

REPUBLIC OF KENYA



Ministry of Energy & Petroleum

NATIONAL NUCLEAR POLICY FINAL REPORT

APRIL- 2024

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ACRONYMS AND ABBREVIATIONS

ASALs	Arid and Semi-Arid Lands
CSA	Comprehensive Safeguards Agreement
CPF	Country Programme Framework
CR WPF	Central Radioactive Waste Processing Facility
EPRA	Energy and Petroleum Regulatory Authority
HRD	Human Resource Development
IAEA	International Atomic Energy Agency
INST –UON	Institute for Nuclear Science and Technology – University of Nairobi
KARI	Kenya Agricultural Research Institute
KEBS	Kenya Bureau of Standards
KEMRI	Kenya Medical Research Institute
KNH	Kenya National Hospital
LCPDP	Least Cost Power Development Plan
MTRH	Moi Teaching and Referral Hospital
NCCP	National Cancer Control and Prevention Plan
NDT	Non-Destructive Testing
NEMA	National Environment Management Authority
NEPIO	Nuclear Energy Programme Implementation Organization
NESC	The National Economic and Social Council
NHSSP	National Health Sector Strategic Plan
NPP	Nuclear Power Plant
NPT	Treaty on Non-Proliferation of Nuclear Weapons
NSG	Nuclear Suppliers Group
NST	Nuclear Science and Technology
NuPEA	Nuclear Power and Energy Agency
R&D	Research and Development
	Social Development Goals

SDGs	Sterile Insect Technique
SIT	Small Quantities Protocol
SQP	State System of Accounting and for Control of Nuclear Material
SSAC	Science, Technology, Engineering and Mathematics
STEM	Technical Cooperation
TC	Training Need Assessment
TNA	

VISION

Achieve technological and industrial leadership through development of globally competitive infrastructure, personnel and skills for the peaceful utilization of nuclear science and technology.

MISSION

Establish a policy guideline for regulation of safe, secure and peaceful utilization of nuclear science and technology across all sectors in a manner that protects persons, property and the environment for present and future generations to come

FOREWORD BY THE CABINET SECRETARY

This Policy embodies the Government of Kenya's commitment to safe, secure and peaceful applications of nuclear science and technology across all sectors.

Nuclear science and technology provides techniques that address varied global issues relating to human health and nutrition, agriculture, water resources management, industrial application, and sustainable energy development process and energy. With the same technology also comes nuclear proliferation concerns that pose a grave threat to international safety and security, hence the lifelong and daunting task of ensuring safe and secure uses of nuclear science and technology.

Kenya has been a member State of the International Atomic Energy Agency (IAEA) since 1965. Kenya's Country Project Framework (CPF) with the IAEA running through to the end of 2022 identifies the priority areas of human health, sustainable energy development, human capacity building and strengthening national radiation safety and nuclear security. Implemented through the IAEA Technical Cooperation (TC) programme, Kenya has made laudable improvements in its human health, sustainable energy development and human capacity development.

In a bid to ensure the continued and full exploitation of nuclear technology to aid towards socioeconomic development, Kenya enacted the Nuclear Regulatory Act 2019. The Act establishes a regulatory framework seeking to ensure the safe and secure uses of nuclear technology in Kenya. In addition the Government of Kenya has intensified efforts at ratification and accession of all remaining relevant international nuclear law treaties and conventions.

This Policy seeks to provide a framework for an integrated approach to planning and sustainable management of nuclear science and technology in the country. It also recommends strong institutional, legal and governance measures to support the achievement of the desired objectives of safe and secure uses of nuclear applications. With the participation of the public and stakeholders in addressing all issues and challenges identified in developing this policy, the realization of the government's goal as articulated in this policy will surely be within reach.

MR DAVIS CHIRCHIR, EGH

CABINET SECRETARY, MINISTRY OF ENERGY AND PETROLEUM

EXECUTIVE SUMMARY

Reliable and affordable energy is key to the realization of Kenya's socio-economic development. In April 2010, the National Economic and Social Council (NESC) recommended the adoption of nuclear power programme as a national priority and as a solution to the escalating demand for electricity and energy to drive the country's development agenda. Subsequently, the Government made a policy decision to include nuclear energy in Kenya's energy mix. This commitment is evident in the Least Cost Power Development Plan (LCPDP), the Energy Policy 2018 and the Energy Act 2019, which have recognized the need for inclusion of nuclear energy in Kenya's energy mix in order to enhance affordability, diversity and resilience. Nuclear-generated electricity is reliable and the cost of production is comparatively lower. This Policy makes specific provisions that will undergird Kenya's nuclear programme, and facilitate its attainment. It analyses the existing legal and policy framework, outlines the applications of nuclear technology and the potential that the nuclear science holds for Kenya, and addresses specific policy concerns such as safety, security, and safeguards as well as constitutional imperatives on public participation and stakeholder engagement, environmental governance and protection, among others. It also addresses policy implementation, monitoring and evaluation.

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The peaceful application of nuclear science technology is a key feature of the exploitation of the technology. The Treaty on Non-proliferation of Nuclear Weapons (NPT) establishes an international legal framework by which States work to steer the use of nuclear science and technology towards peace and development and away from development of nuclear weapons. The NPT remains a key framework for global efforts on non-proliferation of nuclear weapons and for peaceful application of nuclear technology. This is primarily achieved through a safeguards system within the United Nations' International Atomic Energy agency (IAEA). Kenya has been a member of the IAEA since 1965 and party to the NPT. It has also signed a Comprehensive Safeguard Agreement and Additional Protocol with the IAEA.

Nuclear science and technology contributes to energy production, industrialization, healthcare, access to water, sea water desalination, mining, oil extraction and improved agricultural production. The Government is committed to the utilization nuclear science and technology for greater socio-economic development. This however has to be carried out in a coordinated, systematic, safe and secure manner, consistent with existing domestic and international legal and policy framework and best practices. This justifies the need for a comprehensive national nuclear policy.

1.2 POLICY BACKGROUND

The Policy document has been developed in tandem with the overarching national development blueprints among them Kenya Vision 2030, the National Energy Policy 2018 and the Least Cost Power Development Plan (2020-2040). It also resonates with the country's commitments under regional and international policy instruments such as the United Nations' Sustainable Development Goals (SDGs), African Union's Agenda 2063, and EAC Vision 2050.

The Kenya Vision 2030 identified reliable and affordable energy as being key to the realization of the economic pillar and the Vision generally. In April 2010, the National Economic and Social Council (NEC) recommended the adoption of nuclear power programme as a national priority and as a solution to the escalating demand for electricity and energy to drive the country's development agenda. Subsequently, the Government made a policy decision to include nuclear energy in Kenya's energy portfolio.

The Least Cost Power Development Plan (LCPDP), the Energy Policy 2018 and the Energy Act 2019 have recognized the need for inclusion of nuclear energy in Kenya's energy mix in order to enhance affordability, diversity and resilience. Nuclear-generated electricity is reliable and the cost of production is comparatively lower.

The Energy Act 2019 provides a comprehensive framework for a robust energy sector in Kenya. The Act made specific provisions on the application of nuclear science and technology for purposes of generation of electricity and for other purposes. These other purposes include application in sectors such as food & agriculture, human health, water resource management, industrial processes, education, research and training, water desalination, oil extraction and mining, among others. In addition, the Act created the Nuclear Power and Energy Agency (NuPEA) and conferred it the mandate and responsibility of promoting and implementing Kenya's Nuclear Power Programme, carrying out research and development for the energy sector, among other functions. To carry these commitments forward and ensure that the application of nuclear science and technology in Kenya is well structured and coordinated and consistent with the applicable legal and policy framework and global best practices, the adoption of a National Nuclear Policy is crucial.

This policy proposes a broad range of measures and actions cutting across several sectors aimed at ensuring systematic utilization of nuclear technology in a safe and secure environment.

1.3 POLICY DEVELOPMENT PROCESS

This policy has been developed by an ad hoc inter-ministerial Committee through a consultative and inclusive process in line with the Constitutional value of participation. Members of the Committee included representatives from the Ministries responsible for Health, Energy, Agriculture, Livestock Fisheries and Irrigation, Water & Sanitation, Environment & Forestry, Trade & Industry, Interior & National Coordination of National Government, Defence, Education, Mining, Information Communication & Technology, Transport Infrastructure & Urban Development, Devolution & the Arid and Semi-Arid Lands (ASALs), the Office of the Attorney General and other relevant Government agencies (*Refer to Annexure 8.1*).

The development of this policy involved:

- (a) Identification of national nuclear technology goals and aspirations;

- (b) Identification of policy interventions on issues and challenges facing the application of nuclear technology;
- (c) Identification of relevant international nuclear law regime necessary for safe and efficient utilization of nuclear technologies and gaps within the Kenyan jurisdiction and how best to address them;
- (d) Building consensus amongst the public and stakeholders through acceptable and meaningful consultations;
- (e) Establishment of synergies and areas of complementarity with other relevant sectoral policies to ensure consideration of cross-cutting issues; and
- (f) The draft Policy was then subjected to thorough stakeholder engagement and nationwide public participation and subsequent validation in compliance with the constitutional requirement for public participation.

1.4 OBJECTIVES OF THE NATIONAL NUCLEAR POLICY.

The objectives of the policy are:

- (a) To entrench Kenya's commitment to peaceful uses of nuclear science and technology.
- (b) To provide a basis for the strengthening of an effective nuclear institutional framework including the promoter, regulator, owner/operator, research institutes and support service organizations.
- (c) To assess the required legal and institutional framework for the regulation, promotion and coordination of nuclear technology in Kenya.
- (d) To reaffirm Kenya's commitment to global efforts to prevent weapons of mass destruction and nuclear materials proliferation under the NPT regime.
- (e) To promote the adoption of new technologies for sustainable development through relevant nationally identified targets under the Sustainable Development Goals (SDGs).
- (f) To identify issues and challenges facing the efficient utilization and adoption of new nuclear technology in Kenya and possible solutions to these challenges.

- (g) To encourage the ratification and accession of all relevant international nuclear law treaties and conventions.
- (h) To promote a robust human and technical capacity development program necessary to support Kenya's application of nuclear science and technology across all the varied sectors.
- (i) To streamline and harmonize all nuclear technology activities, efforts and interventions across various sectors in the country for safe radiation protection and surveillance.
- (j) To create a framework for safe and secure utilization of nuclear technology within acceptable environmental standards which promotes nuclear security and physical protection.
- (k) To ensure the environment is protected for the benefit of the present and future generation against any harmful effects of applications of nuclear science and technology and;
- (l) To provide a mechanism for international and regional cooperation with other States and relevant agencies to promote the safe, secure and peaceful uses of nuclear science and technology.

1.5 SCOPE OF THE NATIONAL NUCLEAR POLICY

The Policy seeks to address various aspects of the application of nuclear science and technology across the various sectors as aforementioned and highlighted in detail Chapter Two.

It covers critical aspects such as safety, security, and safeguards in the utilization of nuclear technology. In addition, the Policy covers education, training, research and development (R&D) of nuclear technologies, and environmental sustainability in the management of radioactive waste.

The Policy also covers constitutional and legal imperatives such as public participation, inclusivity, and local content, as well as affirmative action relating to gender, youth, and persons with disability. Finally, it makes provisions on resource mobilization, implementation, monitoring, and evaluation.

CHAPTER TWO: APPLICATIONS OF NUCLEAR SCIENCE AND TECHNOLOGY

2.0 INTRODUCTION

In Kenya, various nuclear applications are already in use in food & agriculture, human health, water resource management, industrial processes, education, research and training, water desalination, oil extraction and mining. However, the full potential is yet to be exploited due to various challenges including lack of an adequate policy, legal framework and institutional capacity. In addition, electricity generation using nuclear technology calls for greater investment in capacity building. The section identifies the current and future uses and applications of nuclear technology. It also identifies the challenges and proposes recommendations.

2.1 NUCLEAR POWER

2.1.1 Introduction

Nuclear power is recognized as a safe, proven, reliable, cost effective, and clean and stable (base load) source of energy. Kenya Vision 2030, which is the country's development blueprint, identifies energy as an enabler for powering the flagship projects.

The current sources of electrical energy in Kenya are hydropower, diesel fired thermal plants, geothermal plants, with smaller quantities supplied from renewable sources previously uptaken under a Feed-in-Tariff policy that include wind, solar, small hydro-plants and biogas.

The need for energy diversification so as to ensure reliability, competitiveness, clean, sustainable and secure energy decarbonization calls for the consideration of other sources of energy. Nuclear energy provides a considerable option.

2.1.2 Situational Analysis

Kenya's energy demand has been rising consistently in the recent years. It is projected to rise further due to the Kenya Vision 2030 flagship projects which are power intensive. According to the Least Cost Power Development Plan (2020-2040), gross electricity consumption is projected to increase to 38,478 GWh by 2035. As such the country needs an energy source which is both affordable and cost effective. The Least Cost Power Development Plan is a proponent of affordable power. Nuclear energy is both cost effective and affordable hence the preference of it given the power intensive demands of vision 2030 flagship project.

The critical need for nuclear energy arises from the rising demand for power in the country due to accelerated investment in the economy. Increase in population, changes in demand and supply also affect energy needs in the economy. The rationale for inclusion of nuclear power in Kenya's energy mix include; diversification of conventional base-load power sources energy security and reliability and decarbonization.

In 2010, the National Economic & Social Council recommended the introduction of nuclear power to meet future electricity demand. The nuclear power option was also integrated in the national energy plan - the Least Cost Power Development Plan.

In November, 2010, the Nuclear Electricity Project Committee was established under the Ministry of Energy to drive the nuclear energy generation programme for Kenya. NEPC was later transformed to Kenya Nuclear Electricity Board vide Gazette Notice No. 131, supplement 156 of 23rd November, 2012.

The mandate of KNEB was to fast-track the development and implementation of the nuclear power programme in order to enhance the production of affordable and reliable electricity generation in Kenya.

Through the Energy Act 2019, KNEB was transformed to the Nuclear Power and Energy Agency which is a State Corporation under the Ministry of Energy. The Act expanded the Agency's mandate to include promoting and implementing Kenya's Nuclear Power Programme, carrying out research and development, and capacity building in the energy sector.

2.1.3 Challenges

- (a) Increased opposition to nuclear energy by the local populace resulting to conflicting statements regarding Kenya's national position on its nuclear power programme despite Kenya's commitment to the realization of social-economic independence envisioned in its vision 2030.
- (b) Mobilization of funding for the development of associated infrastructure remains a challenge owing to the restricting and limited budgetary allocations.
- (c) Inadequate institutional and human capacity to support the nuclear power programme.

- (d) An incomprehensive legislative and institutional framework for the safe and secure utilization of nuclear energy for electricity generation.
- (e) Inadequate higher educational programmes for human resource development for the nuclear power programme.
- (f) Lack of a strategy for local, national, regional and international communication on nuclear power programme.
- (g) Inadequate local industrial capacity with requisite capabilities to deliver a NPP.
- (h) Limited dissemination, uptake and retention of nuclear knowledge in Kenya leading to low public acceptance of nuclear power in Kenya.

2.1.4 Policy Interventions

In order to progress further its nuclear power programme, the government shall be guided by the following policy interventions:

- (a) Clear statements reflecting broad political support across various institutions within the national and county governments. This should be communicated nationally, regionally and internationally.
- (b) Establish clear national strategy for peaceful nuclear technology for power generation, indicating its long term commitment and recognizing the importance of safety, security and non-proliferation.
- (c) Consider viable funding and financial options for the national nuclear power programme guaranteeing the safety and security at all times for sustainable development.
- (d) Provide for the coordination of all activities to establish the national nuclear infrastructure;
- (e) Establish or strengthen the key nuclear related organizations including an independent and effective nuclear regulatory body (i.e. the Kenya Nuclear Regulatory Authority), Nuclear Energy Programme Implementing Organization (the Nuclear Power and Energy Agency), NPP Owner/Operator, Nuclear Power Research and Development Institute, Radioactive Waste Management Organization and Technical Service Organization.

- (f) Government of Kenya and key organizations involved in national nuclear programme should demonstrate strong commitment to leadership and implement management systems that will ensure success and promote a safety and security culture as well as the peaceful use of nuclear technologies.
- (g) Develop a comprehensive national legal framework covering all aspects of nuclear law, including safety, security, non-proliferation, nuclear liability and other legislative, regulatory and commercial aspects, which is a necessary complement to the conclusion of the international agreements.
- (h) The Kenya Nuclear Regulatory Authority, the national Nuclear Regulatory Body, should ensure that a full and comprehensive set of regulations and guides are in place for the regulation, control and inspection of all peaceful applications of nuclear energy, including construction, commissioning and operational activities of Nuclear Power Plants, at the appropriate time.
- (i) The Kenya Nuclear Regulatory Authority should consider the various regulatory approaches that are applied for nuclear power programme of the same size, and should tentatively plan its approach, taking into account the Kenya's legal and industrial practices, the NPP Vendor country regulatory framework and the guidance provided in the IAEA safety standards and guidance.
- (j) Government of Kenya should consider support through international cooperation and open exchange of information related to nuclear safety, entering in bilateral or regional cooperation agreements with countries with an established nuclear power programme and maintaining a national technical cooperation programme with the IAEA.
- (k) Have a clear commitment to its international non-proliferation obligations and should provide information and complimentary access as required by the Comprehensive Safeguards Agreement and the Protocol Additional to the CSA with the IAEA. Establish a robust, reliable, and flexible national transmission network (grid) that will safely transmit power generated from nuclear power plants in line with the integrated national energy plan.

- (l) Ensure a strategic reserve of nuclear sites by identifying, facilitating acquisition and developing the infrastructure of suitable nuclear power plants sites and waste disposal sites.
- (m) Pursue an open fuel cycle policy and there shall be no enrichment activity to be undertaken in the front end of the fuel cycle.
- (n) Manage the radioactive waste in such a way as to avoid imposing an undue burden on future generations; that is, the generations that produce the waste have to seek and apply safe, practicable and environmentally acceptable solutions for its long-term management.
- (o) Support and create conducive environment for the expansion and participation of local industries in the nuclear power industry.
- (p) Ensure effective public and stakeholder involvement in the implementation of the nuclear power programme in accordance with the constitution.
- (q) Develop domestic nuclear power capability in partnership with other governments and organizations like the IAEA to enable it to optimize the utilization of nuclear technology to this end.

2.2 FOOD AND AGRICULTURE

2.2.1 Introduction

Nuclear technology has played a major role in improving food security. It has been used in early plant disease diagnosis, in developing over 300,000 mutant varieties of plants species for commercial production stemming from 170 different plant species, and irradiation technology has been used to preserve food through the control of microorganisms including those that cause food-borne disease.

The analysis of genetic diversity has been used to improve the selection of desirable animals for higher productivity, resistance to endemic diseases and resistance to harsh environments.

Sterile Insect

Sterile Insect Technique (SIT) has been used in the reduction of insect pests all attributable to nuclear technology.

The food and agricultural sector is the backbone of the economy contributing about 24% of the country's Gross Domestic Product and 65% of the export earnings as per the Food and Agricultural Organization of the United States website, 2022. In addition, agriculture provides the livelihood of over 80% of Kenyan population. Hence, strengthening of the agricultural sector is a precondition for achieving sustainable economic growth. The government has undertaken major policy reforms to address poverty and food insecurity in a holistic manner.

2.2.2 Challenges

Challenges in crop, livestock production and food safety include;

- (a) Limited availability and/or adoption of appropriate technologies.
- (b) Recurrent droughts.
- (c) Inadequate human capacity on relevant nuclear technologies.
- (d) Different standards and requirements in external trade in crops and livestock products.
- (e) Outbreaks of animal diseases.
- (f) Extinction of crop varieties and animal species.
- (g) Inadequate capacity to undertake maintenance on nuclear equipment.
- (h) High food spoilage and infestation.
- (i) Inadequate regulatory framework for use of nuclear technologies in crop, livestock production and food safety.
- (j) Public acceptance of irradiated food is low.

2.2.3 Policy Intervention

Policy interventions/ actions for crop, livestock and food production includes:

- (a) The government shall promote the application of nuclear and isotopic techniques to establish the most appropriate practices to enhance agricultural productivity under both rain-fed and irrigated conditions.
- (b) Develop and review appropriate policy and legal environment for use of nuclear technology in animal production that are in harmony with regional and international best practices to promote external trade in crop and livestock products.
- (c) Develop capacity to use nuclear technology for food preservation, storage, and quality assessment. Integrate institutional arrangements and capabilities for the efficient and effective management of the food safety system.
- (d) Promulgate appropriate legislation to regulate use of nuclear technologies in Crop, livestock production and food safety.
- (e) Effect behavioral change through heightened public awareness about food safety issues.

2.3 HUMAN HEALTH

2.3.1 Introduction

In the medical field, nuclear technology is used in the diagnosis and treatment of medical conditions such as cancer. It is also used in the sterilization of surgical equipment.

HIV/AIDS, communicable diseases such as Malaria and Tuberculosis, as well as noncommunicable diseases such as cardiovascular conditions, cancer and diabetes, are major causes of morbidity and mortality in Kenya. These negatively impact and curtail the country's efforts to achieve Sustainable Development Goal 3 on "*good health and well-being*".

The burden of cancer in Kenya is 47,887 cases annually, according to Global Observatory for Cancer (GLOBOCAN) data from 2018. This represents a 30% increase from 2012. About 60–80% of cancer patients present are at an advanced stages resulting in poor treatment outcomes (National Cancer Control Strategy, (2017–2022)).

Kenya continues to experience a nutritional transition with 42% of Kenyan women overweight or obese. Poor nutrition and physical inactivity cause obesity.

In accordance with the *Constitution of Kenya, 2010*, the County Governments are responsible for bringing health services closer to the people in the Counties. The current health strategic plan builds on the achievements realized under the National Health Sector Strategic Plan (NHSSP I-2005-2014) and takes cognizance of the fact that the objectives of the NHSSP II have not been fully achieved due to challenges such as limitations in funding and the prevailing unfavorable infrastructure such as roads, power, water and food supply.

The Health Sector and Services Steering Committee was inaugurated to oversee the planning of health facilities. It is expected to have a revolving fund to provide financial support for medical supplies, rehabilitation and equipment for health facilities.

2.3.2 Situational Analysis

Kenya's population is about 48 million with an estimated annual incidence of cancer of about 1% (48 000), with 80% (38 000) needing radiotherapy, of which only 2000 have access to treatment at public facilities while almost the same number access private facility treatment. Cancer of esophagus, breast, cervix, prostate, stomach, liver, ovary, leukemias, colorectum and Kaposi sarcoma are some of the leading cancers in Kenya. Over 80% of cancer patients are diagnosed late due to inadequate diagnostic services and a low level of cancer awareness among the public.

The high morbidity and mortality from cancer in Kenya is attributed to late case presentation, reflecting the lack of preventive services and poor access to timely diagnosis and treatment as a result of inadequate skills, poor infrastructure, and financial constraints. One of the key factors contributing to poor treatment outcomes is the lack of proper skills and diagnostic infrastructure, including nuclear imaging.

Due to the increasing demand for diagnostic services for oncology and other NCDs including cardiovascular diseases, there are plans to upgrade and modernize the existing Kenyatta National Hospital nuclear medicine unit and to expand the services across the country. The availability and access to well trained professionals in Nuclear Medicine remains one of the

main challenges facing a sustainable diagnostic and therapeutic in-vitro Nuclear Medicine services in Kenya.

Kenya has four (4) functional public Radiotherapy and Cancer Treatment Centre based at the Kenyatta National Hospital (KNH), Moi Teaching and Referral Hospital (MTRH), Coast General Hospital (CGH) and Kenyatta University Teaching Referral and Research Hospital (KUTRRH). There are also plans for commissioning of 2 more new Radiotherapy and Cancer Treatment Centre in Nakuru and Garissa counties.

The KNH Radiotherapy and Cancer Treatment Centre does not have the requisite number of qualified Nuclear Medicine professionals. The facility is equipped with one linear accelerator, two Cobalt-60 units, brachytherapy unit, one dual head gamma camera and one conventional simulator. The major achievements in early diagnosis and treatment of cancer include training of personnel, expansion of services and acquisition of radiotherapy equipment. Kenya will therefore need IAEA's support to facilitate training of radiographers in nuclear medicine, medical physicists, procurement of equipment, and establishment of a quality management system to improve the standard of clinical practice in planning and procurement.

The Moi Teaching and Referral Hospital (MTRH), public radiotherapy and cancer treatment centre is the second biggest national referral hospital located in Eldoret. The hospital has two completed bunkers for external beam radiation and brachytherapy. Private hospitals such as Aga Khan and Texas Cancer Centre in Nairobi have been able to ease some of the burden experienced by the public health facilities.

Through the IAEA TC Programme and efforts of the government along with other partners, Kenya has received the following support:

- (a) Upgrading radiotherapy and nuclear medicine services at KNH in terms of equipment and capacity building of staff.
- (b) Development and deployment of a training curriculum at a diploma level for Radiation Therapists (RTs).
- (c) Building capacity in terms of nutrition by measuring maternal body composition and breast intake among infants.

2.3.3 Challenges

- (a) Limited cancer diagnosis and treatment facilities and sparse distribution of treatment facilities as patients travel up to 600 kilometers to access treatment at the 4 public radiotherapy and treatment facilities.
- (b) Focus on cancer research is minimal which is attributable to lack of facilities, personnel and funding.
- (c) There is need to establish quality management systems to improve the standard of clinical practice in planning and procurement.
- (d) Non conformity of procurement law with international best practices in commercial transactions for Radiopharmaceuticals importation e.g. importation of radioisotopes Tc99^N
- (e) Inadequate diagnostic (radiological and laboratory) services in most health facilities leading to delays in cancer detection and early diagnosis.
- (f) Delays have led to potentially curable diseases progressing to advanced stages, leading to the only available service as palliative care.
- (g) There is need to develop training curricula in collaboration with all the relevant parties to ensure an increase in the number of available medical professionals i.e radiation oncologists, medical physicists and oncology nurses.
- (h) Finalization of National Cancer Control and Prevention Plan.

2.3.4 Policy Interventions

The government shall be guided by the following measures/actions:

- (a) Promote research on cancer diagnosis and treatment.
- (b) Procurement of diagnostic and radiotherapy equipment should be undertaken to expand access to oncology services.
- (c) Nuclear medicine and radiotherapy services should to be upgraded.

- (d) Cancer control, prevention and screening programs should be increased.
- (e) County hospitals countrywide should be equipped with diagnostic, radiological and laboratories facilities.
- (f) To fully optimize the use of nuclear medicine techniques, there should be developed a local radioisotope production plant.
- (g) An updated National Cancer Control and Prevention Plan (NCCP) needs to be developed and finalized.
- (h) Adoption of international best practices in ensuring compliance of Kenya’s procurement laws on Radiopharmaceuticals importation.

2.4 WATER RESOURCE MANAGEMENT

2.4.1 Introduction

Some of the nuclear techniques in use include the use of stable isotopes to understand the spatial distribution of various processes that affect groundwater availability and quality both at the local as well as at regional levels. This information provides a basis for assessing the impact of climate change and other factors on groundwater resources. Nuclear energy is also used for sea water desalination.

Water resource management involves planning, developing, distributing and managing the optimum use of water resources. The Government of Kenya has recognized the important contribution that is made to national development by promoting and supporting “integrated water resource management” to enhance water availability and accessibility. The vision of the water sector was embodied in the Vision 2030 Development Blueprint to ensure the availability of safe and clean water accessible to all by the year 2030.

In support of the drive towards integrated water resource management, it is imperative for Kenya to consider and adopt scientific solutions to water resource management through utilization of nuclear technology.

2.4.2 Situational Analysis

In water resource management, some of the nuclear techniques in use in Kenya include the use of stable isotopes to understand the spatial distribution of various processes that affect groundwater availability and quality both at the local as well as at regional levels. This information provides a basis for assessing the impact of climate change and other factors on groundwater resources.

The application of nuclear technology in water resource management would therefore result in the following significant benefits:

- a) Attaining water security through the development of water catchment area database by use of isotope hydrology to enable planning of water resources and hence meeting demands for economic growth.
- b) Opportunities for increased collaboration/cooperation through building partnerships to drive innovation towards the use of nuclear technology in water resource management.
- c) Development of practical scientific solutions to integrated planning and management of water resources.

2.4.3 Challenges

Currently, the use of nuclear technology in water resource management is limited as a result of the following factors:

- (a) Inadequate human resource capacity in isotope hydrology/isotope techniques.
- (b) Insufficient engagement with existing scientists in the benefits of applying nuclear technology to improve water resource management and lack of a database for applied research scientists.
- (c) Inadequate infrastructure to support the application of nuclear science research, methodologies and analytical techniques such as an isotope hydrology laboratory for analysis of isotopes of water.

- (d) Inadequate training modules in isotope hydrology in tertiary and institutions of higher learning.
- (e) Inadequate government funding in isotope hydrology research and capacity building.

2.4.4 Policy Interventions

The government shall be guided by the following interventions:

- (a) Build capacity of scientific and technical staff on nuclear/isotope techniques in water resource management through among others.
 - i. Promoting collaboration/engagement with scientists on the use and benefits of nuclear technology in water resource management and keep a database of scientists who can engage in applied research in nuclear technology;
 - ii. Establishment of well-equipped isotope hydrology facilities for research and training;
 - iii. Collaboration with relevant tertiary and other institutions of higher learning to include training modules in isotope hydrology in their training courses; and
 - iv. Mobilizing financial resources for capacity building, isotope hydrology research and related infrastructure development;

2.5 INDUSTRIAL APPLICATIONS OF NUCLEAR TECHNOLOGY

2.5.1 Introduction

Nuclear technology is used in the provision of various services such as improving product quality; optimizing industrial processes; providing Non-Destructive Testing (NDT) and Dosimeter service. This section details the proposed policy intervention by the government in providing a safe and secure environment for the utilization of nuclear technology in industrial application to foster economic growth.

2.5.2 Situational Analysis

Industrial sector has immense potential for both wealth and employment creation and poverty eradication. It is envisioned that the sector will provide impetus towards the achievements for Sustainable Development Goals (SDGs). This sector is expected to contribute to Gross

Domestic Product (GDP) by at least 10% per annum as espoused by the Kenya National Bureau of Statistics.

Nuclear technology has various industrial applications; improves the quality of goods, and to measure the thickness and density of many materials. Other uses include quality control, inspection of finished goods, tracking leakages in piping systems; monitor the rate of engine wear and corrosion of processing equipment. Specifically, industries that use radioactive materials include aviation, construction and automobile industry. Mining and petroleum companies also use radioactive materials for a range of activities including location and quantification of oil, natural gas and mineral deposits.

The industrial application of radiation and radioisotopes in Kenya is under-developed but has great potential.

2.5.3 Challenges

- (a) Inadequate standards for nuclear applications in industries.
- (b) Inadequate capacity to regulate current and emerging nuclear technologies.
- (c) Limited awareness in the utilization of nuclear technology in industrial applications.
- (d) Inadequate research in nuclear technology geared towards industrial development.
- (e) Lack of a safe and secure waste management and disposal system for industrial radioactive waste.
- (f) Inadequate infrastructure and human capacity for applications of nuclear technology in industries.
- (g) Inadequate collaboration with relevant partners for the purpose of exploiting the full benefits of nuclear technology.

2.5.4 Policy interventions

The government shall be guided by the following policy interventions:

- (a) Develop and enforce appropriate standards for nuclear application in industries;

- (b) Promote and create awareness in the utilization of nuclear technology in industries;
- (c) Enhance research in nuclear technology geared towards industrial development;
- (d) Strengthen the infrastructure and human resource capacity for nuclear technology including the setting up facilities for training & research and testing & calibration of nuclear equipment; and
- (e) Strengthen collaboration with relevant partners to fully benefit from industrial applications of nuclear technology.

2.6 SEA WATER DESALINATION

2.6.1 Introduction

Desalination is a technique where the excess salts are removed from sea water converting it into safe usable water. Desalination methods are categorized into thermal processes and membrane processes.

2.6.2 Situational Analysis

With the growth of world population, the availability of freshwater has continued to decrease, yet access to enough water for drinking and domestic uses, and commercial and industrial processes is critical to health and wellbeing. With a population of 53 million (as of 2022), 15 percent of Kenyans rely on unimproved water sources, such as ponds, shallow wells and rivers, while 41 percent of Kenyans lack access to basic sanitation solutions.

In response to water scarcity, Kenya has ongoing/ planned small scale sea water desalination projects to supply fresh water to coastal communities. In 2019 an NGO funded solar-powered desalination plant was commissioned to serve 25000 locals in the coasts of Kiunga, a village in Kenya near the border with Somalia. Additionally, Kenya is set to commence construction of a desalination plant in Likoni, Mombasa County. This desalination plant is designed to have a capacity of 100,000 cubic meters per day, supplying drinking water to over a million people.

With the advances in desalination technologies, sea water has become the ideal water source to cope with the freshwater shortage.

Benefits of Sea Water desalination include:

- (a) Sea water is abundant, about 71% of the earth surface is covered with water and out of this earth surface water, 97.4% is sea water and 2.6% is freshwater. Therefore, Sea water desalination provides a reliable source of water;
- (b) Sea water is rich in minerals which have a market interest including a large demand for salt in many geographical areas which can be obtained as a by-product of seawater desalination;
- (c) Wide commercially available technologies for sea water desalination for the country. The advances in key equipment (membranes, pumps, energy cost recovery devices) has turned sea water desalination processes energy efficient, resulting in a low investment cost and low operational cost and hence affordable solution to cope with freshwater shortage typical in tropical as well as off-shore areas.

2.6.3 Challenges

- (a) Sea water desalination requires a reliable and affordable source of energy;
- (b) Absence of research and development strategy and relevant infrastructure to support the application of nuclear technology in sea water desalination.
- (c) The core process of seawater desalination is based on Reverse Osmosis Membrane technology, which on its own does not provide safe drinking water, nor does it guarantee efficiency of the plant and hence other efficient pre-treatment and post-treatment technologies need to be incorporated to provide safe drinking water; and
- (d) Brine disposal can be an environmental and economic issue in some areas where the fauna and flora are sensitive to local seawater salinity increase. Brine disposal should be studied and engineered case by case.

2.6.4. Policy Intervention

The government shall be guided by the following policy interventions:

- (a) Promote the adoption of nuclear technology to complement renewable resources in sea water desalination as a cost effective solution;

- (b) Development of a strategy for sea water desalination considering the most suitable combination of energy-efficient technologies to be adopted to optimize water production costs and quality and government/partnerships funded research and development; and
- (c) Development of a robust regulatory framework to address the disposal issues related to concentrate disposal/ brine disposal and disposal of any other by-product in an environmentally acceptable way.

2.7 EDUCATION, RESEARCH, TRAINING AND DEVELOPMENT

2.7.1 Introduction

Nuclear technology can be used in research in various sectors such as medicine, agriculture and industry through production of radioisotopes and neutron beams for neutron activation analysis, material structure studies and neutron transmutation doping among other applications bringing innovations and inventions that foster economic growth.

The Government of Kenya recognizes the role of nuclear science applications as a prerequisite for sustainable social and economic development and hence in 1979, the Institute of Nuclear Science and Technology at the University of Nairobi was established to offer training and research programmes in peaceful applications of nuclear technology. Since then various nuclear research programmes have been established in various government institutions.

2.7.2 Situation Analysis

An optimal utilization of nuclear science and technology can only be achieved if there are adequate educational institutional and research facilities. Currently, the Institute of Nuclear Science and Technology, University of Nairobi, is the focal point of Nuclear Science training in Kenya. Also through collaborations with other countries and institutions like the IAEA,

Kenya has been able to train varied specialists in the field of nuclear science and technology.

The importance of qualified personnel in the overall development of nuclear technology cannot be over-emphasized as it is critical in capacity development.

Collaboration and cooperation in capacity development is critical for newcomer countries. Kenya is a member state of the IAEA and has established a Technical Cooperation Programme

with the IAEA to build capacity for its nuclear power and research reactor programs. Further, Kenya has concluded cooperation agreements and MoUs with countries with advanced nuclear power programs on various aspects of nuclear science and technology such as capacity development. Research reactor project implementation will be pursued within these or expanded cooperation agreements and MoUs.

1. Collaboration with the Republic of South Korea

The Republic of Korea has played a significant role in the development of the Kenya nuclear power program. This has been effected through cooperation agreements and Memorandum of Understanding (MoUs) at various levels. A Government to Government (G2G) Memorandum of Understanding between the two countries was signed in 2016. The MoU aimed at promoting bilateral cooperation in the field of nuclear energy through exchange of technical data, information, experience, know-how, visits and joint work.

To date, over 50 Kenyans have been trained in the field of nuclear engineering and energy policy at the KEPCO International Nuclear Graduate School (KINGS), Korea Advanced Institute of Science and Technology (KAIST) and Seoul National University (SNU). Additionally, Kenya is pursuing establishment of an advanced science and technology institute (KAIST-Kenya) in collaboration with KAIST - South Korea.

NuPEA, Korea Electric Power Corporation (KEPCO), Korea Nuclear Association for International Cooperation (KNA) and KEPCO International Nuclear Graduate School (KINGS) signed an MOU in 2016. The MOU is aimed at promoting bilateral cooperation in the field of nuclear energy through exchange of technical data, information, expertise, experience, visits and joint work. The cooperation involves postgraduate training programs in: Nuclear Power Plant Engineering; and Energy Policy and Engineering. Additionally, NuPEA and the Korea Atomic Energy Research Institute (KAERI) signed an MOU in 2017. The MOU is focused on Technical cooperation in Research and Development in Nuclear Energy.

2. Collaboration with Russian Federation

The Russian Federation, through the State Atomic Energy Corporation (ROSATOM) has signed an MOU with Kenya through NuPEA on peaceful uses of nuclear science and technology. In part, the two parties have agreed to partner in enhancing the skills of

administrative, scientific, and technical personnel in various areas of peaceful use of atomic energy through education and training.

3. Collaboration with People's Republic of China

The Government through NuPEA signed an MOU in 2015 with China General Nuclear Power Corporation (CGN) on Nuclear Power Development Cooperation. In part, the agreement is focused on cooperation on training and specifies that:

- a. CGN wishes to provide a training program to Kenya and ultimately help Kenya develop its training capability; and
- b. The training program shall cover the training demand for the entire process of the nuclear power project development in the next ten (10) years based on CGN's Systematic Approach of Training.
- c. Consultancies to offer assistance in technical issues.

2.7.3 Challenges

The following are identified as some of the problems and challenges facing the development of nuclear science training, research;

- a) Limited financial resources for scholarships, equipment and projects leading to low student enrolment.
- b) Lack of comprehensive guidelines on proper utilization of nuclear energy technologies in the country;
- c) Low staff recruitment due to insufficient funding leading to inadequate personnel (to PhDs level) to develop and sustain nuclear technology programmes in the country;
- d) Inadequate and out dated infrastructure for experimental research studies;
- e) Declining government funding to training and research institutions.
- f) Inadequate knowledge management in terms of retention given the stringent patent laws.

2.7.4 Policy Interventions

The government will pursue the following policy options:

- (a) Undertake a Training Needs Assessment for nuclear science and technology applications in the country;
- (b) Expand capacity building in nuclear, nuclear science and associated technologies and services, engineering, nuclear physics, and associated technologies and services in order to meet the needs of a nuclear reactor installation, operation, maintenance, safety, security and management of nuclear waste;
- (c) Expand the teaching programmes in the national universities to include nuclear science trained chemists, physicists and biologists to handle production and teaching of medical radioisotopes, nuclear medicine and radiobiology;
- (d) Promote learning, innovation and creativity under well-coordinated programmes in nuclear technology applications;
- (e) Cultivate and sustain interest in Science, Technology, Engineering and Mathematics (STEM) from early childhood education and promote inter-institution collaboration.
- (f) Development of an accommodative knowledge management strategy for a nuclear power programme.

CHAPTER THREE: POLICY LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 INTRODUCTION

This National Nuclear Policy is founded on an existing policy, legal and institutional framework. The relevant legal and policy instruments are identified and highlighted below. The institutions relevant in Kenya's nuclear programme are also identified and discussed.

3.2 NATIONAL, REGIONAL AND INTERNATIONAL POLICY INSTRUMENTS

The national Policy Instruments that undergird the Nuclear Policy include the Kenya Vision 2030, Sessional Paper No. 4 of 2004 on Energy, The Energy Policy, 2018 and the Least Cost Power Development Plan 2020-2040. The relevance of these instruments is elaborated below:

a) The Kenya Vision 2030

The Kenya Vision 2030 is a long-term development plan to transform Kenya into "a newly-industrializing, middle-income country providing a high quality of life to all its citizens in a clean and secure environment". The vision aims to create a secure and prosperous country by the year 2030.

Launched in 2008, this is the key blueprint that guides the government's development agenda. This blueprint has three pillars, namely, economic; social, and political governance. The Vision hopes to see Kenya achieve significant economic growth, and offer reasonable or quality standards of living to the citizenry, including quality healthcare, food security, clean and safe water and proper sanitation. Industrialization as envisaged in the blueprint, will obviously, demand reliable and affordable power.

(c) National Energy Policy, 2018

Deriving from the Sessional Paper No. 4 of 2004 on Energy, the overall objective of this Energy Policy is to ensure affordable, competitive, sustainable and reliable supply of energy at the least cost so as to support the national **development** needs while at the same time ensuring environmental protection and conservation. The Policy recognizes the potential of nuclear technology to produce power at relatively low cost consistent with the country's Least Cost Power Development Plan, and proposes efforts to harness its use.

d) Vision 2050 EAC

Through the East Africa Community (EAC) Vision 2050, the regional bloc has committed to transforming the EAC into a prosperous high middle-income region that is globally competitive, affording quality life to its citizens by 2050. The Vision places focus on infrastructural development, trade and improvement of living conditions of the people of East Africa. The focus is to create an environment that supports agriculture and local enterprise and manufacturing, among other sectors. The impetus for generation of affordable and reliable power through the use of nuclear technology and the application of nuclear science in the other aspects as aforementioned support the ambitions contained in the Vision 2050.

e) Agenda 2063

Agenda 2063 is Africa's most recent and comprehensive action plan for economic renaissance. Through it, African states have articulated their collective ambition for social, political and economic transformation of the continent with specific results by the year 2063. At the centre of Agenda 2063 is a vision for an economically prosperous Africa through inclusive growth and sustainable development. The key goal of the plan is to create an economically prosperous and inclusive continent based on sustainable development. These calls for application of technology

These ambitions require investment and growth in enterprise. Through supporting investments through provision of capital and technical advisory services, KDC will be helping spur growth, and help Kenya fulfil its commitments under the Agenda 2063.

f) Sustainable Development Goals (SDGs)

The United Nations General Assembly adopted 'the 2030 Agenda for Sustainable Development,' in September 2015. This development blueprint will guide the UN and most of UN members' development agenda until 2030. The Agenda enumerates 17 sustainable development goals (SDGs)goals that the nations of the world are committed to working towards during the implementation period. These include eradication of poverty and hunger to ensure good health and wellbeing; quality education; clean water and sanitation, affordable clean energy; decent work and economic growth; industry, innovation and infrastructure, and reduced inequality; sustainable cities and communities; responsible consumption and production; peace, justice and strong institutions and partnerships for the goals.

Seven goals are of specific relevance to the Nuclear Policy. These are SDG 1 (ending poverty); SDG 3, (Good health and well-being); SDG 7 (affordable and clean energy); SDG 8 (decent work and economic growth); SDG 9 (Industry, innovation, and infrastructure); SDG 11 (Sustainable cities and communities); and SDG 13 Climate action. Utilization of nuclear technology bears the potential to advance these goals through applications in healthcare, water, and sanitation, and low-cost power production. This in turn will support industrialization and economic growth, thereby creating jobs, improving standards of living and improving livelihoods. Although nuclear is a non-renewable source of energy, it is nonetheless a clean source of energy, which, unlike coal or thermal generation, does not emit greenhouse gases.

3.3 SITUATIONAL ANALYSIS

3.3.1 National Institutional Framework

Several institutions in Kenya are instrumental in the formulation and implementation of policies that relate to nuclear science and technology, and its application to various sectors. This part of the policy identifies key institutions and underscores their relevance in nuclear technology and science. These include:

a) Ministry of Energy and Petroleum

The Ministry of Energy and Petroleum is responsible for setting and operationalizing the national energy agenda. Consequently, the National Energy Policy 2018 identifies nuclear energy as a potential component of Kenya's energy mix given its capacity to produce enormous amounts of electricity at a relatively economical cost. To this end, the Ministry of Energy set in motion a milestone approach assessed by the IAEA in realization of Kenya's nuclear power programme. The Ministry of Energy and Petroleum is therefore the key driver of all efforts geared towards the commissioning of Kenya's first 1000MW nuclear plant in 2027.

b) Nuclear Power and Energy Agency (NuPEA)

Established under the Energy Act No. 1 of 2019, the Agency implements and promotes the development of nuclear electricity generation in Kenya. In discharging its mandate under the Energy Act, it undertakes research and carries out development, distribution, and awareness activities in the nuclear power and energy sector. NuPEA is therefore the Nuclear Electricity Programme Implementing Organization (NEPIO) and the custodian of the Kenya Nuclear Power Programme.

c) Kenya Nuclear Regulatory Authority

The Authority is established under the Nuclear Regulatory Act No.29 of 2019 to ensure the safe, secure, and peaceful use of nuclear science and technology. It regulates the siting, design construction, and operation of nuclear facilities in addition to the manufacture of necessary component parts and decommissioning of facilities. The Authority undertakes inspections and enforcement to ensure compliance with stipulated conditions of authorization. Further, it is the nuclear sector regulator and issues licenses contemplated under the Act.

d) Energy and Petroleum Regulatory Authority (EPRA)

EPRA is the energy sector regulator established under the Energy Act No. 1 of 2019 and it regulates the generation, transmission, and generation of electrical energy. EPRA issues licenses to various energy subsector players, protects their interests, and ensures the safety of consumers. In the operationalization of the nuclear power programme, EPRA will be instrumental in granting requisite approvals, setting nuclear power tariffs, and ensuring the safety of operations.

e) Energy and Petroleum Tribunal

The Energy Act No. 1 of 2019 establishes the Energy and Petroleum Tribunal with the jurisdiction of hearing and determining disputes and appeals under the Energy Act and any other written law. Disputes arising from the nuclear energy sector will be referred to this tribunal for adjudication.

f) Kenya Electricity Transmission Company (KETRACO)

KETRACO is a state corporation registered under the Companies Act CAP 486 Laws of Kenya with the mandate to plan, design, construct, operate, and maintain the national high voltage electricity grid and regional power interconnections. The company will be instrumental in the evacuation and transmission of nuclear energy on the national grid.

g) Kenya Power and Lighting Company (KPLC)

KPLC is a public utility company responsible for distributing and retailing electricity to both domestic and commercial consumers. It will be responsible for distributing and selling generated nuclear electricity.

h) Kenya Electricity Generating Company (Kengen)

Kengen is registered under the Companies Act CAP 486 Laws of Kenya. Its core mandate is to generate electricity by developing, managing, and operating public power plants in Kenya. Potentially, the company will be responsible for generating nuclear electricity under the proposed Kenya Nuclear Power Programme.

i) Ministry of Environment Climate Change and Forestry

The Ministry focuses on conservation, protection, and sustainable management of the environment. In pursuit of its mandate, the ministry develops policies and programmes which impact other environment-related sectors such as nuclear science and technology. Consequently, this nuclear sector policy must align with the policies and strategies adopted by the Ministry.

j) National Environment Management Authority (NEMA)

NEMA is established as the environment sector regulator under the Environmental Management and Coordination Act No. 8 of 1999 as amended by Act No. 5 of 2015. It exercises general supervision and coordination over all environmental matters, and it is the government's principal instrument in implementing environment-related policies. Concerning nuclear power, NEMA will be responsible for issuing requisite licenses for the Environmental Impact Assessment (EIA) and the Strategic Environmental and Social Assessment (SESA).

k) National Environment Tribunal

The tribunal is established under the Environmental Management and Coordination Act as a forum for appealing the decisions of NEMA such as issuance of licenses, declining the issuance of a license, or the imposition of certain conditions. The tribunal will have jurisdiction to adjudicate questions of nuclear power-related EIA and SESA licenses.

Apart from the core institutions discussed above, several other national institutions will potentially be involved in the application of nuclear science and technology and the operationalization of Kenya's Nuclear Programme. Notable institutions include County Governments; the National Land Commission; the Ministry of Investments, Trade and Industry; Ministry of Interior and Coordination of National Administration; the Ministry of Water Sanitation and Irrigation; the Kenya Maritime Authority; the Kenya Marine Fisheries

Research Institute; the Water Resources Management Authority; the Kenya Wildlife Services and the Kenya Forest Service.

3.3.2 International Atomic Energy Agency

Kenya has benefited from technical support by the International Atomic Energy Agency (IAEA) through various national, regional and interregional projects. The HRD assistance from the IAEA TC programme is through fellowships, training courses, Expert Missions, Scientific Visits, Peer reviews, Advisory and technical support. Kenya is participating in the IAEA RAF project (RAF1009), titled “*Supporting Embarking Countries in Establishing National Infrastructure for Research Reactors (AFRA)*”. The objective of the project is to support the development of infrastructure for establishing nuclear research reactors that enable education and training, industrial, medical, and research applications. Among the planned activities are conducting training and other human resource development activities for organizations relevant to the new research reactor programme.

Additionally, the IAEA has developed capacity-building programmes to support development of nuclear competence using research reactors including Distance Training; the Internet Reactor Laboratory (IRL); Basic Training: Regional Research Reactor Schools; Intermediate Training: EERRI Group Fellowship Course; and Advanced Training at International Centers based on Research Reactors (ICERR). Kenya is participating in the IRL project, a virtual training program on research reactors. The main training centre is the National Center for Energy and Nuclear Science and Technology (CNESTEN) in Morocco. CNESTEN has a TRIGA research reactor and is the host facility for the African region and the convener of IRL training. In 2019, Kenyatta University (national project counterpart) signed an agreement with the IAEA to host the IRL project for Kenya’s institutions.

3.3.3 National Legislative Framework

The core legal instruments include the Constitution; the Energy Act 2019; the Nuclear Regulatory Act 2019; the Environmental Management and Coordination Act, 1999; and the Physical and Land Use Planning Act, 2019. These instruments are discussed below.

(a) The Constitution

The Constitution is the supreme law that provides a foundation for all other laws, policies and governmental action. In Article 10, the Constitution lays down constitutional values and principles of governance. Of relevance are the principles of good governance, integrity, transparency and accountability, and sustainable development. The call is that these principles must undergird all processes relating to the national nuclear programme and development generally. These touch directly on relevant areas such as land acquisition, management of land, and other resources. The Constitution guarantees every person the right to a clean and healthy environment under Article 42 and requires environmental protection under Article 69. Section 69 requires the state to (i) encourage public participation in the management, protection, and conservation of the environment; (ii) establish systems of environmental impact assessment, environmental audit and monitoring of the environment; and (iii) eliminate processes and activities that are likely to endanger the environment. All these constitutional dictates require the meticulous execution of a plan that will result in benefits with the least or no detriment to the environment and people.

(b) Energy Act 2019,

The Energy Act, 2019 and the regulations made under it constitute the current specific legal framework for the energy sector. This law creates several entities that oversee various aspects of the energy sector and makes general provisions relating to energy. Of particular interest are sections 54 to 57 which make provision for the development and use of nuclear science and technology, for various applications including electricity generation. Section 54 establishes NuPEA as the NEPIO.

(c) Nuclear Regulatory Act 2019,

The Nuclear Regulatory Act 2019 is the principal legislation governing nuclear development, handling, and use in Kenya. It provides for a comprehensive framework for the regulation of safe, secure, and peaceful utilization of atomic energy and nuclear technology; the production and use of radiation resources; and the management of radioactive waste. The Act establishes the Kenya Nuclear Regulatory Authority (KNRA) as the national nuclear regulatory body.

(d) Environmental Management and Coordination Act, 1999

This Act (as amended from time to time) and its regulations are the principal laws in Kenya on the management of environmental issues. This Act deal regulates threats of pollution and environmental degradation, and factors that threaten to harm the environment. Under the Act, policies, plans, programmes and projects which may have an impact on the environment require Strategic Environmental Assessment and Environmental and Social Impact Assessment before they can be implemented. Under the Act, the implementation of the nuclear program including the location of sites and attendant activities will require licensing. The legal framework on environmental management under this Act will need to be strengthened to enable it to deal specifically with concerns that arise in the implementation of a nuclear programme.

(e) Physical and Land Use Planning Act, 2019 (PLUPA)

PLUPA regulates planning and provides for diverse plans and procedures for their preparation. Consequently, planning for the Nuclear Power Programme should be undertaken through a participatory process that requires the involvement of stakeholders in the planning process. Ultimately, the siting of the Nuclear Power Programme (NPP) and other planning considerations in respect thereof must comply with the PLUPA.

3.3.4 International Treaties

At a global level, joining international treaties and conventions is an important component for the implementation of nuclear power to a country. The ratification of international instruments facilitates access to international assistance (including technical, regulatory and financial assistance). international cooperation provides the platform to exchange information and experience. Importantly, Kenya has acceded to key international instruments in the areas of nuclear security and safeguards (non-proliferation) as listed below.

The international instruments that Kenya has ratified in the area of *nuclear security* are:

- a) The Convention on the Physical Protection of Nuclear Material (CPPNM);
- b) The 2005 Amendment to the Convention on the Physical Protection of Nuclear Material;
- c) The International Convention for the Suppression of Terrorist Bombings (the Terrorist Bombings Convention);

- d) International Convention for the Suppression of Acts of Nuclear Terrorism (the Nuclear Terrorism Convention);
- e) The International Convention for the Suppression of the Financing of Terrorism;
- f) UN Security Council Resolution 1373(2001) (UNSCR 1373(2001)) adopted under Chapter VII of the UN Charter; and
- g) UN Security Council Resolution 1540(2004) (UNSCR 1540(2004)) adopted under Chapter VII of the UN Charter.

The international instruments that Kenya has ratified in the area of *nuclear safeguards* (non-proliferation) are:

- a) The Treaty on the Non-Proliferation of Nuclear Weapons.
- b) Protocol Additional to Agreements between States and the IAEA for the Applications of Safeguards (The Additional Protocol).
- c) The African Nuclear-Weapon Free Zone Treaty (Treaty of Pelindaba).
- d) Comprehensive Nuclear Test Ban Treaty.
- e) 1963 Partial Test Ban Treaty.

The relevant international instruments adopted under the auspices of the IAEA that Kenya needs to ratify in the area of nuclear safety are as follows:

- a) The Convention on Nuclear Safety.
- b) The Convention on Early Notification of a Nuclear Accident.
- c) The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.
- d) Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

The Government of Kenya also recognizes the need to establish a legal and regulatory framework for civil liability for nuclear damage in line with the internationally accepted principles for nuclear liability espoused in the following conventions under the auspices of the IAEA:

- a) The Vienna Convention on Civil Liability for Nuclear Damage (1963);
- b) The Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (1997);
- c) The Joint Convention Relating to the Application of the Vienna Convention and the Paris Convention (1988); and
- d) The Convention on Supplementary Compensation for Nuclear Damage (1997).

3.4 CHALLENGES

- a) The nuclear regulatory body charged with ensuring safe and secure utilization of nuclear technology has yet to develop regulations, guides and standards to operationalize its new mandate of regulating nuclear power and other nuclear technology applications;
- b) Kenya is yet to ratify some key legal instruments in the international nuclear law regime.
- c) Overlap of the key functions of some of the key public institutions and ministries utilizing nuclear science and technology.
- d) Lack of sufficient collaboration framework among the stakeholders relevant to the development of nuclear technology.

3.5 POLICY INTERVENTIONS

The government will pursue the following policy options:

- (a) Develop regulations under the Nuclear Regulatory Act No. 29 of 2019.
- (b) Finalize the development of a comprehensive legal framework of policies and laws to ensure all aspects of nuclear law i.e safeguards, security, safety and nuclear liability are fully addressed.

Ratify all relevant treaties and international conventions under the international nuclear law regime.

CHAPTER FOUR: POLICY PRIORITY AREAS AND INTERVENTIONS

4.0 INTRODUCTION

The implementation of a successful nuclear power programme requires strict adherence to international best practices. Through the collaboration with the IAEA Kenya is following the ‘Milestone Approach’ in the implementation of the programme. The core policy priority areas that require specific policy interventions are on nuclear safety, security and safeguards. The IAEA milestone approach has identified 19 infrastructural issues essential to the development of a successful nuclear power programme.

4.1 NUCLEAR SAFETY

4.1.1 Introduction

Safety is the realization of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards. Such radiation hazards result from an uncontrolled release of radioactive materials from nuclear/associated facilities or associated activities. As Kenya is committed to making a knowledgeable commitment to the development, safety measures constitute the first milestone in making this a reality.

4.1.2 Situational Analysis

In order for Kenya to be part of the global nuclear safety regime and share responsibility for its sustainability, it is imperative to ratify the Convention on Nuclear Safety, Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Convention on Early

Notification of a Nuclear Accident and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (‘the Joint Convention’). These conventions are the cornerstone of nuclear safety and nuclear emergency preparedness and response. Equally, the imperativeness of the code of conduct on the Safety and security of Radioactive Sources should be considered.

As a result of ratifying these conventions and adopting the code of conduct on the Safety and Security of Radioactive Sources Kenya will be in a strong position to conclude bilateral and multilateral agreements on international cooperation relating to prompt information exchange and provision of mutual assistance for preventing or minimizing injury and damage (including trans-boundary radiological harm) if nuclear accidents or radiological emergencies occur.

4.1.3 Challenges

- a) Key nuclear safety conventions have not yet been ratified.
- b) Inadequate research and development in nuclear safety that enhances regulations, policy development and standardization;
- c) A wanting safety culture in the country leading to laxity to embrace safety practices
- d) Inadequate guidelines/standards for identification, handling, transportation, management of nuclear and radioactive material; and
- e) Inadequate capacity in handling, transportation, management of nuclear and radioactive material and sources

4.1.4 Policy Interventions.

The government will pursue the following policy options:

- a) Government will develop and approve a national strategy for nuclear safety,
- b) The key organizations relevant to the nuclear power programme identified in chapter three shall be expected to recognize their nuclear safety responsibilities and develop and implement an Integrated Management System to manage nuclear safety.
- c) The government will ensure effective participation of all key national organizations in the global nuclear safety regime (The Global Nuclear Safety Regime is defined as the institutional, legal and technical framework for ensuring the safety of nuclear installations throughout the world. (See *INSAG-21 STRENGTHENING THE GLOBAL NUCLEAR SAFETY REGIME*).
- d) The government will ensure ratification and domestication of all relevant international conventions and ensure continued participation in international activities and international networks for strengthening safety: These treaties and conventions are as identified in chapter three.

- c) National research and development in nuclear safety shall be encouraged and sustained;
- d) Kenya Nuclear Regulatory Authority should develop and enhance guidelines and standards for identification, storage transport management of radioactive material and sources; and
- e) The Government shall ensure continuous capacity building on management of nuclear resources and radioactive material.

4.2 NUCLEAR SECURITY AND PHYSICAL PROTECTION

4.2.1 Introduction

Security and physical protection measures are intended to prevent unauthorized access, attacks against and sabotage of nuclear or radioactive materials and facilities during storage, use, transport, that could result in substantial radiological consequences. The security vulnerabilities include illicit trafficking and smuggling of nuclear materials, information security, insider threats, theft and unlawful access control. The key functions of nuclear security involve prevention, detection and response to nuclear security events.

4.2.2 Situation Analysis.

Besides the domestic legal regime already identified and discussed in Chapter Three, Kenya is a signatory or party to various international treaties and conventions regarding the peaceful use of nuclear technology. The Nuclear Regulatory Act No. 29 of 2019, established the Kenya Nuclear Regulatory Authority and mandates it to, among other things, ensure the country fulfills national and international obligations in respect of nuclear safety, security and safeguards. While undertaking this role, the KNRA is expected to coordinate the threat assessment process, and ensure persons authorized to handle nuclear materials have sufficient security and physical protection at all times and ensure cooperation with the IAEA and other relevant international agencies. The KNRA is expected to adopt the IAEA guidelines and other international best practices in regulation of nuclear security matters.

The government has also established the Nuclear Security Coordination Center which is mandated to assess nuclear security threats and other security issues relating to radioactive materials and radioactive sources in use, storage, and transport and together with the regulator establish a sustainable strategy.

4.2.3 Challenges

- (a) Inadequate security and physical protection measures in handling, storage and management of nuclear material, radioactive material, nuclear facilities and associated facilities;
- (b) Inadequate capacity in handling nuclear/radioactive material, detection and response to security incidents;
- (c) Inadequate infrastructure for detection and response to security incidents at the facilities or during transport;
- (d) Lack of adequate prosecution and enforcement capabilities; and
- (e) Weak security culture.

4.2.4 Policy Intervention

The government will pursue the following policy options:

- a) The government will ensure that all relevant international conventions and agreements that relate to nuclear security and safety are ratified and domesticated to demonstrate commitment to the international legal framework;
- b) The government shall identify all necessary elements of a domestic legal and regulatory framework for nuclear security arising from the international legal instruments, and plan to implement them through new or amended legislation;
- c) The government shall include in its legal and regulatory framework the requirement for a national threat assessment, a design basis threat for a nuclear power plant and as appropriate, a DBT or a threat assessment using an alternative threat based approach for other nuclear material and facilities;
- d) The government shall implement the nuclear security regime, which comprises in the legal and regulatory frameworks and administrative measures governing nuclear security, the organizations responsible for nuclear security, and the nuclear security measures themselves;

- e) The government shall enhance the existing security measures to manage nuclear security issues;
- f) The government shall ensure capacity building on handling nuclear/radioactive material, detection and response to security incidence;
- g) The government shall develop a security mechanism on the transportation, handling, storage and management of nuclear and radioactive material;
- h) The government shall enhance existing prosecution and enforcement capabilities to handle nuclear security related offences and crimes;
- i) Establish and maintain a strong nuclear security culture through continuous trainings;
and
- j) The government shall undertake tests and exercises, periodic assessments and public sensitization on nuclear security and physical protection.

4.3 NUCLEAR SAFEGUARDS

4.3.1 Introduction

Nuclear safeguards are a set of activities by which the IAEA seeks to verify that a State is living up to its international undertakings not to use nuclear programmes for nuclear weapons purposes. The nuclear safeguards system is based on assessment of the correctness and completeness of the State's declarations to the IAEA concerning nuclear material and nuclearrelated activities.

Nuclear safeguards contribute to the following:

- a) Nuclear transparency and confidence building in the context of non-proliferation obligations of the state at the regional and international level;
- b) It provides the State and its neighbours more security;
- c) It provides the State an increased access to nuclear technology;
- d) Giving the IAEA the capability to provide assurance that all the declared nuclear material in the state are used for peaceful purposes;

- e) It gives the IAEA the capability to provide assurance of the absence of undeclared nuclear material and activities in the State.

It is important that a country embarking on the nuclear power programme understands the Non Proliferation Regime and the pillars that strengthen it.

4.3.2 Situational Analysis

Kenya is a party to the Treaty on Non-Proliferation of Nuclear Weapons (NPT), whereby it has committed to three common objectives: Preventing the proliferation of nuclear weapons; Pursuing nuclear disarmament; and Promoting the peaceful uses of nuclear energy. The NPT has made it obligatory for Kenya as a non-nuclear weapon State party to submit all nuclear material in nuclear activities to IAEA safeguards, and to conclude a comprehensive safeguards agreement with the Agency (Article III of NPT).

Kenya has also signed Non-Proliferation Treaty, Small Quantities Protocol (SQP), Additional Protocols, Convention on Physical Protection of Nuclear Materials (CPPNM), CPPNM Amendments, African Nuclear Weapon Free Zone, the Comprehensive Test Ban Treaty, the Plant Treaty and London Convention Prot. 1972. The country also entered into a Comprehensive Safeguards Agreement (CSA) with IAEA on 8 December 2009.

The country has established a Systems of Accounting for and Control of Nuclear Material (SSAC) under the SQP but as it embarks on nuclear power generation significant upgrade will be needed in the infrastructure of current SSAC to meet the obligation under the CSA on SSAC.

Kenya has enacted the Nuclear Regulatory Act no. 29 of 2019 which is consistent with Kenya's international obligations on safeguards.

Kenya continues to demonstrate a political commitment to Non-Proliferation and Safeguards and has demonstrated transparency in its effort to introduce the first NPP by working very closely with the IAEA and following the Milestone Approach; and Kenya through the Nuclear Regulatory Body has participated in the United States Nuclear Regulatory Commission (USNRC) International Regulatory Development Partnership.

4.3.3 Challenges

- (a) Some relevant international instruments need to be ratified and requirements relating to nuclear safeguards fully complied with;
- (b) Inadequate guidelines/standards develop safeguards specific guidelines/standards, rules, regulations, and procedures;
- (c) Inadequate SSAC for the country. The SSAC lacks adequate Authority, Independence, Human resources, and Financial resources;
- (d) Inadequate capacity in handling, transportation and management of radioactive material.

4.3.4 Policy Interventions

The government will pursue the following policy options:

- (a) The government shall develop and approve a national strategy for implementation of nuclear safeguards;
- (b) The government shall arrange that the State should become a party to the remaining relevant international instruments namely: The agreement on the Privileges and Immunities of the IAEA (XV.A of the IAEA statute) -INFCIRC/9/Rev.2 and The “No Military” use undertaking;
- (c) The government shall take the necessary actions to support and adhere to the guidelines and requirements of number of international arrangements intended to strengthen the Non-proliferation regime and facilitate access to nuclear technology including the following:
 - i. Nuclear power supplying country group (NSG)
 - ii. Zangger Committee
 - iii. Bilateral agreements e.g. 123 Nuclear Cooperation Agreements
 - iv. Multilateral Nuclear Approach including fuel supply guarantee (MNA)
 - v. Other international agreements / cooperation

- vi. Proliferation Security Initiative (PSI), the Global Threat Reduction Initiative (GTRI)
 - vii. UN Security Council Resolution 1540 and 1887.
-
- (d) The government should plan to rescind its Small Quantities Protocol adopted on 18th of September, 2009 in a timely manner;
 - (e) The Kenya Nuclear Regulatory Authority should develop safeguards specific guidelines/standards, rules, regulations and procedures;
 - (f) The government shall develop a plan for enhancing the SSAC to ensure adequate authority; independence; human resources; and financial resources;
 - (g) Since Kenya has Additional protocol in force it has to start to provide information to the IAEA on its plans related to nuclear facilities and activities; and
 - (h) Kenya Nuclear Regulatory Authority will appoint staff responsible for nuclear safeguards.

CHAPTER FIVE: CROSS-CUTTING POLICY ISSUES

5.0 INTRODUCTION

Aside from the interventions on nuclear safety, security and safeguards outlined in the previous chapter, the successful and sustainable utilization of nuclear technology in Kenya will require other cross-cutting policy interventions. These cross-cutting issues include emergency preparedness and response, human resource capacity development, environmental sustainability, public participation and stakeholder engagement, nuclear and radioactive waste management, gender, youth and persons with disability, industrial involvement, electrical grid, site and supporting facilities, and procurement, among others.

5.1 RADIATION PROTECTION

5.1.1 Introduction

It is essential that activities involving radiation exposure, such as the production and use of radiation sources and radioactive material, the operation of nuclear facilities and radioactive waste management, be covered by measures to protect individuals exposed to radiation. The Nuclear Regulatory Act No. 29 of 2019 provides guidelines on this. Ionizing radiation and radioactive substances are natural and permanent features of the environment, and the risks associated with radiation exposure can therefore only be restricted, not eliminated entirely. Moreover, the use of human-made radiation is widespread. Sources of ionizing radiation are essential to modern health care and the use of nuclear energy, applications of radioactive substances and ionizing radiation continues to grow. Also, the use of nuclear techniques is expanding in industry, agriculture, medicine and many fields of research.

5.1.2 Situational Analysis

Kenya, like several other countries, uses radiation sources in medical, industrial, agricultural, hydrological and research applications with a view to improving the overall quality of life for its citizens. The safe and secure utilization of these radiation sources is underpinned in Kenya's national nuclear law, namely, the Nuclear Regulatory Act No.29 of 2019. The Nuclear Regulatory Act, 2019 establishes a legal framework for the safe management of all sources and types of ionizing radiation.

In line with IAEA safety standards, the Act makes provision for regulatory control of radiation protection on the basis of three (3) principles, namely,

- a) Justification of the benefit to be gained from the facilities or activities that give rise to radiation risks;
- b) Optimization of the protection and safety system in order to reach the highest level of the safety that can reasonably be achieved; and
- c) Requires mechanisms to be put in place to ensure that dose limits are not exceeded in relation to individual risks.

The Nuclear Regulatory Act, 2019 also requires the nuclear regulatory body to assess applications for authorizations to conduct prescribed activities against the verification that specifically enumerated radiation protection requirements have been met. These radiation protection requirements constitute a premise for protective actions to reduce existing or unregulated radiation risks.

5.1.3 Challenges

- a) Inadequate enforcement of legal and regulatory requirements for radiation protection due to constraints on existing human resource capacity.
- b) Loss of regulatory control of radiation sources (orphan sources) resulting in increased risk of radiological harm to people and the environment.
- c) Inadequate integration of nuclear safety and radiation protection requirements for the Nuclear Power Programme.
- d) Limited capacity building for relevant personnel on radiation protection requirements and associated management of radiological hazards in the event of accidental loss or intentional mishandling of radiation sources.

5.1.4 Policy interventions

The government will pursue the following policy options:

- a) The Kenya Nuclear Regulatory Authority should identify staffing needs and develop a strategy for filling identified gaps within its organization structure to facilitate effective performance of regulatory functions.
- b) Kenya Nuclear Regulatory Authority should develop a plan for an enhanced regulatory framework to strengthen monitoring and control of orphan radiation sources to minimize radiological risks in collaboration with relevant stakeholders.
- c) Kenya Nuclear Regulatory Authority should give appropriate consideration and planning to cater for the additional needs of the proposed Nuclear Power Programme including integrating safety/radiation protection; security/physical protection and safeguards requirements.
- d) Kenya Nuclear Regulatory Authority should plan for increased and systemic capacity building for personnel involved in the enforcement of radiation safety and security of radioactive materials.

5.2 NUCLEAR AND RADIOACTIVE WASTE

5.2.1 Introduction

Radioactive waste is radioactive material for which no further use is foreseen that contains, or is contaminated with, radionuclides at activity concentrations greater than clearance levels as established by the regulatory body. Conventionally, radioactive waste is generated through the use of radioactive sources or generators in medicine, industry and research. Radioactive waste is also produced in the extraction, processing and combustion of raw materials containing naturally occurring radioactive materials. Gaseous, liquid and solid radioactive wastes are generated as by-products of the operation of nuclear power plants or related facilities. All countries handle material that emit ionising radiation, either through industry application, medicine, agriculture, research, metrology, testing and also energy production.

It is therefore a prerequisite for a country to have a policy or national plan and strategy to handle waste that emit ionising radiation. Radioactive waste management entails several steps depending on the type of radioactive material being handled. Type in this case depends on the classification by the national nuclear regulator, their defined regulations, rules and guidelines

specific design features; operating procedures and practices, including maintenance, refueling and operational occurrences; the operational history of the plant; and fuel integrity.

Radioactive waste is classified depending on its quantity, toxicity and half-life. Spent nuclear fuel can be described as high level waste in countries which adopt an ‘open’ fuel cycle (no reprocessing) policy and/or strategy. Unlike other conventional waste, nuclear and radioactive waste has a unique feature of decay with passage of time, as a result affecting resource and manpower requirements in their management, which substantially reduces with time. Radioactive waste must be managed in such a way as to avoid imposing an undue burden on future generations; that is, the generations that produce the waste have to seek and apply safe, practicable and environmentally acceptable solutions for its long-term management. The generation of radioactive waste must be kept to the minimum practicable level by means of appropriate design measures and procedures, such as the recycling and reuse of material.

5.2.2 Situation Analysis

In Kenya the bulk of radioactive waste generated is disused, sealed and unsealed radioactive sources which are used widely in medicine, industry, agriculture and various research areas. Currently, the radioactive waste is conditioned and stored by Material Testing and Research Division (MTRD). The Central Radioactive Waste Processing (CRWP) Facility conditions and temporary stores waste generated from various sectors. This facility is designed to provide a short relief of management of radioactive waste since it is not a permanent/final/long-term solution to radioactive waste.

Kenya Nuclear Regulatory Authority is the licensing authority for activities related to radioactive waste management. It is also the owner of the CRWP Facility. However, with the planned construction of a research reactor and a nuclear power plant there will be a need to further develop an enhanced radioactive waste management facility to incorporate all radioactive sources.

The Nuclear Regulatory Act, 2019, establishes a legal framework for the management, among other things, spent fuel and radioactive waste. NuPEA is currently the main adviser to the government on radioactive waste management and nuclear fuel cycle. This is in accordance with the responsible Agency for implementing Kenya’s nuclear power programme and policy maker on matters on nuclear energy.

Kenya has a Central Radioactive Waste Processing Facility (CRWPF), “*Oloolua National Laboratory and Regional Centre for Radiation Safety and Nuclear Security*” which is utilized by collaborative partners, such as the IAEA, European Union, USA and regional neighbors, as a regional reference and resource center for radiation and nuclear related trainings, drills, and research. This facility handles low-level radioactive waste from nuclear sources.

5.2.3 Challenges

- a) Lack of radioactive waste disposal sites/facilities for handling high- level radioactive waste that which is generated from operation of nuclear power plants.
- b) Inadequate expertise in radioactive waste management.
- c) Policy and regulations for storage, transportation, handing, processing and disposal of nuclear and waste material not yet developed.
- d) Establishment of a waste management organization for both nuclear waste and radioactive waste.
- e) Lack of enhanced regulations in other sectors of the industry that deal indirectly with radioactive waste such as Technologically Enhanced Naturally Occurring Radioactive Materials (TENORMs) in mining industry.

5.2.4 Policy Intervention

The government will undertake the following measures/actions:

- a) Develop the national policy and a clear strategy for the processing, storage and disposal of radioactive waste (including spent fuel);
- b) Undertake siting and development of waste disposal and storage facilities for all classification of waste;
- c) Revise and develop the national laws and regulations associated with radioactive waste management and disposal;
- d) Establish the responsible organization and appropriate financing mechanism for spent fuel and radioactive waste management;
- e) Develop plans for any national facilities for radioactive waste management, consistent with the NPP construction programme;

- f) The government shall be responsible for Nuclear Power Plants decommissioning and final repositories of radioactive waste and spent nuclear fuel, assuring financial resources for this purpose by a dedicated mechanism established earlier in national nuclear power programme;
- g) The government will assign the permanent responsibility to continue following international efforts and progress on radioactive waste management and revise national policy as appropriate;
- h) The NPP owner or operator should be required to provide a preliminary NPP decommissioning plan from the selected vendor as required by the regulatory body in its authorization process.

5.3 EMERGENCY PREPAREDNESS

5.3.1 Introduction

Nuclear and radiological emergencies are events involving potential release of significant amounts of radiation and radiological particles, from a radioactive source, nuclear or associated facilities, leading to possible exposure of radiation to people and the environment. Emergency Preparedness and Response (EPR) includes all technical and organizational measures taken to protect the population and the environment from the harmful effect of radiation.

5.3.2 Situation Analysis

Kenya has the National Emergency Response Plan and National Disaster Risk Management Policy that provide guidelines to preparedness and response to conventional emergencies. Further, a draft National action plan for management of chemical, biological, radiological, and nuclear material has been developed. The Disaster Risk Management Authority Bill, 2021 is currently under parliamentary legislation process.

5.3.3 Challenges

- (a) Inadequate EPR measures for nuclear/radiation emergencies.
- (b) Inadequate capacity in management of nuclear/radiation emergencies.

5.3.4 Policy Interventions

- (a) The government will evaluate the existing national arrangements for emergency and will establish the needs for new arrangements in preparedness for response to a radiation emergency at national and international level;
- (b) The government should specify the lead institutions with responsibilities for emergency preparedness and response which ought to be multi-sectoral for maximum results.
- (c) The Kenya Nuclear Regulatory Authority, should develop basic regulations on emergency preparedness and response, as necessary for development of infrastructure;
- (d) The government through the Kenya Nuclear Regulatory Authority, should develop and implement emergency preparedness programmes at the local, national, and international level;
- (e) The government should prepare a national plan for dealing with emergencies irrespective of their causes (i.e. nuclear accidents or nuclear security events);
- (f) The government, the national regulatory body and the NPP operating organization should demonstrate emergency response capabilities by conducting appropriate exercises that include local authorities and local communities; and
- (g) The government shall ensure the development of capabilities for the coordination of emergency preparedness and response at an international, national, local and NPP operator level.

5.4 HUMAN RESOURCE DEVELOPMENT

5.4.1 Introduction

To ensure safe and secure utilization of nuclear technology, establishment of specialized and highly trained workforce with an understanding on handling/management of nuclear/radioactive material, is crucial. Effective human resource management and sustenance ranges from education, training, continual monitoring and improvement of the workforce's performance. Human resource development is thus critical in enhancing organizational effectiveness and productivity. The Government of Kenya through its's Nuclear Energy Programme Implementing Organization (NEPIO)-Nuclear Power & Energy

Agency has developed a draft Human Resource Development Strategy (HRD). The draft HRD is under continuous improvement as further studies centered on institutional mapping and analysis of training programs have been recommended.

5.4.2 Situation Analysis

Kenya has been collaborating with the IAEA, through the Country Programme Framework (CPF) (2017-2022) and African Regional Cooperation Agreement, for technical cooperation in implementing development projects that apply nuclear technology in agriculture, research, cancer treatment and nuclear energy development. Technical cooperation projects have ensured continuous capacity building of Kenyans through financing of activities like training, fellowships, scientific visits and technical meetings in various countries. Memorandum of Understanding with countries that have advanced nuclear technology (South Korea, United States, China, Russia) have been signed to provide academic scholarships. In addition, a human resource development strategy is still under development and provides guidelines in development and management of human resources in different nuclear technology fields. However, appropriate measures are required to capture and retain skills created from nuclear technology training to enhance technology and knowledge transfer and employment.

5.4.3 Challenges

- (a) Inadequate human resource capacity in research and application of nuclear technology.
- (b) Inadequate measures to retain local expertise in nuclear technology.
- (c) Inadequate funding for human resource development.
- (d) Inadequate procedures in establishment of new/essential nuclear institutions resulting in delays in local skill development.

5.4.4 Policy Intervention

In order to tap on the potential benefits of nuclear technology in all sectors for sustainable development, the government shall be guided by the following policy options in developing its' human resource;

- (a) The government will determine the human resource needs of the programme based on the established objectives of the national nuclear energy programme.

- (b) The government will compare human resource needs to existing and expected national human resources (gap analysis);
- (c) The government will determine how to address the identified human resource gaps and develop the national workforce plan;
- (d) The government shall analyze the national education system (schools and universities) and will finance the identified improvements, including the development of training facilities dedicated to nuclear energy;
- (e) The government shall identify national institutions and institutions in other States that could provide education and training and could start training in key areas relating to nuclear energy and nuclear safety;
- (f) The Government shall adopt a strategy for attracting, training and retaining an adequate number of experts to meet the needs of all organizations involved in prospective nuclear energy programme;
- (g) The Government shall facilitate/enable all relevant key nuclear organizations to implement strategies that attract and retain skilled personnel;
- (h) All relevant organizations should commence the education and training in academic and vocational institutions of the necessary number of persons for ensuring a successful NPP;
- (i) The National Nuclear Safety Regulatory Body shall review and assess the NPP operating organization's programme with regard to human resources management;
- (j) Additional budgetary allocation will be made for science related projects and research;
- (k) Ensure development of human resource capacity and facilities for other programmes that utilise nuclear technology like Health, Agriculture, Environment, Mining and Industry.
- (l) Ensure adequate human resource development in application of nuclear techniques in crop, livestock and food production sectors through collaboration with states and other agencies.
- (m) Develop a training curricula for radiation oncologists, medical physicists and oncology nurses to broaden human resource capacity in Human Health management; and
- (n) Support training in operation and maintenance of instruments/equipment that are used while performing nuclear-related work/activities in all sectors utilizing nuclear technology;

5.5 ENVIRONMENTAL MANAGEMENT & SUSTAINABILITY.

5.5.1 Introduction

Kenya has a wide variety of ecosystems namely; mountains, forests, arid and semi-arid areas, freshwater, wetlands, wildlife, coastal and marine all offering many opportunities for sustainable human, social and economic development. Kenya's environmental resources contribute directly and indirectly to the local and national economy through revenue generation and wealth creation. Sustainable environment is therefore essential to Kenya's development policy.

5.5.2 Situation Analysis

Kenya has a robust environmental framework, premised on the Environmental Management and Coordination Act, 1999 and its regulations, and is a signatory to various international conventions on protection of the environment. There exists a host of other sectoral laws and policies dealing with various facets of the environment, such as water, forests, minerals among others, to aid the pursuit of sustainable development objectives as set out in the Vision 2030.

The Nuclear Regulatory Act No. 29 of 2019, establishes the Kenya Nuclear Regulatory Authority as the nuclear safety regulator for the nuclear power programme and other nuclear applications in Kenya. The National Environmental Management Authority established under EMCA, is the designated environmental regulator and KNRA should develop the skills and resources required to fulfil its respective responsibilities and the interface between these two entities.

NuPEA which is the country's NEPIO in collaboration with NEMA is undertaking a Strategic Environmental and Social Assessment, which is at the tail end. The assessment evaluates land use, water use, water quality, and potential nuclear impacts on people and the environment. Notable impacts associated with the nuclear power programme (NPP), such as radioactive effluents and the normal operation of a nuclear power plant and related facilities have been considered.

There is a need to enhance the existing environmental regulatory framework (environmental laws, regulations and responsibilities) to cover additional environmental challenges posed by

application of nuclear technology. Further to that there is a need for increased commitment and support for environmental sustainability, provision of sufficient resources and capacity to enforce compliance and removal of institutional barriers to environmental sustainability.

The use of nuclear technology in environmental management which include the use of radiotracers to monitor pollution impacts, treating effluents and in understanding climate change trends in terrestrial and oceanic systems should also be promoted.

5.5.3 Challenges

- (a) NPP technology is characterized by unique aspects that may affect the environment such as routine and accidental radiological releases to air and water and hence need unique regulations;
- (b) Inadequate environmental laws and regulations to address/guide the process of Environmental Impact Assessment of a NPP;
- (c) Insufficient capability in organizations exercising environmental oversight over environmental assessment for NPP. The main organizations being the Environmental Regulator – NEMA and the Nuclear Safety Regulator- KNRA;
- (d) No clear interfaces in oversight functions between the Environmental Regulator and the Nuclear Safety Regulator and hence possible conflicts; and
- (e) High international and local public interest concerns regarding environmental assessment of NPPs and hence the process requires significant resources to generate public support and acceptance.

5.5.4 Policy Interventions

The government will pursue the following policy interventions:

- a) Empower sector regulator through adequate financial and human resource to facilitate their leadership in environmental, health, and quality enforcement in Nuclear Technology in order to enable it discharge its mandate effectively.

- b) Promote and support capacity building in the field of nuclear technologies and environment.
- c) Define the roles and responsibilities of the environmental regulator for the NPP and for the peaceful application of nuclear energy.
- d) Define a clear interface between the Environmental Regulator (NEMA) and the Kenya Nuclear Safety Regulator (KNRA).
- e) Ensure that all entities tasked with environmental regulation for the NPP have the skills and resources required to fulfil the assigned roles and responsibilities.
- f) The NPP Owner Operator shall perform a complete assessment of the environmental impact of the selected NPP, in accordance with national requirements, and should submit the Environmental Impact Assessment report (study) to the appropriate authority for licensing purpose.
- g) Ensure that plans for systems and facilities for necessary environmental monitoring (including radiation monitoring) will be developed, with clearly assigned roles for the NPP operating organization and the nuclear environmental regulator; and
- h) Promote the use of nuclear technology in environmental management which include the use of radiotracers to monitor pollution impacts, treating effluents and in understanding climate change trends in terrestrial and oceanic systems.

5.6 PUBLIC PARTICIPATION, STAKEHOLDERS' ENGAGEMENT AND CONFLICT MANAGEMENT

5.6.1 Introduction

Public participation and stakeholder engagement is key to utilization of nuclear technology. Public engagement also enhances information sharing and reduces conflicts. Therefore, there is a need for a comprehensive and systematic approach to public participation and stakeholder involvement in the application of nuclear technology in line with national values as enshrined in article 10(2) of the *Constitution of Kenya, 2010*.

5.6.2 Situational Analysis

Kenya does not have a standard public participation strategy. As such the threshold on public strategy is not clear. Currently, the country engages in both stakeholder sensitization and workshops involving the local populace. As nuclear energy directly touches on environment, the designate environmental authority-NEMA prescribes a criterion for this for Strategic Environmental Social Assessments directly involving the public. This is in compliance with article 10 (2) of the Constitution of Kenya, 2010.

5.6.3 Challenges

- a) Absence of sustained public participation and engagements by the government.
- b) Limited public awareness and understanding of benefits of nuclear technology applications;
- c) Absence of an effective communication policy and strategy on stakeholder engagement on national nuclear strategies; and
- d) Inadequacy of government driven mechanisms for addressing and responding to conflicts and social unrests and hence lengthy dispute resolution mechanisms that derail development.

5.6 4 Policy Intervention

The government will pursue the following policy interventions:

- a) Develop and implement a National Stakeholders Involvement Strategy for nuclear energy programme;
- b) Organize periodic national and local public opinion survey on national nuclear energy programme;
- c) Develop and implement a national education programme on the aspects of nuclear energy peaceful utilization and benefits;
- d) The NPP Owner Operator shall develop and implement a Stakeholder Involvement Plan and promote engagement with the local community around NPP site;

- e) The Nuclear Safety Regulator shall develop and implement a Stakeholder Involvement Plan and promote engagement with the public on the national nuclear energy programme;
- f) The government shall undertake public consultation and sensitization forums on nuclear technology applications to increase public awareness and understanding of beneficial uses of nuclear technology applications;
- g) Develop a public communication strategy and a specific public participation guideline for community involvement on nuclear technology at national and county levels; and
- h) Adopt alternative dispute resolution mechanisms that will ensure speedy resolution of complaints related to public engagement and communication.

5.7 GENDER, YOUTH AND PERSONS WITH DISABILITY

5.7.1 Introduction

In the spirit of the Constitution, Gender balance, youth and persons with disability shall be incorporated in the development of nuclear technology in Kenya. Procurement is a key infrastructural issue necessary for a successful Nuclear Power Programme. The Kenya's Public Procurement Process is guided by The *Public Procurement and Asset Disposal Act* of 2015 and its Regulations developed in 2020. The Act mandates all procuring entities to reserve a minimum of thirty per cent of the budgetary allocations for enterprises owned by women, youth, persons with disabilities and other disadvantaged groups, in its procurement and asset disposal planning.

5.7.2 Situational Analysis

Kenya has a diverse population with varied ethnic, racial and linguistic groups. The enumerated population was recorded as 47.6 million as of August 2019 census with an expected annual growth rate of 2.3%. According to the 2019 Population and Census results, the country has a 75 % young population with 32.73 million (68.9%) living in rural areas. Male population accounts for 23,548,056 (50.5%) of the population while the female population 24,014,716 (49.5%).

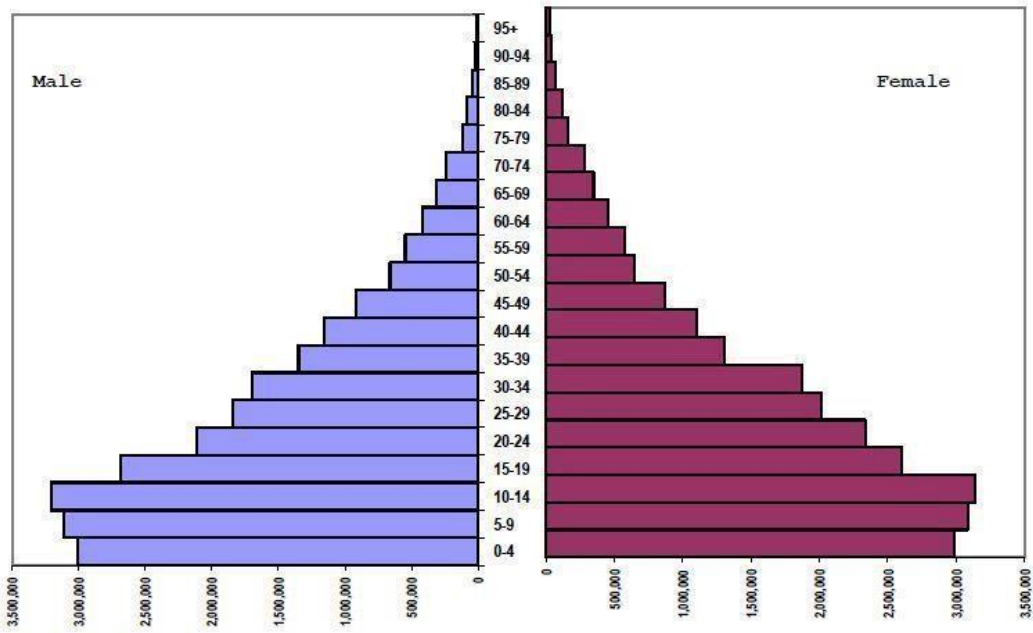


Fig. Demographic of Kenya (Source: 2019 Kenya Population and Housing Census Report)

According to the 2019 census, 2.2% (0.9 million people) of Kenyans live with a form of disability. The census further indicates that 1.9% of men have special needs compared with 2.5% of women.

5.7.3 Challenges

- a) Inadequate implementation of the policy on gender balance, youth and persons with disability;
- b) Inequality in accessing available opportunities; and
- c) Lack of adequate knowledge on nuclear technology within the special interest groups

5.7.4 Policy Intervention

The government will pursue the following policy options:

- a) The government and institutions responsible for nuclear technology shall comply with Article (27) (8) of the Constitution of Kenya, 2010;
- b) Inclusion of gender, youth and persons with disability issues in policy formulations in nuclear technology applications;

- c) The government shall adopt programmes geared towards addressing gender, youth and persons with disability imbalance in nuclear technology applications and make special consideration for training and awareness creation for special interest groups on nuclear technology matters.

5.8. LOCAL/INDUSTRIAL PARTICIPATION

5.8. 1 Introduction

The Public Private Partnership Act, 2021 defines local content as the added value brought to the Kenyan economy from project-related activities by way of local distribution of accruing benefits including through the procurement of locally available workforce, services and supplies and systematic development of national capacity and capabilities. Section 83 of the aforementioned Act provides amongst others for the mechanisms for technology transfer locally and that local content requirements provided under any other written law and policy are complied with. Section 83(2) of the Act obligates the Committee, to issuance such guidelines and standards on local content as shall be deemed necessary based on the priority requirements of the Kenyan economy.

This provision articulates that the *Public Private Partnership Act, 2021* makes it mandatory for Public Private Partnerships (PPPs) to give priority to Kenyan goods and services meeting a minimum standard and that skilled and qualified Kenyan citizens are employed where possible. The Public Procurement and Asset Disposal Act, 2015 and Regulations provides a guidance on promotion of the local industry, sustainable development, protection of the environment and promotion of citizen contractors. As per the Act, the public entities in Kenya are required to ensure that the tender documents contains a mandatory requirement specifying that all tenderers include a local content plan which includes;

- a) Transfer of technology
- b) Positions reserved for employment of local citizens;
- c) Capacity building and competence development programme for local citizens;
- d) Timeframes within which to provide employment opportunities;

- e) Demonstrable efforts for accelerated capacity building of Kenyan citizens;
- f) Succession planning and management; and
- g) A plan demonstrating linkages with local industries which ensures at least forty percent (40%) inputs are sourced from locally manufactured articles, materials and supplies partially mined or produced in Kenya, or where applicable have been assembled in Kenya.

Nuclear Power Plant projects are a major undertaking in terms of not just capital investments, but also public acceptance. This applies to the potential supply base/ industries also which needs to be convinced that the proposed projects are real in terms of schedules, budgets and commitment to localization via required government support for investments, training and on-going future business.

While the first time undertaking of a Nuclear Power Project presents high profile business opportunity to the local supply base/ industries, a country should put appropriate policies in place to capture and retain value created from available resources to stimulate employment, entrepreneurship, value addition, diversification, transfer of technology and knowledge across the value chain the economy.

5.8.2 Situational Analysis

The government has to set clearly its localization goals in the development of the nuclear power programme by developing a long term policy to encourage national industry to enhance its ability to participate in nuclear programme. The National Industrial Policy should clearly stipulate targets for industrial participation and localization of nuclear technology as well as Government's possible incentives to the industry. The Industrial Policy should also address the mechanisms for assessing standards and quality a task that is currently mandated to the Kenya Bureau of Standards (KEBS).

In 2018, NuPEA developed a guide document to direct/advise on the methodology to be adopted in the development of a strategy and a policy, carried out field survey of Steel, cement, aggregate companies and transportation companies with potential for involvement in NPP.

Kenya is required to develop and upgrade local industry continuously so as to meet nuclear industrial standards.

5.8.3. Challenges

- a) Absence of local content/ local industrial participation and development policy/ strategy;
- b) Inadequate human capital development/capacity building programme to build knowledge and technical capacity in nuclear technology applications within the local industries;
- c) Inadequate funding and financing mechanisms that will be provided to local industries to achieve the localization goals; and
- d) Inadequate legislation/regulatory framework for local industry participation in nuclear technology, enforcement of the requirement of for knowledge transfer and enforcement of the requirement for prioritization of utilization of locally available good and services;

5.8.4 Policy Interventions

In order to tap on the potential benefits of local participation/ industrial participation in nuclear technology applications, the government shall be guided by the following policy interventions:

- a) Arrange a survey of national industry capabilities that could support a nuclear power programme;
- b) Establish and implement a strategy and a localization plan (or a local content plan) for national industrial participation to nuclear power programme;
- c) Implement the funding and financing mechanisms that will be provided to local companies to achieve the localization goals and should perform analyses to avoid NPP project risks and any negative impacts on the project schedule;
- d) Develop and implement education framework for human capital development / capacity building programme in conjunction with local industry players to build knowledge and technical capacity in nuclear technology applications; and

- e) Establish a local industrial participation/ local content monitoring unit to ensure compliance with local content requirements by investors in nuclear power and nuclear technology development.

CHAPTER SIX : POLICY IMPLEMENTATION, MONITORING AND EVALUATION

6.1 Introduction

Effective monitoring and evaluation are critical to the implementation of nuclear science and technology sector programmes and projects. Importantly, it provides a platform through which the various organizations involved are able to maintain their roles and ensure achievement of the goal of the Policy.

6.2 Challenges

- a) Lack of a nuclear science and technology policy monitoring and evaluation mechanisms.
- b) History of incomplete implementation of past policies by relevant government ministries and agencies.

6.3 Policy intervention

- a) Formulate a monitoring and evaluation framework for this policy.
- b) Formulate a monitoring and evaluation framework for programmes and projects under this policy.

IMPLEMENTATION MATRIX				
POLICY INTERVENTIONS/ STRATEGY	SHORT TERM 2020-2025	MEDIUM TERM 2020-2030	LONG TERM 2020-2035	RESPONSIBILITY ENTITY
Adoption of a clear statement, which reflect broad political support, of its intent to develop a nuclear power programme, and it should communicate that intent locally, nationally, regionally and internationally.	X			Ministry of Energy
Establish clear national strategy to use peaceful nuclear technology for power generation, indicating its long term commitment and recognizing the importance of safety, security and non-proliferation.	X			Ministry of Energy, NuPEA, Ministry of Interior and Coordination of National Government, KenGEN, KNRA
Establish and/or strengthen the key nuclear related organizations including and not limited to an independent and effective	X	X	X	Ministry of Energy, NuPEA, Ministry of Interior and Coordination of National

IMPLEMENTATION MATRIX

POLICY INTERVENTIONS/ STRATEGY	SHORT TERM 2020-2025	MEDIUM TERM 2020-2030	LONG TERM 2020-2035	RESPONSIBILITY ENTITY
nuclear regulatory body (i.e. the Kenya Nuclear Regulatory Authority), Nuclear Energy Programme Implementing Organization (the Nuclear Power and Energy Agency), NPP Owner/Operator, Nuclear Power Research and Development Institute, Radioactive Waste Management Organization and Technical Service Organization.				Government, Kengen, KNRA
Development of a comprehensive national legal and regulatory framework covering all aspects of nuclear law, including safety, security, safeguards, nuclear liability and other legislative, regulatory and commercial aspects, which is a necessary complement to the conclusion of the international agreements.	X	X	X	Ministry of Energy, and all other relevant government ministries

IMPLEMENTATION MATRIX

POLICY INTERVENTIONS/ STRATEGY	SHORT TERM 2020-2025	MEDIUM TERM 2020-2030	LONG TERM 2020-2035	RESPONSIBILITY ENTITY
The national Nuclear Regulatory Body should ensure that a full and comprehensive set of regulations and guides is in place for regulating, control and inspection of all peaceful applications of nuclear energy, including construction, commissioning and operational activities of Nuclear Power Plants, at the appropriate time.	X	X		KNRA
Establishment of a robust, reliable, and Flexible national transmission network (electric grid).	X	X		KETRACO
Nuclear sites -identifying, acquisition and developing the infrastructure of suitable nuclear power plants sites.	X	X		Ministry of Energy, Ministry of Lands and Physical Planning, National Land Commission, KNRA, NEMA,
Initiate and identify spent fuel and radioactive waste disposal sites.			X	KNRA, Waste Management Organization, NEMA
Development and implementation of a	X			Ministry of Health, NEMA,

IMPLEMENTATION MATRIX				
POLICY INTERVENTIONS/ STRATEGY	SHORT TERM 2020-2025	MEDIUM TERM 2020-2030	LONG TERM 2020-2035	RESPONSIBILITY ENTITY
nuclear fuel cycle, radioactive waste management policy and strategy.				MoE, NuPEA
Develop and implement a policy and strategy for expansion and participation of local industry in nuclear power programme	X	X	X	Ministry of Industrialization, KAM, KeBS, EBK, The National Treasury and Planning, Office of the Attorney General
Public and stakeholder involvement in the implementation of the nuclear power programme and nuclear technology.	X	X	X	NuPEA, Ministry of Energy, KNRA, and other relevant stakeholders
Collaboration with governments and international organizations to optimize the utilization of nuclear technology.	X	X	X	All government agencies and relevant institutions
Training Needs Assessment (TNA) for	X	X	X	All government agencies and
Strengthen capacity in nuclear engineering,	X	X	X	Training and research institutions

IMPLEMENTATION MATRIX				
POLICY INTERVENTIONS/ STRATEGY	SHORT TERM 2020-2025	MEDIUM TERM 2020-2030	LONG TERM 2020-2035	RESPONSIBILITY ENTITY
nuclear physics, and associated technologies and services.				
Establishment of a research reactor facility.	X	X	X	Research Institutions, Training Institutions, Medical Institution
Establishment of isotope hydrology facilities for research and training.	X	X	X	Ministry of water & Sanitation and other relevant research and training institutions.
Development and review appropriate policy and legal environment for use of nuclear technology in crop, livestock, food security and water resource management	X	X	X	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Ministry of Health, Ministry of Water and Sanitation and relevant institutions
Develop a comprehensive policy and strategy on nuclear technology for medical training,	X	X	X	Ministry of Health and other relevant government institutions

IMPLEMENTATION MATRIX				
POLICY INTERVENTIONS/ STRATEGY	SHORT TERM 2020-2025	MEDIUM TERM 2020-2030	LONG TERM 2020-2035	RESPONSIBILITY ENTITY
diagnosis, treatment and medical research and update the National Cancer Control and Prevention Plan (NCCP)				
Develop and enforce appropriate standards for nuclear technology applications in industries	X	X	X	KEBS in collaboration with the Regulator Body
Adopt an integrated management system in the application of nuclear technology.	X	X	X	All relevant institution
Enhance safety skills and behavioral competency to integrate ensure nuclear safety in all key organizations.	X	X	X	All relevant institution
Enhance the existing security measures to manage nuclear security issues.	X	X	X	All relevant institution
Enhance existing prosecution and enforcement capabilities to handle nuclear security related offences and crimes.	X	X	X	All relevant law enforcement institutions

IMPLEMENTATION MATRIX				
POLICY INTERVENTIONS/ STRATEGY	SHORT TERM 2020-2025	MEDIUM TERM 2020-2030	LONG TERM 2020-2035	RESPONSIBILITY ENTITY
The government through the national regulatory body should develop and implement emergency preparedness programme at the local, national, and international level and specify the national institutions with responsibilities for emergency preparedness and response	X	X		All relevant Government entities and KNRA
Evaluate the existing national arrangements for emergency and prepare a national plan for dealing with emergencies irrespective of their causes (i.e. nuclear accidents or nuclear security events)	X	X	X	All relevant Government entities and KNRA
Enhancement of the existing EPR guidelines to address nuclear and radiation emergencies	X	X	X	NDMU, NDOC, KNRA, Security Agencies
Capacity building on handling nuclear/radioactive material, detection and response to security incidence.	X	X	X	NDMU, NDOC, KNRA, Security Agencies

IMPLEMENTATION MATRIX				
POLICY INTERVENTIONS/ STRATEGY	SHORT TERM 2020-2025	MEDIUM TERM 2020-2030	LONG TERM 2020-2035	RESPONSIBILITY ENTITY
Develop an implementation framework for enforcement of environmental laws, regulations and standards relating to nuclear technology.	X	X	X	NEMA, nuclear regulatory and other relevant authority
Review and harmonize existing legal and institutional framework to address emerging issues in nuclear technology development and environmental management.	X	X	X	All relevant institutions
Provide economic incentives for investment in nuclear technology.	X	X	X	The National Treasury and Planning,
Ratify and implement all treaties and international conventions relevant to nuclear applications.	X	X	X	Office of the Attorney General
Tax and fiscal incentives; Specialized tax concessions and provision of grants.	X	X	X	The National Treasury and Planning, Donors and investors

IMPLEMENTATION MATRIX

POLICY INTERVENTIONS/ STRATEGY	SHORT TERM 2020-2025	MEDIUM TERM 2020-2030	LONG TERM 2020-2035	RESPONSIBILITY ENTITY
Increased budgetary allocations.	X	X	X	The National Treasury and Planning, Donors and investors
Adopt financial options from local and international sources	X	X	X	The National Treasury and Panning, Donors and Investors