REPUBLIC OF KENYA

Ministry of Energy

NATIONAL ENERGY POLICY

October, 2018

TABLE OF CONTENTS

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 citizen's participation 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 stakeholder engagement and public participation through workshops held in all the 47 counties. The document sets out the national policies and strategies for the energy sector.

The overall national development objectives of the Government of Kenya as set out in the development blue print, Kenya Vision 2030 include 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 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 opportunities associated with exploiting these resources towards addressing the country's energy needs.

Several initiatives are being pursued to enhance the country's power generation capacity and to diversify the energy mix. 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 sector to work together to ensure that the proposals contained in this policy are implemented.

Hon. Charles Keter, EGH
Cabinet Secretary
Ministry of Energy

PREFACE BY THE PRINCIPAL SECRETARY

In the last ten years the Policy direction of the energy sector has been governed by Sessional Paper No. 4 of 2004 on Energy. 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 and the Government's Big Four Agenda made it necessary to review the sector policy.

The energy 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 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 utilization of these resources for the country's energy needs. Local content development in the sector remains a pivotal agenda for the Ministry. At the same time, interventions have been made at ensuring increased access to electricity supply by industries 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 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.

Dr. Eng. Joseph K. Njoroge, CBS
Principal Secretary
Ministry of Energy

EXECUTIVE SUMMARY

Preamble

1. The process of formulating this Policy entailed comprehensive reference of the Constitution, Sessional Paper No. 4 of 2004 on Energy, Energy Act 2006, legislation and regulations applying in the energy sector, 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 County followed by similar 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 subsequently held where several suggestions and comments were received, including request by several stakeholders for additional time to allow for further input. This document has been enriched from the foregoing consultative process which has been participatory and transparent as required by the Constitution.

2. This Policy document is organised into nine substantive chapters, starting with the Introduction under Chapter 1. Chapter 2 deals with Coal while Chapter 3 provides for Renewable Energy including electricity generation from geothermal and hydro resources. Chapter 4 covers Electricity while Chapter 5 provides for 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. The Acronyms and Glossary of Terms used herein are provided after Chapter 9.

Introduction

3. The overall objective of this Energy Policy is to ensure affordable, competitive, sustainable and reliable supply of energy at the least cost in order to achieve the national and county development needs, while protecting and conserving the environment for inter-generational benefits.

4. The energy sector has been guided by the Sessional Paper No. 4 of 2004 on Energy and governed by several legislation, principally the Energy Act, No. 12 of 2006 and the Geothermal Resources Act No. 12, of 1982. The Feed in Tariff Policy 2008 which was last revised in 2012 has been instrumental in accelerating investment in the renewable energy sub sector. Adoption of the Kenya Vision 2030 and the promulgation of the Constitution, 2010, made it necessary to review both the Policy and the applicable legislation and regulations so as to align them with the Vision and the Constitution.

Coal

5. 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 2030.

6. The Government shall promote efficient utilisation of coal resources while minimising the environmental impacts associated with its use. A conducive investment environment targeting power generation from coal will be created by providing fiscal incentives to attract investment in this sector.

Renewable Energy

7. Renewable energy, derived from the naturally occurring resources including geothermal, hydro, solar, wind, 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.

8. 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. As at 2017, Geothermal's contribution to the total grid installed capacity of 2,333.07MW was at 652MW (28%). Further, the Government will encourage investment in the geothermal subsector so as to achieve at least 1,093MW of geothermal electric power generation by 2020 and 2,056MW by 2024, and enhance direct use of the resource.

9. 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, 823.8MW has been exploited and accounts for 35.3% of installed generation capacity as at 2017. Potential for small hydros is over 3,000MW, of which, less than 25MW has been developed.

10. 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.

11. 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 of energy resource areas to investors.
    (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.

12. 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

13. Electricity is a secondary source of energy generated through the consumption of primary energy sources namely petroleum, coal, renewable energy and nuclear energy. Due to its versatility in utilization, electricity is crucial to the socio-economic development of the country. Access to electricity is associated with rising or high quality of life.

14. 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 enhanced 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.

15. 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 2024 is proposed. Through this plan the Government will in the medium to long term commit itself to development of technologies that result to least cost based on

technology of screening curves. The screening curves take into account the elements of capacity factor, capital and discount rates. As at December, 2017, the installed capacity had reached 2,336 MW

16. The National Government shall:-

(a) Establish the Energy Institute to, inter alia, 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

17. The importance of energy efficiency and conservation in the Kenyan economy cannot be overemphasized. Challenges impacting on the 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.

18. The Government shall:

(a) Develop and implement sustainable, awareness and sensitization programmes on energy efficiency and conservation;

(b) Implement energy efficiency and conservation initiatives in all sectors;

(c) Undertake research and development in energy efficiency and conservation; and

(d) Collaborate with the private sector in energy efficiency and conservation.

Land, Environment, Health and Safety

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

20. 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.

21. The Government shall facilitate:

    (a) Development of a National Resettlement Action Plan Framework for energy related projects; including livelihood restoration in the event of physical displacement of communities.
    (b) Access to land where exploration blocks fall on private land, community land and cultural heritage areas including game parks/reserves.
    (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

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

23. 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

24. The Government shall:

    (a) Explore and adopt all viable financing options from local and international sources for cost effective utilization of all its energy resources, and in so doing shall endeavour to maintain a competitive fiscal investment climate in the country.
    (b) Support Public Private Partnerships in the development, operation and maintenance of energy infrastructure and delivery systems.

25. The Government shall set up a Consolidated Energy Fund to fund infrastructure development; energy sector environmental disaster mitigation, response and recovery; hydro risk mitigation; water towers

conservation programmes; energy efficiency and conservation programmes as well as promotion of renewable energy initiatives.

Cross Cutting Issues

26. 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 Energy Institute to undertake training, research, development, dissemination, nurture talent, innovation and to enhance capacity building in the sector.

27. The Government shall:

    (a) Promote a conducive environment to attract investments in the energy 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 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 resource areas.

28. 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 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. Over the next five years, the Government aims to focus on manufacturing, universal healthcare, food security and affordable (the "Big Four") to further strengthen the economy, progress industrialization and create jobs, thereby contributing towards the realization of the Vision 2030

3. Kenya's implementation of appropriate broad-based policies has led to a stable macroeconomic environment resulting in positive economic growth of 5.7%, 5.9%, 4.9% in the year 2015, 2016 and 2017 respectively. 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.

4. 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. Key macroeconomic indicators have remained fairly stable with overall inflation rate decreasing significantly from 6.6% in 2015 and to 6.3% in 2016. This was attributed to lower energy and transport prices. In 2017, interest rates declined due to the impact of their capping that became effective in September 2016. In the money market, the Kenyan Shilling strengthened against most of the major trading currencies but weakened against the Euro and the US Dollar in 2017. The current account deficit widened on account of significant growth of imports against a slower growth of exports. Thus, there was a moderate build up in inflationary pressure from 6.3% in 2016 to 8.0% in 2017 mainly due to significant increase in oil and food prices.

5. 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.

6. The principal taxation policy pursued by the Government of Kenya (GoK) in the energy sector is based on the need to create a sustainable balance between fiscal revenue generation and 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.

7. Given this policy regime, the energy sector has continued to play its role as a significant contributor to fiscal revenues through taxes, levies and duties imposed on various petroleum products, electrical energy and materials sourced by service providers for operations, maintenance and infrastructure expansion.

8. Energy shortages and supply disruptions coupled with high cost remain serious obstacles to economic activity. Tax and other concessions are planned to encourage investment in development

of energy infrastructure particularly by private investors involved in power generation from geothermal as well as other forms of renewable energy such as wind, solar and biomass.

9. 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 POLICY OBJECTIVES

1. The overall objective of the Energy Policy is to ensure sustainable, adequate, affordable, competitive, secure and reliable supply of energy at the least cost geared to meet national and county needs while protecting and conserving the environment.
2. Specifically these objectives are:

   (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 sector plan is put in place for effective development.

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

   (j) Promote capacity building in the sector through 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 products.

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

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

   (p) Ensure that investors and operators in energy 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 related disasters.

(s) Encourage generation of electricity from renewable resources, build and maintain the necessary distribution and transmission 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

1. The Constitution has enhanced protection and enforcement of fundamental rights amongst other gains. It provides for a two tier structure of government, i.e. the National and the County Governments. It distributes the functions and powers between the two levels as detailed in Chapter Eleven and the Fourth Schedule.
2. Specifically in relation to the energy sector, Part 1 of the Fourth Schedule provides that the National Government shall be responsible for:-

   (a) Protection of the environment and natural resources with a view to establishing a durable and sustainable system of development including water protection, securing sufficient residual water, hydraulic engineering and the safety of dams.

   (b) Energy policy including electricity and gas reticulation and energy regulation; and

   (c) Public investment.

3. In relation to the County Governments, Part 2 of the Fourth Schedule provides that they shall be responsible for county planning and development including electricity and gas reticulation and energy regulation.

4. It is necessary to review and align the energy sector policy, legal and regulatory framework with the provisions, spirit and aspirations of the Constitution.

1.3.2 Current Policy and Legislation

1. The energy and petroleum sector is guided by Sessional Paper No. 4 of 2004 on Energy and several other legislations and policies, the principal ones being:

   (a) The Energy Act, No. 12 which was enacted in 2006. It sought to amend and consolidate the legislation 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 Feed in Tariff Policy 2012 which was issued in 2008 and revised in the year 2010 and 2012. This Policy was formulated to promote investment in electricity generation from renewable energy sources.

2. Alongside the foregoing principal Acts, there are several other Acts that impact the energy sector, including:-

   (a) The Standards Act, Chapter 496 of the Laws of Kenya that provides for establishment of minimum quality specifications, mode, materials and apparatus used in the country.

   (b) The Environmental Management and Co-ordination Act, 1999, which regulates the environmental issues including those relating to the energy sector.

   (c) 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

   (d) 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.

   (e) The Public Procurement and Asset Disposal Act No. 33 of 2015 that establishes procedures for efficient public procurement and for the disposal of unserviceable, obsolete or surplus, stores, assets and equipment by public entities.

   (f) The Anti-Corruption and Economic Crimes Act No. 3 of 2003 which provides for prevention, investigation and punishment of corruption, economic crime and related offences.

   (g) The Public Officer Ethics Act No. 4 of 2003 which provides for code of conduct and ethics for public officers.

   (h) The Ethics and Anti-Corruption Commission Act No. 22 of 2011 which establishes the Ethics and Anti-Corruption Commission.

   (i) The Land Act 2012 No. 6 of 2012 which provide for matters relating to public, private and community land.

   (j) The Land Registration Act, No. 3 of 2012 which provides for registration of titles to land and the objects of devolved government in land registration.

   (k) The National Land Commission Act 5 of 2012 that provides for the establishment of the National Land Commission.

   (l) The Environment and Land Court Act No. 19 of 2011 that provide for the establishment of the Environment and Land Court.

   (m) The Urban Areas and Cities Act No. 13 of 2011 that provide for the, classification, governance and management of urban areas and cities.

   (n) The National Government Loans Guarantee Act No. 18 of 2011 that provides for the transparent, prudent and equitable management of the authority to guarantee loans conferred on the National Government.

(o) The Consumer Protection Act No. 46 of 2012 that provides for consumer protection and prevention of unfair trade practices in consumer transactions

(p) The County Government Act, 2012 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 (MoE)

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

2. Energy Regulatory Commission (ERC)

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

3. Energy Tribunal

This quasi-judicial body was established under section 108 of the Energy Act, 2006. The Tribunal adjudicates appeals originating from 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 undertakes 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 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. 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.

10. Independent Power Producers (IPPs)

IPPs are private companies which generate power and sell electricity in bulk to KPLC. Currently there are fourteen (14) IPPs in operation as listed below which account 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).
(j) KTDA(various plants)(hydro power plants)
(k) Lake Turkana Wind Power (LTWP) (wind power plant)
(l) Strathmore Solar (solar power plant)

(m) Regen-Terem (hydro power plant)

(n) Biojoule Kenya Ltd (biogas power plant)

11. 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.

2.0 – COAL RESOURCES

2.1 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 Kenya 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 country has coal deposits for commercial exploitation and the Government is fast tracking exploration and development of the resource for power generation and other industrial uses.
4. The introduction of Clean Coal Technologies (CCTs) in coal fired power plants reduces emissions and extracts sulphur and carbon from the atmosphere thus making coal an environmentally viable source of energy.

2.2 Demand for Coal

1. In Kenya, coal is mainly used by cement manufacturers to complement heavy fuel oil for process heat. As at December 2017, consumption of coal declined from 486.29 thousand tonnes of oil equivalent to 462.7 thousand tonnes of oil equivalent.
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.
3. As a medium term measure, the Government intends to import coal to support electricity generation.

2.2.1 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 be in operation in the year 2024 running on imported coal. However, there is need to develop adequate and appropriate coal handling and storage facilities onshore.
2. The Government has concessioned Blocks in the Mui Basin for coal resource development with the objective of generating about 1,000MW in Kitui County as part of the coal contribution of 2,000MW in the 5,000+MW project.

2.2.2 Challenges in Midstream and Downstream Coal

1. Inadequate technical capacity for coal midstream and downstream activities.
2. Absence of large import coal handling facilities.
3. Underdeveloped road and railway transportation system.
4. Negative public perceptions on use of coal to generate electricity.

5. Limited funding for coal generation projects.
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 Utilization	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
1. Develop local expertise and enhance local content in coal utilisation through training and collaboration with other Government organs, training and research institutions.	✓	✓	✓
2. Develop and implement appropriate legal, fiscal and regulatory framework for utilisation.	✓	✓	✓
3. Undertake extensive public awareness and stakeholder engagement on the use of coal as a cheap source of electricity generation.	✓	✓	✓
4. Adapt appropriate clean coal technology and provide suitable fiscal incentives.	✓	✓	✓
5. Enhance regional co-operation in data and information exchange for coal exploration.	✓	✓	✓
6. Enhance budgetary support for utilisation of coal resources.	✓	✓	✓
7. Encourage private sector participation in coal utilisation through PPP and JV arrangements by providing appropriate incentives.	✓	✓	✓
8. 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.	✓	✓	✓
9. Develop an integrated infrastructure for coal storage, transportation and utilization to facilitate development of the coal industry.	✓	✓	✓
10. Ensure compliance with the best coal industry practice in coal utilisation.	✓	✓	✓
11. Enforce investors' compliance with the regulatory framework and agreed work plans.	✓	✓	✓
12. Provide incentives to encourage and promote the use of coal as an electricity generation source.	✓	✓	✓

3.0 – RENEWABLE ENERGY

3.1 BACKGROUND

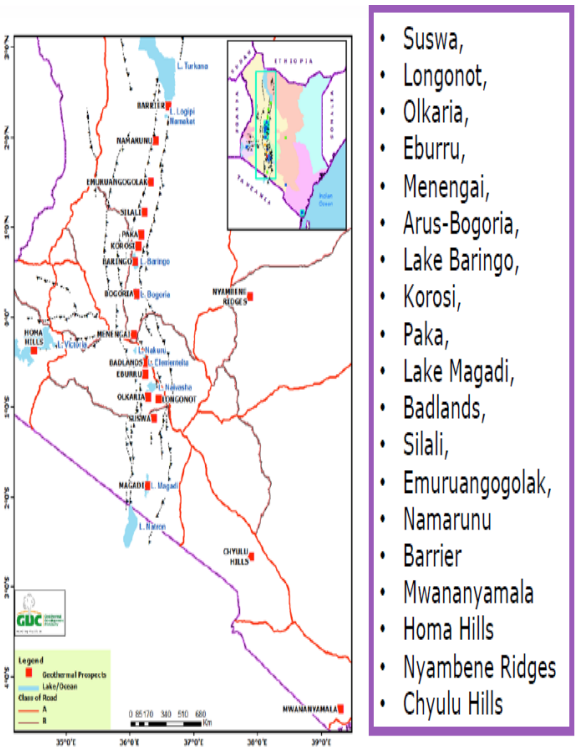
1. Renewable Energy (RE) is derived from natural processes that are replenished constantly. In its various forms, it derives directly or indirectly from the sun, or from heat generated deep within the earth. Included in the definition is energy generated from solar, wind, biomass, geothermal, hydropower 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 MoE, biomass provides about 69% of the country's overall energy requirements while petroleum accounts for about 22% and electricity about 9%. As at June, 2017 65.6% of the electricity component was generated using renewable energy sources with fossil fuels providing the balance of 34.4% as indicated table 4.3.

3.2 GEOTHERMAL ENERGY

3.2.1 Background

1. Geothermal is the energy formed 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.

3.2.3 Policies and Strategies

Geothermal	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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

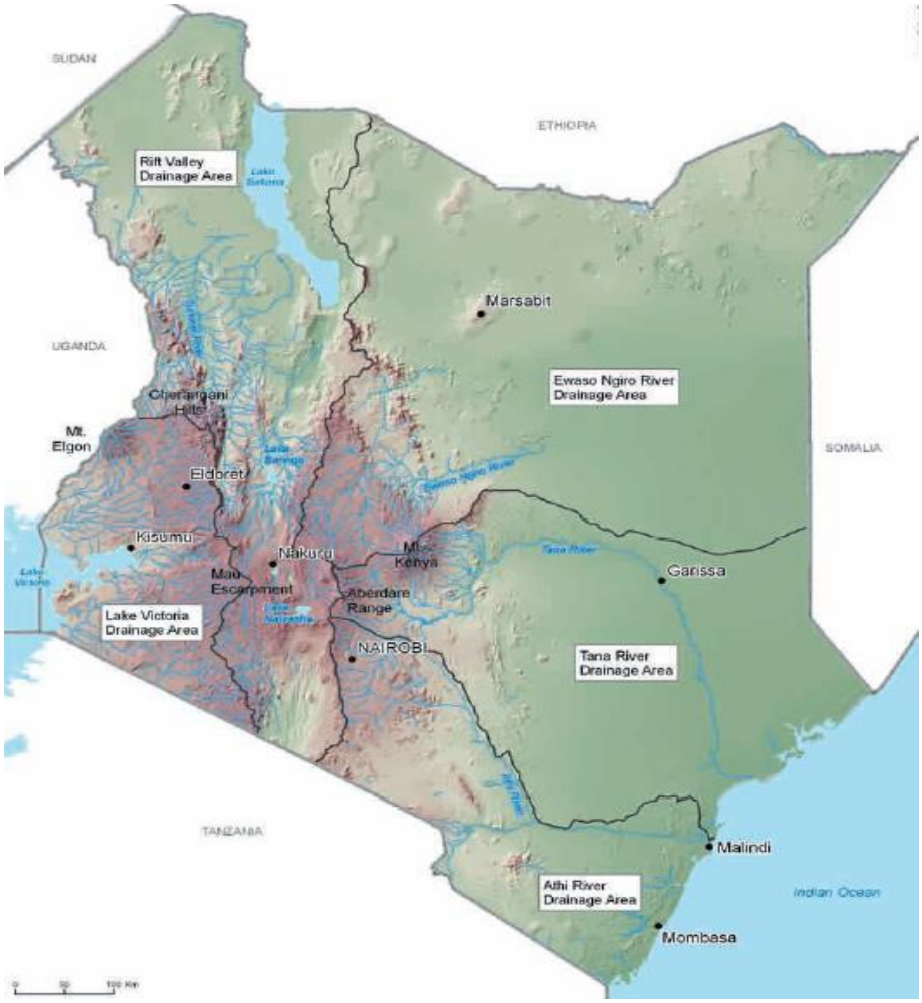
1. Hydropower is electricity generated using the energy of moving water. Rain or melted snow, usually originating in hills and mountains, create streams and rivers that eventually run to lakes, seas or oceans. This energy has been exploited for centuries. In the late 19thcentury, hydropower became a 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 a considerable hydropower potential estimated at - 6,000MW as at December, 2017 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 17.5MW 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 2017, the installed capacity of hydropower generation was 823.8MW equivalent to 35.3% of total installed capacity. It is estimated that the undeveloped hydroelectric power potential of economic significance is 1,630MW. 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 (329MW), Rift Valley (305MW), Athi River (60MW), Tana River (790MW) and Ewaso Ng'iro North River (146MW).
2. Beyond the existing schemes, Kenya still has substantial hydropower potential. This is reflected by current plans to develop large hydro projects in Karura and High Grand Falls (both in the Tana catchment area), Nandi Forest (in the Lake Victoria North catchment area) and Magwagwa (in the Lake Victoria South catchment area), and Arror (in the Rift Valley area). This development could lead to additional hydropower capacity of over 800 MW in the long term. There is a large pipeline of small hydropower projects under the Feed in Tariff (FiT) scheme. Feasibility studies of smaller hydropower projects are still on-going.

Figure 3.2 - The 5 Water Towers and Drainage Basins



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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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.	✓	✓	✓

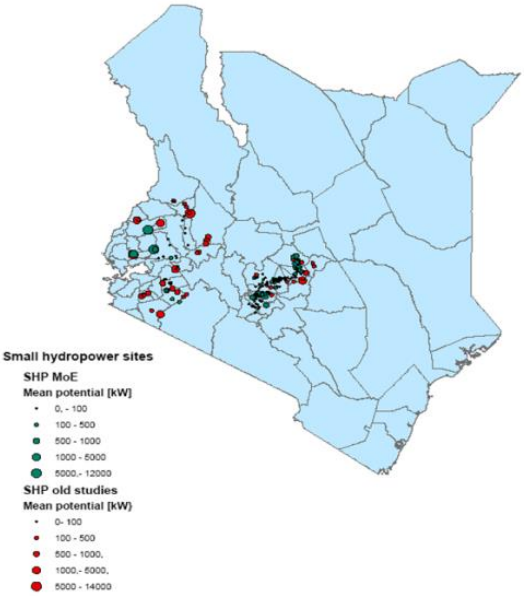
3.3.2 Small Hydros

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. Most of this potential is situated within the country's five main drainage basins. The implementation of some of these projects are undertaken by both the Government and private investors. As at the end of 2017 Government run schemes were a total of 11.7MW while those by private developers were about 5.81MW.
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 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 2017, only a few schemes had been developed as stand-alone systems or to feed to the national grid

4. By the end of 2017, 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 MoE (dots in green colour) as well as a summary compilation from various studies (dots in red colour). As can be seen, the potential for small hydropower sites is mainly located in counties that have high population density and high energy demand.

Figure 3.2: Small Hydropower Schemes



3.3.2.2 Challenges

Development of small hydros subsector has faced the following challenges:

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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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

3.4.1 Background

1. Biomass is organic matter that can be used to provide heat, make fuel and generate electricity. Wood-fuel, the largest source of biomass has been used to provide heat for thousands of years. Many other types of biomass are also used as an energy source such as plant residue from agriculture or forestry and the organic component of municipal and industrial wastes. Landfill gas is also considered a biomass source. Biomass resources can be replenished through afforestation programmes.
2. There is a gap between the existing tree cover vis-a-vis the minimum requirement of 10% prescribed by the Forest Conservation Management Act No. 34 of 2016. 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.

3.4.2 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.

3.4.3 Policies and Strategies

Biomass	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 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 MoE 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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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. As at June 2017, the installed capacity for solar energy was at 0.66 MW. By the year 2020, it is projected that the installed capacity of solar photovoltaic systems will reach 100MW generating 220 GWh annually.
4. The Government initiated a programme for electrification of institutions far from grid using solar PV systems. As at December 2017 solar PV systems had been installed in 4,685 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:

Table 3.0: Operational Solar/Wind Hybrid Generation Capacity

No.	Off-Grid Station Name	Existing Diesel Capacity (Kw)	Existing Solar Capacity (Kw)	Existing Wind Capacity (Kw)
1.	Mandera	2,000	350	0
2.	Kakuma	800	60	0
3.	Merti in Isiolo.	128	10	0
4.	Habaswein	360	30	50
5.	El Wak in Wajir	360	50	0
6.	Mfangano	520	11	0
7.	Rhamu (Mandera)	184	50	0
8.	Eldas	184	30	0
9.	Takaba	184	50	0
10.	Laisamis	184	80	0
11.	Lodwar	2,000	60	0
12.	Marsabit	2,000	0	0
TOTALS		**8,904**	**781**	**550**

6. There are also plans to develop 26 diesel/solar hybrid at various sites of the country with a capacity of 114kW.

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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 MoE developed a Wind Atlas in 2008 with indicative data.
3. To augment the information contained in the Wind Atlas, MoE with the assistance of Development Partners, 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

No.	Site	Average wind speed data
1.	Narumoru	5.39
2.	Maralal	5.67
3.	Malindi	7.78
4.	Ngong I	8.85
5.	Ngong III (50)	9.24
6.	Ngong III (80)	9.17
7.	Meru (Mugae)	7.71
8.	Meru (Kiremu)	6.82
9.	Meru (Mweromalia)	8.44
10.	New Marsabit	9.67
11.	Bubisa West	11.11
12.	Bubisa East	9.71
13.	Kerio Valley	5.55
14.	Kisumu	3.91
15.	Masono	3.41
16.	Kisii	5.06
17.	Narok	5.49
18.	Loitoktok	5.05
19.	Kinangop	7.02

Source: *KenGen, 2018*

7. The installed capacity of wind power connected to the grid as at June 2017 was 26.05MW. The 300MW Lake Turkana Wind power Plant was commissioned in 2017 and delivery of power to the grid expected in 2018. Other committed projects include 310MW at Ngong, Kipeto, Prunus, Bahari Wind, Ol Danyat and Chania Green. There are proposals for development of 820 MW of wind power at Marsabit, Meru, Ngong, Kinangop and Limuru,
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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 MoE 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.

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 2018-2022**	**Medium Term 2018-2026**	**Long Term 2018-2030**
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) for capacities not exceeding 50MW,10MW and 40MW respectively. A 1st and 2nd Revision were done in 2010 and 2012 respectively, revising the tariffs, including geothermal and grid connected solar technology and Standard PPA Initial submissions from potential investors pointed to generation tariffs higher than the FiTs due to increases in the cost of generation equipment and financing. However this trend has since changed with some technologies attracting lower tariffs. To benefit from the lower tariffs while simultaneously attract investors a review of the FiT tariffs is proposed to provide for the introduction of the renewable energy auctions where the industry determines the price for the project through competitive bidding. As at 2018 a number of investors had expressed interest to develop projects under the FiT policy, including:

   (a) 104 small hydropower projects with total capacity of 579.71MW.

   (b) 19 wind power projects with total capacity of 898.20MW.

   (c) 6 biomass/biogas energy projects with total capacity of 496.09MW.

   (d) Solar energy projects with a total capacity of 2,519.40MW.

   (e) Geothermal energy projects with a total capacity of 15MW.

4. 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 up to 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. Preference for certain renewable energy technologies and not others
5. Inadequate technical and financial capacity.
6. Current tariffs are not market reflective and do not cater for hybrid renewable energy systems.

3. 11.3 Policies and Strategies

Feed-in-Tariffs	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 and hybrid technologies.	✓	✓	✓

3.12 OTHER RENEWABLES

3.12.1 Background

1. Other renewable energy sources and technologies have not attracted considerable interest or commercialised. These include ocean energy, biomass gasification, bio-refinery technologies and concentrating solar power energy storage. Ocean energy possess a high potential 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, marine currents and ocean 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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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) Slow growth in load demand which is not commensurate with gradual increment in 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 2018-2022	Medium Term 2018-2024	Long Term 2018-2030
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.			
(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 2018.
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 2017, 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 2007 due to accelerated economic growth. Peak demand increased from 1,044MW in FY 2007/08 to 1,656MW in FY2016/17 while the number of electricity consumers more than trebled from 1,060,383 in FY 2007/08 to 6,182,292 by June 2017 as detailed in Table 4.2.
2. Peak demand is projected to grow from 1,812MW as at July 2018 to 2,421 MW by 2022 and to 2,989, MW by 2025 and 4,244MW by 2030. To meet this demand, an additional 5,000 MW of new generation is to be developed to bring total installed capacity to at least 6,652MW by 2024. Annual energy consumption is projected to increase from 8,272GWh in 2016/17 to 14,334GWh in 2021/22.
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 2017,73.5% of the population was connected to electricity compared to only 15% at 30th June 2004. The national electricity distribution network as at 2016/17 was1,212km of 66kV lines, 30,846km of 33kV lines and 37,234km of 11kV. The existing medium voltage (66kV,33 kV and 11 kV) distribution lines cover areas in which about 63% of Kenya's population of 40 million live.

Table 4.2 Demand and Consumer Statistics

Financial Year	Energy Generated (GWh)	Energy Sold (GWh)	Peak Demand (MW)	Number of Consumers
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
2014/15	9,280	7,655	1,512	3,611,904
2015/16	9,817	7,912	1,586	4,890,373
2016/17	10,205	8,272	1,656	6,182,282

***Source**: KPLC Annual Report and Financial Statements, 2017*

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 2,336MW as at June 2017. 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 2017, 78.79% of the electrical energy was generated using renewable energy sources while 21.21 % 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 (June 2017)		Annual Generation (FY 2016/17)	
		(MW)	Percentage	(GWHrs)	Percentage
Renewable Energy	**Hydro**	823.8	35.3%	3,340.9	32.74%
	Geothermal	652.00	28%	4,451.0	43.62%
	Wind	26.05	1.1%	63.2	0.62%
	Biomass	28.00	1.2%	0.7	0.01%
	Solar	0.66	0.02%	0.5	0.01%
	Imports	-	-	184.0	1.80%
	Total	**1,530.51**	**65.6%**	**8,040.79**	**78.79%**
Fossil Fuels	**MSD**	716.32	30.7%	2,015.55	19.75%
	Gas Turbines	60	2.6%	108.2	1.06%
	HSD (Isolated Stations)	26.24	1.1%	40.8	0.40%
	Emergency Power Plant	0	0	0.0	0.00%
	Total	**802.56**	**34.4%**	**2,164.06**	**21.21%**
Installed Capacity and Units Generated		**2,333.07MW**		**10,204.85 GWhrs**	

Source: KPLC 2017 Annual Report

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 6,652 MW by 2024 has been proposed and is being implemented. Through this plan the Government will in the medium to long term commit itself to development of technologies that result to least cost based on technology of screening curves. The screening curves take into account the elements of capacity factor, capital and discount rates. As at December, 2017, the installed capacity had reached 2,336 MW.
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. Table 4.4 below show the new generation capacity additions and cumulative installed capacities for the period of 2017-2024.

Table 4.4 – New Generation Capacity Additions in MW for the period 2017 to 2024

TECHNOLOGY	CUMULATIVE INSTALLED CAPACITY (MW)							
	2017	2018	2019	2020	2021	2022	2023	2024
HYDRO	823.80	-	-	-	-	-	89.00	-
THERMAL	742.56	-	-	-	-	-	-	-
GEOTHERMAL	652.00	10.00	225.00	207.00	47.00	261.00	245.00	410.00
GASOIL	60.00	-						
WIND	26.05	100.00	200.00	100.00	110.00	191.00	40.00	100.00
SOLAR	0.66	0.25	92.00	170.00	110.00	90.00	110.00	131.00
COAL	-	-						981.00
IMPORTS	-	-	400.00	-	-	-	-	-
CO-GENERATION	28.00	-	-	-	-	-	-	-
TOTAL	2,333.07	110.25	917.00	477.00	267.00	542.00	484.00	1,622.00
CUMULATIVE TOTAL	**2,333.07**	**2,443.32**	**3,360.32**	**3,837.32**	**4,104.32**	**4,646.32**	**5,130.32**	**6,752.32**

Source: LCPDP 2017

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 period between 2017-2024 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 34.4% of installed capacity and its contribution to the actual energy mix as at June 2017 was approximately 21.21%. The installed thermal capacity is 802.56MW.
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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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.	✓	✓	✓
9. Enforce compliance for pollution prevention in thermal power plants.	✓	✓	✓

4.4.7 Nuclear Energy - Electricity Generation

4.4.7.1 Background

1. The uptake of nuclear power has been growing over time across the world. Various countries without existing nuclear power plants in their energy mix have expressed interest in investing in nuclear electricity generation, while developed countries with existing nuclear plants have been expanding their capacities. All over the world, as of June 2017, there were 451 nuclear power plants in operation and 55 under construction and 230 are in the planning stage as detailed in Table 10.3**.**
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 Ministry of Energy. In November 2012, the Kenya Nuclear Electricity Board was established vide Legal Notice 131 of 2012 effectively becoming the successor to NEPC to fast track the development of generation of electricity using nuclear energy.

4. Nuclear energy across the world elicits varied reactions in relation to plant safety, management or radioactive waste management and proliferation concerns in the wake of heightened nuclear incidents. It is important to note that the international nuclear industry through comprehensive R D&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 by long and safe operation of nuclear power plants. In fact, the International Atomic Energy Agency (IAEA) was awarded the prestigious Nobel Peace Prize in 2005 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 2027. Additional units of 1,000MW each are expected to be commissioned in 2030, 2033, and 2035. 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 generating electricity.
2. It is a clean non- pollutant way to generate electricity as it does not produce any GHG emissions.
3. Uranium which is the fuel used in nuclear power plants 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 330,000m², solar 33,000,000m² and wind 165,000,000m².

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.
6. Negative public perceptions on nuclear power plants.

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 2018-2022**	**Medium Term 2018-2026**	**Long Term 2018-2030**
1. Transform the Kenya Nuclear Electricity Board to the Nuclear Power and Energy Agency under statute, mandated to, *inter alia*, 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.	✓	✓	

Nuclear Power Generation	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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.	✓	✓	
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 2027 and 4,000MW by 2035.		✓	✓
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. Kenya's existing transmission network comprises of 4,766 circuit km at 132 kV and above voltage levels as at June 2017. This comprises of 585 km of 400kV lines, 374.59 km of 220 kV lines and 839.11 km of 132 kV lines.
2. As at 30th June 2017, Kenya has Thirty-eight (38) generation substations with a generation capacity of 10,204.85GWh and transmission substations with a capacity of 4,787 MVA.
3. The existing transmission system capacity is severely constrained particularly during peak hours. The problem is partly due to inadequate reactive power in major load centres and also transmission constraints particularly in the Western and Nairobi regions.

4. One of the recommendations under Sessional Paper No. 4 of 2004 on Energy 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. KETRACO is currently undertaking new transmission projects aimed at developing a robust grid system to:-
   (a) Enable evacuation of electric power from various generation plants and injecting it to the national grid.
   (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. The LCPDP of 2018 has identified 10,000 km transmission line as priority projects for implementation. These projects include 2,650km of 132kV lines, 2,700km of 220kV lines, 2,000km 400kV lines and 612km of 500kV HVDC lines. The projects fall into four broad categories based on their specific objectives, namely:

   (a) **System strengthening projects**

   These Projects will improve capacity to transfer electrical energy and address the challenge of low voltages, high transmission losses, unreliability of supply and network security.

   (b) **Power evacuation projects**

   The projects target evacuation of power from various generation plants for injection into the national grid.

   (c) **Regional interconnectors**

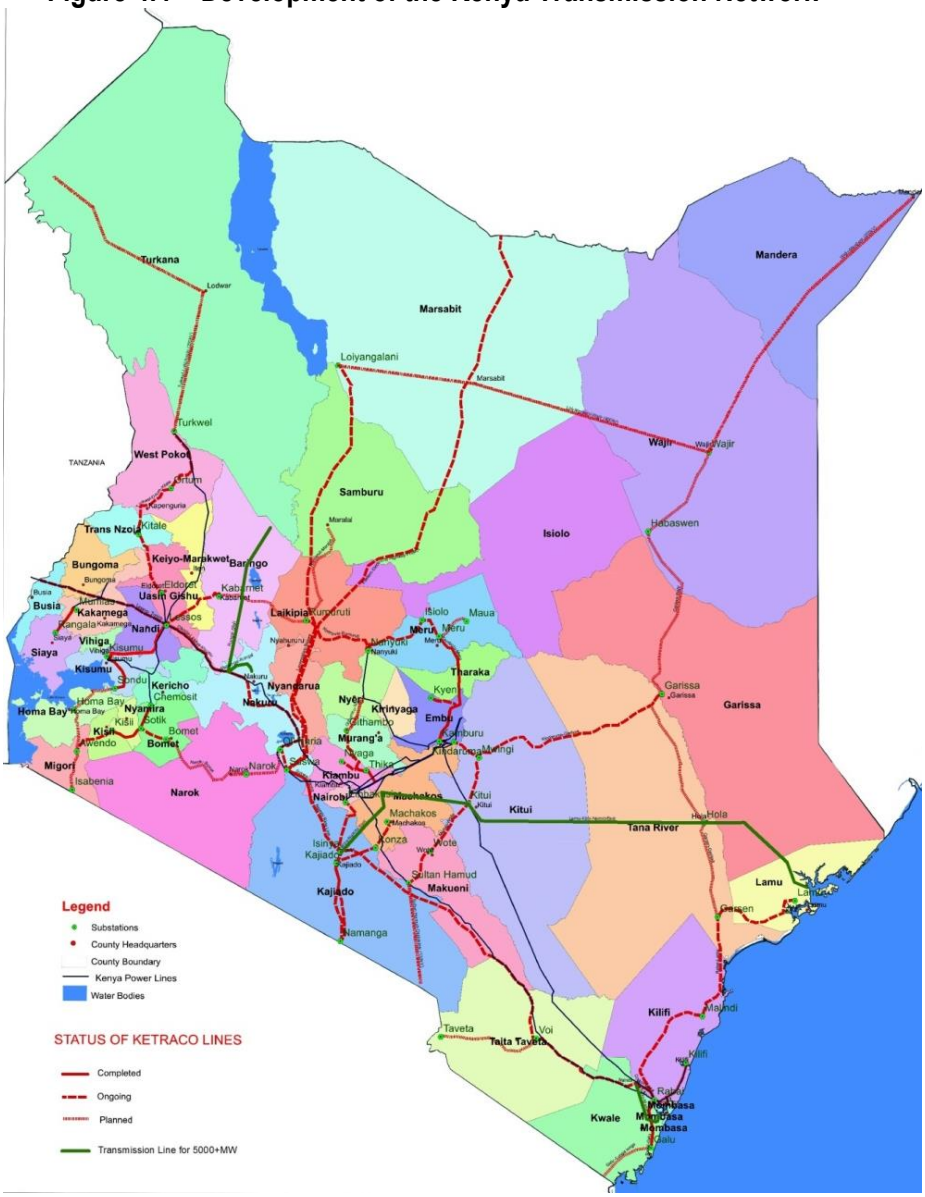
   The Government has entered into partnerships through which regional power integration is being spearheaded in order to facilitate regional trade.

(d) **Electricity access projects**

The projects in this category fall under the Energy Scale - Up Programme and their main objective is to increase electricity access and address the challenges of access and low connectivity.

4. It is projected that by 2031 16,000 km of transmission lines and associated substations will have been constructed. Figure 4.4 shows the development of the Kenya transmission network as at June 2017.

Figure 4.4 – Development of the Kenya Transmission Network



5. 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 4.5.

Table 4.5 - Imports and Exports of Electrical Energy

Year ended 30th June	Kenya – Uganda (kWhs)		Kenya – Tanzania (kWhs)		Kenya – Ethiopia (kWhs)	
	Imports	Exports	Imports	Exports	Imports	Exports
2008	24,665,248	46,359,936	1,036,864	n/a	n/a	n/a
2009	28,570,508	26,557,446	1,220,868	n/a	n/a	n/a
2010	37,135,529	26,291,418	1,101,026	526,740	n/a	n/a
2011	29,946,605	30,265,350	860,527	838,800	n/a	n/a
2012	35,805,150	41,214,150	1,080,674	1,097,820	n/a	n/a
2013	41,000,000	30,000,000	1,200,000	1,000,000	n/a	n/a
2014	83,000,000	37,000,000	1,300,000	2,000,000	2,100,000	n/a
2015	76,000,000	38,000,000	600,000	2,000,000	2,800,000	n/a
2016	65,000,000	43,000,000	n/a	2,000,000	2,600,000	n/a
2017	180,000,000	20,000,000	n/a	2,000,000	3,400,000	n/a

Source: KPLC Report 2016/17

6. 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 4.6 details planned regional inter-connectors.

Table 4.6 – Planned Regional Inter-connectors

No	Transmission Line	Distance (km)	Voltage	Capacity (MW)	Status as at Dec 2014
1.	Lessos (Kenya) –Tororo (Uganda)	132.5	400 kV	250	In progress
2.	Eastern Africa Electricity Highway	686	500kV HVDC	2000	In progress
3.	Kenya – Tanzania	97	400kV	1,300	In progress

Source: KETRACO, 2017

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 and inadequate 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 process.
7. Encroachment of the wayleaves trace.
8. Limited private sector participation in development and operation of transmission infrastructure.
9. Inadequate policy, legal and institutional framework for the operationalization of the independent system operator.
10. Undeveloped legal, regulatory and institutional framework for a competitive wholesale electric power market

4.5.5 Policies and Strategies

Electric Power Transmission	**Short Term 2018-2022**	**Medium Term 2018-2026**	**Long Term 2018-2030**
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.	✓	✓	✓
5. Allocate sufficient funding to implement the power transmission master plan.	✓	✓	✓

Electric Power Transmission	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 2018, 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 2017, just about 73.5% 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 4.7.

Table 4.7 - Power System Statistics

Financial Year	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
UNITS PURCHASED (GWh)	6,692	7,303	7,670	8,087	8,840	9,280	9,870	10,205
UNITS SOLD (GWh)	5,624	6,123	6,341	6,581	7,244	7,655	7,912	8,272
System Losses(GWh)	1,068	1,180	1,329	1,507	1,596	1,624	1,905	1,933
Losses as % of Energy Purchased	16.00	16.20	17.30	18.60	18.1	17.5	19.4	18.9
Average Unit Yield Sold (cents)	1,368.88	1,257.81	1,596.71	1,437.74	1,552.45	1,497.38	1,467.50	1,564.63
System Loss in Billion KShs	14.62	14.84	21.22	21.67	23.10	2433	28.73	30.24
Incremental Loss Reduction (%)	0.30	-0.20	-1.10	-1.30	0.5	0.50	-2.3	0.9

Source: *KPLC Annual Report 2016/2017*

4.6.2 Distribution System

1. As at 30th June 2017, the distribution system comprised of 1,212 km of 66 kV lines, 30,846 km of 33 kV lines, 37,234 km of 11kV lines and low voltage lines, primary distribution substations with transformation capacity of 4,416MVA and distribution transformers with total capacity of 7,276MVA.
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 while safeguarding the existing obligations.

4.6.3 Rural Electrification

1. The Rural Electrification Schemes Programme (the Programme) was initiated in 1973 with the objective of providing electricity supply to areas considered economically unviable by the distribution licensee. The Programme 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 to be the lead agency under the Programme. The mandate of REA includes accelerating the pace of rural electrification by managing the Rural Electrification Programme Fund (REP Fund), developing rural electrification master plans, mobilizing resources for rural electrification as well as promoting the development and use of renewable energy.
2. By June 2016, 88,581 public facilities in the country out of which 60,617 were electrified (68.4%) under the Programme and 27,964 were un-electrified (31.6%). The un-electrified public facilities will be electrified through the grid extension and renewable energy options such as installation of solar PV systems in the off grid areas. There has been accelerated connectivity of rural customers which have increased from 133,047 in 2007 to 1,269,510 in 2017.
3. The cumulative capital expenditure since inception of the Programme is at Kshs. 96 billion as at June 2017. The units of electricity sold under the rural electrification schemes customers increased by 12 million kWh (an increase of 2.2%) from 537million kWh in 2015/16 to 549 million kWh in 2016/17.
4. Towards the promotion of renewable energy, the Government through REA is presently implementing a 54MW solar power plant project situated in Garissa County and plant is to be commissioned in 2018. In addition, REA is implementing 25No. Solar PV/Diesel Hybrid Mini Grid power projects at various sites country wide. The projects are expected to be commissioned in 2018.

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 on the cost of production. Electricity consumers continue to demand more reliability and better quality of service commensurate with the tariffs they pay, though 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. Towards socio-economic transformation of the country, the Government has set a target of universal access to electricity by 2020. Electricity access is a critical element that is necessary in a country's economic growth. It 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 2017, 73.5% 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. Consequently the Government is currently implementing the Last Mile Connectivity Project funded by exchequer and Donors.

3. Going by the current pace at which connections are being effected, particularly by the achievement of 73.5% access to electricity by 2017. The country is on course to achieve universal access by 2020. This would not have been 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 homes in rural areas.
13. High costs of rural electrification projects.
14. Lack of adherence to technical standards.
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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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.	✓	✓	✓

Electric Power Distribution	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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.	✓	✓	✓
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.			

Electric Power Distribution	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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.	✓	✓	✓
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 2017, the total unit sales which include all connected customers (6,182,282) were 8,272 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. Delayed implementation of power generation projects from 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.

4.8.2 Policies and Strategies – Electricity Cross Cutting Issues

Electricity - Cross Cutting Issues	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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, facilitate 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 MoE and the Kenya Association of Manufacturers signed a Memorandum of Agreement to establish a Centre for Energy Efficiency and Conservation (CEEC). The CEEC picked-up from 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. Further to this, the Energy Management Regulations were enacted in 2012 by

ERC. The total energy audits undertaken on behalf of the MoE under the Regulations are 975 indicating a saving potential of KShs. 9.8 billion and 389,690MWh 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.

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.	✓	✓	✓

Energy Efficiency and Conservation	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
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 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 value chain. Energy generation, transmission and use pose various dangers to human life and the environment. The challenge for players in the energy sector is the provision of affordable, competitive, reliable and sustainable energy whilst upholding people's rights to land, environment, health and safety
3. The Environmental Management and Co-ordination Act, No. 8 of 1999 (EMCA, 1999) is the umbrella legal framework in respect to environmental management in Kenya. Its implementing agency is the National Environmental Management Authority (NEMA). It recognises a "Lead Agency" as any Government institution in which any law vests functions of control or management of any element of the environment or natural resource. Lead Agencies therefore play an important role in enforcing compliance with environmental 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 "*inter alia*… 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. A Strategic Environmental Assessment is 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 projects. Comprehensive environmental impact assessments are conducted for all projects prior to their implementation to ascertain the level of potential environmental damage, the required mitigation measures and associated costs.
6. Other authorities that have regulatory mandate in the energy sector in terms of environment, health and safety are the Directorate of Occupational Safety and Health Services (DOSHS) under the Occupational Safety and Health Act of 2007, Water Resources Management Authority (WRMA) under the Water Act of 2002 and the Kenya Maritime Authority (KMA) under the Merchant Shipping Act & Kenya Maritime Authority Act of 2006.
7. Vision 2030 acknowledges that land is a vital factor of production in the economy together with its aesthetic, cultural and traditional values. Some key initiatives envisioned to address environmental problems which relate to the energy sector are:
   (a) Sustainable management of natural resources.
   (b) Pollution and waste management.
   (c) Disaster risk management.
   (d) Use of incentives for environmental compliance.

8. The Constitution provides for protection of the right to property. Energy sector players, to whom land access and utilization is critical in their operations, must be alive to this fact. In addition, Article 42 of the Constitution provides for every person's right to a clean and healthy environment. The Constitution also 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 sector, amongst them construction of generation, transmission and distribution infrastructure, disposal of hazardous waste, handling and management of radioactive materials. Several multilateral environmental agreements/treaties have been developed globally with Kenya ratifying and domesticating a number of them. The Constitution provides that any treaty or convention ratified by Kenya forms part of the Laws of Kenya. It is necessary to develop guidelines to ensure the application and compliance of the relevant conventions in the energy sector.

6.2 SUPPLY SIDE ENVIRONMENTAL CONCERNS

6.2.1 Coal Midstream

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 of, 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 for 2017 from ERC indicates that there has been 134 accidents/incidents out of which 88 were fatalities and 59 were personal injuries related to electrical accidents.

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.

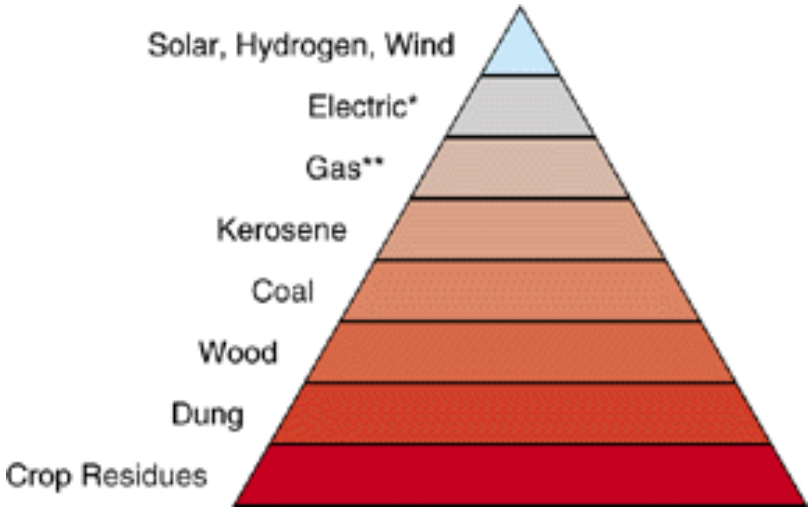


Figure: 6.1 - The Energy Pyramid[1] - Efficiency of Solid Fuel compared to other fuels

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. As at 2017 Biomass contribution to Kenya's final energy demand is at 69%.

3. Kerosene is widely used in households for lighting and cooking. In 2017 about 448 thousand cubic metres were used, up from 372 thousand cubic metres consumed in 2016. 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 like LPG or natural gas and electricity.

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).

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	6.80	0.13	12,833.25	2.28	15.53	0.30
	UK	2.78	0.07	508.23	2.16	5.99	0.15
	Norway	5.71	0.06	23403	1.24	7.07	0.08
	France	3.71	0.09	7043	1.18	4.37	0.10

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

MDC	China	2.17	0.33	4047	3.04	6.59	1.01
	India	0.65	0.37	859	2.43	1.58	0.90
	Malaysia	2.83	0.26	4656	2.36	15.47	0.14
	Indonesia	0.87	0.23	823	1.96	1.72	0.45
Africa MDC/ LDC	South Africa	2.58	0.34	4148	3.01	7.17	1.02
	Egypt	0.87	0.32	1254	2.50	2.17	1.80
	Ghana	0.35	1.21	320	1.45	0.51	0.30
	Kenya	0.55	1.48	169	0.56	0.31	0.27

- ✓ 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. Kenya also ratified the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) on 28th December 2016. Climate change action in Kenya is guided by the Climate Change Act of 2016 and the National Climate Change Action Plan (NCCAP) 2018-2022. Kenya, in its Nationally Determined Contributions (NDCs) submitted to the UNFCCC in 2016, undertook to abate greenhouse gas emissions by 30% (140MtCO2e) by 2030.
3. The NDC Sector Analysis Report 2018 examined the energy sector and identified the prioritized actions and their mitigation potential as shown in Table 6.2 below.

Table 6.2: Energy Sector Prioritized Mitigation Action

Sector/Sub-sector	**Energy Sector Prioritized Mitigation Action**	**Emission Reduction (tCO_2e)**	
		Action up to 2022	**Action up to 2030**
Energy Supply/ Electricity Generation	Developing new 2405 MW of grid-connected renewable electricity generating and retirement of three thermal plants by 2022.	9.2	9.2
Energy demand side	Develop and distribute 4 million improved biomass stoves by 2022.	6.3	6.3
	Develop and distribute 1 million clean energy (LPG, biogas and ethanol) stoves by 2022	0.8	0.8
Total sector emission reduction potential of the prioritized actions		**16.3**	**16.3**

4. 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 6.3 shows projects developed and submitted for consideration under CDM.

Table 6.3 - 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	171.026
Conversion of the Kipevu Open Cycle Gas Turbine to Combined Cycle Operation	Development Carbon Fund (World Bank)	KenGen	44.808
Redevelopment of Tana Hydro Power Station	Development Carbon Fund (World Bank)	KenGen	42,258
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	

Source: *NEMA 2017, Climate Change and CDM in Kenya*

5. 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.

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 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 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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 infrastructure.	✓	✓	✓
6. Develop and enforce a legal and regulatory framework on encroachment and trespass on energy infrastructure.	✓	✓	✓
7. Develop and implement a national Resettlement Action Plan Framework for energy 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 sector.	✓	✓	✓
4. Enforce compliance with business and operating standards.	✓	✓	✓
5. Develop mechanism and strategies to empower consumers to convert to modern clean energy 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 sector.	✓	✓	✓
7. Mainstream ecosystem and biodiversity management in energy sector.	✓	✓	✓
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	✓	✓	✓

Environment, Health and Safety	Short Term 2015-2019	Medium Term 2015-2024	Long Term 2015-2030
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 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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
1. Support the development and implementation of the national policy on climate change	✓	✓	✓
2. Facilitate capacity building for participation in international climate change negotiations.	✓	✓	✓

Climate Change Mitigation	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
1. Establish a Disaster Preparedness, Prevention and Management (DPPM) Unit to spearhead response to accidents and disasters in the energy 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 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.	✓	✓	✓

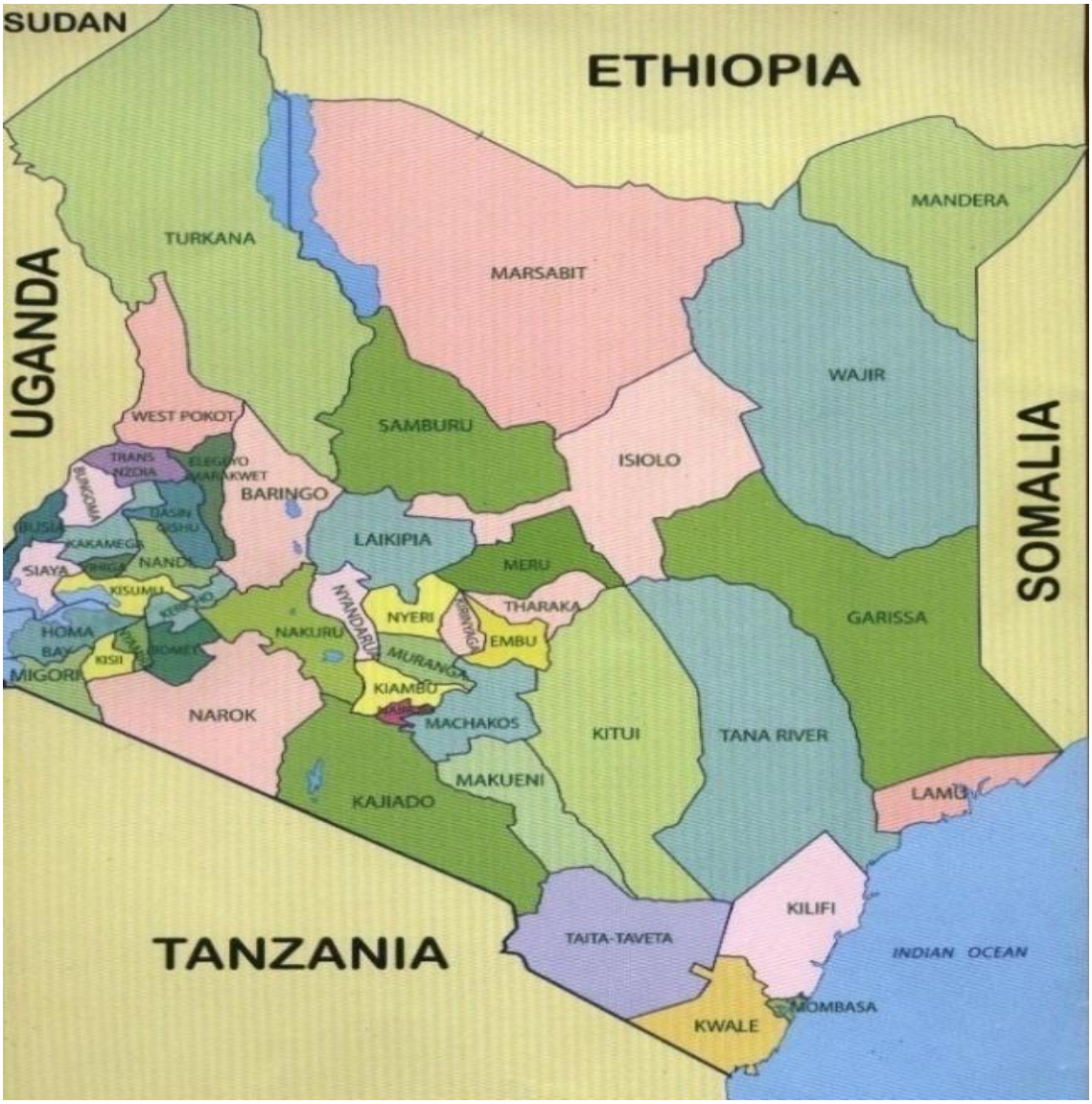
7.0 – DEVOLUTION AND PROVISION OF ENERGY SERVICES

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

Figure 7.1 – Kenya and its 47 Counties



3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

8. 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 tw**o 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 Policy.
b)	Preparation of Integrated National Energy Plan, incorporating, 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 importation, transportation, storage of coal for the purposes of electricity generation.
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 sector.
k)	Prosecution of offences created under the Energy Act
l)	Certification of electrical workers and contractors, solar system installation technicians and contractors.

3. Energy Operations and Development

a)	Generation importation and exportation, of coal, geothermal and other energy based natural resources.
b)	Transportation and storage of coal.
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) Providing security for energy infrastructure including 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 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 coal products.

b) Regulation and licensing of biomass and charcoal producers, transporters and distributers.

c) 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) Collect and maintain energy data.

d) Implementation of county electrification projects.

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

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

g) Security of energy infrastructure including power plants, control centres, electric supply lines and substations.

8.0 – ENERGY FINANCING, PRICING AND SOCIO-ECONOMIC ISSUES

8.1. BACKGROUND

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

8.2. CHALLENGES

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

8.3. POLICIES AND STRATEGIES

Energy Financing	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
1. Explore and adopt all viable financing options from local and international sources to ensure cost effective utilization of all locally available energy resources.	✓	✓	✓
2. Create a competitive and predictable investment climate in the country to attract investments in the energy sector.	✓	✓	✓
3. Provide adequate fiscal incentives for energy resource and infrastructure development.	✓	✓	✓
(a) to attract investment in energy 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.	✓	✓	✓
5. Dedicate not less than two percent of the income from energy sector to support training, research, development and demonstration.	✓	✓	✓

Energy Financing	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
6. Ensure a reasonable return on investments through cost-reflective pricing.	✓	✓	✓
7. Develop adequate infrastructural facilities to enterprises involved in the development of the energy sector.	✓	✓	✓
8. Liaise with the National Treasury to enhance the internationalization of Kenya's Capital Market by encouraging financial instruments and stocks of Kenya's energy corporate units to be quoted in international financial markets to attract foreign portfolio investment capital.	✓	✓	✓
9. Expand the scope of venture capital financing to include investments in the energy sector.	✓	✓	✓
10. Review the relevant legislations to provide fiscal incentives in the energy sector.	✓	✓	✓
11. Provide letters of comfort to private investors and letters of guarantee to state corporations.	✓	✓	✓
12. Continuously engage development partners to establish financial facilities for financing energy related projects at minimal interest rates especially for renewable energy and energy efficiency projects.	✓	✓	✓
13. Seek financing of clean energy projects through carbon credits under clean development mechanism and other financing associated with clean energy.	✓	✓	✓
14. Package attractive investment instruments which will be appealing to alternative investors such as savings and co-operative societies, pension schemes and venture capitalists.	✓	✓	✓
15. 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 resource or infrastructure projects, including development of infrastructure for strategic petroleum reserves and power generation projects.	✓	✓	✓
16. 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 Energy Institute.
   (b) Operations of the Energy Efficiency and Conservation Agency.
   (c) Assist in energy sector environmental disaster mitigation, response and recovery.

(d) Hydro risk mitigation during times of prolonged drought.

(e) Water towers conservation programmes.

(f) Promotion of renewable energy initiatives, including pre-feasibility studies.

(g) Decommissioning of energy infrastructure.

(h) A mechanism for price stabilization.

2. Sources of money for this fund will include:

(a) Penalties and fines relating to offences in the energy sector as levied by ERC and the Energy Tribunal.

(b) Contribution from energy 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 PRICING AND SOCIO-ECONOMIC ISSUES

8.5.1 Energy Pricing

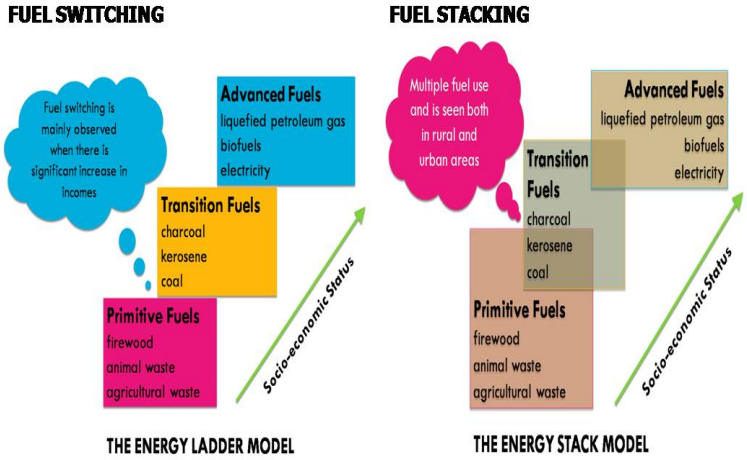
Electricity

1. Electricity pricing is based on the principles of Long Run Marginal Cost (LRMC) of supply. The end-user-tariff incorporates all prudent costs in the value chain and a fair return to the investors. The bulk tariffs are negotiated between producers and the off-taker, however, the Power Purchase Agreement is subject to approval by the Commission. The retail tariffs are regulated by the Commission and may be subject to review at least every three years.
2. Fuel costs and exchange rates gains/losses are pass-through costs in the current regime. These account for power cost variations in the event of fluctuation in the international crude oil prices as well as volatility for the Kenya shilling against foreign currencies, mainly the US dollar.
3. Other 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.

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 the energy ladder, provides 60% of cooking energy needs in Kenya.
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.

8.5.4 Policies and Strategies

Energy Pricing and Socio-economic issues	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 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 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 sector.	✓	✓	✓
6. Develop a framework to ensure local communities benefit from energy 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 sector.
3. Overlap of roles and functions of institutions in the energy sector.
4. Lack of benefits sharing mechanisms and uncoordinated management of energy 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 sector.

9.1.3 Policies and Strategies

Legal and Regulatory Framework	**Short Term 2018-2022**	**Medium Term 2018-2026**	**Long Term 2018-2030**
1. Review and align the energy 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 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 sector under Article 2(5) of the Constitution are complied with.	✓	✓	✓
(c) All ratified treaties and international conventions affecting the energy 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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
(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 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 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 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 resources.	✓	✓	✓
9. Support and encourage community policing initiatives to curb vandalism of energy infrastructure.	✓	✓	✓
10. Ban scrap metal trade to deter vandalism.	✓	✓	✓
11. Retain ownership and control of strategic energy 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 PLANNING

9.2.1 Background

1. Sessional Paper No 4 of 2004 identified the need to integrate energy planning with the national economic, social and environmental policies, as energy 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 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 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 Planning	**Short Term 2018-2022**	**Medium Term 2018-2026**	**Long Term 2018-2030**
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 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 projects.	✓	✓	✓
6. Develop systems that ensure security and reliability in provision of energy services products.	✓	✓	✓
7. Ensure implementation of the integrated energy master plan.	✓	✓	✓
8. Ensure that all projects under the integrated energy master plan are implemented through competitive bidding processes.	✓	✓	✓
9. Government may implement strategic energy projects through State Corporations or PPP arrangements where necessary.	✓	✓	✓

9.3 RESEARCH AND HUMAN RESOURCE DEVELOPMENT

9.3.1 Background

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

9.3.2 Challenges

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

9.3.3 Policies and Strategies

Research and Development	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
1. Establish a Energy Institute to undertake training, research, development, dissemination, nurture talent, innovation and to enhance capacity building in the sector.	✓	✓	✓
2. Encourage energy 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 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 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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
1. The Government shall comply with Article 27(8) of the Constitution.	✓	✓	✓
2. Mainstream gender, youth and persons with special needs issues in energy 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 sector programmes and projects.

9.5.2. Challenges

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

9.5.3 Policies and Strategies

Policy Implementation, Monitoring and Evaluation	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
1. Enhance the capacity of the central planning unit at the ministry to collect, maintain and disseminate energy data.	✓	✓	✓
2. Ensure that the energy data is disseminated through the website of the ministry on a quarterly basis.	✓	✓	✓

9.7 SHARING OF BENEFITS FROM ENERGY 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 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 resources with the local communities.

9.7.3 Policies and Strategies

Sharing of Benefits from Energy Resources	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
1. The Government shall develop and implement a legislative framework to ensure equitable sharing of benefits accruing from the exploitation of energy 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 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 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 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 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 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
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 sectors.	✓	✓	✓
3. Establish capacity building programmes in conjunction with local industry associations, local training institutions and international institutions.	✓	✓	✓

Local Content	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
4. The government to develop and implement legislation for energy 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 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 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 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 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 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 sector.

9.9.3 Policies and Strategies

Community engagements, expectations and conflicts	Short Term 2018-2022	Medium Term 2018-2026	Long Term 2018-2030
1. The government shall develop and implement a legislative framework for pro-active and sustained engagement with the governments, investors and communities in energy 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 resources.	✓	✓	✓
5. The government to develop and implement a monitoring and evaluation mechanism on regular reporting on stakeholders consultations.	✓	✓	✓

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*

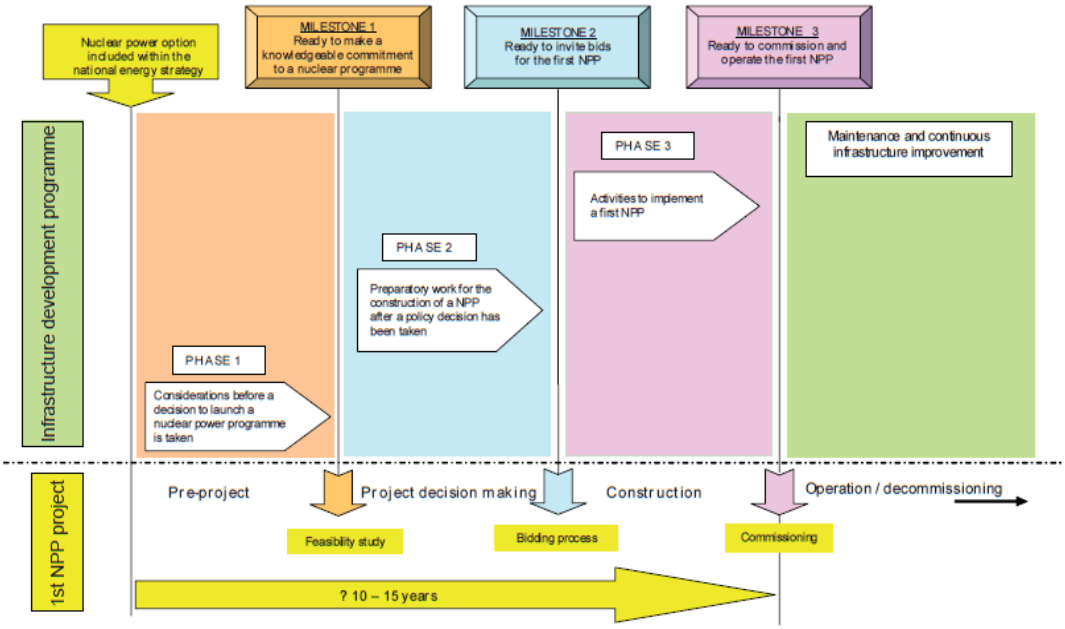
Table 10.3 Nuclear electricity generation figures around the world

Country	In Operation		Nuclear Share in Electricity Production	Under Construction	
	Number	*Electricity Generation (MW)*	*Percentage %*	*Number*	*Expected Elec. Output (MW)*
Argentina	3	1635	5.9	1	25
Armenia	1	375	39.4	-	-
Belgium	7	5,918	51.1	-	-
Brazil	2	1,884	3.1	1	1340
Bulgaria	2	1,926	33.1	2	1,906
Canada	19	13554	15.1	-	-
China					
• Mainland	44	40614	1.8	13	27,230
• Taiwan	6	4,982	19.3	2	2,600
Czech Republic	6	3,930	38.3	-	-
Finland	4	2,769	28.4	1	1,600
France	58	63,130	74.1	1	1,630
Germany	7	20,339	28.4	-	-
Hungary	4	1, 889	42.1	-	-
India	22	6255	2.9	7	4824
Japan	42	3975222494	29.2	2	2,653
Korea Republic	24	1,552	32.2	4	5,360
Mexico	2	482	3.6	-	-
Netherlands	1	1318	3.4	-	-
Pakistan	5	1,300	2.6	2	2028
Romania	2	28264	19.5	-	-
Russia	37	1,814	17.1	6	4573
Slovakian Republic	4	688	51.8	2	880
Slovenia	1	1,860	37.3	-	-
South Africa	2	7,121	5.2	-	-
Spain	7	8612	20.1	-	-
Sweden	8	3,333	38.1	-	-
Switzerland	5	13,107	38.0	-	-
Ukraine	15	8918	48.1	2	2070
United Kingdom	15	99333	15.7	-	-
USA	98		19.6	2	2234
TOTAL	**451**	**365,837**	**14.1**		**55,859**

Source: Table collated from IAEA database, July 2017

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
CBE	Cross Border Electrification
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 Limited
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 Limited
KETRACO	Kenya Electricity Transmission Company Limited
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
KPLC	Kenya Power and Lighting Company 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
MMBTU	Million British Thermal Units
MMCFD	Million Cubic Feet per Day
MoE	Ministry of Energy
MoU	Memorandum of Understanding
MSD	Medium Speed Diesel
MTPA	Million Tonnes Per Annum
MW	Mega Watt
MWe	Megawatt Electric
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organization
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.