	

6.7.2 Environment Health and Safety

Policies and Strategies Environment, Health and Safety	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Provide a procedure for enforcement of environmental rights under Article 70 and specifically provide for notification of breach and giving time to remedy the breach.	✓		
2. Provide a mechanism for management of oil spills including clean-up and penalties in consultation with other statutory authorities.	✓		
3. Promote sustainable development as provided for under Article 10 (2)d of the Constitution be incorporated in the Proposed Energy Bill.	✓		
4. Develop and implement Environmental Impact Assessment (EIAs) and other guidelines for the energy sector. Monitor their implementation through Environmental Management Plans.	✓		
5. Facilitate the development of standards for equipment, products, protective equipment, facilities and operating practices in the energy sector to ensure safe operations. Where there are no local standards, international standards shall apply.	✓		
6. Provide for measures which act as a catalyst for consumers to move up the energy ladder including fiscal incentives on LPG appliances, construction of import handling facilities for LPG, and introduction of cleaner fuels and technologies.		✓	
7. Encourage acquisition and installation of fire extinguishers in homes.	✓		
8. Develop guidelines to ensure the application and compliance of relevant conventions in the Energy Sector.	✓		
9. Enhance sectoral, regional, gender and environmental considerations in energy planning and development.	✓		

Policies and Strategies Environment, Health and Safety	Implementation Plan Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
10. Strengthen NERC's capacity to provide leadership and enforce environmental health and safety requirements, environmental disaster risk management and response in the energy sector in consultation with other statutory authorities.	✓		
11. Enhance and strictly enforce penalties for vandalism of energy sector infrastructure, equipment and materials.	✓		

6.7.2 Climate Change Mitigation

Policies and Strategies Climate Change Mitigation	Implementation Plan Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Support the development of the national position on climate change and participation in international climate change negotiations to improve the investment climate for CDM projects.	✓		
2. Ensure that the proposed National Energy Institute undertake research, which advances clean energy technologies.	✓		
3. Collaborate with other stakeholders on climate change on energy issues to address the challenges.	✓	✓	

6.7.4 Sector Specific EHS Strategies and Implementation Plan

6.7.4.1 Electricity

Policies and Strategies Electricity Sector EHS Concerns	Implementation Plan Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Put in place mechanisms to mitigate negative effects of generation transmission and distribution of electricity.	✓		
2. Encourage the use of electric trains, trams and cars.			✓

6.7.4.2 Fossil Fuels

Policies and Strategies Fossil Fuels EHS Concerns	Implementation Plan Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Carry out rapid urban air quality assessments on energy sector emissions and identify key problem sectors/areas that need to be prioritized in tackling air pollution by energy sector emissions.	✓		
2. Develop strategies to reduce transport emission, including:			

Policies and Strategies Fossil Fuels EHS Concerns	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
(a) 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 and/or revamping vehicle emission inspection and maintenance programs for existing vehicle fleets.	✓		
3. Ban the importation of two stroke motorcycles.		✓	
4. Continuously update and enforce the specifications standards for supply of clean fuels.		✓	✓
5. Ensure that all energy generation plants adhere to emission standards and further employ more efficient technologies. 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. Provide incentives for acquisition of fuel efficient technologies in motor vehicles.	✓		
7. Put in place mechanisms for elimination of kerosene as an energy source in households by 2022.		✓	

6.7.4.3 Renewable Energy

Policies and Strategies Renewable Energy EHS Concerns	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Actively support and promote the uptake of renewable energy technologies.	✓	✓	
2. Ensure sustainable production and use of wood fuel resources.	✓	✓	
3. The Government shall ensure promotion of modern production technologies, introduce a regulatory framework for wood fuel and support commercial woodlots.	✓	✓	✓
4. The Government shall support the national tree cover policy aimed at increasing the national tree cover to 10% and above.		✓	
5. Promote the development, commercialisation and widespread utilisation of renewable energy technologies. In addition, the price of charcoal and wood should also reflect the cost of replenishing raw materials.			✓

6.7.4.4 Nuclear Electricity

Policies and Strategies	Implementation Plan		
Nuclear Electricity EHS Concerns	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
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.		✓	✓

6.7.5 Conservation of Catchment Areas

Policies and Strategies	Implementation Plan		
Conservation of Catchment Areas	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Support conservation initiatives and ensure proper coordination of all relevant statutory authorities.	✓		
2. Ensure effective management of the catchment areas to safeguard both the installed capacity and potential power generation sites.		✓	
3. Identify and map out water catchment areas boundaries and gazette them as protected areas.	✓		
4. Support hydro power generators in catchment area conservation initiatives through both fiscal and other mechanisms.		✓	✓

6.7.6 Disaster Prevention and Management

Policies and Strategies	Implementation Plan		
Disaster Prevention and Management	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. 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. This is especially so in areas with high risk and/or high hazard rating.		✓	✓
2. 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. Provide for the:			
(a) Creation of a Disaster Response Unit at the Ministry responsible for Energy. This unit will coordinate with the National Disaster Operations Centre (NDOC) when such situations arise in the energy sector.	✓		

Policies and Strategies Disaster Prevention and Management		Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
(b)	Creation of Disaster prevention and mitigation units in each energy entity. The NERC shall enforce this requirement through licensing and other regulatory tools. In addition, every energy entity shall be required to have access to the requisite adequate response units including fire trucks and ambulances.	✓		
(c)	The Consolidated Energy Fund shall cater for among others the energy sector disaster mitigation and response to cater for compensation arising out of environmental damage.		✓	
(d)	Mandatory taking out of an environmental liability insurance policy by entities in the sector.	✓	✓	✓
(e)	County Governments to set up energy 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)	Mainstreaming weather and climate data and information to the sector's core activities.		✓	
(g)	Undertaking of deliberate and coordinated training and education programmes to develop the capacity for disaster preparedness activities.		✓	
(h)	Provide for enhancement of petroleum depots safety by prohibiting the parking of a petroleum tanker in an oil terminal/depot for more than one hour after loading.	✓		
(i)	All County Governments to designate parking lots for petroleum tankers and prescribing a fine for non-compliance by a County, in the sum of one million shillings.	✓	✓	
(j)	Full clearance of all way leaves and access roads to prevent occupation and potential disaster including reallocation of existing occupants to prevent encroachment.			
4.	Develop mechanism for provision of security for all energy installations, which shall be treated as national protected zones.	✓		
5.	The following strategies will be used for risk reduction and adoption:			
(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 helps to enhance of evaluation risk and vulnerability. Risk mapping shall be a continuous exercise updating risk assessment results in the maps and subsequent zoning		✓	

Policies and Strategies Disaster Prevention and Management	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
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 will mitigate vulnerability. The plans shall include rapid reaction activity plans and initial attack or emergency steps.		✓	
(d) Disaster plans and costing centres: Update to date disaster management plans are key in reducing risk and vulnerability.		✓	
6. 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. This shall be instituted into the energy production and delivery systems, and in particular, the following broad policy measures will be undertaken by all the energy sector investments:			
(a) Establishment of functional hazard monitoring systems for feedback purposes		✓	
(b) Support the development and operationalization of a Control of Major Hazard Facilities Framework in consultation with other statutory authorities.	✓		

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.

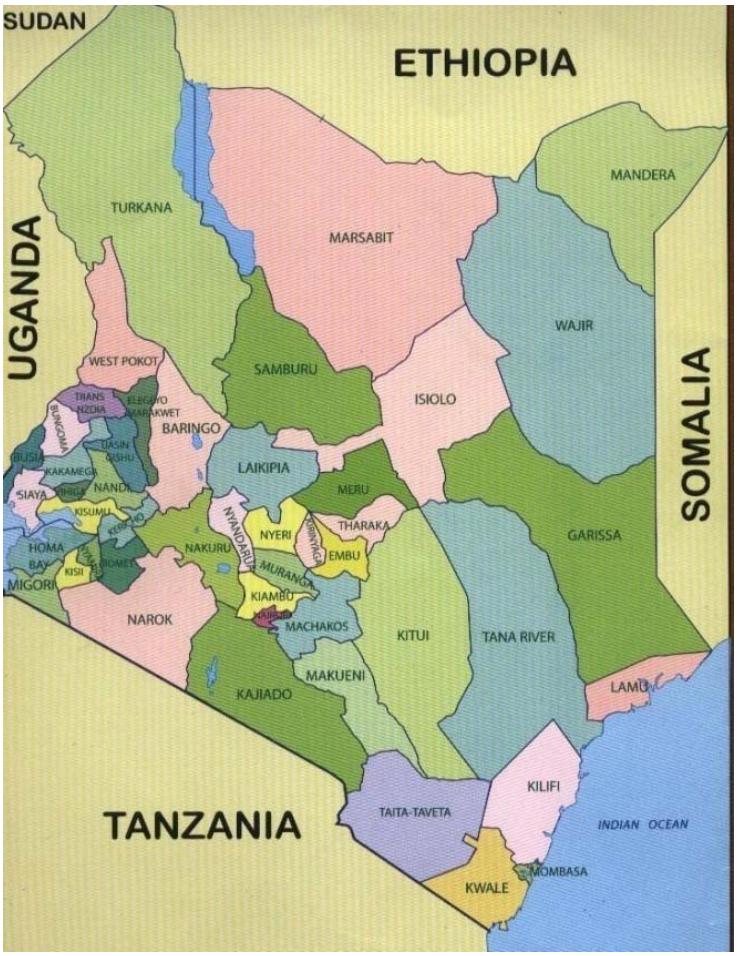
7 Under Article 202 (1), the Constitution further requires that Revenue raised nationally be shared equitably among the national and county governments. Under Article 202 (2): County governments may be given additional allocations from the national government's share of the revenue, either conditionally 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 10.4 in 10.0 - Annextures.

7.3 ACCESS TO ENERGY SERVICES BY COUNTY

It is estimated that worldwide, 1.456billion 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 or standards to guide County governments on devolved responsibility.

7.5 Policies and Strategies and Implementation Plan – Access to Energy Services

	Policies and Strategies Access to Energy Services	Implementation Plan Short Term 2014-2017	 Medium Term 2014-2022	 Long Term 2014-2030
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. Amongst the roles to be addressed in the framework include:	✓		
a)	Licensing of County Governments to provide distribution and reticulation services for gas and electricity.	✓		
b)	Establish energy disaster management centres in all the counties.	✓		
c)	NERC shall establish a National Forum for energy regulators.	✓		
d)	Formulate cooperation arrangements between National Electrification and Renewable Energy Authority and County Government for implementation of rural electrification programmes.	✓		
2.	Fifteen per cent of benefits due to the National government from specific county natural energy resources developed by sector players will be paid to the specific County government and five per cent to the specific local community. These payments will be in lieu of direct levies or charges by County Governments on energy installations.	✓	✓	✓
3.	Minimum standards shall be developed to guide County governments on devolved responsibilities in the energy sector.	✓		
4.	Licensing shall primarily be undertaken by the National Government. However, some of the licensing services will be systematically devolved to the County governments as detailed in Table 10.5 in 10.0 - Annexture.	✓	✓	

	Policies and Strategies Access to Energy Services	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
5.	The national government shall encourage and assist each county to assess its potential for electricity generation as well as develop appropriate strategies to exploit such potential.	✓	✓	
6.	The national government shall offer for purchase by the county government and/or local community, a portion of its equity stake in a company exploiting the energy resources domiciled in their jurisdictions.		✓	
7.	All minerals and mineral oils as defined by law shall vest in and be held by the national government.	✓		
8.	The national and county governments to regularly update energy status and atlas for all counties	✓	✓	
9.	The national government shall provide a definition for local communities affected by energy infrastructure projects under article 71 of the Constitution.	✓		
10.	Determination of taxes and levies for energy services and products shall be vested in the national government.	✓		

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, utilization, 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 investment 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.
6. Inadequate local development of energy technologies.
7. Lack of energy trading mechanism for spot and long term markets.
8. Foreign exchange fluctuations

8.3. Policies and Strategies and Implementation Plan – Energy Financing

Policies and Strategies Energy Financing	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. The Government shall explore and adopt all viable financing options from local and international sources to ensure cost effective utilization of all its energy resources and in so doing shall endeavour to maintain a competitive fiscal investment climate in the country.	✓		
2. The Government shall continue to provide financial support for energy infrastructure development. Such support may include:	✓		
(a) Specialized tax concessions for domestic energy producers of petroleum products such as tax credits, deductions, exemptions and allowances and particular incentives on clean burning petroleum products thus encouraging adoption of clean and efficient refining technologies, following the discovery of commercially viable crude oil in		✓	

Policies and Strategies Energy Financing	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
Kenya.			
(b) Fiscal incentives for the refining sector similar to that provided to refineries by governments in the Middle East and Asia. This recognizes the investment in infrastructure that is commonly accessed by the industry and benefits the entire economy.		✓	
3. Provision of incentives for renewable energy projects so as to reduce the reliance on expensive petroleum based energy in the long term.		✓	
4. The national government shall grant appropriate fiscal incentives for energy expansion projects from time to time.		✓	✓
5. Provide for high import duty for non efficient energy technology while zero-rating efficient technologies.		✓	
6. Allow procurement of equipment for exploration, exploitation and development of energy sources related spares and accessories free of duty and taxes.		✓	✓
7. 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.	✓	✓	
8. Support public generators in joint venture partnerships in situations where the IPPs will be unwilling to participate in development of energy production projects without Government participation due to perceived project risks.		✓	
9. Grant tax holiday to investors in exploration, production and processing of coal and petroleum for a period of between 5 and 10 years depending on size of investment.	✓		
10. Dedicating a certain percentage of the nation's income from conventional energy sub-sector to support training, research, development demonstration and technology acquisition		✓	
11. Providing fiscal incentives for prospective investors in energy	✓		
12. Reviewing the existing laws and regulations for the operation of energy sector industries so as to increase private sector participation in the industries.	✓		
13. Ensuring a reasonable return on investments through cost-effective energy pricing.		✓	
14. 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 alternative sources such as 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 an Energy Finance Corporation as a company under the Companies Act and registered as a financial institution under the Banking Act charged with among other things:-
   (a) Sourcing for funds to finance energy sector investments;
   (b) Providing loans and grants to institutions within the energy sector and any other person or company investing in the Energy Sector.
   (c) Managing the Consolidated Energy Fund.
7. 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.
8. Review the Income Tax Act, (Cap 470), the Customs and Excise Act, (Cap 472) and the Value Added Tax Act, 2013 to provide fiscal incentives in the energy sector.
9. Develop a National Energy trading market in the country including spot and long term markets for energy products.
10. Provision of letters of comfort to Independent Power Producers (IPPs) and letters of guarantee to state corporations.
11. Encourage development partners to establish financial facilities for financing energy related projects at minimal interest rates especially for renewable energy and energy efficiency projects.
12. Waive duty on renewable energy power generation equipment such as solar equipment.
13. Introduce tax concessions to encourage adoption of clean and efficient coal technologies.
14. Provide incentives to attract investment in petroleum retail networks in the remote areas of the country.

15. Seek financing of clean energy projects through carbon credits under clean development mechanism (green energy) and other financing associated with clean energy.
16. The Government to provide incentives for private investors intending to develop private ports with container terminals, gas terminals and oil jetties with storage facilities.
17. Package attractive energy investment instruments which will be appealing to alternative investors such as pension schemes, investment co-operative societies and venture capitalists.
18. The County governments will be encouraged to source for their own funding for energy projects within their mandate according to Article 209 and 212 of the Constitution and national government support.
19. Encourage public private partnerships in energy projects including strategic petroleum reserves infrastructure development and power generation projects.
20. Source for funds for strategic petroleum stocks through government appropriation, development partners, international financial institutions and strategic stocks bonds.

8.4.1 Public Private Partnerships

The Government will support Public Private Partnership (PPP) as provided for in the PPP Act, 2013. Systems have been set for participation of private sector in financing, construction, development, operation, or maintenance of infrastructure or development projects through concession or other contractual arrangements and the establishment of institutions to regulate monitor and supervise project agreements or infrastructure or development projects.

8.4.2 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, response and recovery.
   (d) Hydro risk mitigation during times of prolonged drought.
   (e) Water towers conservation programmes.
   (f) 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 except those with specific purposes.
   (b) Penalties and fines relating to offences in the energy sector as levied by NERC and the Energy Tribunal.

(c) Contribution from energy sector player

(d) Contribution from Treasury other than funds provided to public institutions for the discharge of their mandates.

(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 TARDA, KVDA etc.

(h) Support from development partners

3. The fund shall be managed by the proposed Energy Finance Corporation.

8.5. ENERGY PRICING AND SOCIO-ECONOMIC ISSUES

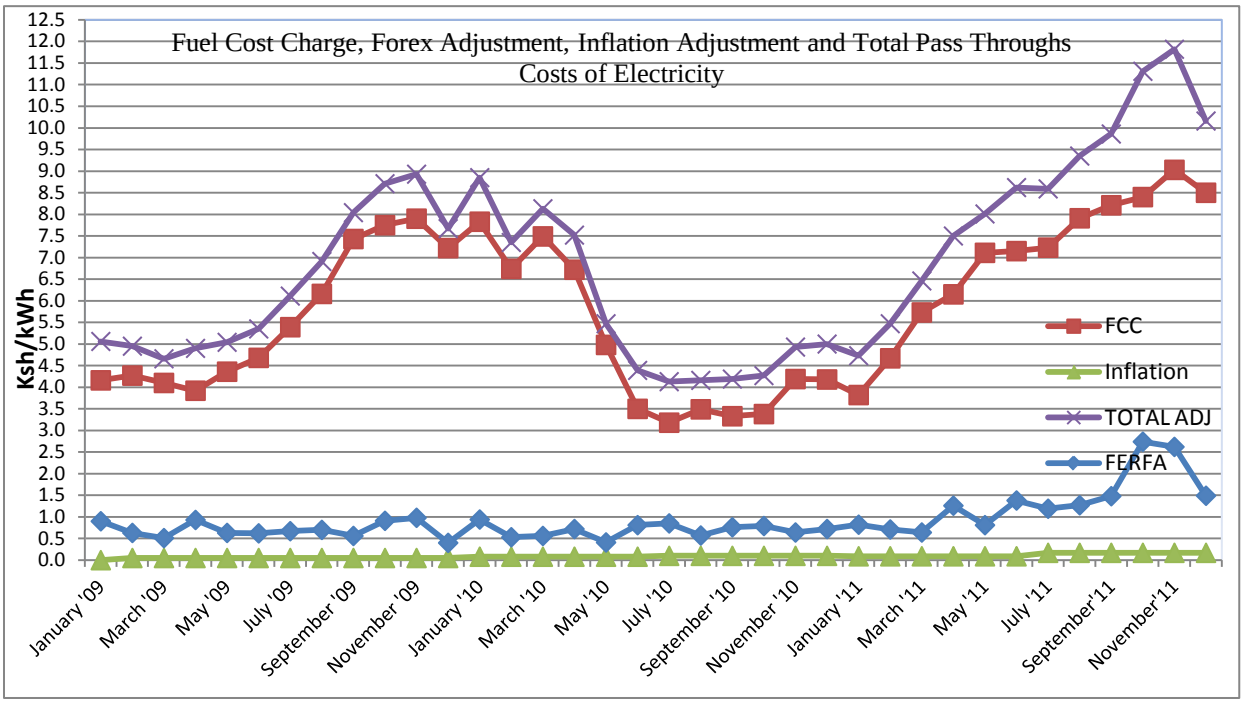
Net domestic sales and consumption of petroleum fuels by consumer category have witnessed a gradual increase in the last five years. The sales recorded an increase of 4.3 percent between 2009 and 2010. A similar trend was observed over the same period for electricity for which consumption grew by 6%.

8.5.1 Energy Pricing

Electricity

1. Electricity pricing is based on the principles of Long Run Marginal Cost (LRMC) of supply. The End-User-Tariff incorporates all prudent costs in the value chain and a fair return to the investors. The bulk tariffs are negotiated between producers and the off-taker, however, the Power Purchase Agreement is subject to approval by the Commission. The retail tariffs are regulated by the Commission and may be subject to review at least every three years.
2. 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.
3. Other fuel costs that affect electricity prices include steam charge, hydro water charges, regional development authorities' charges.
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 and 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%.

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 NERC 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 the former local authorities have also been imposing charges on energy utilities for land leases for wind and geothermal project developments.
3. The end result is the cost of energy for the end consumer is likely to go up significantly.

8.5.2 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.

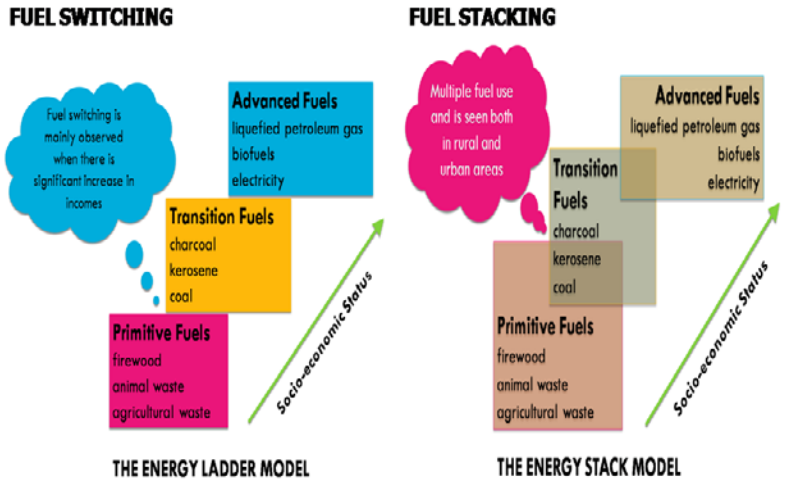
2. Due to the upward trend in international pricing of petroleum products, and the deterioration of the Kenya shilling against the dollar, the Government in 2010 introduced a petroleum price capping mechanism.

8.5.3 Household Energy Consumption Patterns

1. 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).

2. 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. 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).

4. 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/ litre		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/ litre	-	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*

5. 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.

8.5.4 Other Socio-economic Issues

Investment in property must benefit the local communities and their economies. Therefore there is need to provide a framework to ensure that the local communities benefit from energy resources within their region.

8.5.5 Policies and Strategies and Implementation Plan – Energy Pricing and Socio-economic issues

	Policies and Strategies Energy Pricing and Socio-economic Issues	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1	The National Government will ensure that energy charges are prudent, cost effective and imposed in a coordinated manner in consultation with relevant stakeholders.	✓		

	Policies and Strategies Energy Pricing and Socio-economic Issues	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
2	The Government and other regulatory agencies shall conduct regulatory impact analysis on any action that could significantly affect energy supplies, distribution, use or pricing and such analysis shall provide a detailed statement of:	✓	✓	✓
	(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 proposed regulations and orders submitted for legislation and which may have an impact on energy pricing.			
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 undertake to maintain a controlling stake in the energy sector and 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.		✓	✓
7	Article 66(2) of the Constitution, establishes the principle that investment in property must benefit the local communities and their economies. Therefore, the national government shall develop a framework to ensure local communities benefit from energy investment in their region.	✓		
8	The Government shall establish a pricing mechanism for energy services and products at the national level to make energy tariffs affordable.	✓		
9	The National Government will provide mechanisms for ensuring that all energy development investors are compensated for annual inflation at 100%.		✓	
10	The Government will ensure that any charges by regulatory agencies, regional development authorities and county governments on energy installations, fuel or energy equipment shall be treated by NERC as a pass through cost payable by end consumers.	✓		
11	The Government shall regularly inform the public on the process of energy development, procurement and the prudently incurred costs.		✓	

	Policies and Strategies Energy Pricing and Socio-economic Issues	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
12	Develop necessary legislation for net-metering		✓	
13	Develop guidelines to cater for lower tariffs during off-peak hours and time of use tariffs.		✓	
14	Develop mechanisms for special tariffs in public schools and hospitals		✓	

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. Lack of benefits sharing mechanisms and uncoordinated 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.

9.1.2 Policies and Strategies and Implementation Plan – Cross-Cutting Issues

	Policies and Strategies Cross Cutting Issues	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1.	The Cabinet Secretary may establish directorates with responsibility for policy development as well integrated national planning in the areas of oil and gas, coal resources, renewable energy, electricity, nuclear energy for electricity generation as well as energy efficiency and conservation.	✓		
2.	Review and align the energy sector's legal and regulatory framework with the Constitution and amalgamate them into one statute.	✓		
3.	Provide for demarcation of roles between the National and County Governments as far as the energy sector is concerned.	✓		
4.	Review the institutional mandates of the various public institutions under the energy sector to streamline their respective mandates, businesses and operations.	✓		
5.	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) Benefits arising from the utilization of the natural resources are equitably shared between the National and County Governments.	✓		
	(c) All the public institutions under the energy sector adopt the	✓		

		Policies and Strategies Cross Cutting Issues	Implementation Plan Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
		Constitutional requirements on national values and principles under Article 10.			
	(d)	All necessary and applicable general rules of international law affecting the energy sector under Article 2(5) of the Constitution are complied with.	✓		
	(e)	All ratified treaties and international conventions affecting the energy sector under Article 2(6) of the Constitution are adhered to.	✓		
	(f)	Consumer rights as is provided for under Article 46 of the Constitution are protected.	✓		
	(g)	County Governments provide and maintain adequate street lighting.	✓		
	(h)	County Governments 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)	The Government develops and manages a prudent energy efficiency and conservation programme.	✓		
6.		Enhance the jurisdiction of the Energy Tribunal within the amalgamated legislation.	✓		
7.		Enhance penalties for existing offences in the energy sector; by providing minimum sentences and classifying these offences as economic crimes.	✓		
8.		Provide and create additional safeguards on utilization of land, environment and natural resources critical to the development of energy infrastructure and service provisions.	✓	✓	
9.		Provide appropriate procedures for access to information that also protects the principle of confidentiality as provided under Articles 33 and 35 of the Constitution.	✓		
10.		Make appropriate provisions for compulsory acquisition of property for energy infrastructure in accordance with Article 40 of the Constitution.	✓		
11.		Generators to provide the scope and components of regulated asset base used in tariff formulation.		✓	
12.		The Government shall put in place mechanisms to enhance public participation in energy matters.		✓	
13.		Establish inter-ministerial collaboration of relevant stakeholders to ensure coordination at policy, regulatory and operational levels on matters relating to development of energy resources.	✓		

	Policies and Strategies Cross Cutting Issues	Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
14.	Integrate relevant policies with an impact on energy sector for example, water policy, transport policy, land policy, environment policy.	✓		
15.	Establish liaison within the region to deal with matters relating to energy e.g. management of cross border resources, information/data sharing and integrated energy planning.	✓	✓	
16.	While conducting feasibility, energy sector players will work in consultation with the local community to ascertain the energy projects to undertake.		✓	
17.	The regulator and licensees shall undertake public awareness on the billing structure/formula of the various energy products including electricity and petroleum.		✓	
18.	The national government shall ensure all licensees and energy sector players develop customer service charters that they adhere to.		✓	
19.	The Government shall support the activities of the police and the general public in community policing initiative to curb vandalism of energy infrastructure.	✓	✓	
20.	The Government shall in collaboration with other stakeholders control and where necessary put stringent measures on scrap metal trade to deter vandalism.	✓		
21.	The government shall create a National Energy Advisory Council to advice on all sector matters.	✓		
22.	Review privatisation of energy sector parastatals with a view of retaining ownership	✓		

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. To fulfil this mandate ERC has started the process of establishing sub-sector specific planning committees for electricity, fossil fuels and renewable energy with a view of institutionalizing energy planning and improving coordination so as to ensure projects were implemented timely and within budget. Energy master plans will be developed to cover the energy sub-sectors and updated regularly.

3. In 2009, ERC established a committee with the responsibility for preparation of the Least Cost Power Development Plan (LCPDP) in the electricity sub-sector. The committee comprises representatives 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), Kenya Nuclear Electricity Board (KNEB), Kenya National Bureau of Statistics (KNBS) and the Ministry of State for Planning, National Development and Vision 2030 Secretariat.

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 master plans.
   (d) Lack of reliable databases for all energy forms.
   (e) Inadequate linkages with other sectors of the economy.
   (f) Delays in project implementation due to cumbersome procurement process, financing challenges, court action and poor governance.
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 and Implementation Plan – Integrated Energy Planning

Policies and Strategies Integrated Energy Planning	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Establish structures and systems for integrated energy planning and monitoring implementation of planned projects including among others an Integrated Energy Planning Committee (IPEC). Towards this end:			
(a) Establish sub-sector committees whose mandates shall be to develop and monitor the implementation of sub-sector master plans.	✓		
(b) Consolidate the sub-sector plans into an integrated national energy plan.	✓		
2. Develop adequate human resource capacity to carry out integrated	✓		

	energy planning.			
3.	Reliable databases for all energy forms shall be made available and updated annually.		✓	
4.	Create linkages with other sectors of the economy.		✓	
5.	Enhance mechanisms for addressing delays in energy project implementation.		✓	
6.	Develop systems that ensure redundancy in provision of energy services.		✓	
7.	Ensure global benchmarking during national energy planning.		✓	
8.	Establish an independent least cost development planning committees for all energy sources.	✓		
9.	The Cabinet Secretary to ensure implementation of the integrated energy master plan.		✓	
10.	All non-allocated energy projects under the integrated energy master plan will be allocated based on competitive bidding process. However, the Government may allocate strategic energy projects to State Corporations where necessary.		✓	✓

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 which are not co-ordinated.
4. Inadequate promotion of local content in energy technologies.
5. Inadequate linkage between local industries and academia.

9.3.3 Policies and Strategies and Implementation Plan – Research and Development

Policies and Strategies Research and Development	Implementation Plan		
	Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. Establish a National Energy Institute to undertake training, research, development, dissemination, nurture talent, innovation and to enhance capacity building in the sector.	✓		
2. Develop a mechanism for public and private entities to allocate adequate resources for research and human resource development.		✓	
3. Government shall enhance manpower, technical capacity and local content in energy related projects. In so doing, it shall endeavour to establish programmes in conjunction with local industry associations, local training institutions and international institutions.		✓	✓
4. Put in place mechanism to attract private sector funding in Research and Human Resource Development.		✓	
5. Promote local, regional and international participation in research activities, particularly in technology-oriented research.		✓	
6. Undertake a National Research and Human Resource Development road-mapping to assess the status of research in key energy technologies.	✓	✓	
7. Promote and assist acceleration of local production of early generation energy technologies such as wellhead generating equipment.			✓
8. 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.	✓		
9. Enhance research linkages between industries and academia.	✓		
10. The National Energy Institute will continuously train and upgrade human resource capacity to keep up with the changing technological issues in collaboration with other local and international training institutions.		✓	
11. The proposed National Energy Institute to develop appropriate training curriculum targeting key areas in the energy sector.		✓	

9.4 GENDER, YOUTH AND PERSONS WITH SPECIAL NEEDS

9.4.1 Challenges

1. Gender, youth and persons with special needs imbalances in various positions in institutions.
2. Inadequate implementation of policy on gender, youth and persons with special needs 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 – Gender, Youth and Persons with Special Needs

Policies and Strategies Gender, Youth and Person with Special Needs	Implementation Plan Short Term 2014-2017	 Medium Term 2014-2022	 Long Term 2014-2030
1. The Government shall promote the one-third gender principle in the energy sector institutions as provided for under Article 27(8) of the Constitution. Specifically, the Government will promote the disadvantaged gender, youth and persons with special needs in uptake of scientific and engineering courses through NEI.	✓		
2. In order to address the challenges faced by women, youth and persons with special needs the Government shall:			
(a) Mainstream gender, youth and persons with special needs 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, youth and persons with special needs 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

Policies and Strategies Policy Implementation, Monitoring and Evaluation	Implementation Plan Short Term 2014-2017	 Medium Term 2014-2022	 Long Term 2014-2030
1. The Cabinet Secretary responsible for energy shall carry out the implementation, monitoring and evaluation of this policy on a quarterly basis.			
2. The Cabinet Secretary shall set up an appropriate mechanism to monitor and evaluate the implementation process at the national and county levels so as to ensure that the gains in this policy benefit all Kenyans.			

9.6 DATA COLLECTION, MANAGEMENT AND DISSEMINATION

Policies and Strategies Data Collection, Management and Dissemination	Implementation Plan Short Term 2014-2017	 Medium Term 2014-2022	 Long Term 2014-2030
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 information.	✓		

9.7 ENERGY RESOURCES BENEFITS SHARING

Policies and Strategies Energy Resources Benefits Sharing	Implementation Plan Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. The National Government shall ensure equitable sharing of accruing benefits from the exploitation of energy resources between the National Government, County Government and the local community where the resource is domiciled.	✓		
2. Some of the benefits accruing from the exploitation of energy resources include, profits, CSR programmes, training, employment, technology transfer amongst others.	✓		
3. This policy has developed framework which shall form the basis for sharing the benefits. One of the benefits to be equitably shared is the government share of profits accruing from energy natural resources. These shall be shared as follows: (a) National government 80% (b) County government 15% (c) Local community 5%	✓		
4. The five percent share for the local community will be delivered through the County Government with written records as a trustee. The local community means a community or group of individuals directly impacted within the operational/project area of influence which may include operational facilities, areas potentially affected by cumulative impacts or unplanned but predictive developments.	✓		

9.8 Energy Resource Depletion Policy

Policy and Strategy Energy Resource Depletion	Implementation Plan Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
The National Government shall develop a national energy depletion policy for all indigenous energy natural resources.		✓	

9.9 Legal and Regulatory Framework

Policies and Strategies Legal and Regulatory Framework	Implementation Plan Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
1. The new Energy Act to, inter alia, provide for:			
(a) Enhance mandate of NERC to cater for the following:			
(i) Regulated contracts;	✓		
(ii) Setting and approval of tariffs in fossil fuels sub-sector;	✓		

Policies and Strategies Legal and Regulatory Framework		Implementation Plan		
		Short Term 2014-2017	Medium Term 2014-2022	Long Term 2014-2030
	(iii) Appointment of a statutory manager to manage the affairs of licensees;	✓		
	(iv) Regulation of common user logistic facilities;	✓		
	(v) Set national energy regulatory standards to be applied across the Counties.	✓		
	(vi) Provision of dispute settlement services through ADR(alternate dispute resolution).	✓		
(b)	Enhanced mandate of the Energy Tribunal to cater for the following:			
	(i) To be a special court within the meaning of Article 169(d) of the Constitution;	✓		
	(ii) Have original jurisdiction to handle energy disputes between Counties and between counties and national government;	✓		
	(iii) Have original jurisdiction on disputes between a licensee and a third party or between licensees; and	✓		
	(iv) Power to grant equitable reliefs and remedies including but not limited to injunctions, specific performance, restitution and damages.	✓		
(c)	All proposals regarding land and environment as outlined in this Policy.	✓		
(d)	New offences.	✓		
(e)	Enhancement of penalties for existing offences by providing minimum sentences.	✓		
(f)	Classification of all energy related offences as economic crimes.	✓		
(g)	Monetary sanctions to be imposed by NERC or the Energy Tribunal in the event of default by licensees, proceeds of which shall be paid into the Consolidated Energy Fund.	✓		
(h)	Recognition and/or ratification of all necessary and applicable treaties and international conventions affecting the energy sector under Article 2(6) of the Constitution.			
(i)	Enhancement of safety at petroleum depots by prohibiting the parking of petroleum tankers in an oil terminal/depot for more than one hour after loading.	✓		
(j)	Provide for minimising connection and standing charges to accelerate connectivity in rural areas.	✓		
(k)	Provide for new sections and regulations to cover coal exploration, utilization and environmental issues.	✓		

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 Nuclear electricity generation figures around the world

Country	In Operation		Nuclear Share in Electricity Production	Under Construction	
	Number	Electricity Generation (MW)	Percentage %	Number	Expected Elec. Output (MW)
Argentina	2	935	5.9	1	692
Armenia	1	375	39.4	-	-
Belgium	7	5,927	51.1	-	-
Brazil	2	1,884	3.1	1	1,245
Bulgaria	2	1,906	33.1	2	1,906
Canada	18	12,569	15.1	-	-
China					
• Mainland	14	11,058	1.8	27	27,230
• Taiwan	6	4,982	19.3	2	2,600
Czech Republic	6	3,678	38.3	-	-
Finland	4	2,716	28.4	1	1,600
France	58	63,130	74.1	1	1,600
Germany	17	20,339	28.4	-	-
Hungary	4	1, 889	42.1	-	-
India	20	4,391	2.9	5	3,564
Japan	50	44,215	29.2	2	2,600
Korea Republic	21	18,698	32.2	5	5,560
Mexico	2	1,300	3.6	-	-
Netherlands	1	482	3.4	-	-
Pakistan	3	725	2.6	1	315
Romania	2	1,300	19.5	-	-
Russia	32	22,693	17.1	11	9,153
Slovakian Republic	4	1,816	51.8	2	782
Slovenia	1	688	37.3	-	-
South Africa	2	1,800	5.2	-	-
Spain	8	7,567	20.1	-	-
Sweden	10	9,298	38.1	-	-
Switzerland	5	3,263	38.0	-	-
Ukraine	15	13,107	48.1	2	1,900
United Kingdom	19	10,137	15.7	-	-
USA	104	101,240	19.6	1	1,165
TOTAL	435	365,837	14.1		62,862

Source: Table collated from IAEA database, July 2011

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

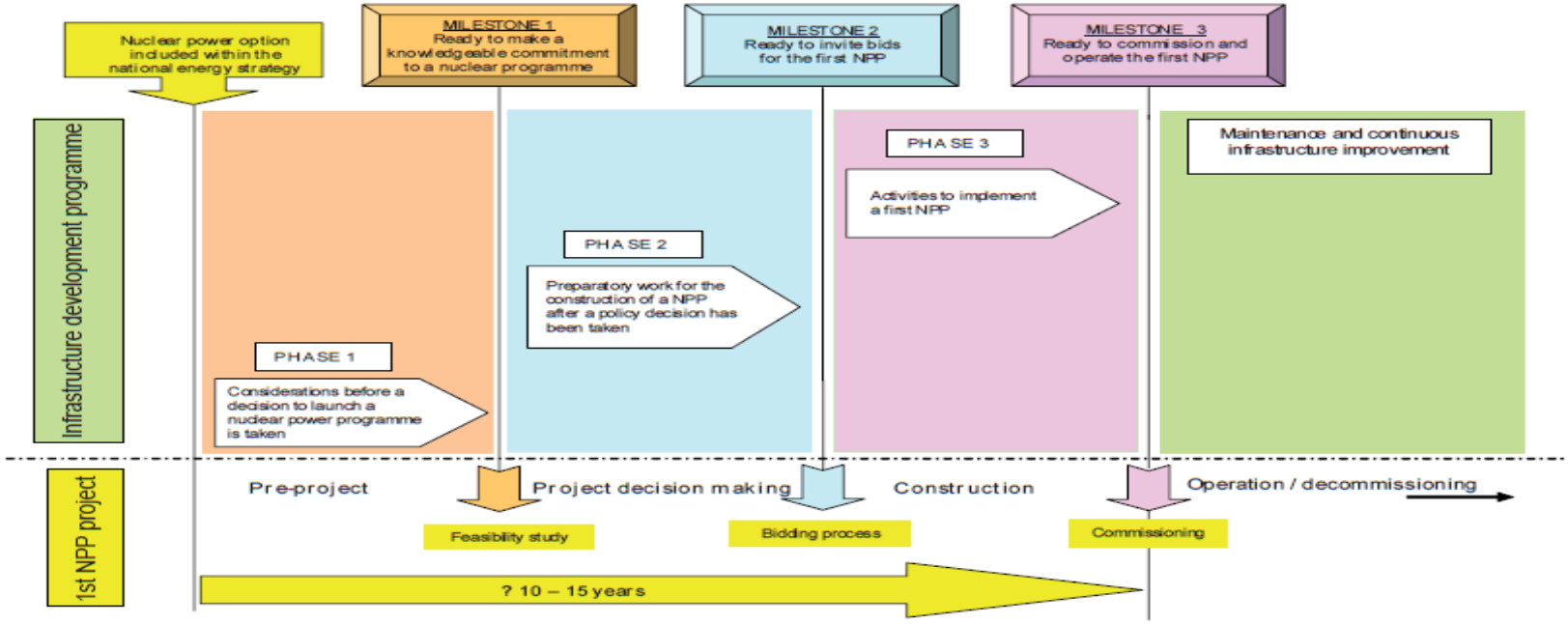


Table 10.4 Summary of the Energy Status in the Counties

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	Some prospects for gas 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%
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%

County	Population	Area (km^2)	Fossil Fuels	Electricity	Renewable Energy
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.	Marsabit supplied by isolated grid while Moyale is supplied from Ethiopian grid, with standby diesel generator sets. 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%
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%.

County	Population	Area (km^2)	Fossil Fuels	Electricity	Renewable Energy
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	Commercially viable reserves of coal in Mui Basin. 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%
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%.

County	Population	Area (km^2)	Fossil Fuels	Electricity	Renewable Energy
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	Oil reserves discovered, exploration still ongoing. 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%
Samburu	223,947	21,022	Limited infrastructure for distribution of petroleum products.	Small section of county with national grid; and isolated grid supplying Bargoi 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%

County	Population	Area (km^2)	Fossil Fuels	Electricity	Renewable Energy
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%
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%
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%

County	Population	Area (km^2)	Fossil Fuels	Electricity	Renewable Energy
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 10.5 Sharing of Licensing Activities between National and County Governments

National	County
Petroleum Gas and Coal.	
Licensing of :- • Exploration and production • Refining • Importation • Exportation • Wholesale • Transit • Storage • Transport – Road, rail, pipeline Issuing of Construction Permits for- • Storage • Service Stations • Transport	Licensing of petroleum, gas and coal products trade- • Retail • Designated parking for petroleum tankers
Electricity	
Licensing of- • Electric power generation. • Electric power transmission. • Electric power distribution. • Retail of electrical energy by counties. • Examination of Electricians. • Electric power import and export. • Appoint, register and oversee the operations of electricity service providers.	Issuance of licences for- • Electrical contractors
Renewable Energy	
(i) Licensing of- • 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- • Solar Water Heater and Photo Voltaic Contractors • Solar System installation Technicians Licensing/issuance of permits for- • Small scale charcoal/biomass producers.

1. 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
EITI	Extractive Industries Transparency Initiative
ERC	Energy Regulatory Commission
ESI	Electricity Supply Industry
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
KNEB	Kenya Nuclear Electricity Board
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
MoU	Memorandum of Understanding
MSD	Medium Speed Diesel
MTPA	Million Tonnes Per Annum
MW	Mega Watt
MWe	Megawatt Electric
NEI	National Energy Institute
NEMA	National Environmental Management Authority
NERA	National Electrification and Renewable Energy Authority
NERC	National Energy Regulatory Commission
NGO	Non-Governmental Organization
NOCK	National Oil Corporation of Kenya
OIEP	Oil Exploration and Production Company
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
SMRs	Small and Medium sized reactors
SAPP	Southern Africa Power Pool
ToE	Tonnes of Oil Equivalent
VAT	Value Added Tax
Wp	Watt Peak

2. GLOSSARY OF TERMS

Conservation includes preservation, maintenance, sustainable use and restoration of natural and cultural environment.

Consumer means any person supplied or entitled to be supplied with electrical energy, oil, gas or coal but does not include a person supplied with electrical energy, oil, gas or coal for delivery or supply to another person.

Dispatch means the process of precisely matching the outputs of generators with load in real time in accordance with clause 6.3 of the Kenya electricity grid code of 2008.

Distribution means the conveyance of electrical energy through a distribution system.

Distribution area in relation to a distribution network service provider means the area in which the distribution network provider is licensed to distribute electricity under the energy Act.

Distribution network means a network which is not a transmission network.

Distribution system means a distribution network together with the connection assets associated with the distribution network, which is connected to another transmission or distribution system.

Energy disaster preparedness and management committee means the committee established under the Cabinet Secretary responsible for energy to deal with disasters in the energy sector.

Energy industry means the sector with fossil fuels (oil, gas and coal), renewable energy and electrical energy as three key sources of primary and secondary energy.

Electricity industry means the industry in Kenya involved in the generation, transmission, distribution, retail and sale of electricity.

Fossil fuels mean oil, gas and coal as primary sources of energy.

Generating station means any station generating electricity, including any buildings and plant used for the purpose, and site thereof, but does not include any station for transforming (other than generator transformer), converting or distributing electrical energy.

High Voltage (HV) means a nominal voltage above 33 kilovolts.

Independent Power Producers (IPP) means electric power producers who sell their outputs to public electricity suppliers under contracts often life-of-plant contracts.

Low voltage (LV) means a nominal voltage less than 1 kilovolt.

Medium voltage (MV) means a nominal voltage of more than 1 kilovolt but not more than 33 kilovolts.

Net metering system means a system that operates in parallel with the electrical distribution facilities of a public utility and measures, by means of one or more meters, the amount of electrical energy that is supplied. It is an incentive for consumers of electrical energy to sell renewable energy generated electricity to a retailer or distributor as the case may be.

Reticulation means the network used to enable supply of energy to a consumer. In the case of electricity, it is the system which enables a consumer to get supply of electricity and consists of low and medium voltage electric supply lines together with service lines, while in gas, it is the system through which a consumer gets a continuous supply of gas at the turn of a tap through a piping network from a centralised storage system.

Retail means—

(a) selling or offering to sell energy to a consumer;

(b) acting as agent or broker for a retailer with respect to the sale or offering for sale of energy;or

(c) acting or offering to act as an agent or broker for a consumer with respect to the sale or offering for sale of energy

System Operator means a person appointed in accordance with the energy Act to exercise system control over the power system.

Transmission means activities pertaining to a transmission network including the conveyance of electricity.

Transmission network service provider means a person who engages in the activity of owning, controlling or operating a transmission system.

Use of system services means transmission use of system service or distribution use of system service

Wheeling charge means an agreed payment for use of system services.