AN ASSESSMENT OF THE STATUS OF BLUE ECONOMY SECTORS IN KENYA

Sector Report on Oil and Gas including Renewable Energy

Presented by

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1.1 Background and context

The growing energy demand has led to increased exploration for oil and gas in Kenya. The quantity of petroleum products imported increased by 5.3% to 6.4 million tonnes in 2019 (Republic of Kenya, 2020). The recent oil and gas discoveries in Kenya have increased interest from both public and private sector players in offshore exploration for hydrocarbons in the country. Like other human activities, the pressures and opportunities created by oil and gas exploration activities imply that efforts should be put in advancing understanding about the resources, the associated environment and the social aspects of their exploitation. Development of new technologies for exploration gives more hope for more offshore and onshore oil and gas discoveries in Kenya. Consequently, offshore and onshore oil and gas discoveries would make a significant impact on the Kenyan economy and would trigger new developments in the country (NOCK, 2012). Emphasis is therefore being put on maintaining national supplies to meet part of the increasing demand and to remain with surplus for export. Consequently, there is a drive to exploit the potential energy resources including oil and gas, wind and solar resources. Besides oil and gas, total electricity demand in the country also increased by 3.9% from 11,182 GWh in 2018 to 11,620.7 GWh in 2019. Electricity generation from wind power in Kenya increased more than fourfold from a total of 375 GWh in 2018 to 1562.7 GWh in 2019 (Republic of Kenya, 2019; 2020).

Oil and gas exploration is a developing activity in the Western Indian Ocean Region including Kenya. This follows the scientific discovery that countries whose landmasses and maritime Exclusive Economic Zone (EEZ) comprise sedimentary basins like Kenya are likely to make discoveries of hydrocarbons (UNEP and WIOMSA, 2015). The exploration for oil and gas in Kenya dates back to the 1950s, and four potential sedimentary basins have already been established namely Lamu basin (252,297.65 square kilometres), Mandera basin (51,441.98 square kilometres), Anza basin (76,107.63 square kilometres) and Tertiary Rift (including Lokichar) basin (116,619.13 square kilometres). The offshore blocks that have been identified

for oil and gas exploration are largely in the Lamu basin which is believed to hold a greater potential and is considered the next edge for oil and gas development in Kenya.

1.1.1 Coastal and Offshore Exploration

It is estimated that the offshore oil and gas potential can yield several billion barrels of oil and trillions cubic feet of gas prospective resources on a gross, un-risked, best-estimate basis. The offshore potential has attracted considerable investment from companies looking to survey and explore the Lamu basin for oil and gas (NOCK 2012). A study of the Lamu basin was initiated by National Oil Corporation (NOCK) in 1991 as part of a long term strategy to re-examine the existing geological, geophysical and geochemical data relating to the sedimentary basin. The study was completed in 1995 and its results were used to sub-divide the Lamu basin into smaller exploration blocks with each block having its unique characteristics. Thereafter, there were enhanced exploration efforts that generated fresh interests in the offshore Lamu basin and resulted the signing of seven (7) production sharing agreements between 2000 and 2002.

Based on initial studies, the Government of Kenya through a Gazette Notice Number 3344 of 13th May 2016, constituted sixty-three (63) petroleum exploration blocks, of which thirty seven (37) are located in the Lamu basin (See Appendix 1 for the 37 blocks). The Lamu basin is the largest basin and extends offshore. All the offshore exploration blocks have been defined by their longitudes and latitudes, their sizes and block maps. Offshore oil and gas exploration has been on-going with mixed results (Deloitte, 2013). A recent exploration well which was drilled offshore, close to the Exclusive Economic Zone border with Tanzania has met an oil column; the first ever oil discovered off the East African coast, with high prospects for finding commercial quantities of oil in the area particularly in the Lamu Basin (UNEP and WIOMSA, 2015). If the identified oil and gas reserves continue to yield even a small portion of the expected outcome, then Kenya will gain from income earnings and savings on fuel imports that will significantly change the national economy and contribute to poverty alleviation among the local residents.

1.1.2 Onshore Oil and Gas Exploration

The onshore oil and gas exploration has attracted significant investment. It has been estimated that the Turkana basin has great potential which has caught the attention of major oil exploration

and production companies particularly Tullow and its Joint Venture Partners. Consequently, successful drilling and findings on land have been made in the Turkana Basin (Deloitte, 2013; Tullow, 2022). In the year 2020, the Early Oil Pilot Scheme (EOPS) successfully completed two years of reservoir and production data gathering. The reservoir and production data gathered during EOPS is currently being used in redesigning the full field development concept. EOPS produced more than 350,000 barrels of oil from the Ngamia and Amosing fields which has provided six months' sustained rate and pressure data. The data confirms reservoir quality and continuity in both fields, enabling the Group to optimise plans to focus on the most productive wells at the crest of the fields, leading to improved rates per well and refined injector/producer patterns. The impact of this on plateau rates and recoverable resources is being assessed. In parallel, the Joint Venture Partners are also working closely with the Government of Kenya on securing approval of the Environmental and Social Impact Assessments and finalising the commercial framework for the project (Tullow, 2022).

Over 86 wells have been drilled with a majority located within the Tertiary Rift. It is estimated that over 4 billion barrels of crude oil reserves have been encountered in the Lokichar sub-basin by Tullow Plc and its partners, with recovery oil estimated to be 750 million barrels (NOCK 2012). The Ngamia-1 exploration well in Kenya marked the start of a significant programme of drilling activities across the acreage. In 2012, the Ngamia-1 well successfully encountered over 200 metres of net oil pay in the East Africa onshore tertiary rift basin that was opened by Tullow. This has since been followed by further exploration success in the South Lokichar Basin at the Amosing, Twiga, Etuko, Ekales-1, Agete, Ewoi, Ekunyuk, Etom, Erut and Emekuya oil accumulations.

1.1.3 Segmentation of the oil and gas industry

The Oil and Gas industry is divided into three segments: Upstream, Midstream and Downstream. These segments are based on the supply chain of the Oil and Gas industry. The Upstream companies focus on exploration and production of crude oil and natural gas through drilling processes to recover these resources both underground and underwater. Some of the exploration blocks are mostly found throughout Turkana County. The Upstream players in Kenya include Tullow Oil, Africa Oil and Total. Once the oil and gas are produced, midstream companies take

over the transportation and storage of the product to different geographical locations that deal with refinery. Midstream companies rely heavily on upstream companies for production in order to be in business. The transportation takes place through tanker ships, trucking fleets or pipelines. At the moment, the Kenya Pipeline Corporation (KPC) which transports petroleum products from Mombasa to Hinterland plays the role of a Midstream company. KPC is cross cutting between Midstream and Downstream because Kenya currently does not have a midstream company. In the event Kenya has a midstream, KPC should be the government's representative. Ministry of Energy and Ministry of Petroleum and Mining refer to KPC as a midstream company and classify the pipeline and storage as midstream operations (Makena, 2021).

The Midstream Company delivers the crude oil and natural gas that is produced during the upstream phase to the Downstream Companies for refining. The Downstream Companies turn crude oil and natural gas into diesel, petrol, gasoline, lubricants, kerosene, jet fuel, heating oil, among other consumable products. So far, Kenya does not have a functional oil refinery to process crude oil from the Turkana oil fields; hence all crude oil is exported. So far, the quantity of crude oil which is produced is not sufficient to justify construction of a new refinery. A refinery (Downstream Company) requires large quantities of crude oil in order to generate enough profits to sustain its operation. The Downstream Company (refinery) relies on profit margins that come from acquiring crude oil and selling it into a finished product (Makena, 2021).

SECTION II

2.1 Impact of Coastal, Offshore and Onshore Oil and Gas Exploration

2.1.1 Impact of Coastal and Offshore Oil and Gas

Oil and gas exploitation has both positive and negative impacts. The positive impacts include increased employment opportunities that are associated with oil and gas exploration thus economically empowering the local communities. If economically viable quantities of oil and gas are found and commercial exploitation begins, the local communities are likely to benefit from the Corporate Social Responsibility initiatives particularly in terms of providing support for education and training. The Government will also gain from increased tax revenue and foreign exchange earnings.

The negative impacts include modification of the marine environment and pollution. Some of the main oil and gas production structures that may have some direct or indirect environmental impacts include seismic survey and drill ships, floating liquefied natural gas plants, offshore oil and gas production platforms and seabed feed pipelines. The initial seismic surveys which use compressed air to generate explosive sound waves that are reflected back as echoes from each geological layer may affect sea life in close proximity and can affect marine mammals such as whales over a distance of up to 20 km or even further. This can however be mitigated by avoiding whale migratory seasons as well as known whale and dolphin breeding and feeding areas. Marine mammal observers (MMO) should also be taken on board to address any encounters with the mammals and guide mitigation procedures following the Joint Nature Conservation Committee guidelines that include procedures for starting soft, observing minimum safe distances from the marine mammals, and constant watching during operations (UNEP and WIOMSA, 2015).

Disposal of waste drilling mud in the deep sea or open water may have widespread impacts, affecting marine mammals, sea turtles, sea birds and fish, though toxicity is typically rapidly diluted by the receiving environment. Further, transportation of petroleum, once economically viable oil and gas reserves are identified and production commences, is vulnerable to poor

maintenance, weak infrastructure and accidents, resulting in potential threats to the coastal and marine environment.

Offshore oil exploration is prone to oil spillage which may result in massive death of marine organisms and disruption of the structure and functions of marine ecosystems. It is therefore important to ensure that as offshore oil and gas exploration increases in scale and intensity, the level of preparedness should be enhanced by the Government and other stakeholders through capacity building to respond to potential accidental oil spills. Mangrove forests are particularly sensitive to oil pollution, and accidental oil spills or blow outs during exploration drilling pose the most significant threats. The Kenyan coast is also endowed with coral reefs, seagrass beds, lagoons, turtle nesting beaches, marine protected areas with valuable biodiversity, fishing grounds, and unique marine animals such as dolphins, dugongs, whale sharks and humpback whales, which would potentially be impacted to varying degrees by a massive oil spill.

Other impacts include physical obstruction and interference with the movement of marine mammals, fish, and access for navigation and fishing activities. Further, wave energy apparatus located close to shore are also likely to affect sediment transport and distribution and could result in erosion in some areas of the coastline and accretion in other areas. This could have negative effects on the inshore reefs and impact negatively on other uses of the coastal zone. They could also be a hazard to shipping. Tidal barrages are also likely to cause changes to sediment transportation, water circulation and biological communities.

Some mitigation measures are being put in place to minimize negative impacts even though in overall terms, the impact is small in terms of scale of the operation compared to the available wider open waters. For example, waste chemicals, surplus cement and some oils are usually collected, stored and properly disposed of or recycled ashore. In addition, it is required by law that oil and gas exploration be preceded by Environmental and Social Impact Assessment (ESIA). ESIAs should identify the likely impacts of activities, the affected areas, and stakeholders and design mitigation measures, monitoring plans and oil spill contingency plans. So far, there is optimism that viable quantities of oil will be found in the EEZ and disturbance to marine life from drilling, including the migrating humpback whales, would be negligible.

2.1.2 Impacts of onshore oil and gas exploration

The positive impacts of oil and gas exploration and development in the inland (onshore) environment include improved infrastructure, water supply, health care, education, and sewage and waste management thus improving the living conditions of the local residents. Oil and gas exploration also results in availability of market for locally produced goods due to increased number of people who come to the exploration site for employment. The potential negative impacts include changes in land use patterns due to development of access roads and informal settlements to support exploration activities. The intensity of exploitation of natural resources would also change to meet the needs of the migrant population that would come to provide labour to the oil and gas exploration activities. Population size and density is likely to vary as people from different places are attracted by the new opportunities presented by the oil and gas exploration and development activities. The population changes would trigger transformation in socioeconomic set up as benefits from the exploration activities may not be evenly distributed to people. The prices of goods and services are also likely to increase due to increased demand. Significant variations are likely to occur in the socio-cultural systems such as social organization, structure, beliefs and traditions, resource access rights, and value systems due to influence from the new migrant population. These changes may be significant for local community groups particularly the indigenous communities that have retained their culture and traditions over the years.

Oil and gas exploration may cause physical disturbance from construction as well as indirect effects associated with opening access. It would also lead to pollution particularly contamination of the environment due to spillage, leakage and solid waste disposal. Oil and gas exploration may accelerate climate change, disrupt wildlife and damage public land. Changes in environment caused by oil and gas exploration may affect the plant and animal communities by disturbing their habitats, food and nutrient supplies, breeding areas, migration routes, and expose them to predators. The atmospheric emissions that are associated with oil and gas exploration operations including venting and purging gases, airborne particulates from soil disturbance during construction and from increased vehicle traffic, particulates from other burning sources such as well testing, among others, are likely to impact on ozone layer and induce climate change. The volumes of atmospheric emissions and their potential impacts depend upon the nature of the processes and technology adopted. Overall, the potential for emissions from oil and gas

exploration activities to cause atmospheric impacts is considered low. Emissions are mainly considered a major issue during oil and gas production (E&P Forum/UNEP, 1997).

The above negative impacts are only potential impacts and can be avoided, minimized or mitigated if proper care and attention is taken during oil and gas exploration or production. Globally, the oil and gas industry has been at the forefront in the development of appropriate management systems operational practices and engineering technology that aim at minimizing environmental impacts, resulting in significant reduction in environmental incidents as elaborated by E&P Forum/UNEP (1997).

SECTION III

3.1 Governance Framework for coastal and offshore oil, gas and renewable energy sector

To increase the contribution of coastal and offshore oil and gas sub-sector in Kenya, a number of policy, legal and institutional frameworks have been instituted by the Government of Kenya.

3.1.1 Institutional Framework

Ministry of Petroleum and Mining: At the apex of the oil and gas sector regulation in Kenya is the Ministry of Petroleum and Mining. Specifically, the State Department for Petroleum and Mining created in 2015 from the then Petroleum Directorate has the mandate of spearheading all petroleum operation programmes in the country including policy formulation, review of fiscal, legal and regulatory framework, monitoring and supervision of oil and gas exploration, development and production activities.[1] According to their website, the petroleum sector is organized into the upstream section which involves the process of exploration, development and production of crude oil and natural gas; the mid-stream section which revolves around storage, refining and transportation of crude oil into consumable petroleum products; and, the downstream section for refined products are made available to the consumers through supply and distribution, for example at petrol stations. On the upstream section, Kenya has four (4) petroleum exploration basin viz, Lamu Basin, Anza Basin, Mandera Basin and Tertiary Rift Basin. Oil and gas exploration breakthrough came in March 2012 with the discovery well – Ngamia 1 Well, in Lokichar Basin in Turkana County. As at December 2015, seventy four (74) wells had been drilled with twelve (12) hydrocarbon discoveries to date, nine (9) of which are in Turkana County. The other three are in Anza Basin and Offshore Lamu.

The National Oil Corporation of Kenya (NOCK)*:* NOCK is involved in all aspects of the petroleum supply chain covering the upstream oil and gas exploration, midstream petroleum infrastructure development and downstream marketing of petroleum products. Indeed, NOCK facilitates and directly participates in oil and gas exploration activities in Kenya in the upstream. NOCK's vision is to be 'fully integrated world class Oil and Gas Company.' One of its stated purposes is 'exploring, developing and producing oil and gas resources for the benefit of the Kenyan people.' In this regard, NOCK is a key stakeholder in oil and gas exploration in the country including coastal and offshore sites.

Ministry of Energy*:* At the top of the governance framework for renewable energy is the Ministry of Energy. The State Department of Energy under the Ministry of Energy is mandated to undertake the following six functions: National Energy and Policy management; Hydro-power

[1]https://www.petroleumandmining.go.ke/.

Development; Geothermal Exploration and Development; Rural Electrification Programme; Promotion of Renewable Energy; and Energy Regulation, Security, and Conservation. The main legislation under the Ministry is the Energy Act, 2019, which also establishes various institutions that are involved in coastal and offshore oil and gas activities as outlined below.

Energy and Petroleum Regulatory Authority: The Energy and Petroleum Regulatory Authority (EPRA) is established under section 9(1) of the Energy Act. Section 10 of the same law provides for the functions of EPRA. Most notably is section 10(b) that provides that the EPRA is responsible to regulate, monitor and supervise upstream petroleum operations in Kenya in accordance with the law relating to petroleum, the regulations made there under and the relevant petroleum agreement.

Energy and Petroleum Tribunal: The Energy and Petroleum Tribunal is established under section 25 of the Energy Act for the purpose of hearing and determining disputes and appeals in accordance with the Energy Act or any other written law.

National Land Commission: The National Land Commission (NLC) is not exactly an oil and gas institution in Kenya. However, its inclusion in this section is mainly because it performs a crucial function pursuant to Article 67(2) of the Constitution, which is to manage public land on behalf of the national and county governments. As part of its obligations under the National Land Commission Act, NLC shall on behalf of, and with the consent of the national and county governments, alienate public land. Since oil and gas exploration is mostly done on public land, the NLC therefore plays an extremely important role in regulating the oil and gas sector to this extent.

National Environmental Management Authority: As was the case with NLC, National Environmental Management Authority (NEMA) is not directly involved in oil and gas sector but it is nevertheless a key regulatory institution. NEMA is established under section 7 of the Environmental Management and Co-ordination Act No 8 of 1999 (EMCA). Section 9 of the EMCA provides for the objects and functions of the authority and in this regard Section 9(1) notes that NEMA is established to exercise general supervision and co-ordination over all

matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment. In relation to oil and gas exploration, section 9(2)(b) provides that NEMA should take stock of the natural resources in Kenya and their utilisation and conservation. Section 68(1) of the EMCA also requires that NEMA be responsible for carrying out environmental audit of all activities that are likely to have significant effect on the environment. In this regard, section 55(1) empowers the Minister, by notice in the Gazette, may declare an area to be a protected Zone. Moreover, through an amendment via the Environmental Management and Co-ordination (Amendment) Act No. 5 of 2015, section 55(6) currently provides that '[t]he Minister shall, in consultation with the relevant lead agencies, issue appropriate regulations to prevent, reduce and control pollution or other form of environmental damage in the coastal zone.' Lastly, under section 3(1) of the Environmental (Prevention of Pollution in Coastal Zone and Other Segments of the Environment) Regulations, 2003, '[n]o ship or any other person in Kenya shall be allowed to discharge any hazardous substance, chemical, oil or oily mixture into the territorial waters of Kenya or any segment of the environment contrary to the provisions of these Regulations.'

3.2 Regulatory framework

There are various laws and regulations governing the petroleum sector in Kenya as discussed below.

Petroleum (Exploration and Production) Act Chapter 308: This is the main legislation regulating petroleum exploration and production in Kenya. The Petroleum (Exploration and Production) Act (Cap 308), which is '[a]n Act of Parliament to regulate the negotiation and conclusion by the Government of petroleum agreements relating to the exploration for, development, production and transportation of, petroleum and for connected purposes. 'Section 2 of the legislation defines "petroleum" to mean mineral oil and includes crude oil, natural gas and hydrocarbons produced or capable of being produced from oil shales or tar sands; Similarly, "petroleum operations" means all or any of the operations related to the exploration for, development, extraction, production, separation and treatment, storage, transportation and sale or

disposal of, petroleum up to the point of export, or the agreed delivery point in Kenya or the point of entry into a refinery, and includes natural gas processing operations but does not include petroleum refining operations. The salient features of the legislation are as follows. First, under section 3 of the Act, the property in petroleum existing in its natural condition in strata lying within Kenya and the continental shelf is vested in the Government. Second, section 4(1) of the Act also provides that '[n]o person shall engage in any petroleum operations in Kenya without having previously obtained the permission of the Minister in such manner, in such form and on such terms as are prescribed by this Act and by regulations made thereunder.' Third, under subsection (2), the legislation provides that all petroleum operations shall be conducted in accordance with the provisions of this Act, the regulations made thereunder and the terms and conditions of a petroleum agreement. Lastly, section 4(3) provides that the Government may conduct petroleum operations either— (a) through an oil company established by the Government to conduct those operations; or (b) through contractors in accordance with petroleum agreements; or (c) in such other manner as may be necessary or appropriate.

The Petroleum (Exploration and Production) Regulations: Also relevant is the Petroleum (Exploration and Production) Regulations, 1984 which under regulation 2(1) provides that a petroleum agreement shall be negotiated on the basis of the model production sharing contract substantially in the form set out in the Schedule, and that no person other than a company incorporated or registered in Kenya under the Companies Act may enter into a petroleum agreement with the Government. The Republic of Kenya has in place a Model Production Sharing Contract. Clause 12(2) of the contract dealing with offshore operations provides that '[t]he contractor shall pay compensation as determined by expert for any damage to and/or any interference with, including but not limited to fishing rights caused by the upstream petroleum operations.' It therefore follows that any contract signed for the production of petroleum should provide for compensation where damages occur in relation to fishing rights.

The Petroleum Act No.2 of 2019: The other important legislation in the petroleum sector is the Petroleum Act, 2019 which is [a]n Act of Parliament to provide a framework for the contracting, exploration, development and production of petroleum; cessation of upstream petroleum operations; to give effect to relevant articles of the Constitution in so far as they apply to

upstream petroleum operations, regulation of midstream and downstream petroleum operations; and for connected purposes. Section 59(1) of the legislation provides for environment, health and safety provisions and requires the contractor to carry out upstream petroleum environmental operations in the contract area in accordance with all the applicable environment, health, safety and maritime laws and best petroleum industry practices. Under section 60(1), the contractor is required to ensure that the management of production, transportation, storage, treatment and disposal of waste arising out of upstream petroleum operations is carried out in accordance with all the applicable environmental, health, safety and maritime laws and best petroleum industry practices.

Energy Act No. 1 of 2019: The Energy Act is the main law in the energy sector including the renewable energy sector. Section 4(1) of the Energy Act provides for the national energy policy to be developed by the Cabinet Secretary in consultation with the relevant stakeholders. The section further envisages that the energy policy shall be reviewed every five years. Under section 8(1), the Cabinet Secretary shall develop a conducive environment for the promotion of investments in energy infrastructure development, including formulation of guidelines in collaboration with relevant county agencies on the development of energy projects and to disseminate the guidelines among potential investors. A number of institutions have been established under the Energy Act as discussed previously.

Maritime Zones Act (Cap 371): The Maritime Zones Act is '[a]n Act of Parliament to consolidate the law relating to the territorial waters and the continental shelf of Kenya; to provide for the establishment and delimitation of the exclusive economic zone of Kenya; to provide for the exploration and exploitation and conservation and management of the resources of the maritime zones; and for connected purposes.' Under its section 5, the legislation provides for Kenya's exercise of sovereignty by providing that 'Kenya shall, within the exclusive economic zone, exercise sovereign rights with respect to the exploration and exploitation and conservation and management of the natural resources of the zone and without prejudice to the generality of the foregoing, the exercise of the sovereign rights shall be in respect of— (a) exploration and exploitation of the zone for the production of energy from tides, water currents and winds; (b) regulation, control and preservation of the marine environment; (c) establishment

and use of artificial islands and offshore terminals, installations, structures and other devices; and (d) authorisation and control of scientific research.'

Kenya Maritime Authority Act (Cap 370): This law is important because it establishes under its section 3 the Kenya Maritime Authority. Section 4 of the Act provides for the object of the Authority as to regulate, co-ordinate and oversee maritime affairs. Section 5(f) is particularly important because it provides that one of the functions of the Authority is to 'develop, co-ordinate and manage a national oil spill contingency plan for both coastal and inland waters and shall in the discharge of this responsibility be designated as the "competent oil spill authority"'.

3.3 Policy Framework

Kenya Vision 2030: The economic and macro pillar of Vision 2030 also focuses on oil and other mineral resources sector. Indeed, some of the flagship projects to be implemented under the sector include to:

- Restructure the institutions within the sector.
- Sub division and creation of new petroleum exploration blocks based on technical data.
- Enhance primary data acquisition, analysis and interpretation in the open blocks so as to make them attractive to investors.
- Establish a national petroleum data centre.
- Conduct a National Airbone Geo-physical Survey.
- Establishment of an Internationally accredited Mineral Certification Laboratory and Audit Agency.
- Establishment of Minerals and Metal Commodity Exchange.
- Creation of Special mineral Processing Economic Zones.
- Enhance partnership in data exchange so as to reduce cost in exploration and access to new technology;

- Skills Development and enhancement of local expertise in petroleum exploration and production through training, technical collaboration with exploration companies and universities.
- Restructure and enhance the National Oil Corporation of Kenya financial capacity to conduct up stream business.
- Commercial production of the Kwale mineral sands project starting in 2014. Over the 13 years life of the project, the estimated production of the mine is approximately 850,000 tons of rutile, 320,000 tons of zircon, and 3.5 million tons of eliminate.
- Development of the rail and road networks for exploitation of the Coal deposits in Mui Basin and other parts of the country.
- Development of Logistics and Supply Chains Management for the oil, gas and other minerals
- Effective management of the environment and social footprints.

The Vision 2030 is therefore a key policy document in the oil and gas sector in Kenya. Indeed, it is the overall framework that highlights government policy in this sector.

Sessional Paper 4 on Energy 2004: The Sessional Paper No. 4 stated vision is '[t]o promote equitable access to quality energy services at least cost while protecting the environment.' Chapter six of this document energy policies and strategies.' The Sessional Paper deals with both petroleum and renewable energy. Under the petroleum sub-sector, the focus is on:

- Divestiture of Government interests in oil refining and marketing, and eventually in the Kenya Pipeline Company (KPC);
- Promoting investments in oil refining including supply and distribution of petroleum products throughout the country;
- Enhancing exploration for fossil fuels particularly hydrocarbons through sub-division of exploration acreage into smaller blocks and collection of additional geological data to attract more oil prospecting companies;
- Financing of strategic stocks by the Government and private sector, equivalent to 90 days demand in the medium to long term; and
- Strengthening regional and international cooperation to promote data and information exchange on oil exploration.

In the Sessional Paper, considerable emphasis has been given to oil exploration including through regional and international cooperation.

Draft National Energy Policy, 2014*:* On its website, the Ministry of Energy and Petroleum has published The Draft National Energy Policy's stated vision is 'Affordable Quality Energy for All Kenyans'. The mission is also stated as: 'to facilitate provision of clean sustainable, affordable, competitive, reliable and secure energy services at least cost while protecting the environment.' On fossil fuels, according to the draft policy, Kenya had no known commercial reserves of petroleum until March 2012 when oil was discovered in Northern Kenya which generated more interest in the sector. The policy itself was developed in 2014 just two years after the major discovery. In order to take care of the increasing demand for petroleum products locally and regionally, the Government planned to set up a new refinery at Lamu which is strategically located.

SECTION IV

4.1 Capacity gaps and further development on Coastal, Offshore and Onshore Oil and Gas

The Government does not have adequate financial resources and technical capacity to undertake coastal and offshore oil and gas exploration on its own. The inadequacy in technical capacity is mainly in the areas of marine geology, petro-chemical fields and technological sphere. Further, there are limited capabilities in engineering, construction, logistics, and supplies, health and safety. Regarding sustainability, the Government agencies that are charged with management of environment and ensuring compliance of mitigation measures and monitoring procedures associated with large projects such as offshore exploration are often lacking the technical capacity. Therefore, engaging in capacity building is fundamental for buy-in and participation, which is crucial to confidence building, transparency, and maintaining long term sustainability. Further, development of renewable energy alternatives including marine based alternatives are weighed down by a number of constraints namely: inadequate long-term hydrological and meteorological data; inadequate transport infrastructure, the need to include local participation in order to develop acceptance; lack of locally available spare parts; insufficient electricity grid coverage; high dependence of rural communities on ecosystem services.

SECTION V

Renewable Energy development in Kenya

5.1 Background and context

The Government of Kenya commissioned Olkaria V geothermal power plant with an installed capacity of 165 MW in November 2019. The Government through Kenya Electricity Generation Company (KeNGen) has further planned to deliver an additional 1729 MW by 2025. Most of the planned capacity is expected to be obtained from renewable energy sources mainly from geothermal, hydro and wind resources (Republic of Kenya, 2019; 2020). The geothermal, hydro and wind energy resources are already being exploited while the tidal energy and wave energy potential have not been tapped yet. Through its Third Medium Term Plan 2018-2022, the Government established an energy technologies development programme to facilitate diversification of the country's non-renewable and renewable energy mix to meet the energy demand for industrialization and development. This programme has provided for two main projects to be implemented during the medium term, namely establishment of Renewable Energies Research Laboratory to conduct research and development in the areas of solar energy, wind energy and biofuels, and establishment of the Centre for Petroleum and Gas Exploration Research and Technology Development in oil and gas exploitation. This centre will focus on the value chain in the exploitation of fossil fuel reserves including socioeconomic considerations (GoK, 2018).

The main sources of renewable energy in the coast of Kenya are solar, wind, tidal and wave. Additional sources of renewable energy that are available in other parts of the country are geothermal and hydro resources. The tidal energy utilises fixed turbines that are inserted into tidal streams. The tidal energy potential exists along the Kenyan coast due to an approximate 4 metres spring tidal range, which creates the necessary water velocities needed to operate the submerged turbines that require water currents of 1.0 to 2.5 m/s (UNEP and WIOMSA, 2015). This energy has so far not been tapped. Wave energy has also not been tapped but there is potential for it in Kenya.

Solar power is increasingly becoming important along the coast of Kenya. Kenya has an average of 5-7 peak sunshine hours, part of which is convertible into electricity due to the dispersion and conversion efficiency of photovoltaic (PV) modules. The total potential for photovoltaic installations is estimated at 23,046 TWh/year. Solar power is a viable option for

rural electrification and decentralized applications. The Government has for sometime subsidized the photovoltaic stand-alone systems for households and public institutions. As part of the medium to long term plan to tap on this potential, the Government aims to install 500 MW and 300,000 domestic solar systems by the year 2030. Already, the use of solar power has been taken up by a number of households in the coast of Kenya and it is also increasingly becoming important in the commercial and industrial establishments. Kenya also has promising wind power potential. There are some excellent wind regime areas particularly in the northwest of the country in Marsabit and Turkana Counties and the edges of the Rift Valley, which are having the highest wind speeds of 9m/s at 50 metres. The Kenyan coast has lower but promising wind speeds of about 5-7m/s at 50 metres. A few installations have been put in place in the Tana Delta and Lamu.

Renewable Energy Sources: Renewable Energy (RE) is most often defined as energy derived from inexhaustible sources - the sun, the wind, and the Earth. Kenya is endowed with significant amounts of renewable energy sources, which, inter alia, include hydro, geothermal, solar, wind. Methane from municipal landfills can be termed renewable if a sustainable supply of the required raw materials can be assured. Other renewable energy sources include power alcohol, biogas, bio-fuels (bio-ethanol and bio-diesel). Uncertainty about the future of the hydro power as a renewable energy resource under climate change is a key issue for the energy sector. The Government recognizes that alternative renewable energy sources hold tremendous potential, especially for reducing heavy dependence on woody biomass. Renewable energy resources in Kenya comprise the following: 16 Kenya TNA Mitigation Report 2013

Wind power: Wind energy remains largely under-developed and under-exploited. A study in 2002 found there is the potential for about 0.6 per cent of total energy to come from community wind energy Government of Kenya (GOK) 2002. Wind energy applications, especially those related to mechanical functions, have a long history in Kenya. In 1986, there were over 200 working windmills, of which about 100 were in Lamu and Mombasa districts. Local expertise for building windmills, especially for water pumping, is still available in the private sector. The Ministry of Energy developed a National Wind Energy Resources Atlas for Kenya in 2003. It provides useful information to facilitate both public and private sector investment in this important energy sub-sector.

Hydropower: Hydro-power (Tables 3.2 and 3.3 and figure 3.2) constitutes around 60 per cent of the total electricity generated in Kenya and is the leading source of electrical energy, with an installed capacity of 761MW. However, hydropower is obtained from the countries major rivers whose water volume is dependent on rainfall which is sensitive to climate variability. Therefore, during drought period, the country suffers from reduced energy generation from hydropower and therefore reverts to emergency thermal generation which leads to emissions of CO2.

Solar energy: About 1.6% of Kenyan households use solar energy, and its adoption has been slow due to the high initial installation costs (KNBS 2007 and Ikiara 2009). It is estimated that Kenya receives 4-6 kW/m2 /day of solar energy, on average, which translates into about 1.5 billion tonnes of oil equivalent, making it a major alternative for energy. Although Kenya is a leader in installation of solar home systems (SHS) in Sub-Sahara Africa, solar energy is currently under-exploited although it is widely regarded as a plausible option to stimulate rural electrification. To date, it is being exploited in Kenya for lighting (photovoltaic)-solar home systems, water pumping (mechanical), refrigeration, and solar water heating. The solar market is currently estimated to be worth over US$ 4 million per year. A solar photovoltaic policy framework and strategy is being developed under the power sector reorganization programme.

Biomass: Biomass energy is the principal source of energy for most Kenyans, particularly in the rural areas. Firewood remains the predominant fuel for cooking in rural areas. Nationwide 68.3% and 13.3% of Kenya's household population utilize firewood and charcoal for cooking respectively thereby exerting enormous pressure on the environment as much of it is obtained from unsustainable sources. In general there are two main approaches to using plants for energy production: growing plants specifically for energy use, and using plant residues from others use. The best approaches vary from region to region according to climate, soils and geography. Ethanol can be used as a fuel for vehicles in its pure form, but it is normally used as a gasoline additive to increase octane and reduce vehicle emissions. Bio-ethanol is produced by several sugar companies in Western Kenya Biodiesel is made from vegetable oils, animal fats or recycled greases. Bio-diesel can be used as a fuel for vehicles in its pure form, but it is normally used as a diesel additive to reduce levels of particulates, carbon monoxide, and hydrocarbons

from diesel-powered vehicles. Jatropha is being promoted as source of bio-diesel in the coast province. 17 Kenya TNA Mitigation Report 2013

Geothermal Power: Kenya has registered significant progress in exploring geothermal energy for power generation. It has an installed capacity of 198 MW, equivalent to about 13% of the country's installed electricity generation capacity which is fed into the national grid from three plants located at Olkaria by 2030. Kenya is one of the leading producers of geothermal energy in Africa although the current production at approximately 198 MW is still fairly small yet the full potential is said to be in the range of 3000-5000 MW.

5.2 Impact of Renewable Energy

There are positive and negative impacts associated with development of renewable energy in the coastal environment. The positive impacts include creation of employment for the local communities in areas where renewable energy are installed. Consequently, besides people who are employed in the major renewable energy installation, there are many people who are acquiring skills in electrical wiring and maintenance so that they can be engaged in self-employment as renewable energy sub-sector is developed further. Wave energy apparatus located close to shore are likely to affect sediment transport and distribution and could result in erosion in some areas of the coastline and accretion in other areas. This could have negative effects on the inshore reefs and impact negatively on other uses of the coastal zone. They could also be a hazard to shipping. Tidal barrages are likely to cause changes to sediment transportation, water circulation and biological communities.

It is required by law that development projects including major renewable energy installations be preceded by Environmental and Social Impact Assessment (ESIA). ESIAs should identify the likely impacts of activities, the affected areas, and stakeholders and design mitigation measures, monitoring plans and contingency plan where necessary.

SECTION VI

6.0 Governance Framework for renewable energy sector

To increase the contribution of renewable energy sector in Kenya, a number of policy, legal and institutional frameworks have been instituted by the Government of Kenya.

6.1.1 Institutional Framework

***Ministry of Energy**:* At the apex of the governance framework for renewable energy is the Ministry of Energy. The State Department of Energy under the Ministry of Energy is mandated to undertake the following six functions: National Energy and Policy management; Hydro-power Development; Geothermal Exploration and Development; Rural Electrification Programme; Promotion of Renewable Energy; and Energy Regulation, Security, and Conservation. The main legislation under the Ministry is the Energy Act, 2019, which also establishes various institutions as outlined below.

The Rural Electrification and Renewable Energy Corporation: The Rural Electrification and Renewable Energy Corporation (REREC) is established under section 43(1) of the Energy Act. Under section 44(1), the functions of the REREC have been elaborated. Most notable in relation to the present study is that under section 44 (1)(j) REREC performs among other things the function to develop, promote and manage in collaboration with other agencies, the use of renewable energy and technologies, including but not limited to biomass (biodiesel, bio-ethanol,

charcoal, fuel-wood, biogas) municipal waste, solar, wind, tidal waves, small hydropower and co-generation but excluding geothermal.

Nuclear Power and Energy Agency: The Nuclear Power and Energy Agency is established under section 54(1) of the Energy Act. Under section 56(2)(f), the Agency is responsible for identifying appropriate sites in Kenya for the construction of nuclear power plants and their related amenities.

Renewable Energy Resource Advisory Committee: Section 73 of the Energy Act provides that all unexploited renewable energy resources under or in any land vests in the National Government. Consequently, section 76(1) establishes the inter-ministerial Committee known as the Renewable Energy Resource Advisory Committee (RERAC). Under section 76(4)(e), RERAC advises the Cabinet Secretary on, among other things, management and development of renewable energy resources. Under subsection (5) RERAC may upon request advise the County Governments on matters relating to renewable energy resources.

Geothermal Development Company: Section 77 of the Energy Act provides that all un-extracted geothermal resources under or in any land shall vest in the National Government. The Geothermal Development Company (GDC) is tasked with developing steam fields and selling geothermal steam for electricity generation to KenGen and private investors.

National Land Commission: The National Land Commission (NLC) is not exactly renewable energy institution in Kenya. However, its inclusion in this section is mainly because it performs a crucial function pursuant to Article 67(2) of the Constitution, which is to manage public land on behalf of the national and county governments. As part of its obligations under the National Land Commission Act, NLC shall on behalf of, and with the consent of the national and county governments, alienate public land. Since major renewable energy projects are often undertaken on public land, the NLC therefore plays an extremely important role in regulating the renewable energy sub-sector to this extent.

National Environmental Management Authority: As was the case with NLC, National Environmental Management Authority (NEMA) is not directly involved in oil and gas sector but it is nevertheless a key regulatory institution. NEMA is established under section 7 of the Environmental Management and Co-ordination Act No 8 of 1999 (EMCA). Section 9 of the EMCA provides for the objects and functions of the authority and in this regard Section 9(1) notes that NEMA is established to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment. In relation to renewable energy exploration and development, section 9(2)(b) provides that NEMA should take stock of the natural resources in Kenya and their utilisation and conservation. Section 68(1) of the EMCA also requires that NEMA be responsible for carrying out environmental audit of all activities that are likely to have significant effect on the environment. In this regard, section 55(1) empowers the Minister, by notice in the Gazette, may declare an area to be a protected Zone. Moreover, through an amendment via the Environmental Management and Co-ordination (Amendment) Act No. 5 of 2015, section 55(6) currently provides that '[t]he Minister shall, in consultation with the relevant lead agencies, issue appropriate regulations to prevent, reduce and control pollution or other form of environmental damage in the coastal zone.' Lastly, under section 3(1) of the Environmental (Prevention of Pollution in Coastal Zone and Other Segments of the Environment) Regulations, 2003, '[n]o ship or any other person in Kenya shall be allowed to discharge any hazardous substance, chemical, oil or oily mixture into the territorial waters of Kenya or any segment of the environment contrary to the provisions of these Regulations.'

6.1.2 Regulatory framework

There are various laws and regulations governing the renewable energy sub-sector in Kenya as discussed below.

Energy Act No. 1 of 2019: The Energy Act is the main law in the energy sector including the renewable energy sector. Section 4(1) of the Energy Act provides for the national energy policy to be developed by the Cabinet Secretary in consultation with the relevant stakeholders. The

section further envisages that the energy policy shall be reviewed every five years. In addition to the energy policy, section 5(1) envisages that the Cabinet Secretary shall develop, publish, and review energy plans in respect of coal, renewable energy and electricity so as to ensure delivery of reliable energy services at least cost. Under section 8(1), the Cabinet Secretary shall develop a conducive environment for the promotion of investments in energy infrastructure development, including formulation of guidelines in collaboration with relevant county agencies on the development of energy projects and to disseminate the guidelines among potential investors. A number of institutions have been established under the Energy Act as discussed previously.

Maritime Zones Act (Cap 371): The Maritime Zones Act is '[a]n Act of Parliament to consolidate the law relating to the territorial waters and the continental shelf of Kenya; to provide for the establishment and delimitation of the exclusive economic zone of Kenya; to provide for the exploration and exploitation and conservation and management of the resources of the maritime zones; and for connected purposes.' Under its section 5, the legislation provides for Kenya's exercise of sovereignty by providing that 'Kenya shall, within the exclusive economic zone, exercise sovereign rights with respect to the exploration and exploitation and conservation and management of the natural resources of the zone and without prejudice to the generality of the foregoing, the exercise of the sovereign rights shall be in respect of— (a) exploration and exploitation of the zone for the production of energy from tides, water currents and winds; (b) regulation, control and preservation of the marine environment; (c) establishment and use of artificial islands and offshore terminals, installations, structures and other devices; and (d) authorisation and control of scientific research.'

6.2 Policy Framework

Kenya Vision 2030: The economic and macro pillar of Vision 2030 also focuses on renewable energy. Indeed, some of the flagship projects to be implemented under the sector include to:

- Restructure the institutions within the sector.

Sessional Paper 4 on Energy 2004: The Sessional Paper No. 4 stated vision is 'to promote equitable access to quality energy services at least cost while protecting the environment.'

Chapter six of this document energy policies and strategies.' The Sessional Paper deals with both petroleum and renewable energy.

In relation to the renewable energy, the sessional paper the focus is on providing incentives to private sector as well as supporting research and development in emerging technologies like cogeneration, wind energy generation, municipal waste, biomass co-generation, feed in tariffs and other renewables.

Draft National Energy Policy, 2014*:* On its website, the Ministry of Energy and Petroleum has published The Draft National Energy Policy's stated vision is 'Affordable Quality Energy for All Kenyans'. The mission is also stated as: 'to facilitate provision of clean sustainable, affordable, competitive, reliable and secure energy services at least cost while protecting the environment.' On renewable energy, the policy notes that it has a potential to enhance energy security, mitigate climate change, generate income, create employment and generate foreign exchange savings. Consequently, the policy provides a detailed analysis of the geothermal energy, hydro energy, biomass, biofuels, biogas, solar energy, wind energy, municipal waste, biomass co-generation, feed in tarrifs and other renewables. The categories are almost similar to Sessional Paper No. 4 of 2004.

SECTION VII

Conclusion and Recommendations

7.1 Capacity gaps and further development on Renewable Energy

Development of renewable energy alternatives including marine based alternatives are weighed down by a number of constraints namely: inadequate long-term hydrological and meteorological data; inadequate transport infrastructure, the need to include local participation in order to develop acceptance; lack of locally available spare parts; insufficient electricity grid coverage; high dependence of rural communities on ecosystem services.

7.2 Conclusions and recommendations

Offshore oil and gas exploration has been on-going with mixed results. If economically viable oil reserves can be found, Kenya will gain from foreign exchange earnings and savings on fuel imports, which can significantly change the national economy and contribute to economic empowerment among the local communities. Efforts should be put in advancing understanding

about the oil and gas resources, the associated environment and the social aspects in order to address the pressures and opportunities created by oil and gas exploration activities. It is also critical to put in place an effective regulatory framework for oil and gas exploration to avoid occupational hazards that may occur if the exploration of the newly discovered oil and gas reserves is carried out with inadequate regulation.

Offshore oil and gas exploration and renewable energy are governed by a robust legal, policy and institutional frameworks that support sound environmental management procedures to ensure that exploration for oil and gas, and development of renewable energy is optimally done for sustainable development in the country. These frameworks provide for mitigation of likely pollution from offshore oil exploration or eventual drilling. It is also important for the country to ensure oil pollution preparedness and insurance for compensation of any eventual loss of livelihoods that could be associated with eventual drilling. In addition, the country needs to sign and ratify all International Maritime Organization (IMO) Conventions relevant to oil and gas exploration, adhere to the conditions of the Nairobi Convention, promote regional coordination on planning of transboundary issues such as oil spill contingency measures, piracy and security. It is also critical to enhance awareness raising and capacity building covering environmental regulators and negotiators in the energy sector, promote effective management and governance of the oil and gas resources and promote participation of the civil society organizations. The government should also ensure that bilateral agreements made with prospecting companies are designed to provide direct and indirect benefits to the local people and the country at as a whole. There is need to embrace nature based solutions by developing and promoting renewable energy alternatives which have not been optimally exploited yet.

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Appendix1: Oil Blocks in the Lamu Basin and their sizes

S. No.	Oil Block	Area (square kilometres)
1	Block L_1A	12,569.67
2	Block L_1B	12,197.99
3	Block L_2	11,680.88
4	Block L_3	8,960.84
5	Block L_4	5,664.50
6	Block 4A	1,818.82
7	Block L_5	2,352.43
8	Block L_6	4,986.07
9	Block L_7	5,520.70
10	Block L_8	5,128.83
11	Block L_9	5,110.06
12	Block L_{10}	4,962.03
13	Block L_{10}B	5,585.35
14	Block L_{11}A	5,008.72
15	Block L_{11}B	4,962.58
16	Block L_{12}	4,981.78
17	Block L_{13}	2,178.45
18	Block L_{14}	11,010.76
19	Block L_{14}A	3,672.63
20	Block L_{15}	2,331.03
21	Block L_{16}	3,619.79
22	Block L_{17}	1,274.69
23	Block L_{18}	3,532.56
24	Block L_{19}	8,802.31
25	Block L_{19}	3,040.59

26	Block L_{20}	10,786.05
27	Block L_{21}	15,669.53
28	Block L_{22}	10,425.38
29	Block L_{23}	10,311.59
30	Block L_{24}	9,930.80
31	Block L_{25}	10,569.13
32	Block L_{26}	13,952.65
33	Block L_{27}	10,585.88
34	Block L_{28}	10,448.47
35	Block L_{29}	3,224.57
36	Block L_{30}	3,146.66
37	Block L_{31}	2,292.88
TOTAL FOR LAMU BASIN		**252,297.65**

Source: Republic of Kenya, Ministry of Energy and Petroleum, 2016.