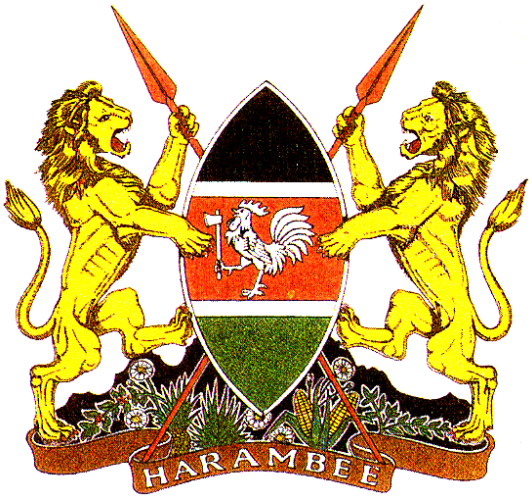
REPUBLIC OF KENYA



Ministry of Energy and Petroleum

DRAFT
NATIONAL ENERGY AND PETROLEUM POLICY

JANUARY 20, 2015

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VISION

Affordable Quality Energy
for All Kenyans

MISSION

To Facilitate Provision of Clean, Sustainable, Affordable, Competitive, Reliable and Secure Energy Services at Least Cost while Protecting the Environment

FOREWORD BY THE CABINET SECRETARY

The enactment of the Constitution of Kenya, 2010 substantially transformed the governance structure of the country and enhanced participation of citizens in administrative decision making processes. This policy document is a result of extensive consultations within the sector and the wider government, insightful benchmarking on best practises from different jurisdictions around the globe and most importantly public participation through workshops held in all the 47 counties. The document sets out the national policies and strategies for the energy and petroleum sector.

The overall national development objectives of the Government of Kenya as set out in Vision 2030 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 realisation of these objectives will be feasible if quality energy services are availed in a sustainable, competitive, cost effective and affordable manner to all sectors of the economy ranging from manufacturing, services, mining, and agriculture to households.

With the discovery of oil and gas as well as coal there is need to put in place an appropriate policy, legal regulatory and institutional framework to ensure that the country benefits from these resources and is able to deal with challenges associated with exploiting them. Key among these is the development of robust frameworks for management of accruing revenues, benefit sharing, local content development and management of stakeholder expectations.

Several initiatives are being pursued to enhance the country's power generation capacity and to diversify the energy mix. As at December 2014, a total of 280MW of geothermal and 20MW of wind power had been added into the grid. Further, the Government continues to pursue coal, natural gas and other renewable energy sources as part of its 5,000+MW project. The intention is to ensure competitive power to drive the socio-economic transformation that this country desires.

We submit these policy recommendations with optimism. Even though the tasks ahead are challenging, they remain achievable. To address our energy challenges we must put to good use the resources and the talents around and within us. I call upon all stakeholders in the energy and petroleum sector to work together to ensure that the proposals contained in this policy are implemented.

Mr. Davis Chirchir
Cabinet Secretary
Ministry of Energy and Petroleum

PREFACE BY THE PRINCIPAL SECRETARY

In the last ten years the policy direction of the energy and petroleum 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 unveiling of the national development blueprint, Kenya Vision 2030, in 2008 and promulgation of the Constitution of Kenya on 27th August, 2010 made it necessary to review the sector policy.

The energy and petroleum sector plays a critical role in the socio-economic development of the country. Indeed, petroleum and electricity as sources of energy are the main drivers of the economy. Discoveries of oil and gas as well as coal present opportunities for the country to develop the sector and the economy. The Ministry has made concerted efforts in the development of an appropriate legal, regulatory and institutional framework for exploration, development and production of petroleum and coal. Local content development in the sector, and particularly in oil and gas, remain pivotal agendas for the Ministry. At the same time, interventions have been made at ensuring increased access to electricity supply by industry and households. The "last mile project" is one such intervention, specifically targeting households, with the aim of achieving universal access by 2020.

The major challenges facing the energy and petroleum sector include; improving the competitiveness, quantity, reliability and quality of supply; high initial capital outlay and the long lead times from feasibility studies to development of 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. The policy recommendations contained herein seek to address these challenges.

Successful implementation of this policy will require all stakeholders to play their role effectively so as to make the vision of affordable quality energy to all Kenyans a reality. The Ministry will provide overall leadership, oversight, guidance and direction to ensure full implementation of this Policy.

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

EXECUTIVE SUMMARY

Preamble

1. The process of formulating this policy entailed comprehensive audits of the Sessional Paper No. 4 of 2004, Energy Act 2006, sector laws, by-laws and regulations, other policies, administrative procedures, government guidelines and circulars relating to energy. All the energy sector organizations carried a situational analysis and prepared a position paper that formed the basis for the initial draft of the policy which was then shared and discussed with stakeholders at a National workshop in Nairobi followed by 48 workshops in the other 46 counties. Desktop analysis and benchmarking with several selected countries were also undertaken. Further consultations with key government ministries, departments and agencies as well as key energy sector stakeholders were held. A National Validation Workshop was held on 14th March 2014 where several suggestions and comments were received, including request by several stakeholders for additional time for submission of more comments, both orally and in writing. The final policy document has benefited from the foregoing consultative process which has been participatory and open as required by the Constitution.

2. This policy document is organised into nine substantive chapters, starting with the Introduction in Chapter 1. Chapter 2 deals with Petroleum and Coal while Chapter 3 deals with Renewable Energy, including electricity generation from geothermal and hydro resources. Chapter 4 covers Electricity while Chapter 5 is on Energy Efficiency and Conservation. Chapter 6 covers Land, Environment, Health and Safety. Chapters 7, 8 and 9 deal with Devolution and Provision of 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

3. The overall objective of the energy and petroleum policy is to ensure affordable, competitive, sustainable and reliable supply of energy to meet national and county development needs at least cost, while protecting and conserving the environment.

4. The energy and petroleum sector has been guided by 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. Adoption of the Kenya Vision 2030 and the promulgation of the Constitution of Kenya 2010, made it necessary to review both the policy and all these statutes so as to align them with the Vision and the Constitution.

Petroleum and Coal

Petroleum

5. Kenya 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. A discovery of natural gas was made in Block L8, Lamu, though it was not found to be commercially viable. 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.

6. The Government shall undertake upstream petroleum operations through petroleum agreements which may include, production sharing contracts, concession agreements, and service contracts.

7. Following the discovery of petroleum and coal deposits, the Government shall:
   (a) Establish a regulatory agency for the upstream petroleum operations;
   (b) Substitute the National Fossil Fuels Advisory Committee (NAFFAC) with two committees:
      (i) A National Upstream Petroleum Advisory Committee (NUPAC) responsible for upstream petroleum exploration and development matters; and
      (ii) A National Coal Advisory Committee (NCAC) responsible for coal exploration and development matters.
   (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; and
   (d) Undertake the requisite process of ensuring transparency and accountability in extractive industries taking into account best industry practices and existing legal framework.

8. There is 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 given its strategic 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.

9. The Government will ensure that there are strategic petroleum reserves in the country. Increased use of LPG shall be encouraged with a view to eliminate the use of kerosene, charcoal and firewood in households. The Government is also evaluating the possibility of using natural gas to support commercial and industrial activities including transportation.

10. 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 and off-loading, storage distribution and fuel dispensing facilities through public private partnerships as appropriate.

11. 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. The Government shall restructure NOCK to have midstream/downstream business separated from upstream business with a view to enhancing capacity of the upstream to fully conduct the activities therein.

Coal

12. Coal is an affordable, competitive, reliable and easily accessible source of energy, especially for electricity generation. Extensive coal exploration has taken place in the Mui Basin of 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 2,000MW of electricity generation by 2017 and 4,500MW by 2030.

13. 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. The National Government shall establish a coal development corporation as a special purpose vehicle to be the lead agency in the development of the coal industry.

Renewable Energy

14. 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 energy 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.

15. 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 achieve at least 1,900MW of geothermal electric power generation by 2017 and 5,500MW by 2030, and enhance direct use of the resource.

16. 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 2014. Potential for small hydros is over 3,000MW, of which, less than 25MW has been developed.

17. In view of the vulnerability of hydropower 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.

18. The National Government shall establish an inter-ministerial Renewable Energy Resources Advisory Committee (RERAC) to, *inter alia,* advise the Cabinet Secretary on:
    (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 as agricultural and municipal waste, forests, and areas with good wind regimes, tidal and wave energy.

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

Electricity

20. Electricity is a secondary source of energy generated through the consumption of primary energy sources namely petroleum, coal, 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 electricity is associated with rising or high quality of life.

21. 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 industry.

    (b) Ensuring provision of affordable, competitive, 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 system losses and collection of revenues.

    (e) Creating a more competitive market structures with clear delineation of roles for public and private sector players in generation, transmission, distribution and retail functions.

22. In order to provide affordable and competitive electrical energy to transform Kenya's economy, a roadmap to raise the generation capacity by at least 5,000MW from 1,664MW as at October, 2013 to slightly over 6,700 MW by 2016 is proposed. Through this roadmap the generation cost is projected to reduce from US¢ 11.30 to 7.41, while the indicative end-user tariffs are projected to reduce from US¢ 14.14 to 9.00 for commercial/industrial customers and from US¢ 19.78 to 10.45 for domestic customers.

23. The National Government shall:-

    (a) Establish the Nuclear Energy Institute 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 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) Formulate and implement a national electrification strategy to accelerate connection with a view to achieving universal access to electricity by 2020.

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

Energy Efficiency and Conservation

24. The importance of energy efficiency and conservation in the Kenyan economy cannot be overemphasized. Challenges to implementation of energy efficiency and conservation measures include lack of awareness of the benefits and methods of conservation, apathy, limited technical capacity and inadequate data.

25. The Government shall establish an Energy Efficiency and Conservation Agency (EECA) to promote energy efficiency and conservation. 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 (GHG) emissions. Measures will also be introduced in the transport sector to promote fuel efficiency by encouraging the use of mass transportation of passengers and cargo to capitalize on the economies of scale as well as promotion of new and efficient technologies.

Land, Environment, Health and Safety

26. Land is a critical resource in the development of energy and petroleum infrastructure. However, due to competing interest in land utilization, the sector faces challenges in developing its infrastructure. Prudent environmental management is key to ensuring sustainable development of the sector.

27. 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.

28. The Government shall facilitate:

    (a) Development of a National Resettlement Action Plan Framework for energy and petroleum 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.

    (c) Establish strategies and mechanisms to eliminate wood fuel, charcoal and kerosene as a household energy source by 2022.

    (d) Creation of disaster response units in each county and in relevant energy sector entities.

Devolution and Provision of Energy Services

29. Under the Constitution, the functions of energy policy including electricity and gas reticulation and energy regulation have been assigned to the National Government while planning and development, including electricity and gas reticulation and energy regulation are assigned to the County Governments.

30. To avoid uncertainty and/or overlap of responsibilities, a framework on the functional devolution of roles between the two levels of government has been developed in consultation with all stakeholders.

Energy Financing, Pricing and Socio-Economic Issues

31. 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 and petroleum infrastructure and delivery systems.

32. The Government shall set up a Consolidated Energy Fund to fund infrastructure development; acquisition of strategic petroleum reserves; energy and petroleum 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

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

34. The Government shall:

    (a) Promote a conducive environment to attract investments in the energy and petroleum sector, taking into account the needs and ability of the people of Kenya.

    (b) Develop and implement a local content policy and regulations to facilitate participation of Kenyans in the energy and petroleum sector, including utilization of locally available goods, services and human resources.

    (c) Put in place framework for pro-active and sustained engagement between the two levels of government, investors and communities in energy and petroleum resource areas.

35. Full and timely implementation of this policy will go a long in facilitating transformation of Kenya into a globally competitive, newly industrialized, middle income and prosperous country with a high quality of life to all its citizens in a clean and secure environment by 2030. Electricity will be affordable, competitive and reliable with a balanced energy mix. The oil and gas as well as coal sub-sectors will have well developed infrastructure and supply since the preliminary findings show high potential. Local content in the sector will also be well developed for enhanced national productivity.

1.0 – INTRODUCTION

1.1 THE ROLE OF ENERGY AND PETROLEUM IN NATIONAL ECONOMY

1. Energy is a critical component in the economy, standard of living and national security of a country. 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 socio-economic pillar. Sustainable, competitive, affordable and reliable energy for all citizens is a key factor in realization of the Vision.

2. Kenya's economy has remained resilient, growing at 5.5% in the second half of 2014 up from 4.7% in 2013, 4.6% in 2012 and 4.4% in 2011 due to implementation of appropriate broad-based policies leading to a stable macroeconomic environment. The setting up of county governments after the general elections held in 2013 have also impacted positively on economic growth as public expenditure rose in line with the devolved system of government. Despite this outcome, low productivity in agriculture, weak manufacturing sector and weak transport system in the face of rising imports and stagnating exports are major concerns.

3. The country has continued to experience a relatively low and stable inflation, moderate interest rates and a relatively stable shilling against the major trading currencies, albeit with some depreciation in the second half of 2014. In 2012 overall inflation was 9.4 percent, dropping to 5.7 percent in 2013 before increasing marginally to 6.9 percent in 2014. The main drivers for the general easing of inflationary pressures include improved supply of basic foods, lower international oil prices and lower costs of electricity, East Africa Community (EAC) integration, Information and Communication Technology (ICT) innovations, strong macroeconomic management and recent investments in infrastructure.

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

5. The principal taxation policy pursued by the Government of Kenya (GoK) in the energy and petroleum sector is based on the need to create a sustainable balance between fiscal revenue generation and to ensure access to modern energy services by the low income segments of the population at reasonable prices. GoK also uses taxation as an instrument to discourage wasteful consumption of energy, and by extension, to encourage its efficient utilization in a cost effective manner.

6. Given this policy regime, the energy sector and petroleum 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.

7. 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 oil and gas, exploitation of coal and geothermal, development of hydroelectric power as well as other forms of renewable energy such as wind, solar and biomass.

8. 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, energy prices are significant determinants 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 AND PETROLEUM POLICY OBJECTIVES

1. The overall objective of the energy and petroleum policy is to ensure sustainable, adequate, affordable, competitive, secure and reliable supply of energy to meet national and county needs at least cost, 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 affordable, competitive, and reliable 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, as well as issues of climate change are factored in energy and petroleum sector developments.

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

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

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

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

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

   (m) Promote cost effective and equitable pricing of energy and petroleum products.

   (n) Protect investor, producer, supplier, consumer and other stakeholder interests.

   (o) Provide incentives for local and international investments in the energy and petroleum sector.

   (p) Ensure that investors and operators in energy and petroleum sector comply with local content requirements.

   (q) Promote and develop government owned agencies in the development of energy resources.

(r) Promote an elaborate response strategy in the management of energy and petroleum related disasters.

(s) Encourage generation of electricity from renewable resources and build the necessary evacuation infrastructure.

(t) Provide for the efficient and optimal distribution of functions between the National and County Governments in the sector while fostering cooperation with 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 and petroleum 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 and petroleum 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, 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 and petroleum 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 used in the country.

(b) The Environmental Management and Co-ordination Act, 1999, which regulates the environmental aspect of the energy and petroleum 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 way-leaves 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 products 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 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.

(i) 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.

(j) The Commission of Revenue Allocation Act, 2011

(k) The Land Act 2012.

(l) The Land Registration Act, 2012.

(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 9th Schedule of the Income Tax Act.

(p) The Urban Areas and Cities Act No. 13 of 2011 that gives effect to Article 184 of the Constitution.

(q) 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.

(r) The Consumer Protection Act that establishes the regime of consumer protection in law to prevent unfair trade practices in consumer transactions and provide for matters connected therewith or incidental thereto.

(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 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 and petroleum policies through which it provides an enabling environment for all stakeholders. Its tasks include national energy and petroleum 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. Kenya Power and Lighting Company Limited (KPLC)

   KPLC is a State Corporation with GoK shareholding of 50.1% and private shareholding of 49.9% as at June 2014. 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 June 2014. It is mandated to generate electric power, currently producing the bulk of electricity consumed in the country. The company currently utilises various sources including hydro, geothermal, thermal and wind to generate electricity.

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 November 2014 there were nine IPPs in operation as listed below and accounted for about 24% of the country's installed capacity:-

(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).
(g) Gikira Hydro (mini-hydro).
(h) Thika Power Limited (thermal power plant).
(i) Gulf Power Limited (thermal power plant).

10. Kenya Petroleum Refineries Limited (KPRL)

Kenya Petroleum Refineries Limited is a limited liability company with its main business being processing of crude oil.

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 oil and gas.

18. Kenya Revenue Authority (KRA)

    KRA is responsible for collection of taxes from energy and petroleum related transactions in line with relevant laws and regulations.

19. National Environmental Management Authority (NEMA)

    NEMA is responsible for enforcement of environmental laws and regulations.

20. Other key players in the energy and petroleum sector include the Kenya Railways Corporation (KR), Kenya Truckers Association (KTA), Kenya Association of Manufacturers (KAM), Kenya Bureau of Standards (KEBS), Kenya Maritime Authority (KMA) and Consumers.

2.0 – PETROLEUM AND COAL

2.1 BACKGROUND

1. The modern way of life is highly dependent on petroleum and coal. These are used and relied on daily in many ways: from the fuels for various modes of transport and generation of electricity to production of fertilizers, pesticides and even clothes. However, these resources are finite.

2. A large percentage of the petroleum (oil and gas) provides fuel for transportation and industries as well as heating, cooking and lighting in homes, institutions and businesses. Some of the petroleum is refined into chemicals which are the building blocks for many products that are used in everyday life such as rubber, plastics, paints, nylon, vinyl, polyester cosmetics, food additives and medicines.

3. 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). Midstream and downstream operations are usually combined.

4. 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, mainly for electricity generation. It is the most affordable fuel worldwide and has potential to become the most reliable and easily accessible energy source.

5. As of 2014 petroleum accounted for about 22% of the total primary energy consumed in Kenya, while coal provided about 1% of the primary energy consumed, mainly by cement manufacturers.

2.2 UPSTREAM PETROLEUM

2.2.1 Petroleum Exploration

1. 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. The Government has taken the initiative to spearhead primary technical data acquisition in the exploration blocks in order to make them attractive to oil and gas exploration companies and by January 2015 there were a total of 70 exploratory wells, about 90,000 line km of two dimensional (2D) and more than 6,300 km^2 of three dimensional (3D) seismic data.

2. Kenya has recently recorded tremendous success in oil and gas exploration. 38 wells have been drilled between 2012 and January 2015, after Ngamia-1 discovery. 34 of those wells have been drilled by Tullow Oil, the latest being Kodos-1 in Kerio Basin that had significant hydrocarbon shows. The API gravity of the oil discovered in Turkana County has been estimated to be between 30^0 and 35^0, indicating high quality oil. Drilling of appraisal wells was ongoing in January 2015.

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	15	10,000
Tertiary Rift	105,673	34	4,000

3. Africa Oil drilled Sala-1 well in Block 9 that had discoveries of natural gas. The block is being evaluated to determine significant appraisal sites.

4. Between 2012 and January 2015, three exploration wells (Mbawa, Kiboko and Kubwa) were drilled off-shore. A discovery of natural gas was made in Block L8, Lamu, though it was not commercially viable.

5. As at January, 2015, Kenya had a total of 46 exploration blocks, as shown in Figure 2-1 below. Out of the 46 gazetted blocks, 41 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, adding immense value through acquisition of high quality data due to deployment of modern data acquisition technologies such as 3D Seismic and Full Tensor Gradiometry (FTG).

Figure 2-1 – Petroleum Exploration Blocks, January 2015

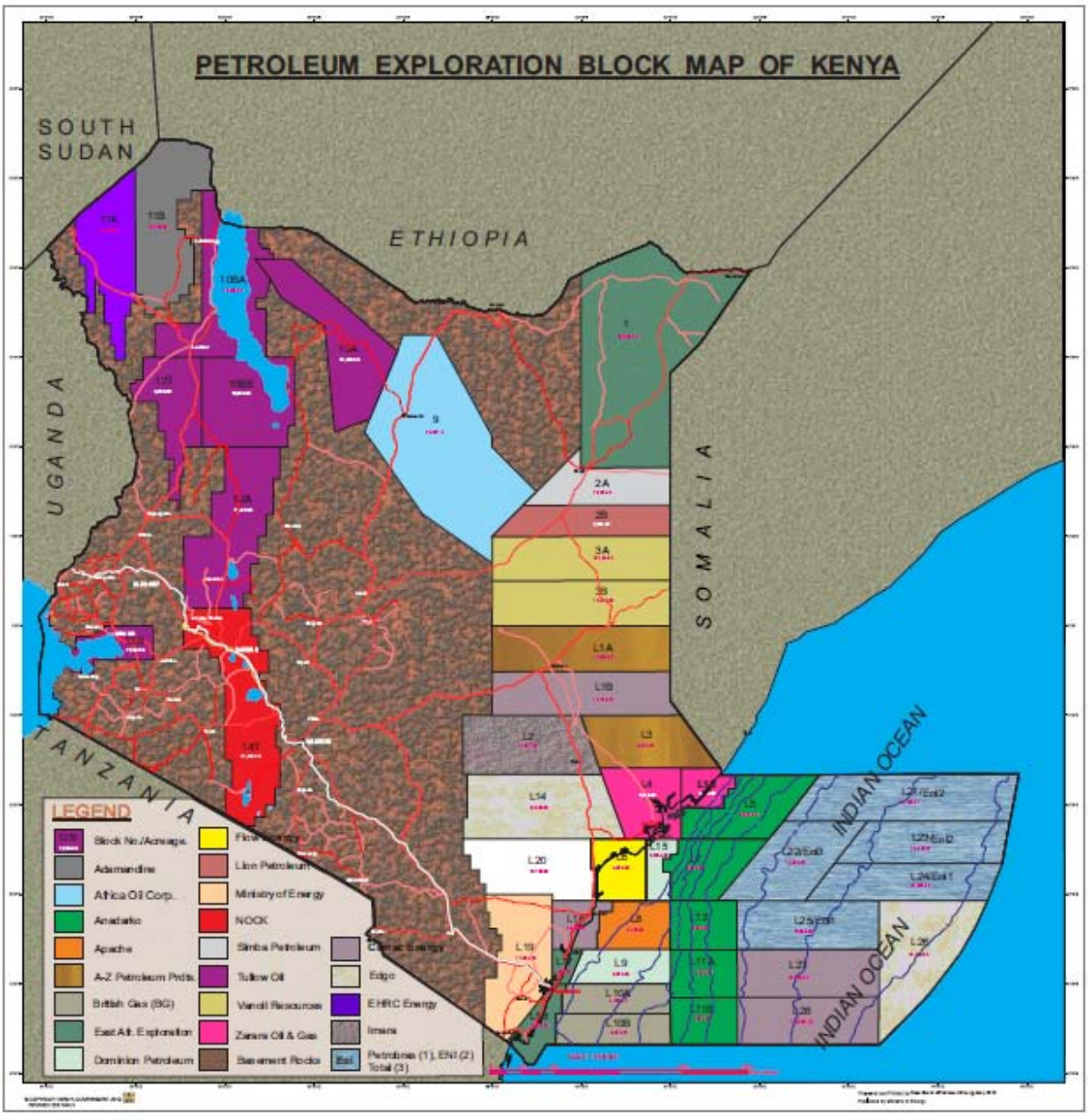


Table 2-2: Licensed Petroleum Exploration Companies as at January 2015

No	Exploration Companies	Exploration Block Nos.	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	1
5.	Vanoil Resources	3A, 3B	2
6.	Africa Oil Corporation	9	1
7.	Zarara	L-4, L-13	2
8.	FAR/Flow Energy	L-6	1
9.	Lion Petroleum	2B	1
10.	NOCK	14T	1
11.	Simba	2A	1
12.	Afren	L-17/ L-18, 1	3
13.	A-Z Petroleum	L-1A & L-3	2
14.	CAMAC Energy	L-1B, L-16, L-27, L-28	4
15.	Rift Energy	L-19	1
16.	Imara Energy Corp.	L-2	1
17.	CEPSA	11A	1
18.	Milio International	L-20	1
19.	Adamantine Energy Ltd	11B	1
20.	Lamu Oil Exploration	L-14	1
21.	Total Exploration & Production Kenya B. V.	L-22	1
22.	ENI Spa	L-21, L-23, L-24	3

6. The marked increase in petroleum exploration interest is attributed to:
   (a) Discovery of oil in Turkana County in 2012 and discovery of gas in Wajir County in May 2014.
   (b) Creation of basin by basin data packages by the Government.
   (c) 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) Increased world demand for natural gas.

7. Licensing of Petroleum Blocks is 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).

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 metres. The minimum work

programme and expenditure obligation for each block is negotiable. The general structure of the PSC is summarized in Annex 10.1 in 10.0 - Annexure.

9. 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.
10. Conventional natural gas is typically found in structures in rocks 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.
11. Unconventional gas types include coal bed methane and shale gas. Methane produced from coal seams is called coal bed methane, coal seam methane, or coal seam gas. Once produced, it is transported and marketed like conventional natural gas.
12. 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.
13. 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.
14. If natural gas is discovered in sufficient quantities:
   (a) Field development will need to include drilling of production wells, installation of offshore and onshore production facilities, and liquefaction plants to process LNG for export
   (b) 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.

2.2.2 Challenges in Upstream Petroleum

1. Attraction of capital for petroleum exploration and production activities, which are highly capital intensive.
2. High cost of acquisition of new technology.
3. Inadequate manpower, technical capacity and local content in oil and gas exploration and production activities.
4. Inability to access potential exploration sites/blocks which are located on private land, cultural heritage, conservancy areas and game parks/reserves.
5. Limited primary technical data in most of the country's exploration blocks.
6. Falling prices of crude oil.
7. Inherent weaknesses in Cap. 308 and in the model PSC which include lack of provisions for:
   (a) Compensation regime.

(b) Competitive bidding for blocks.

(c) Community awareness and participation.

(d) Natural gas fiscal terms.

(e) Mechanism for working out Government revenue out of monetary gains from transfer of PSC interests.

(f) Defined criteria for evaluating PSC terms.

(g) Environmental protection, conservation and management.

(h) Harmonization with the 9th Schedule of the Income Tax Act.

8. Ineffective enforcement of upstream laws and regulations.
9. Inadequate policy for sustainable utilization of petroleum revenue, its management and sharing of benefits between national government, county government and local community.
10. 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.
11. High cost and inexistence of gas infrastructure to support gas discovery and development both offshore and onshore.
12. Inability to disaggregate into component elements of supply chain e.g cost of wholesale gas, transportation and distribution in order to price the gas.
13. Unlike oil, there is no world gas price.
14. Lack of petroleum master plan.
15. Flaring of gas from oil producing fields: 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. Nonetheless, there are instances when it is necessary to flare associated gas. This is normally in relation to preventing excessive pipeline pressure and/or in response to a specific emergency (such as equipment failure).
16. Unrealistic expectations from the public especially local communities.

2.2.3 Policies and Strategies

Upstream Petroleum	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Establish a National Upstream Petroleum Advisory Committee to advise the Cabinet Secretary on all upstream petroleum exploration and development matters.	✓		
2. Establish a regulatory body for upstream petroleum operations.	✓		

Upstream Petroleum	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
3. Undertake upstream petroleum operations through petroleum agreements which may include production sharing contracts, concession agreements and service contracts.	✓	✓	✓
4. Ensure that oil and gas resources are managed in line with the Constitution.	✓	✓	✓
5. Develop and enforce laws and regulations on flaring of oil and gas.	✓	✓	
6. Promote petroleum exploration and production activities through PPP arrangements.	✓	✓	
7. Establish an Upstream Petroleum Data Centre for the safe, secure custody and management of upstream petroleum data.	✓	✓	✓
8. Establish Upstream Petroleum Laboratory.	✓		
9. Promote the establishment and growth of upstream petroleum support services.	✓	✓	✓
10. Promote the acquisition and processing of data using developing technologies to sustain and increase investment in petroleum exploration.	✓	✓	✓
11. Facilitate partnership in the exchange of data to minimize exploration costs.	✓	✓	✓
12. Coordinate capacity building in petroleum development	✓	✓	✓
13. 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.	✓		
14. Develop and enforce laws and regulations on upstream petroleum activities.	✓	✓	✓
15. Ensure transparency and accountability in petroleum upstream operations taking into account best industry practices and efforts shall be made to align them with existing legal framework.	✓	✓	✓
16. Develop systems that will enhance corporate governance in the Government institutions charged with petroleum exploration and development.	✓	✓	✓
17. Restructure NOCK to separate midstream/downstream business from upstream business with a view to enhancing capacity of the upstream to fully conduct the activities therein.	✓	✓	✓
18. Support and fund Government entities mandated to undertake upstream activities.	✓	✓	✓
19. Establish a one-stop shop for upstream petroleum licensing and operations.	✓	✓	✓
20. Strengthen monetary and fiscal regimes to maximize the government stake on petroleum exploitation while taking into account the investors interests.	✓	✓	✓

Upstream Petroleum	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
21. Provide incentives for investments in marginal oil and gas discoveries that could have the potential to deliver much financial and socio-economic value.	✓	✓	✓
22. Develop a legal framework that ensures local content covering technology and knowledge transfer, capacity building of local industry and local employment opportunities among others in the energy and petroleum sector.	✓	✓	✓
23. Ensure that petroleum exploration and production activities shall include technology transfer and development of local manpower including engaging qualified local personnel as a priority.	✓	✓	✓
24. Enhance manpower and technical capacity in petroleum exploration by establishing programmes in conjunction with local industry associations, local training institutions and international institutions.	✓	✓	✓
25. Support local investors that have the capacity and interest to participate in and/or undertake petroleum exploration and production.	✓	✓	✓
26. Subject upstream petroleum activities to the PSC regime and the 9th Schedule of the Income Tax Act.	✓	✓	✓
27. Adopt a transfer pricing mechanism as defined in the income tax law to address the possibility of tax avoidance by affiliated parties in the gas value chain and international best practices.	✓	✓	✓
28. Develop and implement an oil and gas master plan taking into account mechanisms for commercialization, utilization and enhancement of local capacity, elements of supply chain, value, development, processing and the market for end products.	✓	✓	✓
29. Provide incentives to fast track discovery of commercial natural gas, coal bed methane (CBM) and shale gas.	✓	✓	✓
30. In the event of discovery of crude oil together with natural gas, the Government will ensure that oil exploration and production companies (OIEPs) take measures to exhaustively produce both products from such wells.	✓	✓	✓
31. Develop an appropriate communication strategy to manage stakeholder expectations	✓	✓	✓

2.3 MIDSTREAM AND DOWNSTREAM PETROLEUM

2.3.1 Petroleum Demand and Consumption

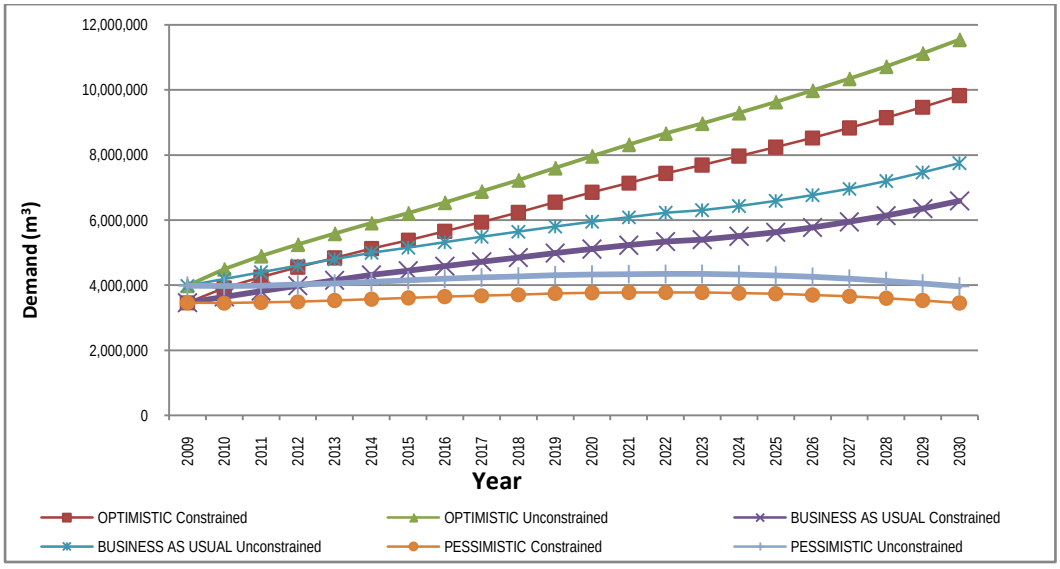
1. The Economic Survey, 2014, indicates that on average the retail and pump outlets and road transport between years 2009 and 2013, accounted for approximately 61.3% of petroleum consumption with industrial and commercial sectors accounting for 14.24% while power generation accounted for 6.37%. Fuel consumption in the electric power generation category reduced by nearly half to 64.1

thousand tonnes from 118.7 thousand tonnes in 2012. The reduction was attributed to the reduction in thermal power generation.

2. Consumption of Liquefied Petroleum Gas (LPG) in 2007 was about 75,000 metric tonnes, of which 35,000 metric tonnes was produced at the KPRL refinery. The Economic Survey, 2014 indicates that the consumption of LPG between the year 2009 and 2013 rose from 74,600 tonnes to 92,900 tonnes. Over the same period, the refinery production declined from 29,400 tonnes to 12,400 tonnes.

3. As at December 2014, total monthly industry demand of petroleum products for local requirements and export was estimated at 340,785 metric tonnes versus the available storage in Mombasa of 492,176 metric tonnes at the KPC and KPRL. Vessel sizes that berth at the only available jetty are limited to 80,000 metric tonnes and therefore for the industry to meet the monthly demand, imports of 44 vessels in a year or 5 vessels in a month are required. In a study report on demand for petroleum products in Kenya released by KIPPRA in August 2010, it was projected that the demand would rise by 3.1% on average per annum from 2009 to 2030. The projections under different scenarios were given and are shown in Figure 2-2.

Fig 2-2 National Demand Forecast for Petroleum Products



2.3.2 Global Geo-Political Issues and Petroleum Prices

1. A number of geo-political issues have affected international oil prices causing price volatility. 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 and recently the production of oil from oil shale in the USA.

2. 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 Murban crude oil prices fluctuated rapidly with the lowest at US$95.6 per barrel (bbl) in January, peaking to US$120 bbl in April and averaging at more than US$110bbl most of the year. In 2012 the average price went up by 3.1% to US$112.97 bbl and US$110 bbl in 2013 being a decrease of 2.5%. Whereas high international oil prices and a weak Kenya Shilling vis-a-vis the hard currency have led to spikes in prices of petroleum products in the domestic market creating inflationary pressure on prices of commodities, high prices enhance project economics and monetization of oil and gas fields that

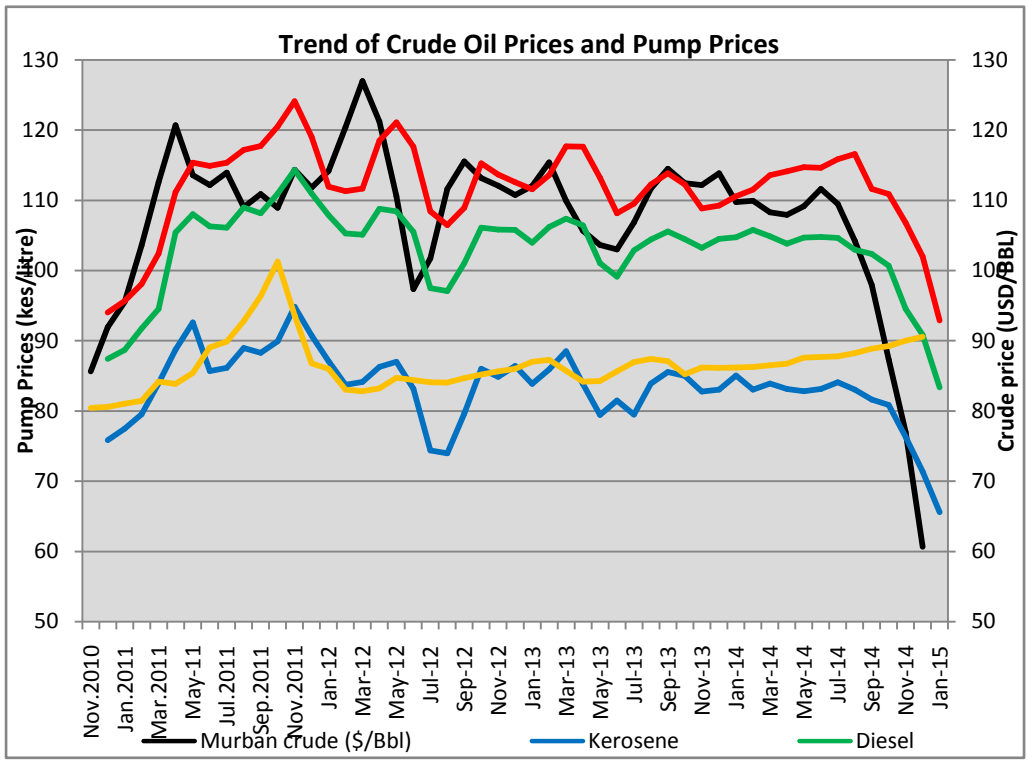
would otherwise have been ranked economically unviable at lower price thresholds. They also improve liquidity of exploration companies thus increasing their risk appetite. It is worth noting that it was in a period of high prices that the first discovery of oil was made in Kenya in 2012.

3. In the recent past, however, the world has witnessed a marked drop in crude oil prices mainly spurred by the production of oil from oil shale in the USA coupled by the refusal of OPEC to reduce production in order to buoy up prices of crude oil by limiting supply. For example, the price of Murban crude oil dropped from a high of US$111.65 per bbl in June 2014 to a low of US$60.5 per bbl in December, 2014. This has provided a relief to motorists and is expected to also impact prices of commodities positively especially in oil importing countries such as Kenya. The downside is that low oil prices make project economics and monetization of oil and gas fields less attractive.

4. Fluctuation of the international prices has been causing shocks in the domestic oil prices. Figure 2.3 shows the time series of the average pump prices in Nairobi and the movement in Murban crude oil prices between November 2010 and December 2014. In particular, over the period December 2010 to June 2014, the increases in pump prices were 22% for super petrol, 20% for diesel and 10% for kerosene. However, since January 2015, there has been a decrease in the price of 18% for super, 20% for diesel and 21% for kerosene due to the decline in price of Murban crude oil over the same period.

5. Imported petroleum products are paid for in US Dollars. The depreciation of the Kenya Shilling against US Dollar negates any drop in international crude oil prices and makes imports more expensive. Figure 2.3 also shows the fluctuation of the exchange rate against the US dollar for the period November 2010 to May 2014 which shows an overall gradual depreciation.

Figure 2-3 - Trend of Crude Oil Prices, Pump Prices and Exchange Rates



Source: *ERC, 2015*

2.3.2.1 Petroleum Taxation Regime

1. Other key costs that impact pump prices include taxes and levies on petroleum products. However, 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 January, 2015.

Table 2-3 - Taxation regime for the sector as at January, 2015

	Super	Kerosene	Diesel
Excise Tax	19.895	0.000	8.244
Road Maintenance Levy	9.000	-	9.000
Petroleum Development Levy	0.400	0.400	0.400
Petroleum Regulation Levy	0.120	0.050	0.120
Total: Taxes & Levies	29.415	0.450	17.764

Source: *ERC, 2015*

2. Other costs which have increased are the transportation and distribution costs and the allowed marketers' margin to cover overheads and profit.
3. 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.

2.3.3 Petroleum Supply and Distribution

The total quantity of petroleum products imported into the country has declined marginally by 3.9% from 4,151 thousand tonnes in 2009 to 3,996 thousand tonnes in 2013. During the same period, the total value of petroleum products exported, including re-exports, decreased by 43.3% from 210.8 thousand tonnes in 2009 to 147.1 thousand tonnes in 2013. The most significant change occurred in 2011 when the value of the petroleum exports had attained a peak of 246.1 thousand tonnes before declining to 182.1 thousand tonnes in 2012. The decline in 2013 was attributed to suspension of refining operations at KPRL as from the second half of 2013 to date.

2.3.4 Oil Marketing Companies

1. As at December 2014 there were 71 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 over 55% being controlled by the three main OMCs.
2. Establishment of open access storage facilities by investors who are not necessarily OMCs will facilitate the operations of OMCs which might not have individual storage facilities. Incentives on land, levies and taxes can attract private sector investment in storage facilities.

2.3.5 Open Tender System

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

2.3.6 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 fluctuating 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.

2.3.6.1 Import/Offloading Facilities in Mombasa

1. Refined petroleum products are offloaded at the Kipevu Oil Terminal (KOT) and transferred to the Kipevu Oil Storage Facility (KOSF) 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 following the construction of the Container Terminal at Kipevu.

2.3.6.2 Storage Facilities in Mombasa

1. KOSF has a storage capacity of 326 million litres while its operational capacity is 269 million litres, comprising 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.

2.3.6.3 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.

2.3.6.4 Common User Truck and Rail Loading Facilities in Mombasa

The truck and rail loading facilities in Mombasa are owned by a few 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.

2.3.7 Petroleum Refining

1. By end of 2013, KPRL had been refining 1.6 million metric tonnes per annum (mmtpa) against a nameplate capacity of 4mmtpa of crude oil. The refinery was producing 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. The Government is considering two options namely, modernizing the Mombasa Refinery in partnership with investors or converting it into an import and storage terminal.
3. The Government plans to build another petroleum refinery in Lamu under the Lamu Port and Lamu-South Sudan Ethiopia Transport Corridor (LAPSSET) project.

2.3.8 Petroleum Transportation

2.3.8.1 Pipeline

1. The primary mode of transport for petroleum products is the pipeline system managed by the Kenya Pipeline Company Ltd. (KPC). Products transported by the pipeline system are super petrol, regular petrol, diesel, illuminating kerosene and aviation fuel. The oil pipeline is 896 km long running from Mombasa through Nairobi to Eldoret and Kisumu and serves the local market and neighbouring countries.
2. The pipeline system, which handles approximately 450 million litres a month, is connected to the KOSF and with provision to draw products from the KPRL after the crude oil has been processed.
3. 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.
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. Replacement of Line 1, which has been in use for 34 years, is ongoing and is expected to be commissioned by 2017.

7. Congestion of the pipeline system and ullage constraints at KOSF and Nairobi Terminal are caused by low evacuation of products by the 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.

2.3.8.2 Rail Transport

As at the end of 2014 only about 1% of petroleum products were 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 set to increase.

2.3.8.3 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.

2.3.8.4 Road Transport

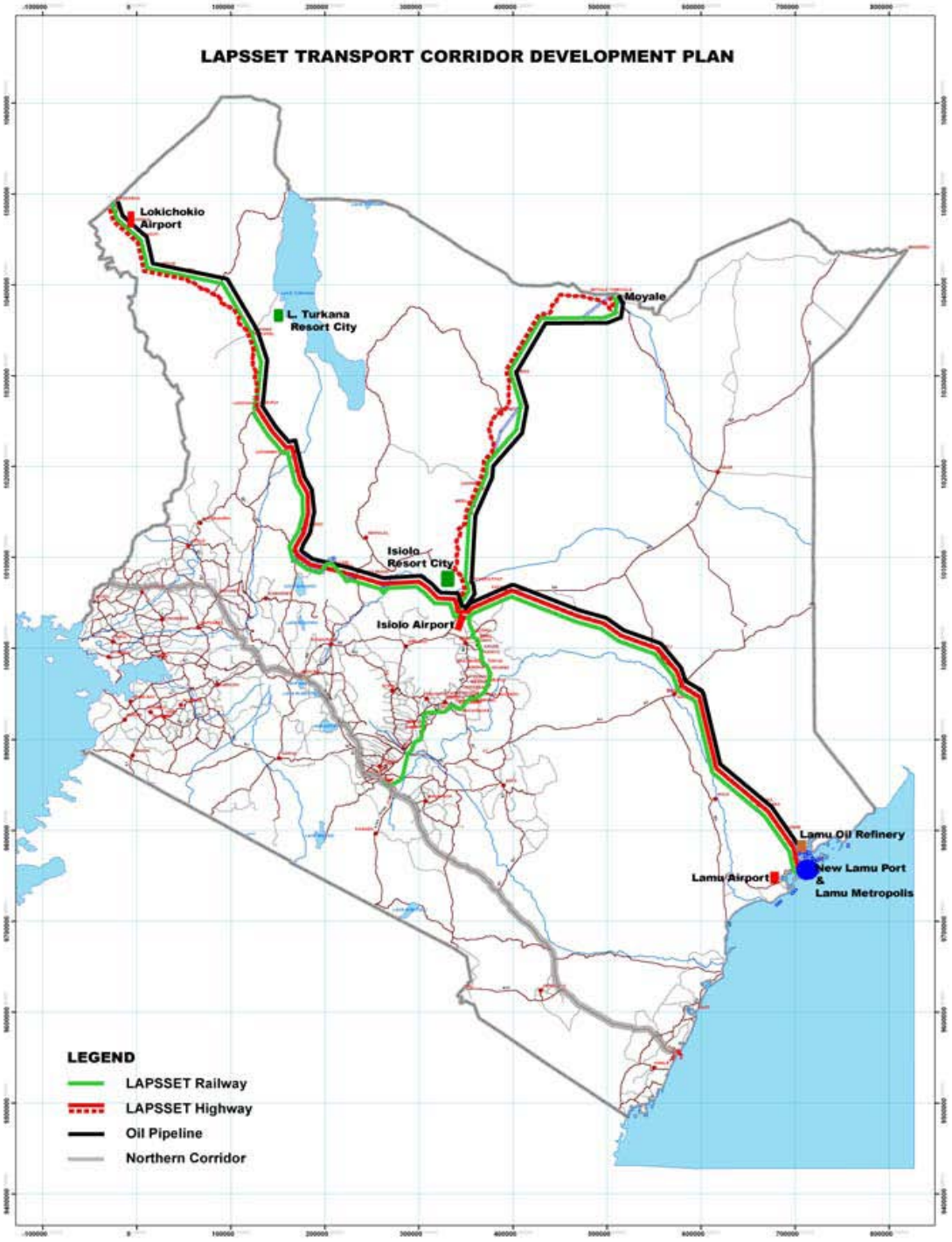
1. Road transport is used to move petroleum products from various depots that are located in Mombasa, Nairobi, Nakuru, Eldoret and Kisumu to their environs and to other towns. Transportation of products from Mombasa to the hinterland is also undertaken by road since the pipeline system experiences challenges 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.

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

1. The Government has started developing the LAPSSET project which includes construction of crude oil pipeline from Lokichar to Lamu.
2. The Government will facilitate the setting up a merchant oil refinery to process crude oil to meet the growing demand for oil products in the region. The refinery will process crude oil from within and outside the region.
3. A modern oil terminal will be put up to facilitate oil tanker loading and offloading in the high seas.
4. The Government will also construct a second pipeline from the Lamu refinery to Addis Ababa to deliver refined oil products to Ethiopia.

5. The Government also intends to construct a spur pipeline to join the Lamu – Addis Ababa pipeline to the existing Mombasa-Kampala pipeline.

Figure 2-4 – The LAPSSET Project



Source: *Ministry of Infrastructure and Transport*

2.3.10 Challenges in Mid and Downstream Petroleum

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, making it impossible for Kenya to handle very large crude cargoes (VLCC) and very large gas cargoes (VLGC). It is to be noted that the maximum draught at the entrance to the Mombasa port is 16 meters after dredging.

(b) For Shimanzi Oil Terminal (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. Absence of an operational crude oil refinery
4. Unreliable power supply.
5. Inadequate infrastructure for storage and evacuation of petroleum products.
6. High initial cost of acquiring the necessary infrastructure.
7. Inadequate incentives for infrastructure development.
8. Lack of proper planning, coordination and integration of petroleum infrastructure.
9. Lack of an oil and gas master plan.
10. 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.
11. Oligopolistic market.
12. Fluctuation of petroleum products' of prices.
13. Adulteration and dumping of petroleum products.
14. Lack of centralized gas reticulation infrastructure to homes.
15. Lack of compliance with waste management regulations on hazardous and noxious substances.
16. Non-optimal utilisation of LPG marine import and storage facility in Mombasa.
17. Inadequate LPG inland infrastructure for cylinder filling, storage and distribution.
18. Ineffective enforcement of laws and regulations governing mid and downstream petroleum activities.
19. Dilapidated railway network.

2.3.11 Policies and Strategies

Midstream and Downstream Petroleum	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Construct a second jetty for off-loading imported petroleum products.	✓		
2. Develop an offshore Single Buoy Mooring (SBM) facility including additional storage facility linked to the SBM in Mombasa through PPP.	✓		
3. Liaise with the ministry responsible to rehabilitate and improve the railway infrastructure.	✓	✓	✓
4. Maximise utilisation of rail transport for petroleum products.	✓	✓	✓

Midstream and Downstream Petroleum	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
5. 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.	✓	✓	✓
6. Carry out detailed analysis of the viable options for the future of the existing refinery.	✓	✓	✓
7. Provide the necessary support for KPRL to facilitate attraction of investors/partners to participate in the modernisation and expansion of the refinery facilities.	✓	✓	✓
8. Facilitate NOCK's role of stabilizing the market by using appropriate measures including increased market presence and importation of at least 30% of the country's demand.	✓	✓	✓
9. Develop mechanisms and strategies to convert consumption of kerosene, firewood and charcoal to environmentally friendly and economic modern fuels such as LPG.	✓	✓	✓
10. Construct LPG import handling, storage, and distribution facilities.	✓	✓	✓
11. Provide fiscal incentives on LPG and related appliances.	✓	✓	✓
12. Encourage private sector investment in additional capacity for handling and storage of LPG.	✓	✓	✓
13. Curb malpractices including illegal filling of cylinders.	✓	✓	✓
14. Enforce compliance with laws and regulations to eradicate malpractices in the petroleum industry such as adulteration, dumping and under dispensing through compliance monitoring and by enhancing penalties.	✓	✓	✓
15. Enforce standards, laws and regulations for construction and operation of retail and wholesale dispensing sites.	✓	✓	✓
16. Enforce compliance with regulations for operational stocks to enhance security of supply of petroleum products.	✓	✓	✓
17. Provide appropriate incentives to facilitate and support public and private investments in the development of petroleum infrastructure including petroleum jetties, gas filling terminals, loading, storage facilities, centralized gas reticulation systems and retail networks in all parts of the country.	✓	✓	✓
18. Enhance the institutional capacity of the Kenya Bureau of Standards (KEBS) and ERC to enforce regulations on the quality and standards of petroleum products.	✓	✓	✓
19. Spearhead the harmonisation of regional standards for petroleum products.	✓	✓	✓
20. Facilitate procurement of the ninety days petroleum strategic reserve stock.	✓	✓	✓
21. Provide adequate security for petroleum installations.	✓	✓	✓

Midstream and Downstream Petroleum	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
22. Ensure reliable power supply to support petroleum business.	✓	✓	✓
23. Where necessary cushion Kenyan consumers from the negative effect of high petroleum prices.	✓	✓	✓
24. Assess the continuing feasibility of pump price regulation.	✓	✓	✓
25. Restrict transportation of petroleum products by road where rail or pipeline infrastructure is available.		✓	✓
26. Put in place enabling mechanisms to allow KPC apply its expertise regionally in petroleum infrastructure development.		✓	✓
27. Put in place strategies to encourage the growth of local OMCs.	✓	✓	✓
28. Enforce compliance with regulations for handling of hazardous and noxious substances.	✓	✓	✓
29. Develop port facilities capable of handling VLGC and VLCC.	✓	✓	✓
30. Develop oil and gas infrastructure such as crude oil pipelines and storage tanks, through PPP and JV arrangements where appropriate.	✓	✓	✓

2.4 MID AND DOWNSTREAM NATURAL GAS

2.4.1 Background

1. 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 which make it burn cleaner than all other fossil fuels.
2. 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.
3. 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 the gas to onshore re-gasification plants.

2.4.2 Utilization

1. Electric Power Generation: The main use of natural gas is through gas-fired power generation, preferably Combined Cycle Gas Turbines (CCGT) for 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.
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. Natural gas is both a feed-stock 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. Natural gas is both a feed-stock and fuel.

3. Gas to Liquids: This application is used to produce diesel and other fuels.
4. Transport: 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.
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.

2.4.3 Challenges

1. Lack of a legal, regulatory and fiscal framework for natural gas development, production and export options.
2. Lack of infrastructure for handling natural gas, such as natural gas liquefaction plants and pipelines.
3. Lack of facilities to exploit natural gas reserves, e.g., petrochemical plants, and fertilizer plants.
4. Lack of gas master plan.

2.4.4 Policies and Strategies

Mid and Downstream Natural Gas	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Develop and implement a gas master plan.	✓	✓	✓
2. Establish a transparent and efficient legislative framework.	✓	✓	✓
3. Attract investment in natural gas by promoting private sector participation in all parts of the gas value chain.	✓	✓	✓
4. Adopt a segmented fiscal structure covering the upstream, midstream and downstream segments to facilitate efficient use of capital and Government oversight.	✓	✓	✓
5. Develop infrastructure to supply residential and commercial consumers with clean and reliable natural gas.			✓
6. Facilitate construction of natural gas infrastructure for electricity generation and other uses.	✓	✓	
7. CNG technology shall be applied for transport starting with public transport initially on pilot basis in areas with supply of natural gas.			✓

2.5 COAL RESOURCES

2.5.1 Overview

1. Coal is a readily combustible rock containing more than 50% by weight and more than 70% by volume of carbonaceous material formed from compaction of variously altered plant remains. It is used as a source of energy, mainly for electricity generation. It is the most affordable fuel worldwide and has potential to become the most reliable and easily accessible energy source.
2. Coal has been identified 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 them and establishing an appropriate institutional framework for their delivery to consumers.
3. The introduction of Clean Coal Technologies (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 4% 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 other industrial uses.

2.5.2 Demand for Coal

1. In Kenya, coal is mainly used by cement manufacturers to complement heavy fuel oil for process heat. As at December 2014, all coal utilised in Kenya was imported. Between 2006 and 2014 consumption of coal averaged 172,000 metric tonnes per annum, as detailed in Table 2.4. This constitutes less than 1% of the total primary energy consumed in the country.

Table 2-4 Coal Imports 2004 to 2013

YEAR	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
KSHS. '000	1,083,769	731,607	820,773	934,578	1,491,007	1,356,343	1,623,680	2,322,491	2,076,776	2,053,187
TONNES	155,000	128,000	171,000	156,000	159,000	138,000	165,200	236,300	211,300	208,900

Source: Statistical Abstract, 2014, Kenya National Bureau of Statistics

2. Coal consumption is expected to increase with the discovery and mining of coal deposits in Mui Basin in Kitui County mainly for electricity generation among other uses. Exploration is also ongoing in other parts of the country.

2.5.3 Coal Upstream Development

1. There are commercially viable coal reserves in the Mui Basin situated in Kitui County as shown in Figure 2-5. The basin is sub-divided into four blocks, namely, A, B, C and D as illustrated in Figure 2-6.
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 between 16 and 27 MJ/kg. Blocks C and D have been concessioned for development. The blocks and extent

of exploratory works therein are detailed in Table 2-5. Blocks A and B are in the process of concessioning as at January, 2015.

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. In this regard it has established 31 more coal blocks for the purpose of establishing coal potential and delineating the blocks for concessioning.

Figure 2-5 - Location of the Mui Basin

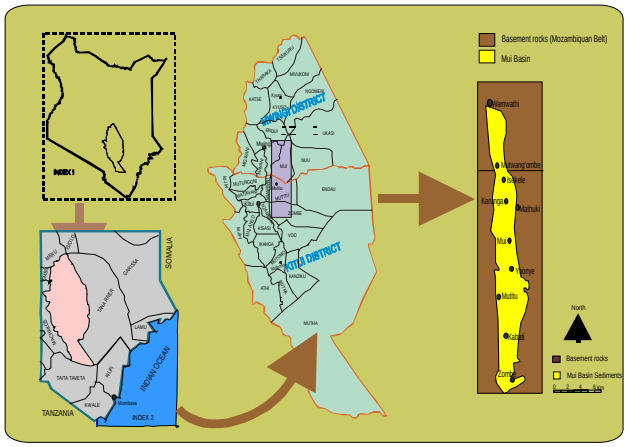


Figure 2-6 - The Four Blocks in the Mui Basin

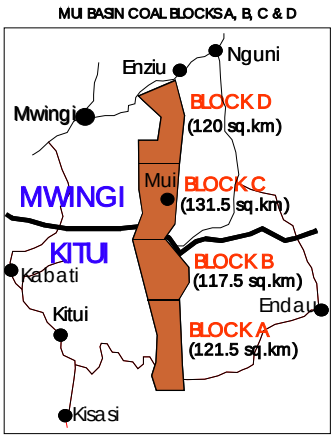


Table 2-5 - Blocks in Mui Basin and the Wells Drilled

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: *MOEP*

2.5.4 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.
7. Access to land for exploration and development

2.5.5 Midstream and Downstream Coal Development

1. 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 2015 with a commissioning date of 2017. However, there is need to develop adequate and appropriate coal handling and storage facilities onshore.
2. The Government has concessioned Blocks C and D in the Mui Basin for coal resource development with the objective of generating about 1,000MW in Kitui County by 2017 as part of the coal contribution of 2,000MW in the 5,000+MW project. As per the 2013 Least Cost Power Development plan (LCPDP), coal is projected to provide at least 4,500MW of electricity by 2030.

2.5.6 Challenges in Midstream and Downstream Coal

1. Inadequate technical capacity for coal midstream and downstream activities.
2. Absence of large import and export coal handling facilities.
3. Underdeveloped road and railway transportation system.
4. Lack of 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. (land – check in cross cutting)

2.5.7 Policies and Strategies

Coal Exploration, Development and Utilization	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Establish by legislation a National Coal Advisory Committee to advise the Cabinet Secretary on all Coal exploration and development matters.	✓		
2. Develop local expertise and enhance local content in coal exploration and production through training and collaboration with exploration companies, training and research institutions.	✓	✓	✓
3. Develop and implement appropriate legal, fiscal and regulatory framework for coal exploration, exploitation, development and rehabilitation.	✓	✓	✓
4. Establish coal energy research centre within the Nuclear Energy Institute capable of handling coal analysis and other related studies.	✓		
5. Adapt appropriate clean coal technology and provide suitable fiscal incentives.	✓	✓	✓
6. Create new coal exploration blocks based on technical data.	✓	✓	✓
7. Enhance regional co-operation in data and information exchange for coal exploration.	✓	✓	✓
8. Establish a one-stop shop for coal licensing.	✓		

Coal Exploration, Development and Utilization	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
9. Enhance budgetary support for exploration and development of coal resources.	✓	✓	✓
10. Encourage private sector participation in coal exploration, mining, development and use through PPP and JV arrangements by providing appropriate incentives.	✓	✓	✓
11. Facilitate development of 960MW coal fired plant within the Mui Basin (Kitui County), and development of other coal fired plants in other feasible sites in the country.	✓	✓	✓
12. Establish the Coal Development Corporation (CDC) as a Government owned special purpose vehicle, registered under the Companies Act, to fast track coal development in the country. Its mandate will include:		✓	
(a) Exploration and appraisal of coal resources.	✓	✓	✓
(b) Provision of data to investors.		✓	✓
(c) Coordination of activities in the coal industry.	✓	✓	✓
13. Develop an integrated infrastructure for coal storage, transportation and utilization to facilitate development of the coal industry.	✓	✓	✓
14. Put in place mechanisms of sharing and management of accruing revenues in line with the Constitution.	✓	✓	✓
15. Ensure compliance with the best coal industry practice in exploration, mining, processing, development and rehabilitation.	✓	✓	✓
16. Enforce investors' compliance with the regulatory framework and agreed work plans.	✓	✓	✓
17. Provide incentives to encourage and promote the use of coal as an electricity generation source.	✓	✓	✓

2.5.8 Cross Cutting Policies and Strategies - Petroleum and Coal

Cross- cutting issues in petroleum and coal related to land, environment, health and safety are covered in chapter six.

Cross Cutting - Petroleum and Coal	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. The National Treasury in coordination with relevant sector ministries to develop framework legislation on the Natural Resources Revenue Management which shall include provisions for creation of a Sovereign Wealth Fund which shall include among others:	✓	✓	
(a) Endowment for future generations when the reserves are depleted.	✓	✓	
(b) Stabilization support in times of economic stress.	✓	✓	

Cross Cutting - Petroleum and Coal	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
(c) Infrastructure development.	✓	✓	✓
2. Kenya will undertake the requisite process for transparency and accountability in petroleum and coal operations taking into account best industry practices and efforts shall be made to align them with existing legal framework.	✓	✓	✓
3. Develop legal and regulatory frameworks and methodologies for determining the oil, gas and coal resource reserves, reporting petroleum and coal discoveries and provide penalties for falsification of data.	✓	✓	✓
4. Government shall classify strategic energy installations such as oil and gas fields, coal mines, refineries, jetties, pipeline systems, petroleum, storage facilities as protected areas and provide security during construction and operation.	✓	✓	✓
5. Adopt a segmented fiscal structure covering the upstream, midstream and downstream.	✓	✓	✓
6. In cases where best industry practices are adopted, efforts shall be made to align them with existing legal framework.	✓	✓	✓
7. Develop and promote a framework for facilitating access to land for exploration and development	✓	✓	✓

3.0 – RENEWABLE ENERGY

3.1 BACKGROUND

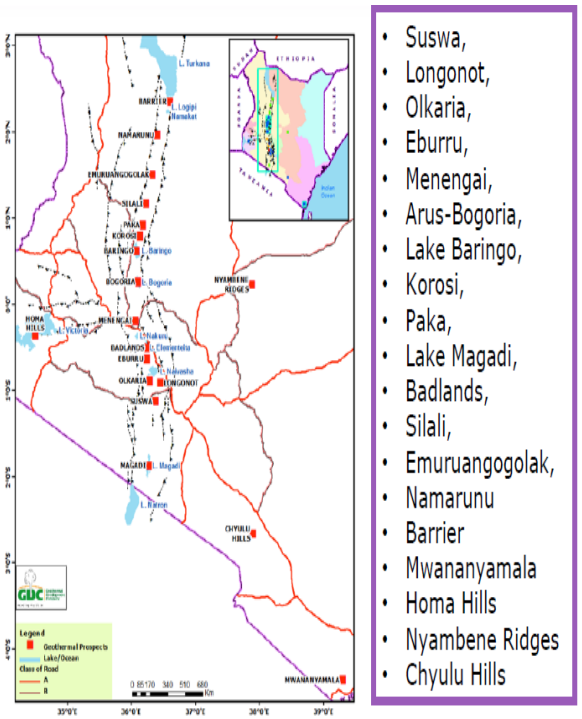
1. Renewable Energy (RE) is derived from natural processes that are replenished constantly. In its various forms, it derives directly or indirectly from the sun, or from heat generated deep within the earth. Included in the definition is energy generated from solar, wind, biomass, geothermal, hydropower and ocean resources, as well as bio-fuels and hydrogen derived from renewable resources. 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. RE has the potential to enhance energy security and reliability; generate income and create employment; enable 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 data from MoEP, biomass provides about 69% of the country's overall energy requirements while petroleum accounts for about 22% and electricity about 9%. As at December, 2014, 69% of the electricity component was generated using renewable energy sources with fossil fuels providing the balance of 31% as indicated table 4.3.

3.2 GEOTHERMAL ENERGY

3.2.1 Background

1. Geothermal is the energy due to the Earth's natural heat. The heat is due to primordial energy generated during earth's formation that is produced from decay of radioactive elements like uranium, thorium 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 the Rift Valley with an estimated potential of more than 10,000 MWe. Other locations include Chyulu, Homa Hills in Nyanza, Mwananyamala at the Coast and Nyambene Ridges; as shown in Figure 3.1 across.

Figure 3.1 - Location of Geothermal Resource Areas in Kenya



- Suswa,
- Longonot,
- Olkaria,
- Eburru,
- Menengai,
- Arus-Bogoria,
- Lake Baringo,
- Korosi,
- Paka,
- Lake Magadi,
- Badlands,
- Silali,
- Emuruangogolak,
- Namarunu
- Barrier
- Mwananyamala
- Homa Hills
- Nyambene Ridges
- Chyulu Hills

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.
   (e) Water heating for fish and crocodile farming, spas and swimming pools.
5. 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

3.2.2 Challenges

1. Relatively long lead time of between 5-7 years from conception to production of electricity.
2. High upfront investment costs.
3. High resource exploration and development risks.
4. Inadequate geothermal expertise.
5. The resources are site specific.
6. Heavy investment in transmission and other support infrastructure due to long distances to existing load centres.
7. Land use conflict.
8. Relocation and resettlement of affected persons during geothermal development.

3.2.3 Policies and Strategies

Geothermal	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. The Government shall continue to support and fund geothermal resource assessment and development so as to manage the geothermal exploration risk and attract investors.	✓	✓	✓
2. Promote research, development and capacity building for geothermal development by providing fiscal and other incentives.	✓	✓	✓
3. Streamline licensing and allocation of geothermal blocks with incentives and sanctions in order to accelerate geothermal development.	✓	✓	✓
4. The government to package incentives through attractive pricing to promote and encourage direct uses of geothermal resources such as utilization of heat, water, gases and minerals.	✓	✓	✓
5. The government to enforce compliance with the regulatory requirement to utilize the best available technologies that optimise the resource and conserve the reservoir	✓	✓	✓
6. Promote early geothermal generation through implementation of efficient modular geothermal technologies.	✓	✓	✓

3.3 HYDROPOWER

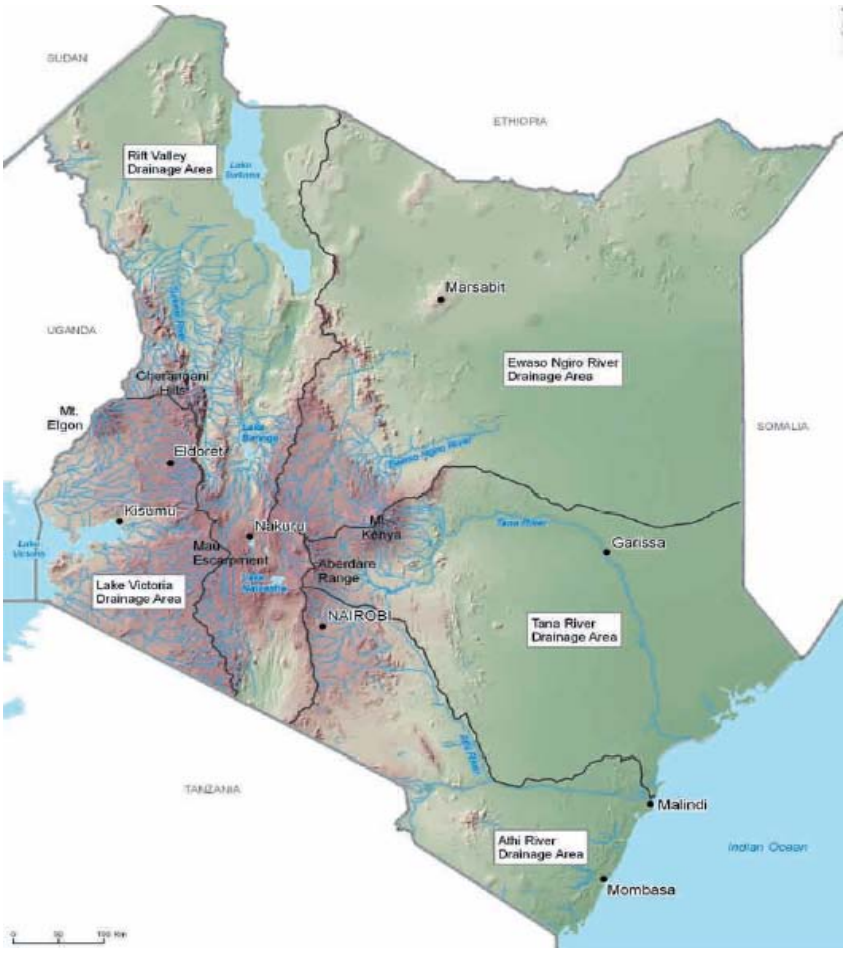
1. Hydropower is electricity generated using the energy of moving water. Rain or melted snow, usually originating in hills and mountains, create streams and rivers that eventually run to lakes, seas or oceans. This energy has been exploited for centuries. In the late 19th century, hydropower became a 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 as of December, 2014 comprising of large hydros (sites with capacity of more than 10MW) and small hydros. Potential for small hydros is over 3,000MW, of which about 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.

3.3.1 Large Hydros

3.3.1.1 Background

1. As at December 2014, the installed capacity of hydropower generation was 821MW equivalent to 38% 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 10MW. 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. A feasibility study for a multi-purpose hydropower project on Tana River after Kiambere hydropower plant (HPP), High Grand Falls Power Project, released in December, 2011 revealed a capacity of 700MW of power together with water storage capacity of 6 billion cubic metres. A further study in the same area also showed a potential for 100MW at the Karura HPP.

Figure 3.2 - The 5 Water Towers and Drainage Basins



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.

3.3.1.2 Challenges

1. Hydropower is vulnerable to variations in hydrology and climate change, leading to reduction of water levels in reservoirs and thus reducing the contribution of hydro power in the energy mix.
2. Inadequate storage capacity in existing power generating reservoirs.
3. The economic risk in hydropower projects is high.
4. Relocation and resettlement of affected persons to create room for the construction reservoirs.
5. Long lead time of between 7-10 years.
6. Inadequate hydrological data within the region.
7. Water levies that have a direct effect on the cost of hydro generated electricity.

8. 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.
9. Absence of synergies and competing interests in the management of hydropower generating infrastructure leading to delays in implementation of viable energy projects

3.3.1.3 Policies and Strategies

Hydropower	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. The government to develop a hydro risk mitigation mechanism to address risks such as prolonged droughts so as to cushion generators, transmitters, distributors and consumers against effects of adverse hydrology.	✓	✓	✓
2. The government to establish a coordinated approach for the management of water reservoirs.	✓	✓	✓
3. Develop a framework for coordination for use of water resource against various interests.	✓	✓	✓
4. The government to finance conservation of hydro power water catchment areas.	✓	✓	✓
5. The Government shall implement hydro power projects as multi-purpose projects.	✓	✓	✓
6. The government to invest in increased storage capacity for hydro power reservoirs.	✓	✓	✓
7. The government to finance pre-feasibility studies for identification of potential hydropower sites.	✓	✓	✓

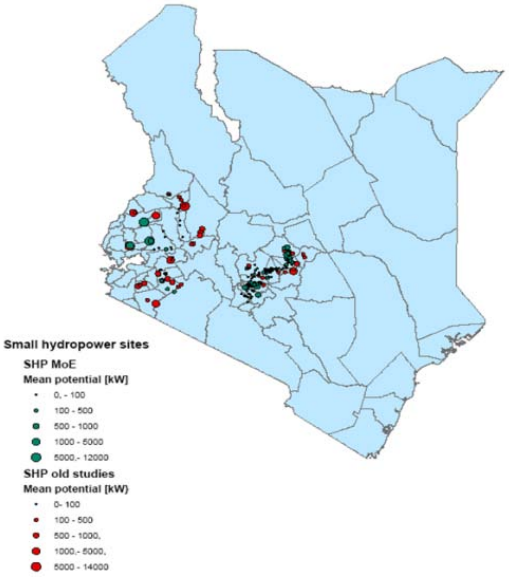
3.3.2 Small Hydros

3.3.2.1 Background

1. Small hydros are hydropower schemes whose potential does not exceed 10MW. The total estimated potential of small, mini, micro and pico hydro systems is 3,000MW of which about 25MW has been developed. 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 at the end of 2014 Government run schemes were a total of 15MW while those by private developers were about 10MW.
2. The government introduced the Feed-in-Tariff (FiT) policy in 2008 to promote the development of renewable energy to supply villages, small businesses or farms, as well as grid supply.
3. 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 2014, only a few schemes had been developed as stand-alone systems or to feed to the national grid.

4. 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.
5. The map in Figure 3.2 shows locations of small hydropower sites appraised by MoEP (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

The upsurge in demand for electrical energy from 2004 revealed an exciting potential for growth in and exploitation of the small hydros subsector. This led to emerging challenges such as:

1. Destruction of catchment areas, threatening long term viability of small hydro power projects.
2. Inadequate financial resources and technical personnel for carrying out feasibility studies and development of sites.
3. Inadequate hydrological data.
4. Competing interests between developing the sites and usage of land and water resources by the concerned communities and institutions.
5. Inadequate technical capacity to design, construct, operate and maintain the projects.
6. Vandalism of electric power infrastructure.
7. Non-compliance with standards, legal and regulatory regime.

3.3.2.3 Policies and Strategies

Small Hydros	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Finance conservation of hydro power water catchment areas.	✓	✓	✓
2. Provide incentives for public private partnerships in small hydros.	✓	✓	✓
3. Invest in hydrological data collection, management and dissemination	✓	✓	✓
4. Promote development of capacity and knowledge on usage of appropriate technologies.	✓	✓	✓
5. Formulate and enforce standards, legal and regulatory regimes for small hydros	✓	✓	✓

3.4 BIOMASS

3.4.3 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 afforestation programmes.
2. There is a gap between the existing tree cover vis-a-vis the minimum constitutional requirement of 10%. The continuous overreliance of Biomass as a primary source of energy threatens achievement of this requirement.
3. Biomass fuels are the largest source of primary energy in Kenya with wood-fuel (firewood and charcoal) accounting for about 69% 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.
4. 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.
5. 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 responsible for energy, agriculture and environment and natural resources.

3.4.4 Challenges

1. Unsustainable use of biomass with attendant negative impacts on the environment.
2. Widening gap between supply and demand for wood-fuel.
3. Emissions from wood fuel leading to health hazards among users.
4. Weak enforcement of the legal and regulatory framework for sustainable production, distribution and marketing of biomass.
5. Insufficient promotion of sustainable afforestation programmes.
6. Inadequate data on biomass production and consumption.
7. Uncoordinated approach in policy formulation and implementation by the relevant ministries and organizations to reduce overreliance on biomass as a primary source of energy.
8. Inadequate recognition of alternative clean modern energy sources to reduce overreliance on biomass energy source.
9. Lack of efficient technologies for production, conversion and consumption of biomass energy.
10. Competing interests over land use between biomass production, food production and other commercial uses.

3.4.5 Policies and Strategies

Biomass	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. The government to undertake a comprehensive base line study on biomass energy resources and potential, and establish status of tree cover in the country.	✓	✓	✓
2. The government to develop, update and disseminate information on biomass energy resources.	✓	✓	✓
3. Formulate and implement a national strategy for coordinating subsistence and commercial biomass production.	✓	✓	✓
4. Promote efficient conversion and cleaner utilization of biomass energy.	✓	✓	✓
5. Promote the use of biomass briquettes as alternatives to woodfuel.	✓	✓	✓
6. Provide incentives for private sector participation in conversion of waste to energy initiatives to reduce overreliance on Biomass energy	✓	✓	✓
7. Undertake public sensitization and awareness programmes to enhance participation in the management, protection and conservation of the environment as provided for in Article 69 (d) of the Constitution.	✓	✓	✓
8. Promote alternative sources of energy and technologies such as LPG, biogas and solar as substitutes for biomass.	✓	✓	✓
9. Collaborate with other relevant ministries and stakeholders to promote sustainable afforestation programmes.	✓	✓	✓
10. Collaborate with other stakeholders to ensure efficient use of land resource for biomass, food production and other human needs.	✓	✓	✓
11. Undertake and promote Research, Development and Dissemination (RD&D) of biomass energy technologies.	✓	✓	✓

3.5 BIOFUELS

3.5.1 Background

1. Unlike other renewable sources, biomass can be converted directly into liquid fuels called biofuels to meet energy needs.
2. The use of biofuels would reduce pollution 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 biofuel 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, there aren't sufficient quantities of bio-ethanol feed-stocks.
4. Land will need to be set aside for the production of energy crops as feed-stock for bio-fuels. Most bio-fuel projects being planned involve sugarcane and sweet sorghum as the main feed-stock 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 biofuels for blending.
2. Limited research data/information for the use and sustainable production of biofuel.
3. Insufficient legal and institutional framework to support sustainable generation, utilisation, production, distribution, supply and use of liquid biofuels.
4. Threat of competition over land use that could lead to food insecurity.
5. Reliance on rain fed, slow maturing feed-stock for biofuels.
6. Inadequate RD&D on alternative biofuel feed-stocks and technologies.
7. Lack of knowledge among the stakeholders on the importance of biofuels for complementing energy needs in the country.
8. Competing uses of the ethanol.

3.5.3 Policies and Strategies

Biofuels	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Undertake RD&D on biofuel feed-stock.	✓	✓	✓
2. Review the existing legal, fiscal, regulatory and institutional framework.	✓	✓	✓
3. Provide incentives for biofuel production projects and consumption.	✓	✓	✓
4. Collaborate with other stakeholders to ensure efficient use of land resource for biofuel feed-stock, food production and other human needs.	✓	✓	✓
5. Create stakeholder awareness and sensitization on the importance and viability of biofuel production and consumption.	✓	✓	✓
6. Implement the bioethanol pilot program.	✓	✓	✓
7. Initiate and implement biodiesel blend pilot program.	✓	✓	✓

3.6 BIOGAS

3.6.1 Background

1. Biogas typically refers to a mixture of gases produced by anaerobic digestion of biodegradable materials such as manure, sewage, municipal waste, green waste, plant material, and crops. A number of pilot and small commercial biogas facilities for heat and electricity generation have been rolled out. These biogas projects have been used to substitute fuel oil in running medium size boilers. 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. Tables 10.1 and 10.2 in 10.0 - Annexure indicates the energy generation potential in the Kenyan floriculture and sisal industry (Source REA Master-plan 2009).

2. In an effort to minimize overreliance on biomass the government has put in place incentives to promote the use of Biogas. A feasibility study carried out under this initiative established that it is possible to construct 6,500 biogas digesters in Kenya every 5 years.
3. Several biogas projects are being undertaken by MoEP and REA in public institutions. The private sector is also implementing a number of similar initiatives all over the country.

3.6.2 Challenges

1. Lack of awareness on the potential and benefits of biogas technology.
2. Inadequate RD&D on biogas technologies.
3. High upfront costs of domestic and commercial biogas plant and equipment.
4. Inadequate capacity and skilled biogas contractors in the country.
5. Insufficient legal and regulatory framework for biogas contracts.

3.6.3 Policies and Strategies

Biogas	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Develop and implement public awareness programs on the benefits and potential of biogas technology.	✓	✓	✓
2. Undertake and promote RD&D of biogas energy technologies	✓	✓	✓
3. Provide appropriate fiscal incentives for local manufacture of biogas plant and equipment, large scale production, storage and distribution.	✓	✓	✓
4. The government to initiate capacity building programs on biogas technology in learning institutions.	✓	✓	✓
5. The government to develop and enforce legal and regulatory requirements on biogas.	✓	✓	✓
6. Support domestic and community based biogas plants among urban, rural population and institutions.	✓	✓	✓
7. Promote the use of biogas as an alternative to woodfuel and kerosene for domestic and commercial energy needs.	✓	✓	✓
8. 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. 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. The percentage of solar energy harnessed for

commercial and domestic applications is insignificant relative to the potential. Solar energy can be used for lighting, heating, drying and generating electricity.

2. Solar water heating systems are mainly used in homes, hotels, hospitals and learning institutions. As of December 2014, a survey to determine the number of installed solar water heating (SWH) units was launched. The demand for solar water heating (SWH) is however, 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 has 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 was estimated that by the end of 2014, more than 6MW of solar PV System capacity was installed in residential and commercial sectors through the private sector initiative. By the year 2020, it is projected that the installed capacity of solar photovoltaic systems will reach 100MWe generating 220 GWh annually.
4. The Government initiated a programme for electrification of institutions far from grid using solar PV systems. As at December 2014 solar PV systems had been installed in 2050 institutions including primary and secondary schools, dispensaries, health and administrative centres.
5. The Government has embarked on a programme to provide solar/wind hybrid generation capacity to off-grid diesel power stations as detailed below:

Power Station	Capacity of RE hybrid	Status
(a) Lodwar	60 kW solar	Completed
(b) Habaswein	30 kW solar / 20 kW wind	Completed
(c) Merti in Isiolo.	10 kW solar	Completed
(d) Hola	50 kW solar	Completed
(e) El Wak in Wajir	50 kW solar	Completed
(f) Mandera	300 kW solar	Completed
(g) Laisamis	80 kW	Completed
(h) Takaba (Mandera)	50 kW solar	Completed
(i) Rhamu (Mandera)	50 kW solar	Completed
(j) Eldas (Wajir)	30 kW solar	Work in progress

6. There are also plans to convert the isolated diesel plants at North Horr in Marsabit County, Hulugho, Kiunga and Faza Island in Lamu County as well as Lokichogio, Lokitaung, and Lokori in Turkana County to hybrid stations.

3.7.2 Challenges

1. Uncoordinated approach in policy implementation and promotion of solar energy projects.
2. High upfront capital cost for plant and equipment.
3. Weak enforcement of standards and regulations.

4. Rampant theft of solar photovoltaic panels, which discourages the installation.
5. Lack of awareness on the potential, opportunities and economic benefits offered by solar technologies.
6. Proliferation of sub-standard solar energy technologies and equipment

3.7.3 Policies and Strategies

Solar Energy	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Undertake awareness programs to promote the use of solar energy	✓	✓	✓
2. Enforce regulations on standards.	✓	✓	✓
3. Regular review of standards for solar energy technologies and equipment.	✓	✓	✓
4. Provide incentives to promote the local production and use of efficient solar systems.	✓	✓	✓
5. Enforce regulations on building codes on water heating and lightning.	✓	✓	✓
6. Provide a framework for connection of electricity generated from solar energy to national and isolated grids, through direct sale or net metering.	✓	✓	✓
7. Enhance penalties for theft and vandalism of solar systems.	✓	✓	✓
8. Support hybrid power generation systems involving solar and other energy sources to manage the effects caused by the intermittent nature and availability of solar energy.	✓	✓	✓
9. Roll out installation of solar PV systems in all the remaining public facilities in the off grid areas.	✓	✓	✓
10. Procure and distribute solar lanterns to light up rural, peri-urban and urban areas.	✓	✓	✓
11. Undertake RD&D on solar technologies.	✓	✓	✓

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, MoEP with the assistance of Development Partners, has together with KenGen 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 is given in Table 3-1.

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 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.

Table 3-1: Average wind speed data for selected sites

	Site	Average Wind Speeds in m/s			
		June 2012	June 2013	September 2014	LTA
1.	Malindi*	7.53	8.92	9.06	8.14
2.	Kinangop	5.99	5.35	7.34	7.06
3.	Meru (Mugae)	10.45	10.66	10.79	7.75
4.	Meru (Mweromalia)	13.62	13.92	11.31	9.21
5.	Meru (Kiremu)	10.45	10.56	9.28	8.23
6.	Meru (Matabiti area)	11.83	-	-	12.29
7.	Bubisa West	-	13.58	13.95	11.08
8.	Bubisa East	-	11.84	-	9.69
9.	New Marsabit	-	10.09	11.21	9.67
10.	Maralal**	-	2.89	5.60	5.36
11.	Naromoru**	-	7.90	7.58	6.01

Source: *KenGen, 2014*

LTA means Long Term Average.

* Relocated to the shoreline.

** Recently installed.

7. The installed capacity of wind power connected to the grid as at November 2014 was 25MW. The 300MW Lake Turkana Wind power project is expected to be commissioned in 2017. Other committed projects include 110MW at Kinangop and Ngong. There are proposals for development of 650MW of wind power at Marsabit, Isiolo/Meru and Ngong.
8. 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 for wind power generation equipments.
2. High capital investment for transmission lines due to wind power potential areas being far away from the grid and load centres.
3. Inadequate wind regime data.
4. Inadequate skilled capacity for wind power technology.
5. Inadequate wind energy industry standards due to fast changing technologies.
6. Competing interest in land use with other activities.
7. Inadequate RD&D in wind technologies.

3.8.3 Policies and Strategies

Wind Energy	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Develop institutional capacity for wide spread use of wind energy.	✓	✓	✓
2. Continually review and enforce regulations and standards for wind energy technology.	✓	✓	✓
3. Collect and compile wind energy data and update the wind atlas.	✓	✓	✓
4. Provide incentives for wind energy development.	✓	✓	✓
5. Support hybrid power generation systems involving wind and other energy sources.	✓	✓	✓
6. Provide a framework for connection of electricity generated from wind energy to national and isolated grids, through direct sale or net metering.		✓	✓
7. Plan and invest in 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).	✓	✓	✓

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, 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. It can also be managed through responsible dumpling and disposal. In addition, waste can be treated to destroy or reprocessed to recover energy or other beneficial resources, if the treatment does not threaten public health, safety, or the environment.

3. Most of the municipal waste in Kenya 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. With appropriate waste-to-energy technologies, municipal waste can be used to provide energy while helping to clean the environment.

3.9.2 Challenges

1. Lack of legal and regulatory framework for exploitation.
2. Lack of management and exploitation by the responsible institutions.
3. Inadequate data and information on potential of municipal waste.
4. Lack of incentives for exploitation.

3.9.3 Policies and Strategies

Municipal Waste	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Develop and implement legal and regulatory framework for exploitation of municipal waste.	✓	✓	✓
2. Develop and implement a framework for collaboration to manage and exploit the municipal waste.	✓	✓	✓
3. Develop programs for data collection and dissemination on the potential of municipal waste.	✓	✓	✓
4. Provide incentives for conversion of municipal waste to energy.	✓	✓	✓
5. Undertake pilot programmes for the generation of electricity using municipal and industrial solid waste.	✓	✓	✓
6. Provide integrated solid waste management plan and roadmaps	✓	✓	✓

3.10 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 energy efficiency besides reducing energy costs and providing an additional revenue stream through export of surplus power to the national grid.
2. A pre-feasibility study completed in 2007 by the Ministry of Energy on cogeneration by sugar companies established potential for generating up to 120MW of electricity for export to the national grid with minor 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 installing 38MW capacity out of which 26MW is dedicated 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 60MW by 2016.

3.10.2 Challenges

1. Inefficient plant and equipment in the cogeneration industry.
2. Unreliable and insufficient supply of agro-waste.
3. Limited technical, human and financial resources for cogeneration development.
4. Under utilization of cogeneration potential in areas where agro-wastes are available.
5. Inadequate data and documented assessment of resources and potential.
6. Lack of clear dissemination strategy of information to investors on issues relating to licensing, taxation and feed in tariff policy.

3.10.3 Policies and Strategies

Co-generation	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Provide incentives for investment in efficient and emerging cogeneration technologies.	✓	✓	✓
2. Promote community programmes and projects in production and supply of agro-waste.	✓	✓	✓
3. Support co-generators in implementing capacity building programmes in cogeneration technologies.	✓	✓	✓
4. Carry out public awareness and sensitization programmes in cogeneration.	✓	✓	✓
5. Formulate and implement a national strategy for coordinating development of co-generation.	✓	✓	✓
6. Undertake RD&D in co-generation technologies.	✓	✓	✓
7. Support PPP arrangements to accelerate investment in cogeneration.	✓	✓	✓
8. Formulate and implement information dissemination strategy to investors on issues relating to licensing, taxation and feed in tariff policy.	✓	✓	✓
9. Develop and implement regulatory framework for certification of cogeneration projects.	✓	✓	✓

3.11 FEED IN TARIFFS

3.11.1 Background

1. A Feed-in-Tariff (FiT) is an instrument to promote the generation of electricity from renewable energy sources. It enables a utility to produce Renewable Energy Sources Generated Electricity (RES-E) and sell the output to a distributor at a pre-determined 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 2014 a number of investors had expressed interest to develop projects under the FiT policy, including:

   (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 project with total capacity of 100MW.

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

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

3.11.2 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.
4. Inadequate technical and financial capacity.
5. Tariffs charged do not generate sufficient revenues to cover capital, operation and maintenance costs of the projects.

3. 11.3 Policies and Strategies

Feed-in-Tariffs	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Encourage the private sector 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.	✓	✓	✓
2. Formulate and implement promotion campaigns to attract potential investors.	✓	✓	✓
3. Periodic review and implementation of FIT policy.	✓	✓	✓
4. Undertake periodic studies on the capital expenditures and operating costs of the different types of technologies and develop sufficient analytical tools to inform the level of tariffs for different technologies.	✓	✓	✓
5. Develop and regularly review model power purchase agreements for the various modes of generation.	✓	✓	✓
6. Provide capacity building programs and financial assistance to community based projects.	✓	✓	✓
7. Expand the scope of FiT to include emerging technologies.	✓	✓	✓

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 with.
2. The oceans contain huge amounts of power that can be drawn from different sources and exploited for generating useful energy. The most developed conversion systems use tidal energy, thermal energy, marine currents and ocean waves. A private investor has expressed interest to develop a 100MW electric power plant utilising tidal waves.

3.12.2 Challenges

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

3.12.3 Policies and Strategies

Other Renewables	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Develop and implement legal and regulatory framework.	✓	✓	✓
2. Carry out RD&D on potential of emerging renewable energies.	✓	✓	✓
3. Provide incentives for exploitation and utilization of emerging renewable energy technologies.	✓	✓	✓

3.13 CROSS CUTTING ISSUES

Cross- cutting issues in renewable energy related to land, environment, health and safety are covered in chapter six.

3.13.1 Challenges

(a) Inadequate criteria for allocation of energy resource areas to investors.

(b) Lack of a framework for management of cross-county energy resource areas.

(c) Environmental protection, conservation and management.

(d) Lack of clear and agreeable formula for working out national government, county government and local community benefits sharing.

(e) Insufficient local credit schemes and financing mechanisms

(f) Inadequate public awareness on the economic opportunities offered by renewable energy and renewable energy technologies.

(g) Lack of a mechanism for integrated planning for renewable energy resources.

(h) Lack of facilities to match load demand with the electrical output.

(i) Inadequate capacity for integration of intermittent power generation into the national grid

3.13.2 Policies and Strategies

Cross Cutting Issues in Renewable Energy	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Establish inter-ministerial Renewable Energy Resources Advisory Committee (RERAC) to advise the Cabinet Secretary on matters relating to renewable energy resource.	✓		
2. Transform the Rural Electrification Authority into the Rural Electrification and Renewable Energy Corporation (RERC) to become the lead agency in the development of renewable energy resources excluding geothermal and large hydros. RERC shall be the one stop shop for information and guidance to investors on renewable energy projects.	✓		
3. In order to promote use of renewable energy and disseminate information on renewable energy technologies, it is proposed to: (a) Assist the counties which do not have energy centres to establish new ones based on existing models.	✓	✓	✓

Cross Cutting Issues in Renewable Energy	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
(b) Develop criteria for the phased transfer of existing energy centres to host County Governments.			
4. Facilitate Partnership with potential financing institutions to enable the public to access credits schemes.	✓	✓	✓
5. Develop regulations for net metering to facilitate and encourage sale to the grid of electrical energy generated from renewable energy systems.	✓	✓	✓
6. Develop and implement master plan for renewable energy	✓	✓	✓
7. Incentivise community based power generation.	✓	✓	✓
8. Partner with relevant institutions to support green energy certification schemes.	✓	✓	✓
9. Develop and implement resettlement action plans (RAP).	✓	✓	✓
10. Enhance the capacity of the system operator to manage power supplies from intermittent energy sources.	✓	✓	✓

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 five elements, as shown below.

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, and 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 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 industry.
   (b) Ensuring provision of affordable, reliable, efficient and sustainable power supplies.
   (c) Increasing the population's access to electricity so as to stimulate economic growth.
   (d) Improving the efficiency of power distribution and supply through reductions in system losses and enhancement of 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 ELECTRIC POWER EXPANSION PLANNING

1. The Energy Act, No 12 of 2006 assigned responsibility for development of indicative national energy plans to the Energy Regulatory Commission. In 2009, the Commission established a committee responsible for carrying out medium to long term planning of the electric power sub-sector through the annual 20 year rolling Least Cost Power Development Plan (LCPDP). Up to year 2011, the LCPDP was being reviewed annually. Currently, the plan is updated every two years, the latest update having been undertaken in 2013.
2. The LCPDP identifies existing potential in generation, possible investments in transmission, forecasts future power demand and how best it can be met at least cost. The process entails three key aspects:
   (a) Load forecasting – Comprises review of load forecast assumptions, variables, historical data set and methodology taking cognizance of the future macro-economy.
   (b) Generation Planning – Involves the review and update of the power system simulation data including plant types, system constraints and costs.
   (c) Transmission Planning - Involves power system transmission simulation to ensure the system is well balanced.
3. Planning of the distribution system is carried out by the national entities responsible for distribution and rural electrification. These plans form inputs to the LCPDP, particularly with regard to the load forecast.

4.3 DEMAND FOR ELECTRICITY

1. As at 2014, electricity provided 9% of overall energy requirements in Kenya, while petroleum and renewable energy provided 22% and 69%, respectively. Demand for electricity has shown an upward trend since 2004 due to accelerated economic growth. Peak demand increased from 899MW in FY 2004/05 to 1,470MW in FY2013/14 reaching 1,512MW by December, 2014, while the number of electricity consumers more than trebled from 735,144 in FY 2004/05 to 2,757,983 by June 2014 as detailed in Table 4.2.
2. Peak demand is projected to grow from 1512MW as at December, 2014 to 3,400MW by 2016 and to 5,359MW by 2018. To meet this demand, an additional 5,000 MW of new generation is to be developed by 2017 to bring total installed capacity to at least 6,600MW. Annual energy consumption is projected to increase from 8,841GWh in 2013/14 to 32,862GWh in 2016/17. It is projected that by 2030, peak demand will be 18,000MW against an installed capacity of 24,000MW.
3. Major drivers of the demand include industrial parks, LAPPSET projects, resort cities, iron and steel smelting industry, the standard gauge railway and the light rail.
4. As at 30th June 2014, 35 % of the population was connected to electricity compared to only 15% at 30th June 2004. The existing medium voltage (33 kV and 11 kV) distribution lines already cover areas in which about 63% of Kenya's population of 40 million live. However, the connectivity rate is still low at about 40% in high-density urban areas and 10% in other areas.

Table 4-2 Demand and Consumer Statistics

Financial Year	Energy Generated (GWh)	Energy Sold (GWh)	Peak Demand (MW)	Number of Consumers
2004/05	5,347	4,379	899	735,144
2005/06	5,697	4,580	920	802,249
2006/07	6,169	5,065	987	924,329
2007/08	6,385	5,322	1,044	1,060,383
2008/09	6,489	5,432	1,072	1,267,198
2009/10	6,692	5,624	1,107	1,463,639
2010/11	7,303	6,123	1,194	1,753,348
2011/12	7,670	6,341	1,236	2,038,625
2012/13	8,087	6,581	1,354	2,330,962
2013/14	8,840	7,244	1,468	2,766,441

Source: KPLC Annual Report and Financial Statements, 2014

4.4 ELECTRIC POWER GENERATION

4.4.1 Background

1. Electricity generation in Kenya is liberalised with several licensed electric power producers whose combined installed capacity was 2,173MW as at December 2014. These include KenGen which accounts for approximately 70% of the installed capacity, and eight (8) Independent Power Producers (IPPs) which account for the balance. In the FY ended 30th June 2013, 69.1% of the electrical energy was generated using renewable energy sources while 30.9% was generated using fossil fuels as detailed in Table 4.3.

Table 4-3 - Electric Power Generation Sources and Energy Generated

Sources of Electric Power Generation		Installed Capacity (December 2014)		Annual Generation (FY 2013/14)	
		(MW)	Percentage	(GWHrs)	Percentage
Renewable Energy	Hydro	821	37.8	3,945	44.6
	Geothermal	593.5	27.3	2,008	22.7
	Wind	25	1.2	18	0.2
	Cogeneration	38	1.7	57	0.6
	Imports	-	-	85	1.0
	Total	1477.5	68.0	6,112	69.1
Fossil Fuels	MSD	579.5	26.7	2,533	28.6
	Gas Turbines	60	2.8	41	0.5
	HSD (Isolated Stations)	25.8	1.2	61	0.7
	Emergency Power Plant	30	1.4	94	1.1
	Total	695.3	32.0	2,729	30.9
Installed Capacity and Units Generated		2173MW		8,840GWhrs	

Source: ERC, 2014

4.4.2 The 5,000+MW 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. Other such activities include; 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.
2. In order to provide affordable electricity for these activities which are expected to transform our economy, a roadmap to increase the installed generation capacity from 1664MW as at October 2013 by at least 5000MW to 6,762 MW by 2017 has been proposed and is being implemented. Through this plan the generation cost is projected to reduce from US¢ 11.30 to 7.41, while indicative 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. As at December, 2014, the installed capacity had reached 2173.
3. This capacity will mainly be developed from an energy mix of Geothermal 1,646MW, Natural Gas 1,050MW, Wind 630MW and Coal 1,920MW through IPPs under the PPP framework. Tables 4.4 and 4.5 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 4-4 – 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

Source: MoEP, 2014

Table 4-5 – 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
RETIRED PLANTS		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

Source: MoEP, 2014

Figure 4-2 – Evolution of the Energy Mix from October 2013

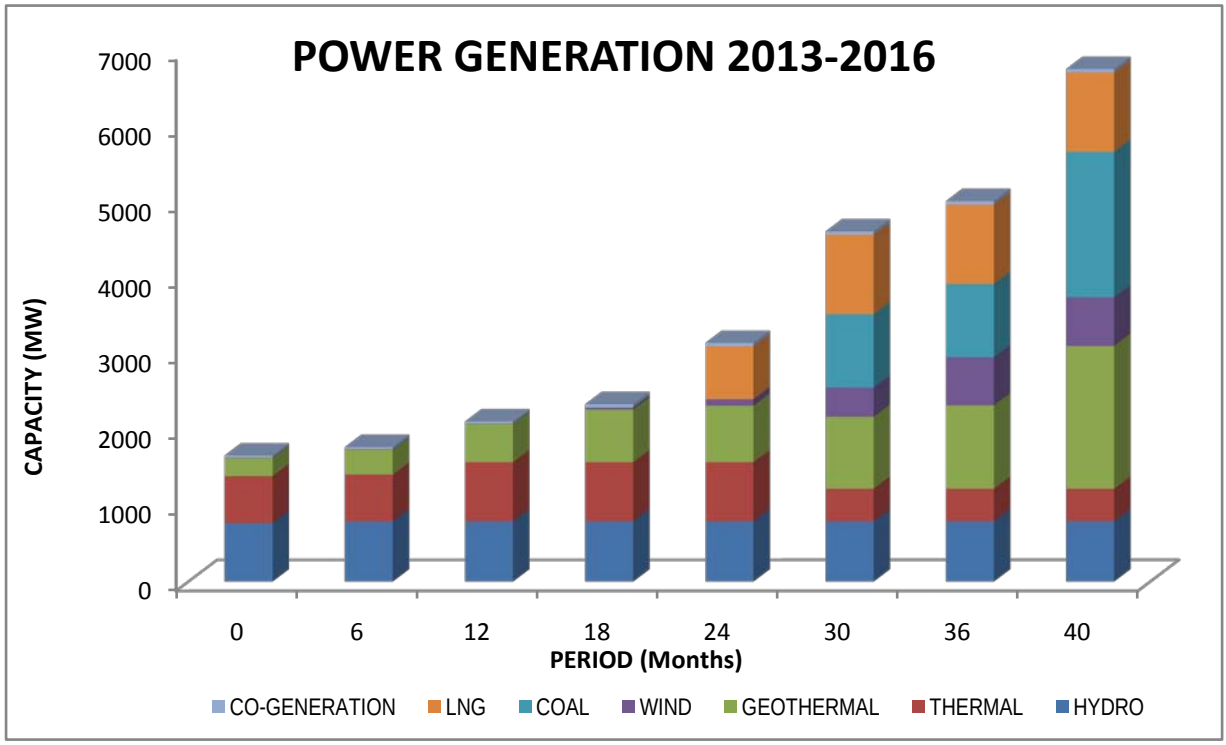
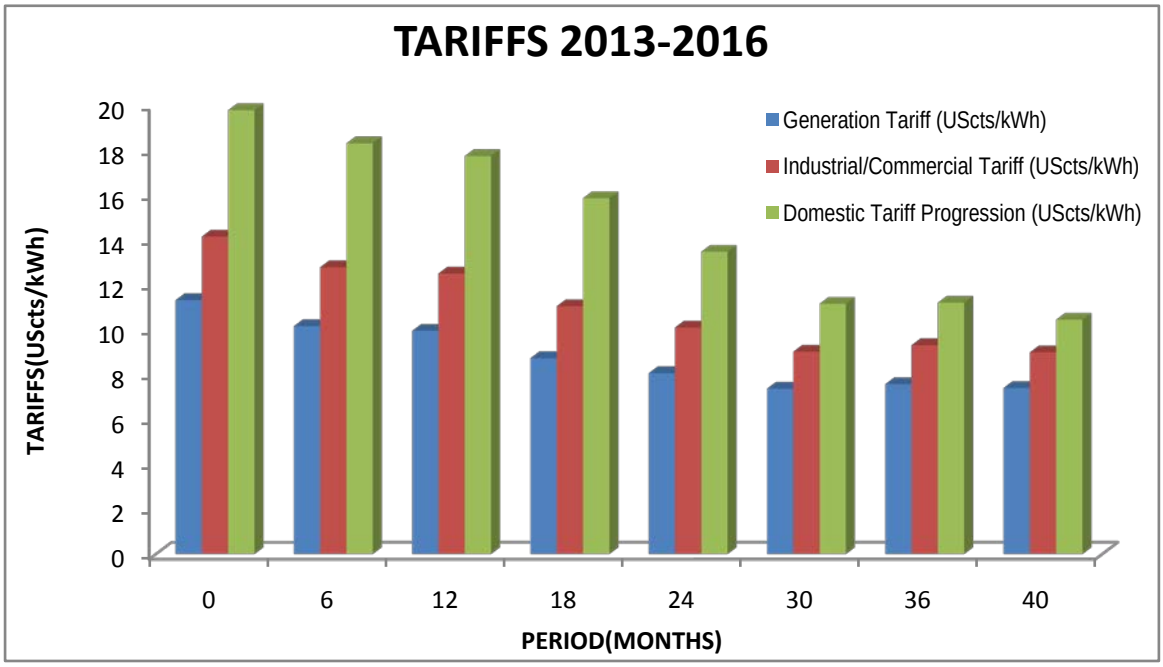


Figure 4-3 – Evolution of Generation and End User Tariffs from October 2013



Source: ERC, 2014

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.

4.4.3 Generation from Renewable Energy Resources

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

4.4.4 Thermal Power Generation

1. Thermal power plants generate electrical energy using fossil fuels, mainly, petroleum, natural gas and coal.
2. Thermal generation accounts for approximately 32% of installed capacity and its contribution to the actual energy mix as at June 2014 was approximately 31%. The installed capacity on the interconnected system comprises:
   (a) 579.5MW 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 by natural gas.

4. 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.

4.4.5 Challenges

(a) Inadequate infrastructure for power supply in the locality of generation plants.

(b) Reliance on fossil fuel leading to high electricity costs.

(c) Underdevelopment of the immerse potential of renewable energy for power generation.

(d) Thermal power generation causes environmental pollution which requires costly mitigation measures.

(e) High price volatility of petroleum products affecting electricity generation cost.

(f) Thermal power plants have a relatively short life span.

(g) Stringent emergency power plan conditions.

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

4.4.6 Policies and Strategies

Electric Power Generation	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Develop electricity infrastructure within the locality of generation plants.	✓	✓	✓
2. Put in place mechanisms to ensure that local communities benefit from future developments of the electricity supply infrastructure.	✓	✓	✓
3. Formulate and implement a renewable energy roadmap from the renewable energy master plan.	✓	✓	✓
4. Facilitate electricity generation using natural gas and coal through PPPs.	✓	✓	✓
5. Develop and enforce a regulatory framework to ensure that all equipment procured for thermal power plants shall be designed and constructed to minimise the environmental impact.	✓	✓	✓
6. Promote the utilisation of Combined Cycle Gas Turbine (CCGT) plants to enhance efficiency.	✓	✓	✓
7. Develop and enforce regulations for compliance with standards for reliable and stable power.	✓	✓	✓
8. Establish natural gas handling and storage facilities in the country.	✓	✓	✓

Electric Power Generation	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
9. Enforce compliance for pollution prevention in thermal power plants.	✓	✓	✓

4.4.7 Generation of Electricity using Nuclear Energy

4.4.7.1 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 2024. 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).

4.4.7.2 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.

4.4.7.3 Challenges

1. Nuclear plants require high upfront capital cost.
2. Nuclear reactors yield products that could be diverted and turned into atomic weapons.
3. Nuclear waste is highly radioactive and non biodegradable.
4. Globally, there is no safe and environmentally acceptable standards for disposal of radioactive and chemical nuclear waste
5. Nuclear accidents are catastrophic as experienced in Chernobyl, Ukraine (1986) and Fukushima, Japan (2011) hence no guarantee on safety.

4.4.7.4 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 these 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.

4.4.7.5 Policies and Strategies

Nuclear Power Generation	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Transform the Kenya Nuclear Electricity Board to the Nuclear Energy Institute under statute, mandated to promote and fast track the nuclear power programme.	✓		
2. Develop a comprehensive legal and regulatory framework for the development, regulation and utilization of nuclear energy for electric power generation.	✓	✓	
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. Carry out 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 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. Identify nuclear candidate sites followed by site evaluation, characterization and selection of feasible sites to be communicated to IAEA.	✓	✓	
11. Identify vendors in nuclear energy technology, engage in bilateral agreements and MOUs with vendor countries.	✓	✓	

Nuclear Power Generation	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
12. Attain 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).	✓		
13. Commission the first 1,000MW nuclear plant by 2024 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.	✓	✓	✓

4.5 ELECTRIC POWER TRANSMISSION

4.5.1 Background

1. The existing transmission network comprises 1,434km of 220 kV and 2,513 km of 132 kV lines, as at June, 2014 and is interconnected with Uganda through a 132 kV double circuit line.
2. As at June 2014, there were nine generation substations with transformation capacity of 1,846MVA and forty-five transmission substations with a capacity of 3,181MVA.
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. These two functions were being performed exclusively by KPLC who owned, operated and maintained the national transmission and distribution network.

4.5.2 Extension of the National Transmission Network

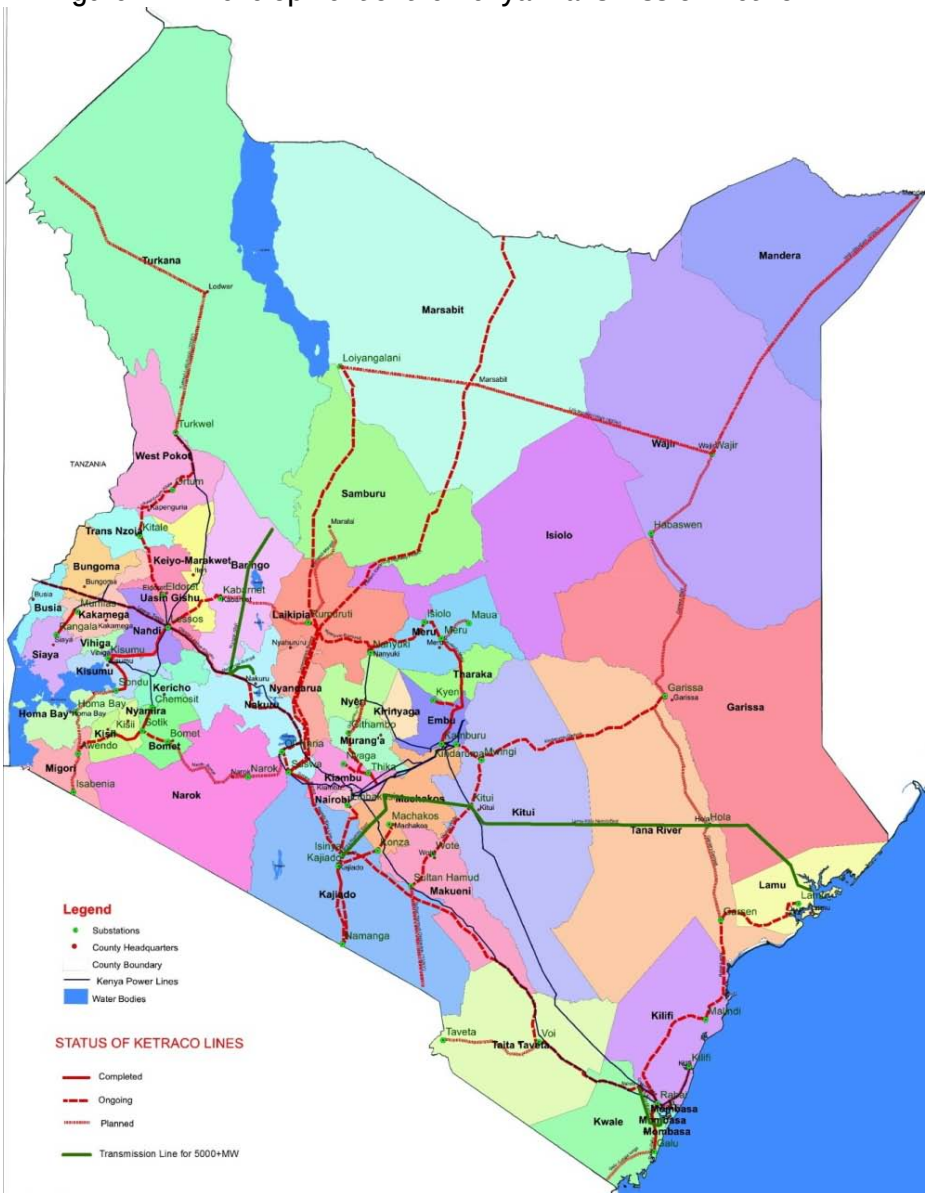
1. As part of its mandate, KETRACO is currently undertaking new transmission projects aimed at developing a robust grid system to:-
   (a) Enable evacuation of the additional 5,000MW by 2017, which entails construction of the 132kV Menengai – Soilo, 400kV Menengai – Rongai, 400kV Silali – Rongai, 400kV Dongo Kundu – Mariakani, 400kV Lamu – Nairobi East, 400kV Kitui – Nairobi East and the 400kV Isinya - Nairobi East transmission lines.
   (b) Improve quality and reliability of electricity supply throughout the country by ensuring adequate evacuation capacity.
   (c) Develop new transmission lines comprising of about 5,000km in the short term and 16,000km by 2031.
   (d) 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.
   (e) Provide interconnection links with the neighbouring countries in order to facilitate power exchange and develop electricity trade in the region.
   (f) Reduce system losses.

(g) 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. As earlier stated, the numerous economic activities springing up in the counties require 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 6,270 km of transmission lines comprising 2,081 km of 132 kV, 1,278 km of 220 kV and 2,299 km of 400 kV AC lines as well as 612 km of 500 kV High Voltage Direct Current (HVDC) line between 2011 and 2017. It is projected that by 2031 KETRACO will have constructed 16,000 km of transmission lines. Figure 4.4 shows the development of the Kenya transmission network.

Figure 4.4 – Development of the Kenya Transmission Network



4. As the transmission network expands through the various institutions as a result of increased generation, it would be necessary to ensure evacuation and uptake of that generation by consumers. This is presently done through power purchase agreements between KPLC as the off-taker and generators. With liberalisation of the energy sector careful implementation of an open access system in transmission should be given due consideration to safeguard the existing obligations.

4.5.3 Regional Interconnection

4.5.3.1 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 and Ethiopia. Quantities of imports and exports of electrical energy (in kWhs) between Kenya and Uganda as well as between Kenya and Tanzania are detailed in Table 4.6.

Table 4.6 - 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
2014	83,000,000	37,000,000	1,300,000	2,000,000

Source: KPLC Report 2013/14

5. 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 4.7 details planned regional inter-connectors.

Table 4.7 – Planned Regional Inter-connectors

No	Transmission Line	Distance (km)	Voltage	Capacity (MW)	Status as at Dec 2014
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

Source: KETRACO, 2014

4.5.3.2 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 need to invest in new power stations is reduced.
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.

4.5.4 Challenges

1. Weak, inadequate and poorly integrated transmission infrastructure.
2. Displacement of population and settlements.
3. Environmental, health and safety concerns.
4. Vandalism on transmission network.
5. Inadequate local technical skills, especially in HVDC systems.
6. Land and wayleaves acquisition.
7. Lack of an appropriate framework to allow limited use of land within wayleave traces.
8. Encroachment of the way leaves trace.
9. Limited private sector participation in development and operation of transmission infrastructure.
10. Inadequate policy, legal and institutional framework for the operationalization of the independent system operator.
11. Undeveloped legal, regulatory and institutional framework for a competitive wholesale electric power market.

4.5.5 Policies and Strategies

Electric Power Transmission	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Facilitate open access to the transmission network while safeguarding the existing obligations and commitments.	✓	✓	✓
2. Provide a mechanism for determination of wheeling charges.	✓	✓	✓
3. Develop and implement the legal, regulatory and institutional framework for competitive electricity market and support regional integration of the power system to enhance regional power trade.	✓	✓	✓
4. National Government in collaboration with neighbouring states to provide infrastructure and finance EAPP power market centre in the region.	✓	✓	✓

Electric Power Transmission	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
5. Allocate sufficient funding to implement the power transmission master plan.	✓	✓	✓
6. Develop and implement the requisite legal and institutional framework to designate one transmission licensee to be the system operator.	✓	✓	✓
7. Provide funding for redundancies in the transmission system to ensure reliability of the system.	✓	✓	✓
8. Improve mechanisms for timely acquisition of way-leaves for power transmission	✓	✓	✓
9. Collaborate with other land regulatory agencies to ensure that energy infrastructure corridors are provided for in the national plan.	✓	✓	✓
10. Develop and implement legal and operational frameworks to enable limited use of land along transmission line corridors as an alternative to outright acquisition of the land.	✓	✓	✓

4.6 ELECTRIC POWER DISTRIBUTION

4.6.1 Background

1. Distribution entails movement of electrical energy from power plants and/or from the transmission system through distribution networks comprising electric supply lines and distribution substations to consumers. Participants in the distribution function include:
   (a) Distribution licensees authorised to design, construct, operate and maintain distribution systems. As at 2015, KPLC is the distribution licensee in most parts of Kenya.
   (b) Rural Electrification Authority, which carries out grid extension at medium and low voltage in areas which are considered uneconomic for electrification by the licensee.
   (c) County Governments that have the function of county planning and development, including electricity and gas reticulation and energy regulation. Consequently, they will work in collaboration with REA and distribution licensees to enhance connectivity in the country.
2. As at June 2014, just about 32% of the population had access to electricity. In addition to those set out in Table 4.2 and Table 4.3, other key statistics about the electricity supply industry are summarised in Table 4.8.

Table 4.8 - Power System Statistics

Financial Year	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
UNITS PURCHASED (GWh)	6,169	6,385	6,489	6,692	7,303	7,670	8,087	8,840
UNITS SOLD (GWh)	5,065	5,322	5,432	5,624	6,123	6,341	6,581	7,244
System Losses (GWh)	1,104	1,062	1,057	1,068	1,180	1,329	1,507	1,596
Losses as % of Energy Purchased	17.90	16.60	16.30	16.00	16.20	17.30	18.60	18.1
Average Unit Yield Sold (cents)	787.55	802.85	1,258.37	1,368.88	1,257.81	1,596.71	1,437.74	1,552.45
System Loss in Billion KShs	8.69	8.53	13.30	14.62	14.84	21.22	21.67	23.10
Incremental Loss Reduction (%)	1.70	1.30	0.30	0.30	-0.20	-1.10	-1.30	0.5

Source: *KPLC Annual Report 2013/2014*

4.6.2 Distribution System

1. As at 30th June 2014, the distribution system comprised of 1,212 km of 66 kV lines, 20,778 km of 33 kV lines, 30,860 km of 11kV lines and low voltage lines, primary distribution substations with transformation capacity of 3,311MVA and distribution transformers with total capacity of 6,317MVA.
2. It is projected that by 2020, capacities of primary and distribution substations, HV lines and MV lines are projected to be 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.
3. As the distribution network expands through the various institutions as a result of increased generation and enhanced transmission, it would be necessary to ensure efficient distribution and supply of electric energy to consumers.
4. The devolved structure in the energy sector calls for careful implementation of an open access system in distribution to be given due consideration to safeguard the existing obligations.

4.6.3 Rural Electrification

1. The Rural Electrification Programme (REP) was initiated in 1973 with the objective of providing electricity supply to areas considered economically unviable by the distribution licensee. The REP was implemented by KPLC until 2007 when the Government established the Rural Electrification Authority (REA) under section 66 of the Energy Act, No.12 of 2006. The mandate of REA includes accelerating the pace of rural electrification by managing the REP Fund, developing rural electrification master plans, mobilizing resources for rural electrification as well as promoting the development and use of renewable energy.
2. As at June 2014, the Government through KPLC and REA had provided electricity supply to 23,167 out of the existing 25,873 public facilities in the country. By June 2015 it is expected that all primary schools will be connected to electricity. Cumulative capital expenditure since inception of the REP is projected to reach KShs 57billion by June 2015.
3. The number of customers connected under the REP rose significantly to 528,552 as at June 2014 up from 453,544 as at June 2013. Units of electricity sold increased by 141 million kWh (an increase of 45.2%) from 313million kWh in 2012/13 to 454 million kWh in 2013/14.

4.6.4 Cross Border Electrification

1. Cross border electrification (CBE) is the extension of the medium and low voltage distribution networks from one country to supply communities and load centres in a neighbouring country in situations where those communities and load centres are far from distribution systems within their own country. Areas that have benefitted from CBE include Lunga Lunga and Vanga in Kenya supplied from Tanzania, Namanga in Tanzania supplied from Kenya and Moyale in Kenya supplied from Ethiopia.
2. CBE is implemented by electricity supply licensees and rural electrification authorities of the member states. It can enhance electricity trade between countries and facilitate increased access to power supply in a cost-effective manner in border regions where distribution systems exist across borders within the Eastern Africa Region.

3. Challenges to CBE include different legal, regulatory and institutional frameworks, technical standards, quality of supply and service levels, tariffs and tariff structures among the countries in the Region.

4.6.5 Reliability and Quality of Supply

1. It is acknowledged that the reliability and quality of supply has a direct bearing on competitiveness of the country as these directly impact cost of production. Electricity consumers continue to demand more reliability and better quality of service commensurate with the tariffs they pay, while the service they receive is below their expectations. KPLC maintains data on reliability and quality of supply that provide the following statistics:
    (a) Number of high and low voltage interruptions.
    (b) Number of transformer failures.
    (c) Number of low voltage breakdowns.
    (d) Average repair time following interruption of supply.
    (e) Cumulative number of customers.
    (f) Quantity of electrical energy purchased and sold.
2. These statistics are not a sufficient measure of the reliability and quality of supply. While it is appreciated that efforts are being made to improve reliability and quality of supply, it is important to track and monitor these aspects using internationally accepted indicators such as system average interruption duration index (SAIDI), system average interruption frequency index (SAIFI) and customer average interruption duration index (CAIDI).
3. In the generation part of the electricity supply chain, plant availability factors are the indicators of reliability of supply.

4.6.6 Connection to Electricity Supply

1. For the socio-economic transformation of the country, the Government has set the goal of 70% and universal access to electricity by 2017 and 2020, respectively. Electricity alone is not sufficient to spur economic growth, but it is certainly necessary. Access to electricity is particularly crucial to human development, as certain basic activities—such as lighting, refrigeration, running household appliances, and operating equipment; cannot easily be carried out by other forms of energy. Sustainable provision of electricity can free large amounts of time and labour and promote better health and education.
2. As at June 2014, just about 32% of the population had access to electricity. A study commissioned by the Ministry of Energy and Petroleum in 2014 established that Kenya has one of the highest connection charges leading to low access to electricity supply. Despite the successful electrification of public facilities in rural areas, neighbouring households largely remain unconnected.
3. Going by the current pace at which connections are being effected, achievement of 70% and universal access to electricity by 2017 and 2020, respectively, will not be possible without a paradigm shift in the electrification strategy.

4.6.7 Challenges in Distribution

1. Vandalism of electric power infrastructure.
2. Lengthy process of way-leaves acquisition.
3. Encroachment of way-leaves trace.
4. Weak distribution network characterized by limited redundancy and aging
5. Frequent and prolonged supply interruptions.
6. High cost of conversion of overhead to underground distribution networks.
7. High distribution system losses.
8. Illegal power line connections and theft of electricity.
9. Physical plans in most cases do not provide an infrastructure corridor for electricity reticulation.
10. High arbitrary levies charged by the public institutions on electric power infrastructure.
11. Lack of a framework and synergies in adoption of parallel system in off-take of power (parallel systems being single and multiple off-taker)
12. Scattered nature of population in rural areas
13. High costs of rural electrification projects
14. Inappropriate technical standards leading to high costs of materials, labour and transport.
15. High electricity connection charges.
16. Majority of consumers cannot afford upfront connection costs.

4.6.8 Policies and Strategies – Distribution

Electric Power Distribution	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Continually support and fund capacity building programs for the realization of energy human resource pool.	✓	✓	✓
2. Government shall ensure and support reinforcement and development of the distribution network so as to improve reliability and quality of supply.	✓	✓	✓
3. Government to facilitate partnership programs in modernization of the distribution networks.	✓	✓	✓
4. Review and enforce legal provisions with respect to energy related offences which are classified as economic crimes.	✓	✓	✓
5. National government to put in place a collaborative framework with the County Governments in planning and developing distribution networks and transferring them to duly licensed distributor(s) to operate and maintain them so at to have only one distributor in a given area at any particular time for efficiency, safety and technical effectiveness of the national grid.	✓	✓	✓

Electric Power Distribution	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
6. Facilitate open access to the distribution network with safeguards for the existing obligations and commitments.	✓	✓	✓
7. Provide a mechanism for determination of use of system charges in a multiple off-taker model.	✓	✓	✓
8. Enforce standards to ensure off-grid networks meet the national power grid standards to enable future inter-connection.	✓	✓	✓
9. Carry out regular review of the electricity market structure to enhance efficiency.	✓	✓	✓
10. Harmonize all levies charged on electricity infrastructure for purposes of managing costs.	✓	✓	✓
11. Regularly review and implement of the rural electrification master plan.	✓	✓	✓
12. Mobilize funds from development partners for specific rural electrification programmes.	✓	✓	✓
13. Support local capacity programs for manufacture, installation, maintenance and operation of appropriate energy technologies in rural areas.	✓	✓	✓
14. Provide incentives to both users and producers of energy technologies in rural areas.	✓	✓	✓
15. Support data collection, dissemination and packaging and disseminate information on energy systems in rural areas to create investor and consumer awareness on economic potential offered by these systems.	✓	✓	✓
16. Collaborate with other government agencies for provision of basic necessities including energy services to nomadic and pastoral settlements	✓	✓	✓
17. Develop the criteria to access and utilize funds for electrification of marginalized areas from the Equalization Fund under Article 204 of the Constitution.	✓	✓	✓
18. Implement the East African Community (EAC) Cross Border Electrification Policy for the cost-effective electricity supply to communities and load centres along the borders of Kenya and her neighbours.	✓	✓	✓
19. Continually review bilateral agreements with countries outside the EAC to enhance cross boarder electrification.			
20. Gather system operation and customer data through appropriate incident management and geographical information systems to enable computation of key performance indicators.	✓	✓	✓
21. Provide for incentives where reliability and quality of supply targets are met and sanctions in events of default.	✓	✓	✓

Electric Power Distribution	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
22. Formulate a national electrification strategy to fast track consumer connections with a view to achieving universal access to electricity by 2020. The strategy shall, *inter alia,* provide for:	✓	✓	✓
(a) Establishment of a national electrification fund to finance the difference between the cost of connections and connection charges based on affordability.	✓	✓	✓
(b) Source of funds and management of the national electrification fund.	✓	✓	✓
(c) Appropriate technical standards for electric supply lines.	✓	✓	✓
(d) Efficient utilisation of resources for the design and construction so as to ensure that connection costs are realistic.	✓	✓	✓
(e) Determination of number and location of households in the country and extent of the electricity supply network.	✓	✓	✓
(f) Prioritisation of areas to be electrified, while ensuring equitable provision of services across the country.	✓	✓	✓
(g) Use of off-grid systems, including stand alone renewable energy solutions where appropriate.	✓	✓	✓
(h) Setting of connection charges on the basis of affordability rather than cost, with options for payments in instalments.	✓	✓	✓
(i) Mechanisms for refunds where persons require connections out of agreed prioritisation and therefore pay more than affordability based charges and the electric supply lines are used to supply other persons.	✓	✓	✓
(j) Role of County Governments in the national electrification strategy.	✓	✓	✓
(k) Roles and management of contractors.	✓	✓	✓

4.7 RETAIL OF ELECTRICAL ENERGY

4.7.1 Background

1. Retailing of electricity entails delivery or supply of electrical energy to consumers through a series of commercial functions i.e. procuring, pricing, selling, metering, billing and revenue collection.
2. Delivery and retailing of electricity is a merchant or commercial function as opposed to generation, transmission and distribution which are of physical nature.
3. The retail function is currently exclusively undertaken by KPLC. Based on this, KPLC has continued to be the single buyer of electricity signing Power Purchase Agreements with generators of electrical energy. This energy is sold by KPLC to all customers including those connected under the Rural Electrification Programme.
4. As at 30th June 2014, the total unit sales which include all connected customers (2,766,441) were 7,251 million kilowatt hours as detailed in Table 4.2.

4.7.2 Challenges in Retail of Electrical Energy

1. High end user electricity tariffs.
2. Illegal power line connections and theft of electricity.
3. Lack of a legal framework for opening up retail for competition.

4.7.3 Policies and Strategies – Retail of Electrical Energy

Retail of Electrical Energy	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. The Government to facilitate investors in the implementation of the strategy to achieve an optimal energy mix that will bring down the end user electricity tariffs.	✓	✓	✓
2. The Government to develop and implement a mechanism for a national uniform tariff.	✓	✓	✓
3. Review and enforce the legal provisions with respect to illegal power line connections and theft of electrical energy and classify such offences as economic crimes.	✓	✓	✓
4. Regularly review the electricity market to facilitate competition in retail of electricity.	✓	✓	✓

4.8 CROSS CUTTING ISSUES

Cross cutting issues in electricity related to land, environment, health and safety are covered in chapter six.

4.8.1 Challenges

1. Lack of updated land use master plans for planning of energy infrastructure.
2. High cost to acquire land and way-leaves for power infrastructure development.
3. Delays in decision making in public energy sector due to complicated corporate governance structures.
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. Inadequate energy data to guide decision making for energy development programs.
9. Insufficient demand for power in some areas due to low economic activities.
10. Poor infrastructure rendering some of the electrification projects unsustainable.

4.8.2 Policies and Strategies – Electricity Cross Cutting Issues

Electricity - Cross Cutting Issues	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
The Government shall:			
1. Facilitate RD&D programs and feasibility to guide integrated planning for electricity projects.	✓	✓	✓
2. 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.	✓	✓	✓
3. Harmonize levies charged on energy infrastructure for purposes of managing electricity costs.	✓	✓	✓
4. Support and ensure reinforcement and development of the distribution network.	✓	✓	✓
5. Ensure that lifeline tariff is appropriately targeted to benefit the poor and marginalized consumer groups.	✓	✓	✓
6. Create awareness and promote clean development mechanisms in energy projects so as to benefit from carbon credits under the 1997 Kyoto Protocol or any successor mechanism.	✓	✓	✓
7. In consultation with power generators, distributors and transmission licensees, construct or cause the construction of supply lines to cater for the needs of the local community in areas where generating plants are located.	✓	✓	✓
8. Institute appropriate and innovative ways to enhance surveillance and security of energy infrastructure.	✓	✓	✓
9. Undertake to progressively interconnect the off-grid network to the national grid where commercially viable.	✓	✓	✓
10. Provide incentives for local assembly and manufacture of energy infrastructure equipment.			
11. Classify strategic energy installations such as power plants, primary substations, control centres as protected areas and provide security during construction and operation.	✓	✓	✓
12. Ensure that the sanctity of power purchase agreements and network service contracts are respected and honoured at all times.	✓	✓	✓
13. Develop and implement legal framework to empower the regulator to enforce provisions of the law.	✓	✓	✓

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. The United Nations Development Programme Global Environmental Facility-Kenya Association of Manufacturers (UNDP-GEF-KAM) Industrial Energy Efficiency Project report of 2005 revealed that wastage of primary energy input ranged from 10% to 30%. This was attributed to a lack of information, motivation, know-how and financial restrictions in adopting emerging energy efficiency and conservation technologies and innovations.
6. The UNDP-GEF – KAM Project ended in 2005. Thereafter, the Ministry of Energy and the Kenya Association of Manufacturers signed a Memorandum of Agreement to establish a Centre for Energy Efficiency and Conservation (CEEC). The CEEC was to continue where the GEF-KAM project had ended; mainly to undertake on behalf of the Ministry – energy audits in mainstream industries, small and medium enterprises (SMEs) and public institutions, capacity building in energy efficiency and conservation, public education and awareness activities as well as administer the Energy Management Awards (EMA) annual events. Total energy audits undertaken on behalf of the Ministry up to 2014 were 250 indicating a savings potential of KShs.7.5 billion Kenya Shillings and 20 MW

equivalent. Assistance from DANIDA to CEEC also saw the completion of a further 150 energy audits translating to indicative savings of KShs. 8.0 billion and 25 MW equivalent.

7. It is expected that with continued efforts through the CEEC and the private sector, it is possible to avoid cumulative emissions of CO_2 to the tune of 7.0 million tonnes by the end of year 2016, equivalent to more than 20,000GWh in energy savings.
8. Sessional Paper No. 4 of 2004 and Sections 104 to 106 of the Energy Act 2006, provide the policy and legal framework for energy efficiency and conservation programmes and strategies in the country.

5.2 CHALLENGES

1. Inadequate awareness and sensitization of the benefits accruing from energy efficiency and conservation.
2. Low uptake of energy efficiency and conservation technologies, appliances and standards.
3. High technical losses in the generation, transmission and distribution systems.
4. Limited technical capacity, training and expertise in energy management, efficiency and conservation.
5. Lack of comprehensive, reliable energy consumption audit data and information covering various sectors.
6. Slow adoption of conservation opportunities and measures due to socio-economic factors.
7. High upfront cost for energy efficiency and conservation projects.
8. Insufficient standards of energy efficiency and conservation equipment and appliances.
9. Lack of tax rebates and fiscal incentives for energy efficiency and conservation equipment and appliances.
10. Low awareness of existing fiscal, and legal, incentives, for generation plants, equipment and infrastructure.
11. Low awareness of the existence of credit facilities such as green energy facility grants and loans and carbon credit from the Clean Development Mechanism (CDM).

5.3 POLICIES AND STRATEGIES

Energy Efficiency and Conservation	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Develop and implement sustainable, awareness and sensitization programmes on energy efficiency and conservation.	✓	✓	✓
2. Implement energy efficiency and conservation initiatives in all sectors.	✓	✓	✓
3. Develop and implement guidelines for carrying out of energy audits and advisory services in the counties.	✓	✓	✓
4. Develop and enforce minimum energy performance standards (MEPS) and rating labels for energy efficiency and conservation equipment.	✓	✓	✓
5. Develop and implement a regulatory framework to provide for incentives and penalties to reduce high losses in generation, transmission and distribution.	✓	✓	✓
6. Provide appropriate fiscal and other incentives to enhance uptake of energy optimisation technologies	✓	✓	✓
7. Build capacity and empower the energy efficiency and conservation directorate and establish an Energy Efficiency and Conservation Agency (EECA) to champion and spearhead energy efficiency and conservation activities.	✓	✓	✓
8. Enforce building codes to enhance the concept of green design in buildings.	✓	✓	✓
9. Develop and enforce standards for fuel economy of motor vehicle operations and maintenance practices.	✓	✓	✓
10. Promote safe and fuel efficient transportation for passengers and cargo.	✓	✓	
11. Adopt the use of new and efficient technologies in energy efficiency and conservation.	✓	✓	✓
12. Develop, disseminate and implement a National Energy Efficiency and Conservation Plan in consultation with relevant stakeholders.	✓	✓	✓
13. Undertake research and development in energy efficiency and conservation.	✓	✓	✓
14. Collaborate in the preparation of education curricula on energy efficiency and conservation.	✓	✓	✓
15. Implement international co-operation programmes in energy efficiency and conservation.	✓	✓	✓
16. Collaborate with the private sector in energy efficiency and conservation.	✓	✓	✓

6.0 – LAND, ENVIRONMENT, HEALTH AND SAFETY

6.1 BACKGROUND

1. Land is a critical resource in the development of energy and petroleum infrastructure. However, due to competing interest in land utilization, the sector faces challenges in developing its infrastructure.
2. Environmental Management in the energy and petroleum sector is key to ensuring sustainability in the energy and petroleum value chain. Energy and petroleum production, transportation and use pose various dangers to human life and the environment. The challenge for players in sector is the provision of affordable, competitive, reliable and sustainable energy and petroleum products 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, ERC to consider, among others, the environmental and social impacts, and compliance with EMCA 1999.
5. Strategic environmental assessments are required for public plans and programmes to identify and minimize any negative environmental impacts. Environmental Impact Assessment Regulations require that mitigating measures be put in place to minimise the adverse impact of energy and petroleum 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 and petroleum 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 and petroleum 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 provides for protection of the right to property. Energy and petroleum 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 provides that sustainable development is one of 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 and petroleum 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 and petroleum sector.

6.2 SUPPLY SIDE ENVIRONMENTAL CONCERNS

6.2.1 Petroleum and Coal

6.2.1.1 Exploration, Development and Production (Upstream)

1. Upstream activities can have negative environmental impacts and therefore should be conducted in a way that protects the environment. The activities also pose serious risks to health and safety of workers and the public, including property loss. Offshore and onshore exploration effects can be minimized by limiting the exploration duration and activities as well as employing newer technologies.

2 Exploration, development and production of petroleum and coal also lead to destruction of environment. However, this can be mitigated by ensuring proper decommissioning and rehabilitation of the environment.

6.2.1.2 Petroleum (Midstream and Downstream)

1. Major environment, health and safety concerns in the petroleum industry are fire outbreaks and oil spills. Since the year 2000 the country has witnessed a number of incidents involving petroleum products which have led to 315 fatalities and 375 serious injuries, loss of property and man hours. These can be mitigated through adoption of international best practices and ensuring strict compliance and enforcement of applicable regulations, standards and training.

2. Personnel handling petroleum products are also 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 personal protective equipment.

6.2.1.3 Coal (Midstream and Downstream)

Concerns in the coal industry include emissions which contribute to global warming, acid rain and degradation of environment, among others. However, modern technologies among them the Clean Coal Technology (CCT) can be applied to reduce pollution significantly. Clean coal energy can be harnessed chemically without combustion with air by capturing 99% of Carbon Dioxide.

6.2.2 Renewable Energy

1. Generally, renewable energy is considered 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 sustainability.

6.2.2.1 Geothermal

1. Geothermal power generation involves drawing fluids at high temperature from deep in the earth. These fluids carry a mixture of gases and liquids which may contribute to global warming, acid rain, noxious smells and ground water pollution if released on the surface.
2. To mitigate these, the plants are equipped with emission control systems to reduce the exhaust. In addition, the practice of re-injecting the fluids into the earth for disposal and stimulation of reservoir also help to reduce environmental risk. Other mitigation measures include extraction of products for industrial use.

6.2.2.2 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.

6.2.2.3 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. This is mainly because of use of inefficient charcoal kilns. 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.

6.2.3 Electricity

1. The construction and operation of electricity infrastructure 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. As result of this, available data from ERC indicates that there have been 145 fatalities and 60 injuries from the year 2010 to 2014.

6.2.4 Nuclear Energy

1. The global, traditional challenge of nuclear energy remains the management of radioactive waste. However, as a result of continued research in the area, radioactive waste management is now well within manageable levels. Spent fuel rods can either be safely stored until the radioactive levels reduce to non-toxic levels or be reprocessed and reused in generation of nuclear energy. The waste also requires special handling and storage facilities to reduce the risk of exposure to employees, the public and the environment.
2. A nuclear meltdown 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 nuclear accidents.

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 wood, peat or coal to produce the same amount of energy and they produce larger quantities of smoke when they burn. Solid fuels produce less heat for the amount of fuel consumed and produce more pollution. This is described as the energy ladder.

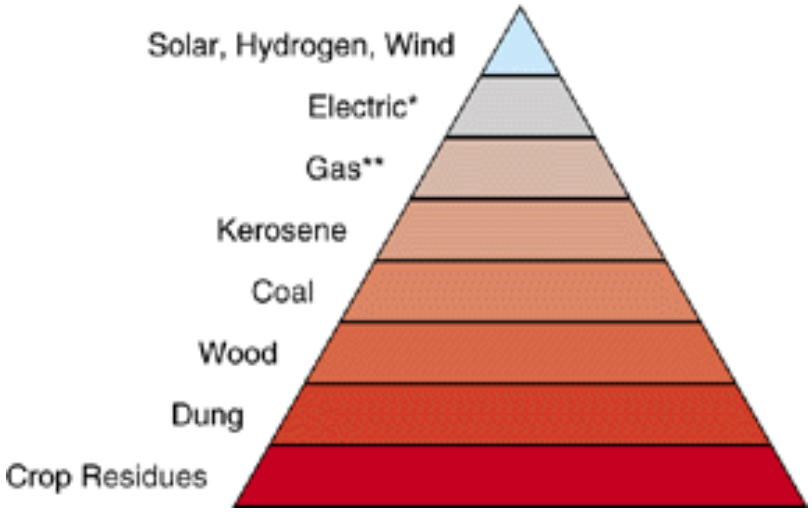


Figure: 6.1 - The Energy Pyramid[1] - Efficiency of Solid Fuel compared to other fuels

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 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 efficient renewable energy solutions, LPG or natural gas and electricity

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

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. This strategy has subsequently been used to prepare a national climate change action plan.

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 Cogeneration Project	Japan Carbon Finance	Mumias Sugar Company	125.591
SonduMiriu 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	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
Sang'oro (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 (ICI), which compares the investment climate for CDM projects in Africa.

Table 6-3 - Projects Developed in Kenya for CDM-ICIAfrica 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 and petroleum sector.

2. The following hazards are a constant threat that must be taken into consideration in planning and management of the sector:
   (a) Climate and weather hazards including floods and droughts.
   (b) Geological 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 disaster prevention, preparedness, management and mitigation institutions. This can be addressed through proper disaster prevention, preparedness and management mechanisms and practices.

6.6 LAND AND SOCIO-ECONOMIC IMPACTS

1. Energy and petroleum development projects have various impacts on communities where the projects are implemented. Key among these is economic and physical displacement. Physical displacement of people affected by the project is prevalent in projects such as hydro power plants requiring water reservoirs, petroleum and coal development, 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.

6.7 CHALLENGES IN LAND, ENVIRONMENT, HEALTH AND SAFETY

1. Inadequate review and update of physical plans and land use.
2. Absence of a comprehensive and fair compensation mechanism.
3. Vandalism of energy and petroleum infrastructure continues to cause adverse impact on security of supply.
4. High costs due to variation from the preferred land use required for development.
5. Potential negative impact on the social, cultural or recreational life of communities.
6. Inadequate operational capacity for disaster prevention, preparedness, management and mitigation.
7. Low compliance with health, safety and environmental laws and regulations.
8. Absence of a national Resettlement Action Plan Framework.
9. Inadequate health, safety, environmental and quality laws to regulate energy projects.
10. Low public awareness and sensitization in the obligatory role of each individual in their right to a clean and safe environment.
11. Inadequate human and technical capacity to handle EHS risks associated with emerging areas such as upstream petroleum, coal and nuclear.

6.8 POLICIES AND STRATEGIES FOR LAND, ENVIRONMENT, HEALTH AND SAFETY

6.8.1 Land and Socio-Economic Issues

Land and Socio-Economic Issues	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Provide linkages with provisions of the National Land Policy, which provide a framework for access, planning, utilization and administration of land in the country	✓	✓	✓
2. Collaborate with the relevant agencies to review and set rates payable for compensation in respect of damage caused by the energy and petroleum sector players.	✓	✓	✓
3. Ensure compliance with the environmental laws on restoration and decommissioning of projects.	✓	✓	✓
4. Collaborate with other land regulatory agencies to ensure that energy and petroleum infrastructure corridors are provided for in the national plan.	✓	✓	✓
5. Ensure enforcement of legal provisions on encroachment and obstruction of energy and petroleum infrastructure.	✓	✓	✓
6. Develop and enforce a legal and regulatory framework on encroachment and trespass on energy and petroleum infrastructure.	✓	✓	✓
7. Develop and implement a national Resettlement Action Plan Framework for energy and petroleum projects.	✓	✓	✓

6.8.2 Environment, Health and Safety

Environment, Health and Safety	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Develop and implement a legal and regulatory framework for enforcement of environmental rights.	✓	✓	✓
2. Develop and implement a compliance mechanism for safety and environmental pollution.	✓	✓	✓
3. Develop and implement Strategic Environmental Assessment (SEAs) for the energy and petroleum sector.	✓	✓	✓
4. Enforce compliance with business and operating standards.	✓	✓	✓
5. Develop mechanism and strategies to empower consumers to convert to modern clean energy and petroleum and technologies.	✓	✓	✓
6. Empower sector regulator through adequate financial and human resource to facilitate their leadership in environmental, health, safety and quality enforcement in the energy and petroleum sector.	✓	✓	✓
7. Mainstream ecosystem and biodiversity management in energy and petroleum sector.	✓	✓	✓

Environment, Health and Safety	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
8. Develop and enforce air quality laws and regulations in collaboration with the relevant agencies.	✓	✓	✓
9. Support establishment of vehicle emission, inspection and maintenance programs	✓	✓	✓
10. Phase out the importation of two stroke motorcycles.	✓	✓	✓
11. Continuously update and enforce the specifications and standards for supply of clean fuels.	✓	✓	✓
12. Enforce emission standards in energy and petroleum production plants.	✓	✓	✓
13. Carry out public education sensitization programmes on benefit of clean fuels and well maintained vehicles.	✓	✓	✓
14. Promote the use of public transport and non-motorized transport.	✓	✓	✓
15. Provide incentives for acquisition and use of fuel efficient technologies in motor vehicles.	✓	✓	✓
16. Provide incentives for use of clean modern household energy to eliminate the use of wood-fuel, charcoal and kerosene as an energy source.	✓	✓	✓
17. Provide incentives for the uptake of renewable energy technologies.	✓	✓	✓
18. Enforce the regulatory framework for wood fuel and commercial woodlots production.	✓	✓	✓
19. Spearhead the national afforestation programme aimed at increasing the national tree cover percentage.	✓	✓	✓
20. Support and promote conversion of cook stoves to uptake modern and clean fuels in households and institutions.	✓	✓	✓
21. Ensure compliance with international standards for nuclear plant siting, construction, operation, decommissioning and waste management to ensure proactive preventive approach to managing the environmental, health and safety risks.	✓	✓	✓
22. Support initiatives and ensure proper coordination of all relevant statutory authorities in conservation of catchment areas.	✓	✓	✓
23. Identify and map out water catchment areas boundaries and gazette them as protected areas.	✓	✓	✓
24. Develop capacity to deal with EHS risks associated with emerging sectors such as coal, nuclear, upstream and midstream petroleum and gas			

6.8.3 Climate Change Mitigation

Climate Change Mitigation	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Support the development and implementation of the national policy on climate change	✓	✓	✓
2. Facilitate capacity building for participation in international climate change negotiations.	✓	✓	✓
3. Formulate a collaborative framework for the implementation of climate change mitigation initiatives.	✓	✓	✓

6.8.5 Disaster Preparedness, Prevention and Management

Disaster Preparedness, Prevention and Management	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Establish a Disaster Preparedness, Prevention and Management (DPPM) Unit to spearhead response to accidents and disasters in the energy and petroleum sector.	✓	✓	✓
2. Establish a collaborative framework of the (DPPM) Unit with the National Disaster Operations Centre (NDOC).	✓	✓	✓
3. Undertake a risk assessment of the energy and petroleum sector and implement the risk mitigation programmes.	✓	✓	✓
4. Undertake capacity building programmes.	✓	✓	✓
5. Enforcement of legal and regulatory requirements.	✓	✓	✓
6. Develop and implement a disaster preparedness, prevention and mitigation policy.	✓	✓	✓
7. Ensure compliance with regulatory provisions on designated parking lots for petroleum tankers.	✓	✓	✓
8. Provide security for all energy and petroleum installations, which shall be gazetted as national protected zones.	✓	✓	✓
9. Formulate a framework for weather and climate data collection and dissemination with the Metrological department.	✓	✓	✓
10. Establish and implement hazard monitoring systems in collaboration with other statutory authorities for disaster prevention and mitigation.	✓	✓	✓

7.0 – DEVOLUTION AND PROVISION OF ENERGY SERVICES

7.1 BACKGROUND

1 The Constitution has introduced significant changes in the governance structures in 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 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.

3 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.

4 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.

5 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.

6 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 functions between the national and County Governments is discussed in section 7.2.

7 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.

7.2 DISTRIBUTION OF FUNCTIONS BETWEEN THE NATIONAL AND COUNTY GOVERNMENTS

1 The Fourth Schedule of the Constitution allocates to the National Government the functions of energy policy, including electricity and gas reticulation and energy regulation, and to the County Governments the functions of county planning and development, including electricity and gas reticulation and energy regulation.

2 Notwithstanding the foregoing, there is a possibility of operational uncertainty as to the extent of responsibility between the two levels of governments. This section provides a framework to guide the two levels of government on their respective functions.

7.2.1 Functions of the National Government

1. Policy Formulation and Integrated National Energy Planning

a) Formulation of the National Energy and Petroleum Policy.

b) Preparation of Integrated National Energy Plan, incorporating petroleum, coal, renewable energy and electricity master plans.

c) Provision of land and rights of way for energy infrastructure.

2. Energy Regulation

a) Regulation and licensing of exploration, production, importation, refining, exportation, transportation, storage and bulk sales of fossil fuels and their derivatives.

b) Regulation and licensing of production, conversion, distribution, supply, marketing and use of renewable energy.

c) Regulation and licensing of generation, importation, exportation, transmission, distribution, retail and use of electrical energy

d) Approval of energy purchase agreements as well as network service and common user facility contracts.

e) Protection of consumer, investor and other stakeholder interests.

f) Preparation and enforcement of regulations and standards.

g) Formulation of national codes for energy efficiency and conservation in buildings.

h) Issuance of energy saving certificates to enhance energy efficiency and conservation.

i) Setting, review and adjustment of energy tariffs and tariff structures.

j) Resolution of complaints and disputes between parties over any matter in the energy and petroleum sector.

k) Prosecution of offences created under the Energy Act

l) Certification of petroleum tanker drivers, electrical workers and contractors, solar system installation technicians and contractors.

3. Energy Operations and Development

a) Exploration, production, importation, exportation, and refining or processing of fossil fuels, geothermal and other energy based natural resources.

b) Transportation, storage and bulk sales of petroleum and coal as well as their derivatives.

c) Generation, transmission, distribution (including reticulation) and retail of electrical energy

d) Collect and maintain energy data.

e) Implementation of the rural electrification programme and management of the rural electrification programme fund.

f) Undertake feasibility studies and maintain data with a view to availing the same to developers of energy resources and infrastructure.

g) Provide technical and other capacity building support to county governments.

h) Administration and management of the Sovereign Wealth Fund, the Consolidated Energy Fund and the National Energy Conservation Fund.

i) Protection of energy infrastructure including oil and gas fields, pipelines and storage depots, refineries, power plants, control centres, electric supply lines and substations.

7.2.2 Functions of the County Governments

1. County Energy Planning

a) Preparation of county energy plans, incorporating petroleum and coal, renewable energy and electricity master plans.

b) Physical planning relating to energy resource areas such as dams, solar and wind farms, municipal waste dumpsites, agricultural and animal waste, ocean energy, woodlots and plantations for production of bio-energy feed-stocks.

c) Provision of land and rights of way for energy infrastructure.

d) Facilitation of energy demand by planning for industrial parks and other energy consuming activities.

e) Preparation and implementation of disaster management plans.

2. County Energy Regulation

a) Regulation and licensing of retail supply of petroleum and coal products.

b) Regulation and licensing of designated parking for petroleum tankers.

c) Regulation and licensing of biomass and charcoal producers, transporters and distributors.

d) Customize national codes for energy efficiency and conservation in buildings to local conditions.

3. County Energy Operations and Development

a) Electricity and gas reticulation.

b) Provide and maintain adequate street lighting.

c) Provision of designated parking for petroleum tankers.

d) Collect and maintain energy data.

e) Implementation of county electrification projects.

f) Undertake feasibility studies and maintain data with a view to availing the same to developers of energy resources and infrastructure.

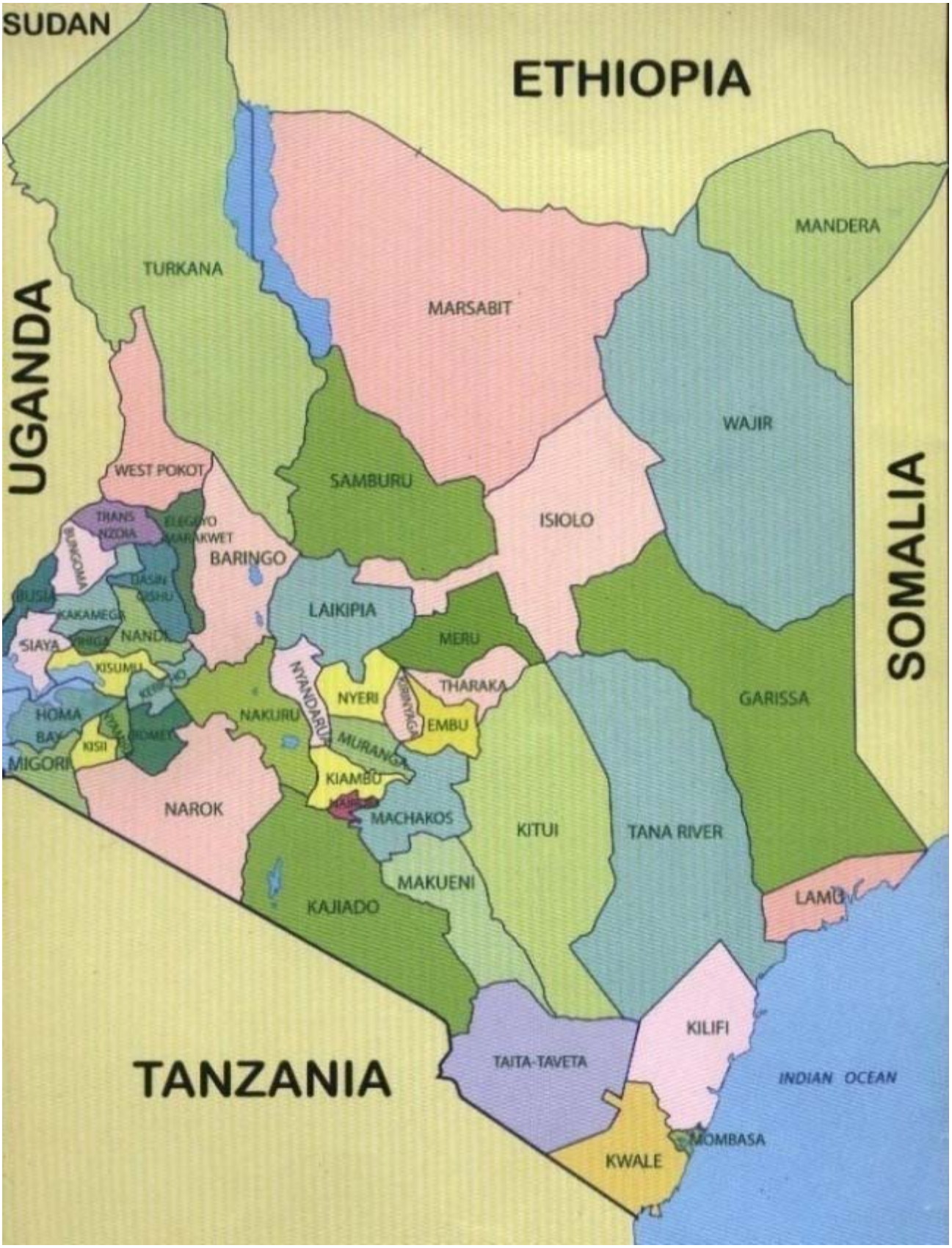
g) Establishment of energy centres for promotion of renewable energy technologies, energy efficiency and conservation.

h) Protection of energy infrastructure including oil and gas fields and pipelines, refineries, power plants, control centres, electric supply lines, substations and depot.

7.3 KENYA AND ITS 47 COUNTIES

1 Under the Constitution, Kenya has been divided into 47 counties as shown in Figure 7.1. The status and challenges of energy and petroleum resources as well as infrastructure and services in the counties are very diverse.

Figure 7.1 – Kenya and its 47 Counties



8.0 – ENERGY FINANCING, PRICING AND SOCIO-ECONOMIC ISSUES

8.1. BACKGROUND

1. The funding required for the energy and petroleum 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 and petroleum sector.
3. 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 and petroleum sector.
2. Low foreign investment from a highly competitive international finance market.
3. High initial capital outlay for energy and petroleum projects.
4. Inadequate institutional capacity to negotiate energy and petroleum contracts.
5. Inadequate local content in energy and petroleum projects.
6. Foreign exchange fluctuations.
7. Unpredictable fiscal regime.

8.3. POLICIES AND STRATEGIES

Energy Financing	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Explore and adopt all viable financing options from local and international sources to ensure cost effective utilization of all locally available energy and petroleum resources.	✓	✓	✓
2. Create a competitive and predictable investment climate in the country to attract investments in the energy and petroleum sector.	✓	✓	✓
3. Provide adequate fiscal incentives for energy and petroleum resource and infrastructure development.	✓	✓	✓
(a) to attract investment in energy and petroleum infrastructure across the country;	✓	✓	✓
(b) for renewable energy projects to reduce reliance on petroleum based energy in the long term;	✓	✓	✓
(c) to encourage adoption of clean and efficient coal technologies.	✓	✓	✓
4. Develop fiscal legislation to encourage efficient technologies and discourage inefficient technologies.	✓	✓	✓

Energy Financing	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
5. Support investment in energy and petroleum sector through PPP arrangements.	✓	✓	
6. Dedicate not less than two percent of the income from energy and petroleum sector to support training, research, development and demonstration.	✓	✓	✓
7. Ensure a reasonable return on investments through cost-reflective pricing.	✓	✓	✓
8. Develop adequate infrastructural facilities to enterprises involved in the development of the energy and petroleum sector.	✓	✓	✓
9. Liaise with the National Treasury to enhance the internationalization of Kenya's Capital Market by encouraging financial instruments and stocks of Kenya's energy and petroleum corporate units to be quoted in international financial markets to attract foreign portfolio investment capital.	✓	✓	✓
10. Expand the scope of venture capital financing to include investments in the energy and petroleum sector.	✓	✓	✓
11. 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 and petroleum sector.	✓		
12. Provide letters of comfort to private investors and letters of guarantee to state corporations.	✓	✓	✓
13. Continuously engage development partners to establish financial facilities for financing energy and petroleum related projects at minimal interest rates especially for renewable energy and energy efficiency projects.	✓	✓	✓
14. Seek financing of clean energy projects through carbon credits under clean development mechanism and other financing associated with clean energy.	✓	✓	✓
15. Package attractive investment instruments which will be appealing to alternative investors such as savings and co-operative societies, pension schemes and venture capitalists.	✓	✓	✓
16. Support and encourage Public Private Partnership as provided for in the PPP Act, 2013 to facilitate private sector participation in financing, construction, development, operation and maintenance of energy and petroleum resource or infrastructure projects, including development of infrastructure for strategic petroleum reserves and power generation projects.	✓	✓	✓
17. Mobilise funds for strategic petroleum stocks through government appropriation, development partners, international financial institutions and strategic stocks bonds.	✓	✓	✓

8.4. CONSOLIDATED ENERGY FUND

1. The Government shall set up a Consolidated Energy Fund to cater for the following:-
   (a) Operations of the Nuclear Energy Institute.
   (b) Operations of the Energy Efficiency and Conservation Agency.
   (c) Acquisition of strategic petroleum reserves and the construction of the appropriate infrastructure.
   (d) Assist in energy and petroleum sector environmental disaster mitigation, response and recovery.
   (e) Hydro risk mitigation during times of prolonged drought.
   (f) Water towers conservation programmes.
   (g) Promotion of renewable energy initiatives, including pre-feasibility studies.
   (h) Decommissioning of energy and petroleum infrastructure.
   (i) A mechanism for price stabilization.
2. Sources of money for this fund will include:
   (a) Penalties and fines relating to offences in the energy and petroleum sector as levied by ERC and the Energy Tribunal.
   (b) Contribution from energy and petroleum sector players.
   (c) Contribution from sovereign wealth fund.
   (d) Contribution from Treasury other than funds provided to public institutions for the discharge of their mandates.
   (e) Funds raised through the stock market (bonds and bills).
   (f) Recovered assets from proceeds of corruption and economic crimes in the energy sector.
   (g) Support from development partners.
   (h) Contribution from consumers.

8.5. ENERGY AND PETROLEUM PRICING AND SOCIO-ECONOMIC ISSUES

8.5.1 Energy and petroleum 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 costs that affect electricity prices include steam charges, hydro water charges, charges imposed by the Kenya Wildlife Service (KWS), Kenya Forest Service (KFS) for lease of land for wind and geothermal project developments, and charges imposed by regional development authorities.

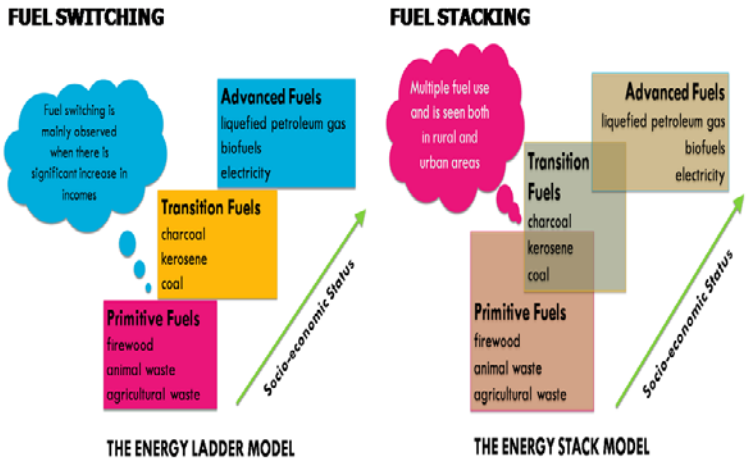
Petroleum

1. Kenya imports all her petroleum products requirements mostly from the Middle East. The international price of crude oil and petroleum products has been fluctuating and has an impact on the cost of petroleum and associated products.
2. 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.
3. Due to the upward trend in international pricing of petroleum products, in 2010 and the depreciation of the Kenya shilling against the dollar, the Government introduced a petroleum price capping mechanism.
4. However, in the recent past the world has witnessed a marked drop in crude oil prices and the price of Murban crude oil dropped from a high of US$111.65 per bbl in June 2014 to a low of US$60.5 per bbl in December, 2014. This has provided a relief to motorists and is expected to also impact prices of commodities positively.

8.5.2 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 as shown in 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).
3. 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)

4. 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).

5. 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*

6. 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 Policies and Strategies

Energy and petroleum Pricing and Socio-economic issues	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Ensure that tariffs and charges are prudent, cost effective and set in a coordinated manner in consultation with relevant stakeholders.	✓	✓	✓
2. Ensure that energy and petroleum projects are completed on time to ensure security of supply and increased access by consumers.	✓	✓	✓
3. The Government shall undertake to maintain a controlling stake in the sector and link the economic policy with the energy and petroleum policy.	✓	✓	✓
4. Provide incentives to encourage production and use of modern energy sources.	✓	✓	✓
5. Develop a framework to ensure implementation of local content in the energy and petroleum sector.	✓	✓	✓
6. Develop a framework to ensure local communities benefit from energy and petroleum investment in their regions.	✓	✓	✓

9.0 – CROSS CUTTING ISSUES

9.1 LEGAL AND REGULATORY FRAMEWORK

9.1.1 Background

A robust legal and regulatory framework is important for effective implementation and management of energy and petroleum policies in the country.

9.1.2 Challenges

1. Legal and regulatory framework for the sector that is not aligned to the Constitution.
2. Outdated and fragmented laws governing the energy and petroleum sector.
3. Overlap of roles and functions of institutions in the energy and petroleum sector.
4. Lack of benefits sharing mechanisms and uncoordinated management of energy and petroleum resources.
5. Inadequate penalties for offences in the sector.
6. Disjointed legal and regulatory frameworks governing operation of government institutions that impact the operations of institutions within the sector.
7. Inadequate powers of the Energy Tribunal due to contradictions in the Energy Act.
8. Privatisation of strategic state-owned enterprises in the energy and petroleum sector.

9.1.3 Policies and Strategies

Legal and Regulatory Framework	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Review and align the energy and petroleum sector legal and regulatory framework with the Constitution.	✓		
2. Incorporate provisions in legislation that will ensure that:			
(a) All the public institutions in the energy and petroleum sector adopt the Constitutional requirements on national values and principles under Article 10.	✓	✓	✓
(b) All necessary and applicable general rules of international law affecting the energy and petroleum sector under Article 2(5) of the Constitution are complied with.	✓	✓	✓
(c) All ratified treaties and international conventions affecting the energy and petroleum sector under Article 2(6) of the Constitution are adhered to.	✓	✓	✓
(d) Consumer rights as is provided for under Article 46 of the Constitution are protected.	✓	✓	✓
(e) Where efficient alternative cheaper modes of transport with adequate carrying capacity exist, long distance road transport shall not be allowed.	✓	✓	✓

Legal and Regulatory Framework	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
(f) A prudent energy efficiency and conservation programme is developed and implemented across the energy value chain.	✓	✓	✓
3. Review the institutional mandates of the various public institutions in the energy and petroleum sector to streamline their respective mandates, businesses and operations.	✓	✓	✓
4. Enhance the jurisdiction of the Energy Tribunal in the new legislation.	✓	✓	✓
5. Enhance penalties for offences in the energy and petroleum sector; by providing minimum sentences and classifying these offences as economic crimes.	✓	✓	✓
6. Provide and create additional legal safeguards on utilization of land, environment and natural resources critical to the development of energy and petroleum infrastructure and service provision.	✓	✓	✓
7. Provide appropriate mechanisms for access to information that also protects the principle of confidentiality as provided under Articles 33 and 35 of the Constitution.	✓	✓	✓
8. Establish inter-ministerial collaboration of relevant stakeholders to ensure coordination at policy, regulatory and operational levels on matters relating to development of energy and petroleum resources.	✓	✓	✓
9. Support and encourage community policing initiatives to curb vandalism of energy and petroleum infrastructure.	✓	✓	✓
10. Ban scrap metal trade to deter vandalism.	✓	✓	✓
11. Retain ownership and control of strategic energy and petroleum sector enterprises.	✓	✓	✓
12. In cases where best industry practices are adopted, efforts shall be made to align them with existing legal framework.	✓	✓	✓

9.2 INTEGRATED ENERGY AND PETROLEUM PLANNING

9.2.1 Background

1. Sessional Paper No 4 of 2004 identified the need to integrate energy and petroleum planning with the national economic, social and environmental policies, as energy and petroleum are 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 planning.

2. The Energy Act, No 12 of 2006 assigned the responsibility for development of indicative national energy plans to the Energy Regulatory Commission. In 2009, ERC established a committee with responsibility for preparation of the Least Cost Power Development Plan (LCPDP) in the electricity sub-sector. Planning committees for the petroleum, coal and renewable energy subsectors, as well as one for the integrated energy and petroleum planning are yet to be established.

9.2.2 Challenges

1. Inadequate structures and systems for integrated planning and monitoring implementation of planned projects.
2. Inadequate capacity to carry out integrated energy planning.
3. Lack of petroleum and renewable energy master plans.
4. Inadequate databases for all energy forms.
5. Weak linkages with other sectors of the economy.
6. Delays in project implementation due to cumbersome procurement process, financing challenges, court action and poor governance.
7. Occasional shortages or disruptions in supply of petroleum products.
8. Occasional power rationing and poor quality of supply, as well as frequent power interruptions.
9. Conflicting and competing interests between various sub-sectors of the economy with regard to development and utilization of energy and petroleum resources.
10. Lack of coordination of planning between the national and county governments.
11. Duplication of efforts leading to inefficient allocation and utilization of scarce public resources.

9.2.3 Policies and Strategies

Integrated Energy and Petroleum Planning	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Establish structures and systems for integrated sectoral planning and monitoring implementation of planned projects.	✓	✓	✓
2. Develop adequate human resource capacity to carry out integrated energy and petroleum planning.	✓	✓	✓
3. Collect and maintain data for all energy forms.	✓	✓	✓
4. Strengthen linkages and synergy with other sectors of the economy.	✓	✓	✓
5. Establish framework for monitoring and evaluation of the implementation of energy and petroleum projects.	✓	✓	✓
6. Develop systems that ensure security and reliability in provision of energy services and petroleum products.	✓	✓	✓
7. Ensure implementation of the integrated energy and petroleum master plan.	✓	✓	✓
8. Ensure that all projects under the integrated energy and petroleum master plan are implemented through competitive bidding processes.	✓	✓	✓
9. Government may implement strategic energy and petroleum projects through State Corporations or PPP arrangements 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 and petroleum sector.

9.3.2 Challenges

1. Inadequate research, development and demonstration in the energy and petroleum sector.
2. Inadequate funding for RD&D.
3. Inadequate promotion of local content development in the energy and petroleum sector.
4. Weak linkages between the energy and petroleum sector and academia.

9.3.3 Policies and Strategies

Research and Development	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Establish a Nuclear Energy Institute to undertake training, research, development, dissemination, nurture talent, innovation and to enhance capacity building in the sector.	✓	✓	✓
2. Encourage energy and petroleum sector entities to allocate adequate resources for research and human resource development.	✓	✓	✓
3. Promote local, regional and international participation in research activities, particularly in technology-oriented research.	✓	✓	✓
4. Enhance research linkages between industries and academia.	✓	✓	✓
5. Ensure that institutions that provide human capital development to build knowledge and technical capacity in the sector are duly licensed and that their training programs are accredited for quality assurance purposes.	✓	✓	✓

9.4 GENDER, YOUTH AND PERSONS WITH SPECIAL NEEDS

9.4.1. Background

1. Access to clean and reliable energy services and petroleum products constitutes an important prerequisite for fundamental determinants of human development, contributing, *inter alia,* to economic activity, income generation, poverty alleviation, health, education, gender equality and environmental safety.
2. Youth and persons with special needs have rights and entitlements enshrined in the Constitution. Gender inclusiveness must be incorporated in all Government appointments, including Government institutions.

9.4.1 Challenges

1. Imbalances in gender, youth and persons with special needs in various positions in energy and petroleum 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 wood-fuel and kerosene on women and children.
4. Inability to access and afford modern and clean energy.

9.4.2 Policies and Strategies

Gender, Youth and Person with Special Needs	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. The Government shall comply with Article 27(8) of the Constitution.	✓	✓	✓
2. Mainstream gender, youth and persons with special needs issues in energy and petroleum policy formulation, planning, production, distribution and use.	✓	✓	✓
3. Undertake public education and awareness on the benefits of using clean and modern services of energy.	✓	✓	✓
4. Undertake measures to make clean and modern energy services affordable and accessible.	✓	✓	✓

9.5 POLICY IMPLEMENTATION, MONITORING AND EVALUATION

9.5.1. Background

Effective monitoring and evaluation are critical to the implementation of energy and petroleum sector programmes and projects.

9.5.2. Challenges

1. Lack of energy and petroleum policy monitoring and evaluation mechanisms.
2. Incomplete implementation of past energy and petroleum policies.

9.5.3 Policies and Strategies

Policy Implementation, Monitoring and Evaluation	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Formulate a monitoring and evaluation framework for this policy.	✓	✓	✓
2. Formulate a monitoring and evaluation framework for energy programmes and projects.	✓	✓	✓

9.6 DATA COLLECTION, MANAGEMENT AND DISSEMINATION

9.6.1. Background

Energy and petroleum data is critical for strategic policies and planning in the sector. Integrity of the data must be maintained through appointment of a single point of data collection, verification, compilation and dissemination.

9.6.2. Challenge

Lack of an integrated mechanism for data collection, management and dissemination.

9.6.3 Policies and Strategies

Data Collection, Management and Dissemination	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. Enhance the capacity of the central planning unit at the ministry to collect, maintain and disseminate energy and petroleum data.	✓	✓	✓
2. Ensure that the energy and petroleum data is disseminated through the website of the ministry on a quarterly basis.	✓	✓	✓

9.7 SHARING OF BENEFITS FROM ENERGY AND PETROLEUM RESOURCES

9.7.1 Background

1. Article 62 (3) of the Constitution provides that all natural resources are vested in the national government in trust for the people of Kenya, while Article 202 (1) states that revenue raised nationally shall be shared equitably among various levels of government.
2. Some of the benefits accruing from the exploitation of energy and petroleum resources include profits, training, employment, technology transfer and CSR programmes. Article 66(2) of the Constitution requires that investments in property shall benefit the local communities and their economies.

9.7.2 Challenges

Lack of a clear framework for sharing of benefits from exploitation of energy and petroleum resources with the local communities.

9.7.3 Policies and Strategies

Sharing of Benefits from Energy and Petroleum Resources	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. The Government shall develop and implement a legislative framework to ensure equitable sharing of benefits accruing from the exploitation of energy and petroleum resources between the National Government, County Government and the local community.	✓	✓	✓
2. The government shall put in place transparent mechanism for the allocation of energy and petroleum revenues raised by the national and the county governments for the benefits of people of Kenya.	✓	✓	✓

9.8 LOCAL CONTENT

9.8.1 Background

1. All energy and petroleum resources found in Kenya belong to all citizens of the country and need to be exploited, developed and managed in a manner that benefits all Kenyans.
2. As a developing economy, the country needs to put appropriate policies in place to capture and retain value created from energy and petroleum resources to stimulate employment, entrepreneurship, value addition, diversification, transfer of technology and knowledge across the value chain and economy.

9.8.2 Challenges

1. Absence of local content development policy.
2. Inadequate legislation for technology and knowledge transfer.
3. Inadequate development of local skills and know-how in the exploitation of natural resources and infrastructure development.
4. Inadequate legislative requirements for collaboration between foreign investors in the energy and petroleum sector and the local investors.
5. Absence of legislative framework to prioritise utilization of locally available goods and services.

9.8.3 Policies and Strategies

Local Content	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. The government shall develop and implement local content policy.	✓	✓	✓
2. The government to develop and implement education framework for human capital development to build knowledge and technical capacity in the energy and petroleum sectors.	✓	✓	✓

Local Content	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
3. Establish capacity building programmes in conjunction with local industry associations, local training institutions and international institutions.	✓	✓	✓
4. The government to develop and implement legislation for energy and petroleum industry linkages for capacity building.	✓	✓	✓
5. The government to develop and implement legislative framework to prioritise the utilization of locally available goods, services and human resources.	✓	✓	✓
6. Government shall ensure the investors and contractors in energy and petroleum sector comply with local content requirements as specified in the policy and legislation.	✓	✓	✓
7. Government shall establish a local content development and monitoring unit.	✓	✓	✓

9.9 COMMUNITY ENGANGEMENTS, EXPECTATIONS AND CONFLICTS

9.9.1 Background

The discovery of various natural resources in the country particularly those related to energy and petroleum sector such as geothermal, oil, gas and coal has resulted in high expectations, confrontations and conflicts among communities where these resources have been discovered. Potential conflicts and social unrest associated with exploitation of these resources can cause costly delays to projects and operations. In some cases, these situations can lead to loss of lives and livelihoods among local populations, employees or contractors, and bring about profound developmental set-backs.

9.9.2 Challenges

1. Absence of sustained engagements by the government.
2. Inadequate laws and regulations that promote waste management in the energy and petroleum sector.
3. Lack of enforcement of environment, health and safety laws and regulations.
4. Lack of pro-active and sustained awareness and sensitization of public about timelines for exploitation of energy and petroleum resources.
5. Land use conflict.
6. Lack of civic and constitutional rights at the grass-root levels.
7. Inadequate of government driven mechanisms for addressing and responding to conflicts and social unrests surrounding exploitation of energy and petroleum resources.
8. Uncoordinated framework between the investors and the communities.
9. Inadequate implementation of communication policy and strategy for stakeholders' engagement and consultation in energy and petroleum sector.

9.9.3 Policies and Strategies

Community engangements, expectations and conflicts	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
1. The government shall develop and implement a legislative framework for pro-active and sustained engagement with the governments, investors and communities in energy and petroleum resource areas.	✓	✓	✓
2. The government to develop and implement awareness programmes for the communities to enhance constructive engagements process.	✓	✓	✓
3. The government to put in place mechanisms to ensure that environment, health and safety compliance audits are regularly carried out.	✓	✓	✓
4. The government to develop and implement laws and regulations to govern waste disposal and management from energy and petroleum resources.	✓	✓	✓
5. The government to develop and implement a monitoring and evaluation mechanism on regular reporting on stakeholders consultations.	✓	✓	✓

10.0 – ANNEXURES

Annex 10.1The 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 10.2Biogas 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*

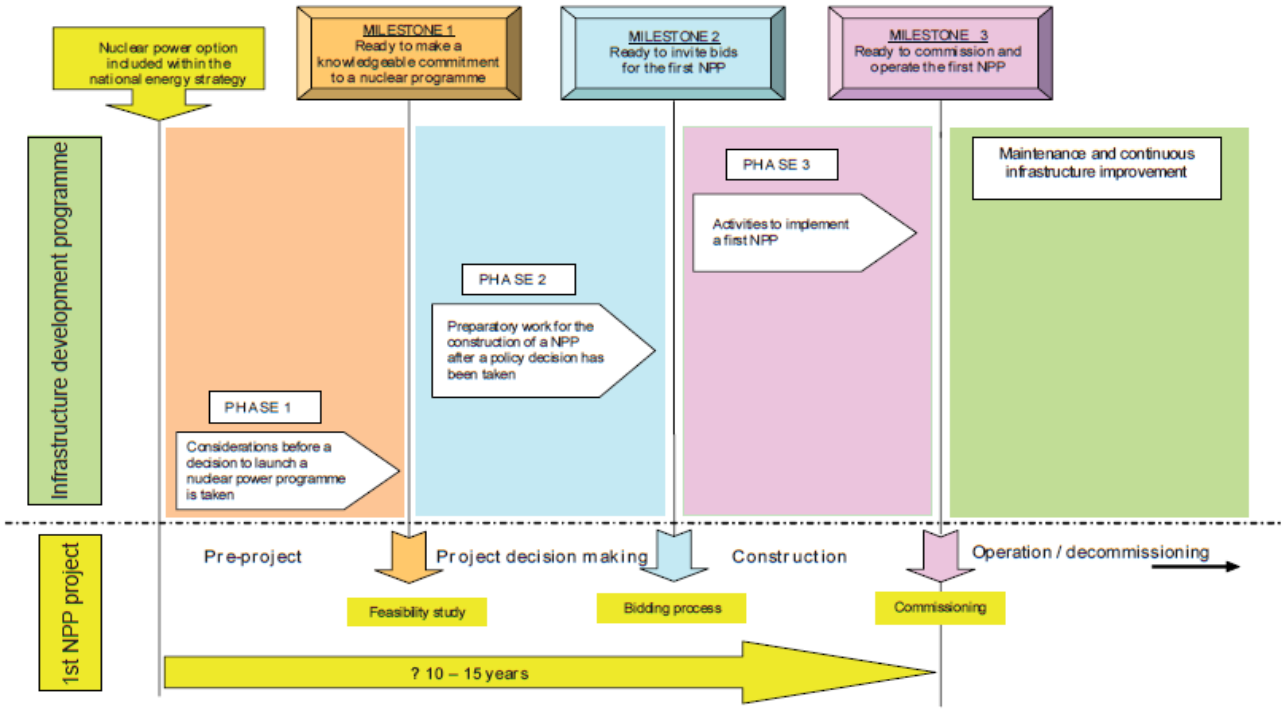
Table 10.3 Nuclear electricity generation figures around the world

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

(Adopted from International Atomic Energy Agency)



ACRONYMS AND GLOSSARY OF TERMS

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	Eastern Africa Power Pool
EHS	Environment, Health and Safety
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	Giga Watt 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	Kilo Watt Hour
LCPDP	Least Cost Power Development Plan
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LRMC	Long Run Marginal Cost
Ministry	Ministry of Energy and Petroleum
MMBTU	Million British Thermal Units
MMCFD	Million Cubic Feet per Day
MoEP	Ministry of Energy and Petroleum
MoU	Memorandum of Understanding
MSD	Medium Speed Diesel
MTPA	Million Tonnes Per Annum
MW	Mega Watt
MWe	Megawatt Electric
NEI	Nuclear Energy Institute
NEMA	National Environmental Management Authority
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
RERC	Rural Electrification and Renewable Energy Corporation
RMS	Regular Motor Spirit
SMR	Small and medium sized reactor

SAPP	Southern Africa Power Pool
ToE	Tonnes of Oil Equivalent
VAT	Value Added Tax
Wp	Watt Peak

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.

Local community means a sub-county in which a natural resource is exploited.

Local Content means the use of Kenyan local expertise, goods and services, people, businesses and financing for the systematic development of national capacity and capabilities for the enhancement of the Kenyan economy.

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 planning and construction of the network used to supply energy to a consumer, and in the case of:

(a) electricity, it is the planning and construction of the network consisting of low and medium voltage electric supply lines together with service lines to enable a consumer to get supply of electricity.

(b) 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 or 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 charges means charges for use of the transmission or distribution system for the movement of electrical energy, and includes wheeling charges.