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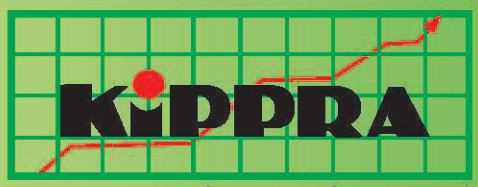

The KENYA INSTITUTE for PUBLIC
POLICY RESEARCH and ANALYSIS

Prerequisites for Enhancing Local Content in the Energy Sector in Kenya

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THE KENYA INSTITUTE FOR PUBLIC POLICY
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Abstract

The energy sector is a crucial enabler to economic growth in many countries. Consequently, there are a number of private firms, governments and development partners who are heavily investing huge amounts of money on energy projects. Due to the nature of these projects, few foreign firms have the requisite resources and technical capacity to handle mega energy investments. In most cases, local firms lack capacity to undertake the projects. Additionally, as countries exploit resources they have, they are mindful of the gains the local communities would accrue from energy projects in terms of skills and technology transfer, employment and building capacity for local firms. This necessitates the development of local content policies and enactment of legislation requiring foreign firms to build capacity to locals. The local policies differ across countries that practice them depending on the level of development. Nonetheless, the prerequisite for effective local content policies include effective legal and institutional framework; local infrastructure; local capacity; investment climate; good governance and political will; and effective monitoring of the local content policies. Energy projects present numerous opportunities and challenges for local content. In addition, there are various emerging technologies that could be transferred to firms. Despite various legislations that necessitate achievement of local content in Kenya, such as enactment of the Energy Act 2019 and Petroleum Act 2019, it is important to have a policy that necessitates achievement of local content in all the energy sub-sectors.

Abbreviations and Acronyms

AWES	Airborne Wind Energy Systems
CBU	Completely Built Unit
CDK	Completely Knocked down
CSP	Concentrated Solar Power
EGS	Enhanced Generated System
FDI	Foreign Direct Investment
GATS	General Agreement on Trade in Services
GDC	Geothermal Development Company
GDP	Gross Domestic Product
GVC	Global Value chain
GW	Giga Watts
ICT	Information Communication Technology
IEA	International Energy Agency
ILO	International Law Organization
IREK	Innovation and Renewable Electrification in Kenya
IRENA	International Renewable Energy Agency
KNBS	Kenya National Bureau of Statistics
KNOC	Kenya National Oil Company
K-OSAP	Kenya Off-Grid Solar Access Programme
KTDA	Kenya Tea Development Agency
LCPs	Local Content Policies
MW	Mega Watts
R&D	Research and Development
SADC	Southern Africa Development Community
SME	Small and Medium Enterprises
TRIM	Trade-related Investment Measures
TTW	Two-Wheeler and Three -Wheeler
UK	United Kingdom
UNCTAD	United Nations Centre for Trade and Development
VAT	Value Added Tax
WEF	World Economic Forum
WTO	World Trade Organization

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1. Introduction

1.1 Background

Countries that are endowed with resources all over the world are progressively tightening their local content requirements with a view to deriving maximum benefits from their resources. Initially, resource-rich nations focused on maximizing revenue generation from their resources. This has shifted to a scenario where such countries do not only focus on revenue generation but also on enhancing the linkage between resource utilization and other important economic sectors (FARO and ACODE, 2016). There is no single universal definition of local content. It is a complex concept that lacks universally agreed definition. Easo and Wallace (2014) contend that in the context of oil and gas, local content denotes the usage of local goods and services at every stage in the value chain. Therefore, local content should be understood in the content of value addition in terms of employing local workforce, utilization of local materials, sourcing services locally, and use of local facilities. In this paper, local content is defined as the value that the indigenous communities derive from extraction of their natural resources in terms of the use of local labour force and procurement of goods and services that are locally available

Local content provisions are embedded in a country's legislation, legal structure, procurement processes and regulations (Columbia Centre on Sustainable Development, 2015). The requirements commit international firms to meet minimum threshold on locally produced goods and services. Local content policies substantially target indigenous industry growth, technological advancement, value addition, job creation and various industrial linkages obtained throughout the value chain. Notwithstanding, such policies are not driven by economic concerns. In most cases, policies are shaped by political considerations that stem from the pressure to convince the communities that the governments are concerned in distributing the gains obtained from extraction of natural resources (Esteves, Coyne and Moreno, 2013; Ramdoo, 2017).

Numerous benefits are derived from the use of local content in the energy sector. For instance, countries witness huge economic benefits. Local content requirements substantially foster growth of investment in the local production, which lead to improved GDP. In addition, short-term objectives are attained such as creation of employment through requirements that foreign firms must use certain quantum of goods and services. Long-term economic objectives are attained especially when the Local Content Policies (LCPs) lead to enhanced sectoral growth. Consequently, the governments obtain huge tax revenues from the manufacturing industries (UNCTAD, 2013). This income is used to improve

the standard of living of the citizens. On promotion of employment creation, some countries have formulated hiring and training targets. Angola and Nigeria are examples of nations that have set targets that encourage use of local labour force in the oil firms. Schmidt and Huenteler (2016) suggest that such targets are only beneficial if coupled with training programmes to enhance acquisition of skills.

Countries with clear local content legislation, policy and institutional framework have proved the prominence of the local content frameworks. Government's ability to work on modalities for local participation determines the success and benefits derived from the local content policies. Mushemeza and Okiira (2016) analyzed the effectiveness of local content framework based on data obtained from different African countries. Based on the evidence collected, scores for the countries ranged between 0.5 (lowest) and 1.5 (highest) as indicated in Table 1. Apparently, Angola and Nigeria, which both have been acknowledged by researchers for their effectiveness in formulation and implementation of the local content, scored the highest on enhancing national industry participation, local employment and skill development (Mushemeza et al., 2017; Ovadia, 2014).

Table 1: Local content framework scores

Country	National industry participation	Local employment	Skills development	Average
Angola	1	1	1	1
Chad	0.8	0.9	1	0.9
Nigeria	1	1	1	1
Ghana	1	0.5	0.5	0.7
Equatorial Guinea	1	0.5	0.5	0.7
Tanzania	0.5	0.5	0.5	0.5
Uganda	0.5	0.5	0.5	0.5

Source: Mushemeza and Okiira (2016)

Protection of local infant industry is a major benefit obtained from the use of local content. Arguments for infant industry indicate that government support through the use of LCPs allows infant industries to compete with international firms in the global market. With time, productive capacity for the firms improves and producers access larger international markets with superior products (Hufbauer et al., 2013; Easo and Wallace, 2014). Subsequently, local firms attain economy of scale, lower their unit costs and hence become competitive and efficient. With larger markets and experienced production capacity, the firms experience huge growth.

Local content requirements compel international firms to transfer skills and technology to local firms and professionals. Consequently, local firms learn, embrace and adapt technologies and production progressions developed elsewhere. Indeed, in sophisticated industries such as oil and gas, barriers to entry are enormous and prohibitive especially in the developing nations (Tordo et al., 2013). The Local Content Act enhances transfer of such sophisticated technologies to the local firms. The Columbia Centre on Sustainable Development (2015) posits that successful local content policies have led to creation of employment, enhanced indigenous private sector, successful transfer of technologies and competitive indigenous workforce.

Similarly, the LCPs face various challenges. Resource allocation is one of the key challenges facing local content. The LCPs distort efficient resource allocations since they negate the principle of comparative advantage. In the absence of government interventions, industries that rely on local content policies cannot withstand competition.

Local content policies are potentially incompatible with the international trade regulations applied to the World Trade Organization (WTO) member states. Particularly, agreements such as the General Agreements on Tariffs and Trade (GATT) ratify the principle of 'national treatment' (Jojarth, 2015). This means that a member state is expected to treat its trading partner as it would treat its nationals. Domestic subsidies to the local firms would therefore violate the regulations put in place by the WTO. Subsequently, a country's trade would be affected by such regulations.

Other challenges that affect the implementation of local content policies include commodity prices volatility, unpredictable resource revenues and erratic political environment. Disputes erupt among communities especially when some communities perceive that particular communities are favoured in allocation of business and employment opportunities. In addition, local content targets sometimes lead to selection of unqualified contractors, hence the quality of services fail to meet the required standards (Ovadia, 2014).

Technological and skills transfer is a key focus for most countries especially in the developing countries. In developing local content targets, countries raise their expectations in developing local expertise and acquisition of advanced technologies (Schmidt and Huenteler, 2016). Most resource-rich countries have formulated legislation on local content that require contractors to design training programmes that would ensure effective transfer of technologies (Columbia Centre on Sustainable Development, 2015). This paper will specifically evaluate the aspect of technology, development of skills and the prerequisites for enhancing local content.

1.2 Problem Statement

Local content policies are used to stimulate local manufacturing in the extractive industries. Among the oil-rich countries, local content has sparked contentious debate over the idea of value creation. There has been a dominant outlook regarding their roles in regulating the energy sector (KPMG, 2016). Adoption of LCPs is a strategy that has been put in place in various countries to enhance participation of local companies in the supply chain, therefore creating backward linkages, and enhancing job creation.

Low understanding of local content deters development of effective policies. Countries such as Nigeria have continuously reviewed their local content policies to enhance local participation in various energy projects. In addition, only a few of the resource-rich nations have embedded local content in their legal frameworks. In Latin America, for instance, only Brazil and Mexico have adopted the local content (IRENA, 2012; Mushemeza et al., 2017). Beside the gaps in understanding local content, there are numerous challenges faced by resource-rich nations adopting the LCPs. In the developing countries, the major challenge is inadequate technical and professional skills (Schmidt and Huenteler, 2016). Inadequate funding of the energy projects, lack of crucial infrastructure and ineffective policies are some of the major challenges facing the sector in relation to local content.

To overcome local content challenges Mushemeza et al (2017) argue that there is need to understand the prerequisites for local content, which include: industrial capacities, resource endowment, effective resource governance, and international agreements. This forms the basis for this paper; to identify the prerequisites for local content and the challenges faced across various energy sub-sectors in connection with local content.

Despite the continuous regulation pattern in the Kenyan energy sector regarding local content, the concept is misunderstood. With inadequate knowledge of the concept, the country encounters snarl in the verge of formulating feasible and effective local content policies. This paper is a situational analysis that focuses on the concept of local content in the energy sector. In particular, the paper emphasizes on the prerequisites for enhancing local content in Kenya.

1.3 Research Questions

(i) What does the local content concept entail in the energy sector?

(ii) What are the opportunities, emerging technologies and challenges facing local content in the energy sector?

iii) What are the prerequisites for local content in the energy sector?

1.4 Objectives of the Study

The main objective of the study is to understand the concept of local content in the energy sector, particularly focusing on the prerequisite for enhancing local content in Kenya.

1.4.1 Specific Objectives

(i) To explore the concept of local content in the energy sector in Kenya.

ii) To identify the opportunities, emerging technologies and challenges facing local content in the energy sector.

iii) To identify the prerequisites for local content in the energy sector in Kenya.

1.5 Justification

Kenya does not have operational local content regulations. This review is important in informing the country's development of operational local content policies. More importantly, this study is essential to the government and its agencies. The key policy makers will gain deeper understanding of the concept of local concept and identify gaps in the current legislation. Consequently, they will incorporate the recommendations in their policy and legislation enactment and implementation of the local content requirements. Similarly, international companies, civil society organizations and development partners will effectively benefit from the study. Particularly, international companies will acquire crucial information in designing effective local content plans and programmes. This will ensure effective delivery of local content in the extractive industries. The civil society organizations, as interested parties, will use the information obtained to advocate for effective policies that seek to benefit the communities with the natural resources.

Researchers will effectively derive invaluable information relating to local content. The local content topic has not been researched widely in Kenya. Therefore, this paper will be instrumental to policy researchers. They will identify gaps that noticeably need further research.

The local SMEs and the public will substantially benefit from the study. Local content legislation provides vast opportunities for the public seeking employment

and the business enterprises in quest of procurement opportunities and joint ventures with the multinational companies. The study will provide opportunities for participation and challenges the public and the SMEs might face in the context of local content.

1.6 Methodology

The development of this paper is based on a review of secondary sources of information through a meta-analysis. Desk review of documents at both global and country levels was used to investigate best practices in the formulation and implementation of local content in resource-rich nations. It was imperative to analyze information provided by other studies on the local content regulations to inform Kenya's development of an operational act. Besides carrying out literature review at face value through counting of existing literature, this paper undertook a qualitative analysis of the concept of local content, emerging opportunities, technologies and challenges, and the critical prerequisite for enhancing local content.

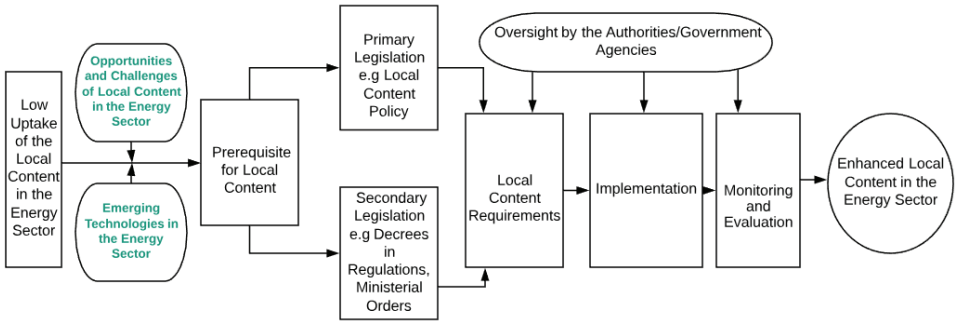
Review of local concept considered the general view point and particular understanding of the various power generation sources. More so, the distinction of the local content concept across the value chains in the oil and gas and the renewable energy sub-sectors prevailed. While the paper focused on bringing out the existing legal framework for Kenya energy local content, the comparison approach was used to critically identify the gaps and learning experiences from legal frameworks of other developed and developing countries.

Scoping of the emerging opportunities, technologies and challenges was undertaken for all power generation sources and across their value chains. The approach put emphasis on Kenya while showcasing the similarities and differences across the globe.

A systematic review was also undertaken to critically review the prerequisite for enhancing local content. This entailed undertaking investigation on the best practices currently applied worldwide.

1.7 Conceptual Framework

Figure 1: Conceptualization of enhancing local content in the energy sector



Source: Author's construction from literature

As shown in Figure 1, low understanding of local content contributes to low uptake of local content in the energy sector. Consequently, few countries that adopt local content policies face numerous challenges, including lack of local capacity, ineffective resource governance, inadequate finances, and incompatibility with international trade agreements. To foster local content in the energy sector, LCPs should be drafted taking into account the following prerequisites: enabling legal and institutional framework, enhancement of local capacity, enabling investment climate, development of local infrastructure, promotion of good resource governance and political will, and effective monitoring. With such preconditions, the local content policy developed would lead to increased skilled workforce, effective sector governance, competitive local contractors, investment growth, advanced technology acquisition and enhanced energy generation.

1.8 Scope of Work

This study comprehensively elucidates the concept of local content, policies and legislations, challenges and opportunities, and the prerequisites for enhancing local content. It highlights the necessary framework required to strengthen Kenyan legislation on local content.

1.9 Organization of the Work

The paper is organized as follows: section one contains the introduction and it also presents the background information regarding local content. The concept of

local content in the energy sector, oil and gas, hydroelectricity power generation, geothermal energy, power generation from solar energy, and wind energy is discussed in section two. Section three explores the opportunities, challenges and emerging technologies in the energy sector. Section four identifies the prerequisites for enhancing local content and evaluates the investment climate in the energy sector. Section five concludes and also provides key policy recommendations

2. Concept of Local Content and the Legal Framework

2.1 Definition of Local Content Concept

Simply defined, the concept refers to acquisition of direct and indirect prospects for employment, usage of goods and services while promoting local skills development and enhancing acquisition and transfer of technologies (Gbedi and Adebisi, 2013). Jojarth (2015) describes the concept of local content as a value-laden conception with a wide range of definitions. The World Bank defines local content comprehensively, including aspects of employment, procurement of raw materials and local ownership of the companies (Wolf, 2009). In its definition of local content concept, the African Development Bank (AfDB) incorporates aspects of local firms based on their incorporation, majority of the members of board being locals and nationals holding the largest proportion of shares in firms. In Kenya, the Local Content Bill 2018 defines it as "a means of maximizing the level of usage of local goods and services, people, business and financing." The Bill seeks to promote maximization of value-addition and creation of employment opportunities in the extractive industry value chain through use of local experts, goods, services and financing and their retention in the country. It will be providing a framework for: establishment of M&E and reporting system; development of local skills across the extractive industry value chain; and application of the mechanism of local content by an operator.

Similarly, 'local' concept substantially differs across the regions. Some counties use the word 'local' to refer to the indigenous citizens whereas other use it to refer to the local community located in a region where the energy projects are being undertaken (Nwapi, 2016). In Kenya, the draft Local Content Bill of 2016 defines local as an individual or an entity undertaking works, supplying goods and services to an operator. If it is an enterprise, it must be incorporated under Kenyan laws and they are owned and controlled in Kenya.

In the extractive industries, LCPs should consider an array of factors: geographical location, reserves' geology, the nature of education, investments, employment rates, infrastructural development, trade agreements, and population among others. Therefore, local content is a multifaceted concept and it cannot be uniformly applied in all resource-rich countries.

2.2 Local Content in the Non-Renewable Energy Sector

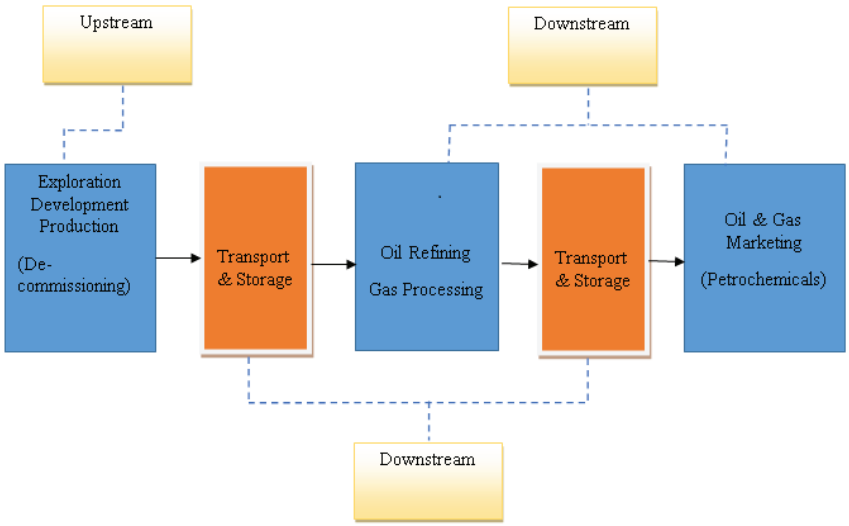
In the oil and gas industry, local content is referred to as the government's interventions that enhance local supply of goods and services procured at every stage of the value chain (Easo and Wallace, 2014). In this context, local content

policies focus, for instance, on enhancing creation of employment for the local population in the sector in all the stages. Such policies demand that international oil companies actively engage the indigenous workforce in the petroleum activities, thus enabling transfer of knowledge and skills that would benefit entire communities and foster indigenous industries (Easo and Wallace, 2014).

There are valid grounds that make a country adopt LCPs at all stages of the value chain. Most developing and resource-rich countries do not have specialized labour and pool of experts in the oil and gas industry. Consequently, international oil companies end up engaging foreign service providers and experts with pertinent skills and knowledge. The vicious cycle emanates from this problem. Indigenous labour force lacks employment and opportunities to gain skills on the job. In additions, foreign experts have established and well-connected networks with the International Oil Companies (IOCs), and this allows them to displace the indigenous companies from the value chain (Easo and Wallace, 2014). The problem is not unique to developing resource-rich nations. In the early stages of exploration of oil and gas, the UK and Norway had to set local content targets since they did not have experts in the field (Levett and Chandler, 2012).

To local content concept is valuable at all segments. Oil and gas industry has three main sections: upstream, midstream, and downstream. Exploration, development and production are in the upstream stage. Midstream comprises transportation and storage whereas downstream covers refining, processing of gas, petrochemical processing and selling the products to the market. The entire structure is demonstrated in Figure 2.

Figure 2: Oil and gas industry framework



Source: UNCTAD (2012)

The exploration stage entails activities focusing on finding oil and gas and evaluating the quantity to warrant exploitation. The process of exploration and appraisal can take place between three and ten years. The results obtained during exploration determine whether there will be development. Development stage comprises activities and investments necessary for site preparation (roads and wells construction, production installation metering equipment, among others). Based on the region and peculiarity of the project, this could take 2-4 years and it accounts for approximately 40-50 per cent of the entire project cost. Production phase follows. The stage entails activities for commercial exploitation of oil and gas. The stage takes between 15 and 25 years after which decommissioning takes place (UNCTAD, 2012; Bertrand, 2014).

Wolf (2009) suggests that at every value chain phase, diverse technologies and inputs are used; therefore, there the possibility of enhancing local content differs from one stage to another. With time, the oil sector progresses from the initial stages, and the extent and nature of the local content varies. Some stages utilize more locally produced goods and services whereas others require imported inputs. The main determinant of the capacity to produce such goods depends on a country's level of industrialization and development (Tordo et al., 2011).

During the exploration stage, the value chain is at an exceedingly specialized level and in the areas with newly discovered oil resources it is apparent that domestic companies might not have the capacity to supply the required inputs. The few opportunities available demand more of unskilled services such as carrying out the basic constructions (Bertrand, 2014).

Similarly, the development stages attract limited local content. The phase is small in scale and it necessitates highly sophisticated processes. Akin to the exploration stage, this phase is financially unfeasible and therefore the firms' experience cessation of operations (Hufbauer et al., 2013). Therefore, any created local content in this stage does not last long. As a result, local companies avoid risks associated with investments in the exploration and development operations unless the appraisal results indicate that the amount of oil discovered would be economically viable.

In all these stages, there is potential to create employment, procure goods and services. Various professionals are required at every stage of the value chain as indicated in Table 2.

Table 2: Professionals required in the oil and gas industry

Professional required	Exploration	Production	Transportation	Refining	Distribution	Marketing
Technical job title	Geoscientists	Petroleum engineers	Mechanical engineers	Chemical engineers	Industrial engineers	Analysts and traders
Operational job	Oil drillers and seismic crews	Oil field workers	Pipeline workers	Plants operators	Terminal operators and truckers	Service station attendants
Support position	Landsmen	Petroleum attorneys	Petroleum accountants	Human resources	Information technology	Administrative assistants

Source: Petrostrategies (2011), http://www.petrostrategies.org/. Accessed on January 2020.

In most developing countries, the industry does not have professionals with the required qualifications to deal with the first phase of exploration and development of oil and gas. As a result, the companies hire expatriates with pertinent skills. To bridge this gap, the governments develop policies that compel the IOCs to provide specialized trainings to locals. As UNCTAD (2012) postulates, the benefits derived from oil and gas activities are based on the communities' capacity to tap into the available job opportunities and indirectly engage in the supportive activities throughout the value chain.

Some of the most important energy regulations and policies for the non-renewable energy include the Petroleum Act of 2019, National Energy and Petroleum Policy and the Energy Act 2019.

2.3 Local Content in the Renewable Energy Sector

Renewable energy has been emphasized as countries seek to generate clean energy. There are various forms of renewable energy popular across the globe, which are directly obtained from the sun or the heat that is generated within the earth. Such energy includes solar heat energy, wind, hydropower, geothermal, biomass and biofuels, among others (Rivers and Wigle, 2011).

Local content in these forms of energy can be evaluated in all stages of the value chain; from power generation, transmission and distribution. In the context of renewable energy, the South Africa Department of Energy defines local content requirements as the import quotas on certain goods and services, or rather local policies and regulations that provide for certain quantum of goods and services to be sourced locally (Kiragu, 2015).

Renewable energy in Kenya is estimated to contribute to approximately 77 per cent of the generated electricity (KNBS, 2019). The Kenya Economic Survey of 2019 (KNBS, 2019) indicates that power generation sources in Kenya in 2018 entailed hydro power at 36.09% per cent, geothermal power at 46.4% per cent, thermal at 13.99 per cent, cogeneration at 0.02 per cent, wind at 3.4 per cent and solar at 0.12 per cent. There are various existing policy tools than facilitate development of renewable energy in Kenya. These include the feed-in tariffs policy, Kenya Vision 2030, Rural Electrification Master Plan 2009, VAT exemption and zero import duties. A programme aimed at scaling up the renewable energy brought about the introduction of zero-rated import duties on the accessories and equipment for renewable energy in 2011. Exemption from VAT and ensuring that there are no import duties significantly reduces the financial burden of firms and promotes renewable energy (Invested Development, 2012). In addition, the feed-in-tariff for the energy sector generated by wind, solar, biogas, geothermal and hydropower provides incentives to firms that are interested in generating renewable energy. The Kenya Vision 2030 set an ambitious target of generation of 23,000 MW by 2030, which necessitates generation of a mix of renewable sources including wind energy, which is targeted to generate 2036 MW. The current energy generation in Kenya is at 11,182 MW (KNBS, 2019). There are several wind project installations in Kenya including the 25.5 MW in Ngong' Hills, 310 MW in Lake Turkana Wind Power Project and four other Independent Power Producers (IPPs), which combined have a capacity to generate 221 MW. Currently, power generated by wind energy is 376 MW (KNBS, 2019). The Energy Act of 2019 encourages net metering as a way of encouraging renewable energy generation (KNBS, 2019).

2.3.1 Hydropower Generation

KPMG (2016) highlights the stages involved in hydropower generation value chain as indicated in Figure 3.

Figure 3: Power value chain

Source: KPMG (2016)

The value chain for electricity begins with the energy producers. They source and refine fuels that are used in production of electricity. After the fuel delivery to the generation facilities, their conversion is done via the generation process. The generated electricity is transmitted and distributed to the customers' location. The process entails energy exchanges and there are various electronic trading platforms (IEA, 2012).

Power generation entails installation of various equipment and construction of power generation sites. In all these steps, usage of raw materials that are locally produced is inevitable. In addition, countries insist on use of local labour force (IRENA, 2012; World Bank, 2012). Apparently, industry operators rely on imported goods, raw materials, and experts who could be provided by the host countries. Consequently, governments come up with legislation that encourages absorption of the indigenous labour force and use of goods and services sourced within the country. This is an act of a country's protectionism (IRENA, 2012).

Transmission and distribution of power usually involves construction of lines from the power generation station to the point of usage (Kuntze and Moerenhout, 2013; IEA, 2012). In each phase of the construction, for instance, the installation of towers, transformers, steal liners, tunnel boring, among others, materials are required, and labour usage is inevitable. The aspect of local content is crucial in the process to ensure that contractors engage the indigenous skills and expertise, and encourage the growth of local industries through backward linkages (Kuntze and Moerenhout, 2013).

Small hydro power is one of these feasible renewable sources of power. The technologies could provide lighting, communication to the local community and also supply power through mini-grids for other users such as small industries. Small hydros produce between 500Kw and 10Mw of power. With regulations that offer opportunities for independent power producers, this technology could offer opportunities for local content. Kenya is among the first countries in Sub-Saharan Africa to establish feed-in tariffs that make it possible for private power producers to generate power and feed it to the main grid. Kenya uses project-driven model, which incorporates local engineers especially in the planning and execution of the mini-hydro projects (Gaul, Kölling and Schröder, 2010). Several tea factories in Kenya, including Uniliver and James Finlays have installed small hydros to generate power for their operations.

2.3.2 Wind energy

There has been tremendous growth in the wind power industry; one of the major economic drivers that has enhanced creation of employment opportunities in various countries (IRENA, 2013). Wind power value chain entails manufacturing and assembly of various components, and the services required in the measurement of wind choosing site, project improvement and funding, installation and operations and maintenance (Rivers and Wigle, 2011). Kuntze and Moerenhout (2013) acknowledges that wind power industry being a young sector in various countries requires local content legislation to protect local companies from stiff competition from foreign firms.

Even though the government has made commitments that encourage renewable energy in Kenya, there is no wind energy policy to guide and give incentives to local companies to wind power equipment in Kenya (IREK, 2017). Kenya lacks strong innovation system that would boost production capacity in the wind energy sub-sector.

2.3.3 PV solar energy

PV solar energy is a major component of clean energy adopted by various countries. Schmidt and Huenteler (2016) contend that most countries have adopted stringent measures and policies around the solar PV energy, which guides the project design, installation, operations and maintenance. The PV value chain stages create an opportunity that enhances local content. Research conducted by Solar Foundation in 2016 indicated that installation of solar accounts for half of the job creation in the US solar jobs, followed by manufacturing that accounts for 15 per cent. Project development takes 13 per cent whereas the sales and distribution comprise 12 per cent. Other categories including research and development accounts for 6 per cent (Solar Foundation, 2017). This clearly indicates that local content legislation in the PV solar energy could be imperative in enhancing creation of jobs for the indigenous communities in a country.

The Energy (Solar Photovoltaic Systems) Regulations, 2012 guide areas related to solar PV system manufacturing, importation, system ownership, among others. The licensing of installation is by the Energy Regulatory Commission. The Commission also stipulates the requirements and qualification of the technicians intending to install PV systems. The regulation licenses solar PV manufacturers, vendors, contractors and importers. Byrne et al. (2014) give the Kenya PV market as an example of markets that are led by the private sector. There has been adoption of over 300,000 home solar systems and approximately 100,000 portable solar lights. The solar products manufacturing environment in Kenya has been enhanced through various policies that give incentives to manufacturers. Policies such as the Energy (Solar photovoltaics) regulation, 2012 and solar PV standards and VAT Act of 2013 have provided an environment for production of quality solar products in Kenya. However, there is inadequate qualified local technicians and the manufacturers rely more on expertise from foreign countries.

2.3.4 Geothermal power

Gislason (2008) describes geothermal as the form of energy that is generated within the earth and it can be converted into electricity directly or used for heating. Local content in the geothermal power generation entails creating jobs for the locals, and sourcing for goods and services that are locally produced to enhance local industrial growth. At every phase of the project's value chain, local content would be inevitable. The first phase entails acquisition of concession rights, fact finding, visiting the site, and concession rights bidding. Resource assessment is the second phase that comprises surface exploration and initial modelling of the resources. The third stage is the framework contracts establishing head of terms, project agreement, power purchasing agreement, and tax concession. Exploration drilling phase comprises drilling of approximately three to five wells. The next phase is the tendering or financial closure that entails finalizing project agreement, acquisition of finances and designing the power plant. The sixth stage is the power plant construction or production drilling stage that involves drilling various wells and construction of power plant. The project is then commissioned and operations begin. The stages are illustrated in the Figure 3.

Figure 4: Geothermal value chain

Source: Gislason (2008)

In Kenya, geothermal energy generation has been undertaken for the last decade through state-owned facilities. With this, the country has built profound technical capacity to handle geothermal energy generation. However, much is needed to ensure that more local firms are involved in providing technical and ancillary services (Johnson and Ogeya, 2018).

2.3.5 Biomass

Biomass energy has become popular. It is obtained from animal and plant waste. The sources could be primary or secondary. Primary sources entail plants that are specifically grown for production of energy. Secondary sources are the waste materials from animal and plant waste, which are used for energy generation. Energy is extracted from biomass through biopower technologies such as direct combustion, gasification, fermentation, pyrolysis, ci-firing and anaerobic digestion (Kološta and Flaška, 2016). Energy from biomass has several uses such as cooking, heating, lighting, cooling and biofuels. USA, Germany, Brazil, China and India

are among the leading countries in biomass energy production. Biomass energy production has various levels in the value chain. All those stages are important, and they offer an opportunity for local content. The processes entail collection of inputs, pretreatment, digestate, plant, and methanation. In all those stages, local capacity can be utilized.

The Government of Kenya (2018) indicated that approximately 193 MW could potentially be cogenerated through sugarcane bagasse. Mumias Sugar Company, for instance, independently produces 36 MW out of which 26 MW is fed to the national grid. The government estimates that other sugar companies can generate approximately 300 MW. With the feed in tariff policy in place, local firms should be encouraged to produce biomass energy.

2.4 Local Content Legal Framework in Kenya

2.4.1 Legal frameworks protecting Kenyan manufacturers

Local content is often seen as a protectionism policy. Its history in Kenya can be traced back in 1965 when Kenya developed and executed the Sessional Paper No. 10 of 1965 which looked at African socialism and it was applied in planning. The document emphasized more on promotion and strengthening of local industries, promotion of employment and encouraging investment. Later, Sessional Paper No. 1 of 1986 was developed which dwelt on economic management for renewed growth and a strategy for the Structural Adjustment Programmes (SAPs), whereby Kenya sought to enhance its production and trading patterns. The strategy shifted focus from protectionism to encouraging local manufacturers to export their products. The development of the Kenya Vision 2030 in 2008 necessitated the need for a policy that would encourage production of Kenyan goods and services. Brand Kenya was established in 2008 to promote Kenyan image and market Kenyan goods and services. This was followed by a presidential directive in 2015 which required that all government agencies should reserve a minimum of 40 per cent of the budget for procurement to source locally produced goods and services. The Enactment of Special Economic Zones Act, 2015 was formulated to encourage local production of goods and services, and it provides for tax incentives and reduced transport costs to local manufacturers. The Public Procurement and Asset Disposal Act, 2015 also sought to promote local manufacturers since it gives preferential treatment to locally produced goods and services.

In 2017, the Ministry of Industrialization developed the 'Buy Kenya Build Kenya' strategy. The strategy is aimed at promoting locally manufactured products and services. In the strategy, the Ministry aims to make consultations with the National Treasury on setting up local content requirements for all government procurement

contracts. The gains will be enhancement of local capacity to produce goods and services that would compete in the global market.

2.4.2 Legal framework in the energy sector

In the light of Kenya's discoveries of oil, coal and various other minerals, there is a heightened attempt to tighten the legal framework. The Kenyan Constitution 2010 is an imperative tool that provides guidelines especially on ownership of natural resources. Various legislations are being prepared to strengthen the existing public procurement law as indicated in Table 3. The current legislation and draft legislations include the Energy Act 2019; Local Content Bill 2018; Petroleum Exploration, Development and Production (Local Content) Regulations, 2014; and Petroleum Act, 2019. The major concern in all the draft laws is to increase participation of the locals in the energy projects, enhance local capacity, use of local goods and services, and develop the local industries.

The draft legislations have several proposals. For instance, the Petroleum Exploration, Development and Production (Local Content) Regulations, 2014 and Petroleum (Exploration, Development and Production) Bill, 2015 require that petroleum licenses and contracts shall be issued to firms that have more than 5 per cent Kenyan shareholding. International firms wishing to supply goods and services to companies that are working in the upstream activities are supposed to form joint ventures with local Kenyan firms, and the local companies should have a minimum of 10 per cent equity or contract value.

The Energy Act 2019 stipulates that all holders of licenses should submit long-term and annual local content plans to the Energy and Petroleum Regulatory Authority. The Authority will be mandated to monitor and impose local content requirements in the energy sector. The Bill introduced institutional changes in the energy sector. It extends the mandate of institutions such as the Energy and Petroleum Regulatory Authority. It also calls for establishment of Energy and Petroleum Institute, which will be a centre of excellence, energy and petroleum, and intermenstrual committee. The Bill imposes compliance to the local content requirements. It also seeks to create a Consolidated Energy Fund that will get funding from various sources such as government bonds, parliament, grants and contributions from several other stakeholders in the energy sector.

The Local Content Bill, 2018 seeks to establish a Local Content Development Committee to oversee, coordinate and manage development of local content in Kenya. The committee will make recommendations on the minimum standard requirements for local content. Appraisal, evaluation and approval of the local content plan will be done by the committee. The Bill gives preference to local

persons in getting jobs and in sourcing for local goods and services. Nevertheless, there is no existing policy on local content that stipulate the percentage of local content in the energy sector projects.

The energy sector is among the sectors that are heavily invested by the government and private firms. The Kenya Electricity Sector Investment Prospectus for 2018-2022 postulated that over the MTP III framework, the estimated investments would cost approximately US$ 14.8 billion.

Concern on the legal framework

Even though Kenya is taking remarkable steps to enhance local content, the legislations especially on local content are coupled with myriad of challenges including lack of clear policy. In addition, the legislation does not clearly indicate how the government can effectively collaborate with the training institutions to enhance acquisition of essential skills. In addition, concession terms should be standardized. To a large extent, ensuring uniformity of the concessions issued by the government is imperative since the problem of handling case by case will be avoided. This will greatly improve coordination of outcomes and enhance transparency. In addition, the definition of 'local' need revision to avoid conflict between communities and the rest of the Kenyan citizens.

Table 3: Legislations supporting local content

Legal Documents	Provisions
The Constitution of Kenya, 2010	• All the mineral and mineral oil belong to the government. The National Government under Article 69 has the right to manage the resources and ensure equitable sharing of the benefits accrued from their use
Local Content Bill, 2018	• It stipulates the role of the National and County government in supporting local content • Seeks to establish Local Content Development Committee
Petroleum Exploration, Development and Production (Local Content) Regulations, 2014	• It seeks to establish a unit for Local Content Development and Monitoring • During bidding for a license, a contractor/licensee is required to submit a local content plan • Preference is given to local firms in the bid processes • Licensee is required to submit employment plan • Contractor is required to prepare technology transfer plan annually • At the beginning of the year, licensees are required to submit local content performance report

Petroleum Act, 2019	• The creation of an upstream petroleum regulatory authority and a local content development and monitoring unit • The proceeds (share of the National Government) from the oil exploration and production shall be shared between the National Government, County Government and the local community at 75%, 20% and 5%, respectively • Local Content and Training • Give employment priority to qualified Kenyans • Contractor to submit local content plan regarding employment and training, R&D, technology transfer, industrial attachments and apprenticeship, legal services, succession of positions held by foreigners, among others
Production Sharing Contract (PSC) Model 2014,	• Requires that contractors adhere to local content laws, policies and regulations • It provides for the employment and training of Kenyans by the contractor • Establishment of training fund • Contractors required to give preference to Kenyan goods and services • Contractors urged to come up with a technology transfer programme to promote transfer of technology to local firms
Natural Resources (Benefit Sharing) Bill, 2014	• Seeks to establish and enforce a model for sharing benefits from resource exploitation between contractors, National Government, County Government and the local communities
African Agenda 2063	• Goal 4 in this agenda seeks to transform economies, create jobs and ensure inclusive economic growth • The agenda stipulates that local companies should generate a minimum of 20% of the extractive sector output
Energy Act, 2019	• The bill was signed into law. It requires that contractors adhere to local content requirements • Submission of local content plan, which must give first consideration to Kenyan goods and services, employment of the locals and training opportunities • Energy Regulatory Commission is tasked to monitor and enforce local content • The Commission shall set targets and formats for local content and reporting • The Commission will set the minimum local content requirements

2.5 Local Content Policies in Various Countries

Several resource rich nations have developed local content legislations over time. In most cases, the legislations are improved when the countries heighten their production activities. In most cases, a country's level of economic growth determines the requirements adopted. Among the areas that the local content has addressed in various nations include employment and labour market development, value creation, stimulating industrial growth and enhancement of technology. Table 4 indicates some of the local content requirements across the resource rich nations.

Table 4: Local content registrations across various resource rich countries

Employment and labour market development	
Employment requirements	
Angola	The country requires that oil firms employ at least 70% of the locals and engage foreign experts only in circumstances where there are no Angolan workers with similar qualifications
Nigeria	The oil firms do not employ foreigners in the intermediate and junior jobs
Tanzania	If the firm hires a foreigner, the country only issues them with work permit if they have submitted a succession plan
Kazakhstan	The minimum requirement for hiring the locals has been put at 95%
Ghana	Clerical and unskilled jobs are preserved for the nationals in the mining sector
South Africa	The mining chatter declares that a minimum of 40% local labour should be involved in the mining sector
Training requirements	
Brazil	Among the determinants in the bidding process for the oil and gas sector includes components such as hiring the locals and training plans
Angola	Oil firms must contribute US$ 0.15 annually for each dollar per barrel of the produced oil. The money is set aside for training of the local personnel. During exploration, a fixed amount of US$ 200,000 per annum is contributed by each firm to support training
South Africa	Firms in the extractive industry are required to set aside 5% of their entire annual payroll for human resource development
Value creation or addition	
Local procurement requirements	
Nigeria	There are precise categories of activities that should be procured from Nigeria as stipulated in the Local Content Act of 2010. The target is set at 80-100%. There is a penalty to firms that fail to comply
Ghana:	Firms have to adhere to the set local content target during procurement of goods and services. At the beginning, the target is 10%. At 5 years it increases to 50%, which escalate to 60-90% after 10 years

Indonesia	Initially, the target for procurement of local goods and services was at 35%. The revision of the target in 2016 led to an increase of the target to 45% (for offshore drilling), 70% (land drilling), 75% (shipping services)
Mexico	In undertaking shallow water projects, the country targeted to attain 25% domestic content by 2015 and 35% by 2025.
Ramdoo (2015); AfDB (2015); Esteves et al. (2013); CCSI (2014; 2015; 2016); CGA (2014)	
Stimulating the development of domestic industries	
Requirements to create local industries	
Angola	Oil firms in Angola are required to source specific goods and services entirely from Angolan firms
Norway and the UK	Joint venture strategies were implemented in the early development stages in the hydrocarbon sectors
Libya	Foreign firms must enter into partnership with the local firms. The foreign firms can only own a maximum stake of 49%
Uganda	The country requires that when goods and services are not available, the licensee can only source them through a joint venture with a local firm. The local firm should hold a minimum of 48% equity stake in the joint venture

3. Emerging Opportunities, Technologies and Challenges

3.1 Introduction

With a clear understanding of local content, numerous energy sector practitioners have held debates on the challenges that emanate from the LCPs' implementation in various parts of the world. Essentially, local content policies differ from one country to another. Consequently, the outcome varies across nations. Despite this, there are some unique and divergent similarities in the challenges faced during their execution. Amid the challenges, there are noticeable opportunities for local content in the resource-rich countries. Local content requirements are formulated to help gain local capture by ensuring the indigenous communities benefit from resources around them. This section critically evaluates the available opportunities in the energy sector and the challenges faced during implementation of LCPs. The paper considerably focuses on the aspect that touches on skills and technology transfer.

3.2 Opportunities Available for Local Content in the Non-Renewable Energy Sector

3.2.1 Opportunities in the oil and gas industry

Oil production has been increasing and it is projected to increase in future. Africa has a huge prospect of oil production emanating from the recent discovery in countries such as Tanzania and Kenya. Table 5 indicates the trend of oil production in various continents. The Middle East and America are some of the regions that produce the highest volumes of oil globally. Their oil production trend has been increasing over the years. Apparently, this could be attributed to the adoption of enhanced technology that increases efficiency and increases production. The increasing trend in global oil production is an indicator of the increasing opportunities for job creation and technology transfer.

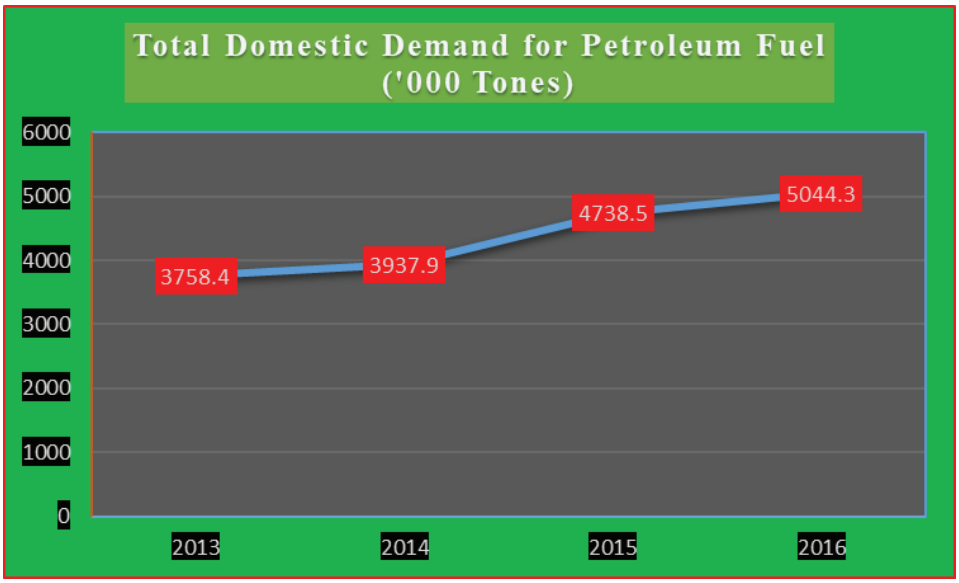
Table 5: Global annual oil production trend by region

	2013	2014	2015	2016	2017	2018
Middle East	31.8	31.4	31.7	34.4	33.7	33.5
Europe	3.9	3.9	3.9	3.9	3.9	3.8
North America	15.8	17.6	18.3	17.5	18.7	20.9
Latin America	12.9	12.7	12.3	11.6	10.8	9.7
CIC	16.3	15.9	15.7	15.7	15.8	15.5
Asia	9.1	9.0	8.9	8.5	8.1	7.8
Africa	10.2	9.5	9.1	8.5	9.0	8.9

Source: IEA (2019)

In Kenya, energy demand has been rising due to increased economic activities and government's efforts to increase connectivity. This has necessitated the country's increased focus on generation of energy from different sources of energy such as oil and gas, and renewable sources. Kenya discovered the first commercially viable oil in Tertiary Rift in 2012. It was followed by the offshore discoveries of gas in the Lamu basin. The Kenya National Oil Company (KNOC) outlines four potential sedimentary basins: Tertiary Rift, Anza, Lamu, and Mandera basins. The potential for Kenya to produce oil and gas is substantially in line with the growing demand for oil and gas both locally and internationally. A snapshot of the petroleum demand trend for the period between 2012 and 2016 as indicated in Figure 5 portrays a positive increase. This encourages the oil and gas industry in trying to meet both local and international demands.

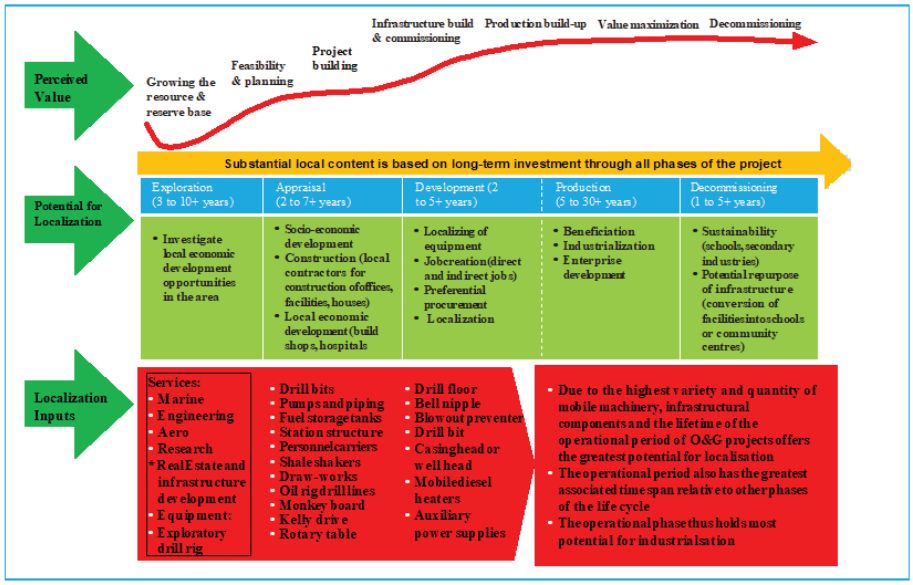
Figure 5: Total domestic demand for petrol fuel



Data Source: KNBS (2018), Economic Survey

As countries continue to focus on local content legislation, it is crucial to point out the available opportunities in the extractive industries across the value chain. Both forward and backward linkages prospects for the oil and gas industry have been diagrammatically expressed in Figure 6.

Figure 6: Backward linkage opportunities are possible along all links in the value chain

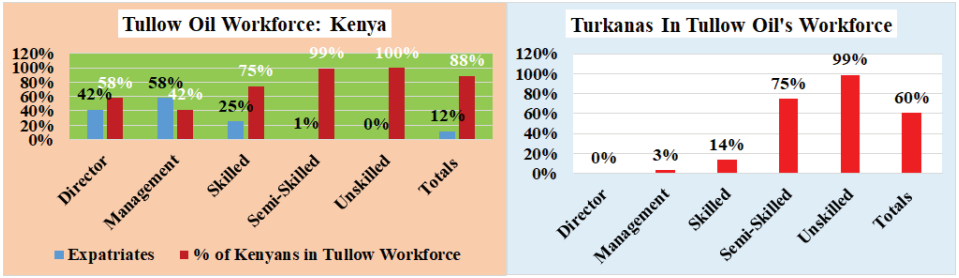


Source: Deloitte (2015)

There are various technological and skills development opportunities as outlined in the figure above. At every stage of the oil and gas value chain, diverse inputs and technologies are used (Tour, Glachant and Meniere, 2011). This has potential for enhancement of local content. Apparently, local content varies with stages. Some stages use more of the local inputs than the imported ones. Consequently, the country's ability to supply local inputs, especially technologies and skills, depends on the its level of development and industrialization.

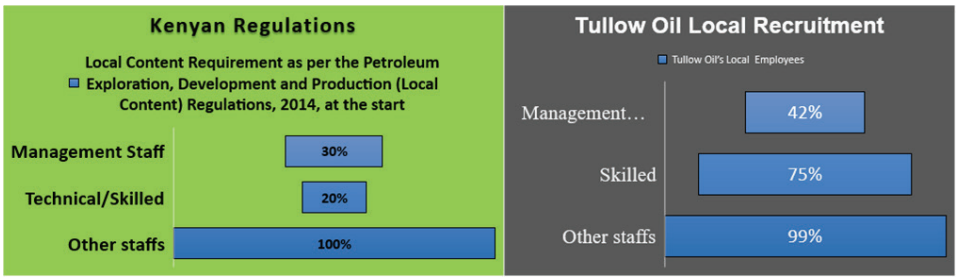
Compared to coal mining, oil and gas operations are capital intensive. Consequently, there are limited local content opportunities in the production phase. Nevertheless, in the construction phase, which takes a number of years, opportunities such as semi-skilled jobs, welding, light engineering, and electrical works prevails. Kenya is still currently in the exploration and development phase. In 2015, Tullow Plc produced a report that indicated the number of jobs created and shared among the locals and international employee at different levels. This study carried out an analysis to establish the percentage of the local workforce in the company as indicated in Figure 7.

Figure 7: Tullow oil contractors' employees composition



Source: Author (2018), based on Cordaid (2015) report'

Figure 8: Kenyan local content regulations versus Tullow Oil contractors' implementation



Source: Petroleum Regulation 2014; Cordaid (2015) report

As indicated in Figure 8, Tullow Oil company has substantially engaged a higher percentage of foreign experts in top management. This could be attributed to the fact that the locals do not have the necessary skills and training to effectively manage the oil industry operations. Nevertheless, the ratio of Kenyans engaged especially in the management and skilled job level will enhance on-the-job learning from foreign experts. The country at large would benefit from effective local content. For instance, effective training education and capacity development can be made a requirement for investing international firms to foster skill development in Kenya oil and gas industry. As indicated in appendix F, in Ghana, Tullow Oil Inc sponsored several technicians to gain skills at recognized universities and vocational organizations. Several Ghana National Petroleum Company (GNPC) staffs were also seconded in various Tullow Oil international offices where they would gain knowledge in the oil and gas industry and transfer the skills to their own country. This is besides various scholarship programmes offered by the same company to Ghanaian students to study oil and gas-related programmes (Kayizzi-Mugerwa and Anyanwu, 2015). Through Tullow Group Scholarship Programme, several scholarships have been given to Kenyans to study courses around oil and gas. More than 70 Tullow Oil scholarships have been issued since 2012 (British Council, 2016).

During the exploration stage, there are opportunities to advance different sophisticated technologies and skills. For instance, foreign firms use seismic technologies to obtain detailed information regarding the site where exploration is being conducted. The data is interpreted using multifaceted computer analysis. Exploratory drilling uses various rigs appropriate to the site under exploration. In such a phase, various equipment, services and products are required. It is at this phase that international firms engage other firms to provide effective services. Veloso (2006) posit that this stage is highly specialized, and for countries that have discovered oil and gas, domestic supply of the necessary equipment and skills is limited.

The development stage presents several opportunities for local content in the oil and gas industry, especially in adoption of multifaceted technologies. It is at this stage that appraisal wells are drilled. The stage is small in scale and sophisticated. The technologies used help the companies to assess the size and commercial feasibility of the discovered oil and gas.

As the oil projects move from development to exploration phase, more opportunities are availed for local content. The production phase entails drilling of the full-scale production and construction of infrastructure that would link the domestic processing facilities. The stage involves the use of technologies that local firms would benefit from and employees would learn vital scales on the methods used in production of oil and gas (Tordo et al., 2013). The opportunities for the local companies would also include: treatment of oil and gas and liquefaction of the natural gas; transport and storage; refining of the crude oil; and the primary distribution.

International oil firms transfer sophisticated technologies and knowledge to local firms and employees by conducting specialized training. In backward linkages, advanced technology stimulates sustained diversification result to development of interlinked technologies (Tour, Glachant and Meniere, 2011). This empowers the local suppliers and there is high possibility of transfer of ownership and control of production to the nationals of the resource-rich country.

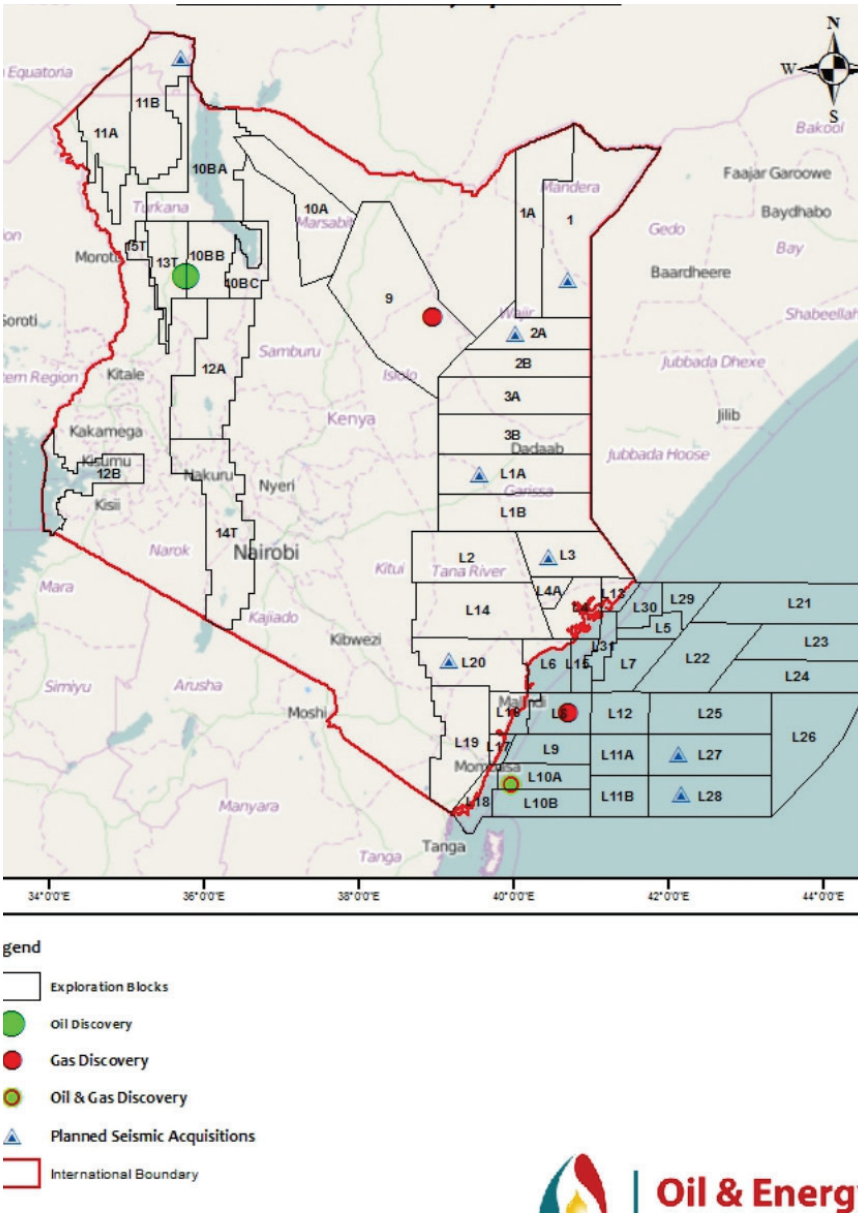
The oil and gas operations provide an opportunity for enhancing growth of inputs and industries. Infrastructural development that emanates from oil and gas operations lead to development of other sectors in the upstream phase. For instance, petrochemical and fertilizer industries grow out of such operations.

Investment opportunities are available for local content through backward linkages in the oil and gas industry. The growth in the industry encourages the existence of oil field services firms and the connected suppliers (including construction, scaffolding, repair, and fabrication). In addition, forward linkages prevail since

growth in the industry stimulates growth of industries that use oil and gas outputs as their inputs (Tordo et al., 2013). An example of such industries are the refining industries, transport and interlinked suppliers. Development of skills by local firms and the connected development in infrastructure opens up opportunities for investment in other synergetic industries such as the petrochemical industries. Appendix A and B highlights opportunities available for local goods and services in the oil industry as adopted from Tordo et al. (2012).

Since 1960, Kenya has drilled a total of 30 wells before the discovery of commercially viable oil at Ngamia 1 in 2012. Most of the discoveries are under appraisal stage and drilling of wells is ongoing to assess the quality and quantity of wells. The Government of Kenya gazetted 63 oil blocks in 2016. They are in the Mandera basin, Tertiary Rift and Lamu Basin. As indicated in Figure 9, there are traces of oil and gas that could boost the Kenyan economy. Among the companies that have already occupied 24 blocks include Apache Corporation, Anadarko Petroleum, Premier Oil, Total, BG Group, CAMAC Energy Inc, Cove Energy, among others. These companies could be persuaded by the government to offer various local content opportunities to local firms and the Kenyan workforce. In the midstream sector, some of the companies involved in Kenya include the Kenya Pipeline Company, Kenya Petroleum Refineries and O&S investors (World Bank, 2016). In offering services, Kenyan companies can either be engaged to offer specialized services, direct services or indirect services.

Figure 9: Oil and gas exploration opportunities in Kenya



Source: World Bank (2016)

Specialized services call for huge investments, strict adherence to required standards, competent technical expertise and high level of technology. Foreign companies providing specialized services could form joint ventures with local firms and provide a platform for transfer of skills and technology to Kenyan companies. In addition, local firms could be engaged in provision of direct services such as civil

work, logistics and transportation, electrical and mechanical work, environmental impact assessments, site preparations and supply of construction materials. Skills from technical institutions such as welding, plumbing, mechanical and electrical work will be used in the industry. Other indirect services can largely be left to the local companies for instance in provision of information technology (IT) services, supply of office materials, provision of security, among others.

Kenyan-based institutions have appreciated the importance of building capacity on oil and gas industry. Institutions such as Morendat Institute of Oil and Gas, and Petroleum Institute of East Africa have been instrumental in offering oil and gas-related courses. Nevertheless, universities in Kenya do not have courses that are specifically tailored for oil and gas industry. Students offered scholarships to build capacity in this sub-sector often go for studies abroad.

3.2.2 Opportunities in the coal industry

In the coal industry, various opportunities exist across various stages in the value chain. The categories under which the opportunities for local content arises include services, capital goods and construction materials, consumables and replacement parts, bulk services and infrastructure and non-core goods as indicated in Appendix D. Specifically, there are opportunities for acquisition of skills and technology transfer for local firms through provision of various services and equipment. The services required in the industry include corporate support services, exploration and mining, and other services required in the operation and maintenance (Bertrand, 2014). The mining firms require exploration services (geoscientific surveying, mapping, remote sensing, etc), sample analysis, drilling services and mining services. All these services are sophisticated, and they provide an opportunity to develop local expertise and transfer of technology to a country. For instance, local firms may benefit from short-term engagement during mining and drilling by providing waste haulage, secondary crushing, auger and reverse circulation (RC) drilling. Similarly, various design, engineering and environmental consultancy is required. Therefore, local firms engaged in provision of such services have the opportunity to build their capacity and acquire technology from multinational firms (World Bank and Kaiser Economic Development Partners, 2015).

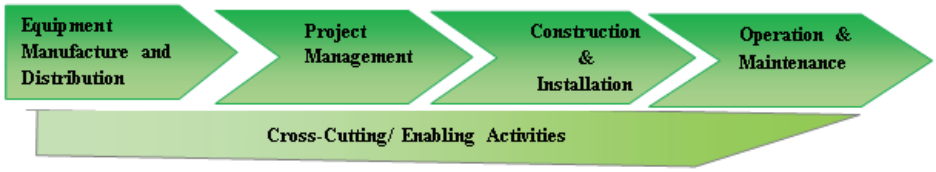
Despite the discovery of coal deposits of approximately 400 million tonnes in Kitui county and in Lamu, Kenya has not effectively used coal as a source of energy. However, the Kenyan Government through its agencies has spearheaded the utilization of coal to enhance energy production. Fenxi Mining Industry Company was awarded contract to ensure generation of coal energy in block C and D of

the Mui Basin and the project was set to have kicked off by 2015. The project was projected to generate 960 MW of power. In addition, Lamu coal plant is also expected to generate approximately 1050 MW. Lamu plant is being undertaken by Amu Power Company and GE Power. GE has the technology to undertake the project effectively. The company is set to provide and install the equipment needed and offer after sale services. Working closely with these companies, local firms will gain significant skills and there is an opportunity for technology transfer. The projects have stalled pending court cases from legal challenges brought forth by politicians and environmentalists citing various reasons to stop the projects, such as health and environmental risks.

3.3 Local Content Opportunities in the Renewable Energy Sector

Various opportunities for transfer of technology and skills exist in the renewable energy sector. Technology transfer can be defined as the diffusion of significant energy technologies from the country of origin to another. The host country acquires, adapts, installs and diffuses technologies from the renewable energy sources from abroad and substantially innovates them. Renewable energy sources are preferred to other sources since renewable energy technologies are flexible and do not require huge initial investments compared to non-renewable energy. The basic renewable value chain for the renewable energy is shown in Figure 10.

Figure 10: Renewable energy value chain



Source: International Labour Organization (2011)

The manufacturing sector, therefore, supplies equipment such as biomass digesters, wind turbines, solar panels, and water turbines. Whether the equipment is locally produced or imported, a well thought out local content policy will provide an opportunity for transfer of skills and technologies. There are countries that demand for the localization of the manufacturing industries for the renewable technologies to maximize the local content (Tour, Glachant and Meniere, 2011). Site preparation, installation, operation and maintenance require specialized skills that would effectively be enhanced through local content requirements. A clear outlook of the skills and occupations that are necessary in some of the renewable energy sub-sectors has been highlighted in the appendices section (Appendix

C). Kenyan laws and regulations such as the Energy Act of 2019 and the "Buy Kenya Build Kenya" initiatives substantially support localization of industries by providing that goods/products made in Kenya shall be given first priority.

3.3.1 Opportunities in the hydro electricity sub-sector

Opportunities for local content in hydropower generation exist in four main stages: power generation, electricity transmission, electricity distribution and trading. At first, producers of energy mines and refine various fuels necessary for production of electricity. Electricity generators use fuels in the production, transmission and distribution of electricity. In all these processes, local firms have the opportunity of learning new technologies from the producing firms (Levett and Chandler, 2012). Countries that have undergone energy reforms have encouraged the private sector to generate power as external producers. In connection, the firms obtain licenses and permits that enable them to produce energy for their own consumption, domestic sale or export.

Two more opportunities exist in the hydropower generation; power storage and information and communication technology (ICT)-empowered smart grid. Most developing countries have not invested in power storage research due to inadequate capacity to undertake such an initiative. There are forms in which electricity can be stored and later be converted back (Mishra, 2013). There are various storage technologies that can be adopted by local firms that can absorb power when there is surplus capacity and later release it during shortages. There is glaring focus on this technology which entails uprating the prevailing facilities (Denis and Joerg, 2013). Smart grid is a noble emergent solution that offer solutions where the customers and the power utility companies can effectively share roles in managing power effectively. Smart grid incorporates the aspect of information communication technologies, automated controls, metering technologies and techniques that manage energy. Consequently, there are opportunities where local firms can provide these technologies to the electricity generating firms. Similarly, there are chances that with effective technologies, local content regulations can aid in enhancing adoption of such technologies by the local firms.

It is estimated that Kenya has 3,000MW - 6,000MW of unexploited power from hydro generation. By 2017, hydro generation in Kenya was 2,776.8 GWh (KNBS, 2017). Potential for more hydro-generation projects exist in five regions: Tana River basin, Lake Victoria basin, Athi River basin, Rift Valley basin and Ewaso Ng'iro North. Despite the huge potential for hydro power generation, hydro plants are capital-intensive and few local firms have the capacity to elect the plants. As a way of growing the local firms, an inclusion in terms of forming joint ventures

with the foreign firms would significantly help. Some of the potential projects in the hydro generation include Kleen energy, Global Sustainable (Kaptis), Frontier, Powertech (Gatiki), Western Hydro and Kenya Tea Development Authority (KTDA) projects, among others.

3.3.2 Opportunities for local content in the wind energy sub-sector

Wind energy provides an array of opportunities for local content within the value chain. Remarkably, since the core constituents (towers and blades) for the wind energy are large in size, manufacturing need to be closer to the market to lower the costs of transport (Levett and Chandler, 2012). To enhance acquisition of wind technology in the host countries, most international firms invest heavily in training the local workforces, especially engineers.

In most developing countries, the wind energy sector technological transfer occurs primarily through importation of turbines from advanced countries. Technology transfer models posit that countries that did not initially innovate turbines can use technology leapfrogs to enhance their domestic manufacturing firms for the turbines (Denis and Joerg, 2013). This strategy significantly fosters technological transfer from foreign firms that have sophisticated turbine technologies. This is made possible through licensing agreements, joint ventures, international trade, and combined research and development.

During deployment of wind energy, various activities are involved that enhance effective transfer of skills and technologies. They include assessment of the site, project planning, financial administration, site construction, grid connection, operation and maintenance, among others. To initiate the transfer of knowledge, international companies enter into joint venture agreements with local firms. Scholars indicate that transfer of technologies requires that the transferee have considerable technological capability (International Labour Organization, 2011). Joint venture enables foreign companies to collaborate with local firms to ensure effective technological transfer at reduced costs. Similarly, the local firms in the joint venture acquire the property rights which is essential for reproduction of the technology for use in the domestic market.

Generally, the policy and market forces have significantly provided the developing nations distinctive opportunity to advance renewable energy technologies. In this context, resources and technologies diffused from overseas facilitates an enabling environment to bridge the technology gap of the host countries. Numerous energy companies have located their manufacturing base in republics such as India (Levett and Chandler, 2012). Localization of the research and development in the

host country is a major component of a successful technology leapfrogging plan.

An assessment carried out by WinDForce indicated that Kenya has a huge potential for wind energy. One of the mega wind projects for Kenya is the Lake Turkana Wind Power Project, which was constructed at a cost of US$ 685 million. By 2017, the project had employed more than 1,500 Kenyans with about 600 coming from the local communities where the project was located (Cookson, Kuna and Golla, 2017). This notwithstanding, it is imperative that such project engage the local firms to enhance transfer of skills and technology into the country. International firms such as DEWI, Vestas Wind Systems A/S, Siemens, Civicon and SECO and RXPE, which have huge experience in wind power technology should transfer the skills and technology to the Kenyan firms. Transmission line construction to connect the project also involved foreign companies such as Spanish contractor and Isolux Corsan S.A. Other wind projects in progress include Meru Wind Phase I, Kipeto, Oldanyat, Prunus, Ngong III, Aperture Green, Chagem/Chania Green and Electrawinds Kenya (Bahari). Due to focus on wind power projects and more specifically the Lake Turkana Wind Project, wind energy sub-sector generated 375.6 GWh in 2018 (KNBS, 2019). This was a huge increase from 61.3 GWh in 2017. This is an imperative move towards wind energy generation; however, a clear assessment of the Lake Turkana Wind project document clearly indicates that there was no conceptualization of local content. The document only cites employment of 300 persons during the construction period. It does not mention whether there were long term jobs that could be created, and a structure that would enhance sourcing of local raw materials.

3.3.3 Opportunities for local content in the solar energy sub-sector

Solar energy offers great potential for local content in the renewable energy sector due to its wide application. Its application entails: heating water, lighting, solar thermal collectors, cooking and industrial heat applications. There are two general categorizations of the solar technologies: active and passive solar. Thermal collectors and photovoltaic panels are components of active solar since they capture energy from the sun. The energy is then converted into other energy carriers for use. Passive technologies have been used in heating water for domestic use, and indoor lighting (Veloso, 2006).

At the commencement of the development of solar energy, countries have the potential of creating value domestically in various engagements at every stage (manufacturing, construction and installation), for instance in operations and maintenance and grid connection. As the indigenous firms develop, more opportunities arise for provision of services that entail research and development.

This is an ideal opportunity to develop local skills. ILO (2011) suggests that operations and maintenance phase requires purely technical and skilled crafts workforce. This is very essential especially in the large scale photovoltaic, concentrated solar power and the solar heat installations. In the small-scale solar installation, skilled workers are engaged on irregular basis to provide maintenance services. Nevertheless, solar installations and maintenance requires a mix of technological skills and specialized skills depending on the type of technology (Denis and Joerg, 2013). With this in mind, policy makers should use this opportunity in the sub-sector. They need to enact policies that would require international firms to collaborate with the local institutions in the development of courses that enhance solar technology in the energy sector.

Mid-sized solar projects are gaining popularity in many countries especially for the large buildings. Suppliers of solar technologies, mostly the manufacturers and distributors, have the potential to enter into joint venture with the indigenous companies. This will offer a platform for the transfer of technologies and acquisition of specialized skills through specialized training to the locals. As the industry grows, local firms in the joint venture will have a firm foundation and capacity to offer independent engineering services and establish a manufacturing base (ILO, 2011).

Kenya is endowed with the sun as a resource. The ability to tap into this resource is enormous. The Government of Kenya and private investors have continuously focused on upscaling the off-grid solar systems. For instance, Kenya Off-Grid Solar Access Programme (K-OSAP) is an initiative that seeks to provide access to electricity to 1.3 million people across 14 North and North Eastern counties. The project is worth US$ 150 million. This is an enormous project that could engage local companies. Other projects include Kenya Energy Modernization Programme, Witu Solar PV plant, 50MW Garissa Solar power plant and Solar hybrid micro-grids for off-grid counties project. The 50MW Garissa Solar power plant was set to serve over 70,000 households (Government of Kenya, 2017). Nevertheless, the project did not have a target on the number of locals who would get employed, neither did it have effective local content plan including plans on technology transfer and trainings.

As the Kenyan government spearheads installation of mega solar projects, it is crucial to consider viability of having a solar equipment industry. A survey by IREK in 2017 aimed at enhancing capacity for solar and wind in Kenya established that Kenya does not have the capacity to manufacture solar power equipment, which is necessary to undertake mega solar energy projects. Most of the solar equipment are imported from abroad (IREK, 2017). Perhaps there should be further analysis to check whether Kenya has the requisite raw materials to manufacture solar

equipment. Perhaps this could be the reason the 50MW Garissa Solar power plant's panels were supplied by a Chinese-owned company (China Jiangxi). Nevertheless, there are Kenyan solar manufacturing companies such as Solinc that were not involved in the projects.

3.3.4 Opportunities for local content in the geothermal power sub-sector

Worldwide, it is estimated that approximately 200GW of geothermal potential is unexploited. From the projections, only 13.3GW has been realized in the 24 countries where there are geothermal operations (IRENA, 2014). The International Renewable Energy Agency (IRENA) posits that there are four regions with high capacity for geothermal: the South Pacific, Central America, East Africa and South America. Kenya is ranked among the top in the list of the countries with the highest projected geothermal exploration opportunities. By 2015, Kenya's geothermal capacity was approximately 740MW (IRENA, 2014).

There are several investment opportunities in the generation of electricity using conventional technologies that include steam turbines and binary turbines. In addition, a wide array of opportunities for development of skills exist in the geothermal power value chain as illustrated in the Table 6.

Table 6: Occupations involved in Geothermal Power Sub-Sector Value chain

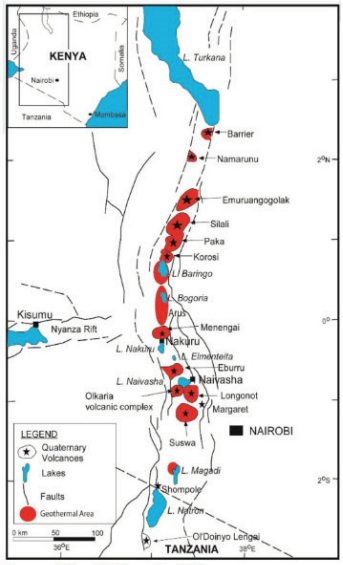
Equipment manufacture and distribution (only for active solar)	Project development	Construction and installation	Operation and maintenance	Cross-cutting/ enabling activities
Designers Electrical engineers Mechanical Engineers Software developers Machinists Welders Sales personnel	Geothermal engineers Permit planners Debt financier representative Land use negotiators Lobbyist Environmental and social NGO representative Procurement professionals	Hydrologists, Hydro-geologists Geologists Geophysicists Geothermal engineers Geochemists Chemical laboratory technicians and assistants Drilling engineers Structural engineers Surveyors	Plant managers Measurement and control engineers Welders Pipe fitters Plumbers Machinists Electricians Construction equipment operators HVAC technicians	Policy-makers and government office workers Trade associations and professional society staff Educators and trainers Management Administration Publishers and science writers Insurance representatives

				Insurance representatives IT professionals Human resources professionals Financial professionals Health and safety consultants

Source: ILO (2011)

Kenya has an estimated geothermal potential of 10,000MW. Its installed capacity is approximately 6.76.8MW. Worldwide, among the countries with commercial geothermal energy, Kenya is ranked 7th (GEA, 2013). There are 23 geothermal prospects in Kenyan Rift Valley. There are three fields under development in Olkaria (developed by KenGen, OrPower and AKiira), Eburru (developed by KenGen) and Menengai (being developed by Geothermal Development Company (GDC). There are other prospects under exploration stage. The companies that have heavily invested in geothermal development in Kenya include KenGen, GDC, Marine Power (AkiiraOne), AGIL, OrPower4 Inc. (Ormat) and Oserian Development Company (Mangi and Omenda, 2016).

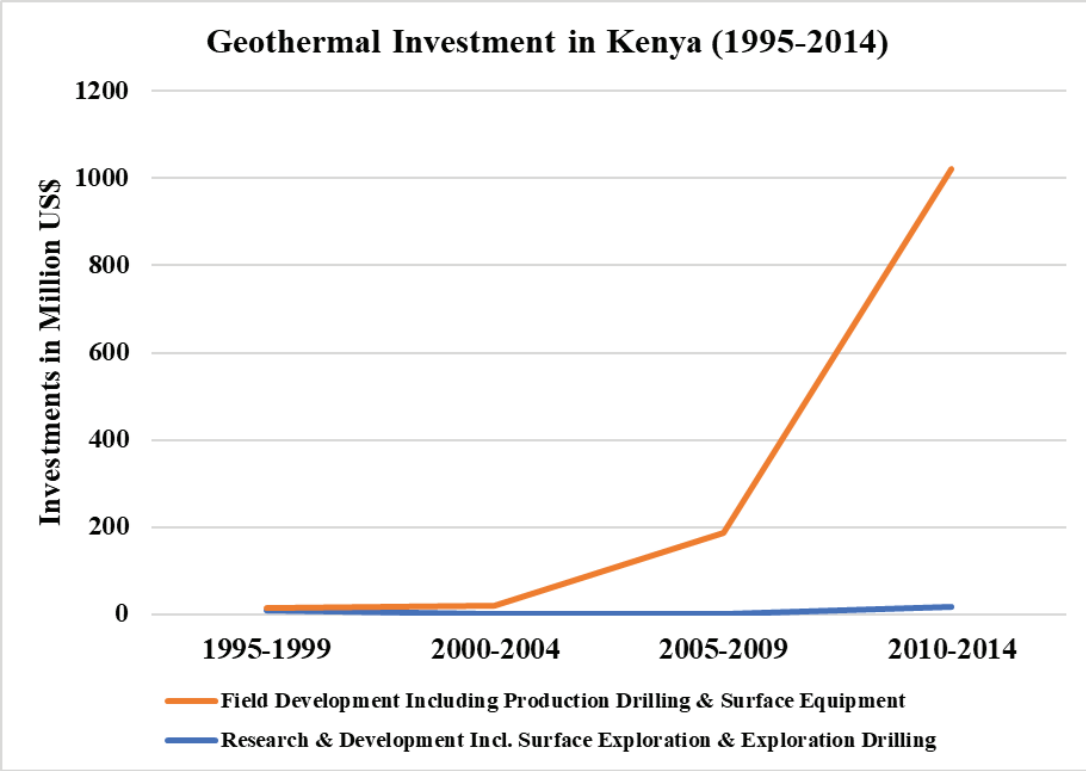
Figure 11: Locations of geothermal fields and prospects in Kenya



Source: Mangi & Omenda, 2016.

Kenya has increased investment on geothermal development with a hope of boosting energy production in the country. Figure 11 indicates the trend in the investment on field development and research and development (R&D).

Figure 12: Geothermal investment trend in Kenya



Source: Mangi and Omenda (2016)

The Government of Kenya has tried to create incentives to geothermal investors by allowing power purchase agreements, feed-in-tariff policy, offering guarantees and steam supply agreements.

Kenyan companies can be involved in supply and services. This would include development of rigs, supply of geo-exploration tools and equipment, drilling materials, design of steam field, construction of pipelines, feasibility studies consultancies, and supplying power plants and equipment. In the development cycle, local companies could offer expert engineering services, develop generation equipment, well-head and conventional power plants, construct sub-stations and develop infrastructure (Kagiri, Muchemi and Njenga, 2014). Among the projects that could offer opportunity for local content to local firms includes Menengai Phase I (465 MW), Suswa (150 MW), Baringo-Silali (200 MW), among others.

3.3.5 Opportunities for local content in the biomass energy production

Biomass is widely used to provide energy globally. In Kenya, over half of the population use this form of energy (Mugo and Gathui, 2010). With the policy reforms and legislations such as Energy Policy, Energy Act 2019, environmental policy, and forest policy, there are opportunities to exploit the energy sources effectively. There are various opportunities for new technologies such as improved charcoal jiko stove which save on charcoal usage, and other biomass technologies including woody crop residuals and biogas. In development and use of these technologies, different experts are needed, and local companies invest in the technologies.

3.4 Emerging Technologies

3.4.1 Emerging technologies and skills in the oil and gas industry

Over the years, the energy sector has witnessed sustained technological advancements. In the oil and gas industry, advancement in technology has focused on various distinct areas: acquisition of sophisticated data especially in the upstream stages, water conservation, prevention of oil spill, research and development, among other areas of focus (Denis and Joerg, 2013).

There has been emerging technologies in computing referred to as digital oil field. It entails installation of high technology sensors that gather big data on the field. With advanced software in the shale oil and gas, it is now possible to establish the elements of deposits and attach equipment that can monitor the deposits. There are major developments ranging from the stratigraphic geological formation analysis and 3D seismology to enhanced formation analysis. Companies have invested in technologies that acquire big data in the oil and gas industry. Geologists require huge amounts of data during the exploration stage (Schmidt and Huenteler, 2016). With digitalized systems, exceptional data volumes are acquired from various sources. The challenge, however, has been detecting patterns and drawing insights from the obtained raw data. To counter the challenge, a new technology developed by Smart Dust company has come up with micro-sensors that are embedded in the formation of rocks and refineries. They are set to detect movements and transmit updated information to the systems. The technology will develop new skills that are aimed at enhancing efficiency in oil production especially by mitigating the uncertainty in oil exploration. Geologists, therefore, will have to focus on acquiring these new set of skills for them to better interpret the information obtained in the system (Nwapi, 2016).

Engineers have worked persistently in developing platformless drilling. The technology aims at advancing subsea compression system that would replace the above-surface rigs used in the oil and gas industry. The system is projected to reduce running cost and it will accelerate production. The technology has been used and tested in Norway by Statoil firm. The countries and firms that are working on acquisition of this technology are spending huge amounts on training programmes aimed at developing skills necessary to undertake oil production using this system (Denis and Joerg, 2013).

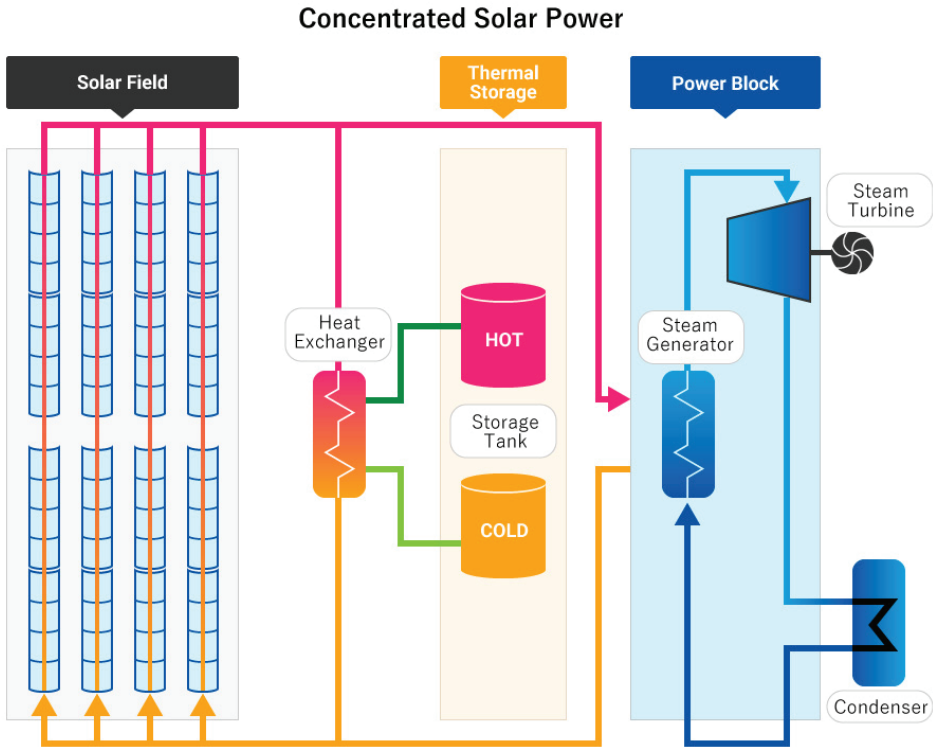
At the fracking sites, oil and gas companies have adopted an advanced water treatment technology. The technology aims at reducing the amount of water used especially in arid areas that produces shale. Initially, fracking wells required between two to five million water gallons. Firms are also coming up with distillation methods meant to recycle the used water (Schmidt and Huenteler, 2016).

There is major progress in robotics as one of the major emerging technologies in the oil and gas industry. Robotics are unmanned and provide incredible capabilities. They are used in inspections, exploration, transportation and extraction, among other uses. These robots include underwater vehicles, drones that are remotely controlled and robot drills (Schmidt and Huenteler, 2016). The equipment has sensors and they are capable of collecting real-time data that reveals the oil and gas infrastructure conditions. These technologies offer an array of benefits since they can withstand extreme weather conditions and temperatures. They are safe and less expensive especially in conducting on-site inspections that are perilous. The robotics increase the speed of lifting heavy oil rigs (Denis and Joerg, 2013).

3.4.2 Solar energy emerging technologies

As the demand for solar energy continues to increase, the industry has experienced tremendous improvement in technology. Three of the most innovative and emerging technologies entails quantum-dot photovoltaics, concentrated photovoltaics, and perovskite cells (IRENA, 2014). Concentrated Solar Power (CSP) is an innovative technology that has been widely acknowledged for generating electricity while at the same time emitting low greenhouse gas emissions. This technology generates power by concentrating the rays of the sun using lenses or mirrors to produce steam or heat fluids. The steam drives a heat engine such as turbines to generate power similar to the traditional power plant and the process is demonstrated in Figure 13.

Figure 13: Concentrated solar power



Source: Chiyoda Corporation (2019)

Quantum-dot photovoltaics is an auspicious technology that emerged in 2010. Colloidal quantum dots are small size electronic materials with enhanced optical elements. They are light in weigh, inherently cost saving and versatile. Initially, the solar cell for the lead sulfide quantum dot had an efficiency of approximately 3 per cent. With increased research and improvements, the lead sulfide has an efficiency level of 12 per cent. Currently, cesium lead triiodide is being used and this has enabled quantum dot form to generate high voltage at an open circuit (IRENA, 2014).

Perovskite solar cell is a novel solar cell that entails perovskite structured compound, which is a hybrid organic-inorganic lead with active layer that harvests light. This technology is a thin-film cell version of photovoltaic technologies and it is cheap to produce, moderately simple to manufacture, highly absorbs light across various visible wavelengths and their power conversion efficiency is commendable (about 22%) (Ramdoo, 2017).

Although the Kenyan government has made a number of policies that support renewable energy, such as the Feed in Tariff and value-added tax (VAT) exemption for solar products, the manufacturing of solar products has not been localized by the major multinational solar companies. The government projected that by 2020, electricity demand generated from the PV systems will be approximately 22GWh per annum (Disenyana, 2009). By 2018, solar generated power was 13.7GWh (KNBS, 2019). Further, the government estimated that by 2020, solar water heating will have grown by approximately 400,000 units. Surprisingly, there are more than 40 leading solar retailers and distributors in Kenya. Among the distributed solar products include charge controllers, lighting products, solar-powered borehole pumps, batteries and hot water systems, among others. Other than the batteries, the rest of the products are imported from China, the US and the UK. Currently, Kenya does not have technical capacity to support solar manufacturing. However, the government projects to establish local manufacturing capacity by 2024. This led to a move where China's Tianpu Xianxing Enterprises partnered with Kenya's Electrogen Technologies to establish solar panel manufacturing industry in Nairobi at an estimated cost of Ksh 9 billion (US$ 140 million) (Disenyana, 2009). However, with a rising demand of solar products, there is need to ensure that multinational companies are encouraged to set up local manufacturing industries in Kenya.

3.4.3 Wind energy emerging technologies

Airborne Wind Energy Systems (AWESs) are the new sources of energy conversion in generating power from the wind. The system entails tethered and flying aircraft or wings targeting the wind that cannot be tapped by the conventional wind turbines. Although research on the new technology started long time ago, it has gained wide application in the past few years and diverse prototypes have been conceptualized globally. Their emergence was as a result of enhanced research, which indicated that at increased attitude, the wind blows in a range of between 200m and 10km from the ground surface (Cherubin, Papini, and Fontana, 2015). Beside its wide application, researchers are still working on several aspects including mechanical, control and electronics design. AWESs are either ground generated or fly generated systems. In the ground generated AWES, electrical energy is obtained on the ground through mechanical works that entail transmission of traction force from the aircraft to the systems on the ground through a rope. Ground AWES can be devices that are fixed on the ground or those that are a moving vehicle. The fly-generated AWES entail production of electrical energy on the flying aircraft. The energy is transmitted to the ground through a spectacular rope with electrical cables (Cherubin, Papini and Fontana, 2015).

3.4.4 Geothermal energy emerging technologies

There is an emergence of Enhanced Generated System (EGS) in the geothermal power generation. Traditional plants use steam, which is disconnected from hot geothermal fluid to drive turbines in the production of electricity. The new emergent technologies are often reservoirs installed underground and have been artificially improved. Water from ground water wells is usually circulated into the deep and improved penetrable hot rocks. It is heated up and sent to the binary plants so that it can generate power. After that, it is circulated back using closed loop. Some power projects function in force mode, where the exiting hot water from the binary plants is used for heat applications before disposal.

Ground Source Heat Pump is another novel technology in geothermal power production. The technology uses moderately constant shallow ground temperatures or groundwater with heightened temperatures. It has two basic configurations; horizontal subsurface loops and borehole heat exchanger which are vertical. This technology has gained wide application globally.

3.4.5 Hydropower generation emerging technologies

Although hydropower generation has not undergone tremendous changes, there are various emerging technologies geared towards power generation and enhancing power distribution. Among the promising technologies are the hydrokinetic-related technologies and the tidal power technology that is slowly gaining popularity especially in developed countries. Tidal power generation technology uses turbines to convert energy from tide into electricity. The technology is being used in small scale, but it has enormous potential for expansion. Hydrokinetic power generation occurs along the river and streams (Denis and Joerg, 2013). Hydrokinetic technologies entail installation of turbines along the water streams, which takes a form of an underwater windmill or a form of boat. The turbine generates energy and transmits it through built-up lines to the tethering system.

Besides energy generation technologies, there are various emerging technologies that have enhanced efficiency in hydropower generation. The use of drones, computer models and applications are some of the modern technologies that have enhanced efficiency in operations of electricity generation (Denis, and Joerg, 2013).

3.4.6 Biomass emerging technologies

Biomass entails different organic raw materials that come from plants. The systems for biomass energy use diverse conversion technologies to generate heat, fuels and electricity. Generally, technologies that convert biomass to energy have to consider the feedstock's volume/mass, size, availability, energy density and their moisture content. Among the modern technologies used for bio-energy conversion includes co-firing, direct combustion processes, thermal chemical processes, pyrolysis, carbonization, gasification, and catalytic liquefaction.

There are various local firms that produced improved cook-stoves. They include *Jiko-koa* and *Jiko-poa*. The government acknowledged the importance of clean cooking and it has been included in the national plans such as the National Climate Change Action Plan (2018-2022) (Government of Kenya, 2018). Clean cooking entails use of improved stoves that use raw materials such as waste from the farms. The entire process of using locally available materials, metal fabrication, recycling, sales and marketing often creates jobs for the locals and significantly boosts local content.

3.5 Challenges Facing Local Content in the Energy Sector

3.5.1 Challenges facing local content in non-renewable energy sector

Coal, oil and gas industries

Generally, extractive industries have an array of required skills. In the developing countries, the basic essential skills are inadequate. Acheampong, Ashong and Svanikier (2016) posit that the extractive industries are among the six major sectors that lack adequate critical skills. Consequently, the shortages in skills is a major detriment to local firms' participation in the industries. In essence, local firms face the challenge of finding indigenous engineers with the necessary skills. In addition, the cost of training the workers to acquire the much-needed skills is high. Practitioners Hydrocarbon industry agree that there are several inhibiting factors in using indigenous machinery that are faced with technological and geological challenges. The industry is sophisticated and multi-component. Therefore, the conventional experiences and approaches used in mining cannot be used in the industry. Subsequently, international oil companies resort to engaging foreign service firms and suppliers. In addition, it is difficult to find competent staff and firms that meet the required standards in the developing countries (Acheampong, Ashong and Svanikier, 2016).

Transfer of technology is hampered by the fact that local firms do not have the capacity to provide machinery and equipment required by the contracted oil firms. Such technology includes the logging technology, horizontal and top drilling, among others. In most cases, the technology is acquired from abroad. Therefore, inability to manufacture the technologies domestically and incapability to provide essential services by the domestic firms hinders effectiveness in the transfer of technologies to the host country (Nwapi, 2016). Most developing countries lack resources that would develop their local capacity. In addition, in cases where the local firms have succeeded to acquire the required technology, they realize later that they do not have adequate indigenous staff equipped to handle the sophisticated technologies and software under consideration. Left with no wider alternatives, the local firms resort to engage foreign experts with adequate know-how and capability to handle the equipment.

Similarly, there is a challenge in enhancing compliance of local content. This specifically arises when the countries' regulations on local content introduce measures that are not consummate based on the local firms' capacity to undertake energy projects. For instance, Nigeria Local Content Act provides for 50 per cent asset ownership by local subsidiaries of multinational firms. More specifically, the 50 per cent entails the equipment to be deployed for the execution of a project. In complex and sophisticated oil and gas industries, obtaining apt local partners with financial muscle to invest 50 per cent equity on the project becomes increasingly difficult. Consequently, the body mandated by the Act to enforce the law significantly face challenges of enhancing compliance. Caxton-Martins (2015) posits that in Nigeria, the board has been unable to stringently enforce the Act, which has occasioned in uncertainty in regulation. The board ended up providing compliance guidelines that created inconsistency in the interpretation and application of the Act. For instance, the guideline required the assets used in the projects to be transferred to the local firms during the contracts' life (Caxton-Martins, 2015).

The oil and gas industry is highly established globally. One unique aspect of the field is that it comprises very few huge international firms that have established their base in numerous countries. The industry has various suppliers with a wide range of goods and services. They offer both standardized and complex products and services. Some of these players are global while others are local. There are numerous subcontractors in the hierarchy especially when the international oil firms enter into contracts with the suppliers (Acheampong, Ashong and Svanikier, 2016). Breaking this chain is an uphill task for the local firms. In addition, a new entrant especially from the host country has to meet the required international standards. This become very challenging for the local businesses willing to venture into the sector.

Oil and gas discovery pose critical challenges in relation to unrealistic expectations. The industry generates attractive revenues; nonetheless, much time is needed until the operations bear fruits. As the activities elevate, the companies reinvest the revenues, therefore only a small component goes into the national revenue. In addition, commercial opportunities envisaged by the local content takes time to materialize. The industry cannot increase its capacity instantaneously. Due to their nature and commercial unviability, some phases such as exploration and development are unattractive to local firms. The firms would want to be engaged in stages where petroleum has been extracted and equipment need to be maintained. Managing expectations from various stakeholders (local community, local firms, politicians, etc) is a big challenge (Bertrand, 2014).

Government policies may sometimes pose severe challenges on investments in the non-renewable energy such as oil and gas. Policies with ineffective royalties and taxes, for instance, may obstruct local and international firms willing to invest in the oil and gas industry. A clear example is the uncertainty that prevailed in Alberta that led to derailing of construction of the oil transportation pipeline (Nwapi, 2016). In 2015, the Government of Alberta had put in place a carbon tax in addition to the introduction of stringent environmental measures. This made the oil and gas company vulnerable to huge costs, which shunned away interested investors (Nwapi, 2016). Such policies hamper the implementation of local content and especially in development of talents and technological transfers.

3.5.2 Challenges facing local content in the renewable energy sector

The renewable energy sector is faced with major policy challenges in implementation of local content requirements. Majorly, the enacted policies focus more on power generation whereas the most prevalent challenge is competition from the highly subsidized conventional forms of energy (MacLeod and Rosei, 2015). The emerging economies and the developing countries face the challenge of policy enactment for the energy sector in light of enhancing their overall economic development. For instance, access to the market and demand for solar and wind products is limited, whereby the production is lower than the demand needed to reduce the price and stimulate technological innovation. Similarly, there is a challenge in creating an enabling policy environment with rational targets that would foster local firms' participation in financing the expansion of renewable energy projects (MacLeod and Rosei, 2015). Therefore, local financial institutions lack interest in such projects. To counter this, most renewable energy projects are supported by donors, and this significantly hampers sustainability of such projects.

The sector is not devoid of technological challenges, especially in adoption and deployment of energy technologies. The first challenge concerns the uncertainty of countries to withstand their first-mover gain in light of rising competition from economies that have lower costs of production. In most cases, developing countries such as Kenya do not export their technologies to other developing or to developed nations in any sizeable scale. Secondly, many developing countries cannot effectively secure technological diffusion or facilitate conditions that would foster development of indigenous technologies for the renewable energy sector (Wagner, 2014). Renewable energy technologies are capital intensive and, as a result, countries with higher levels of economic development would influence the development of renewable technologies compared to those with lower levels of development (REN21, 2014).

Investment challenge in the renewable energy sector cannot be ignored. Despite the observable new investment trajectories in renewable energy globally, there has been noticeable decline in the amount invested over the years. REN21 (2014) revealed that in exception of hydropower, the global new investment for renewable energy stood at approximately US$ 214 in 2013. This was a decline of about 12 per cent from 2012 records and a further 23 per cent decline in comparison with 2013 records (REN21, 2014). The decline was attributed to uncertainty over the United States and Europe support policies and retrospective decrease in support noticed in other countries. Nevertheless, even though Europe had reduced investment in renewable energy by approximately 40 per cent, China and other emerging economies had substantially increased their investments. Another challenge in relation to renewable energy investment is that the new energy sources in the sector are being instituted on uneven ground. Worldwide, nuclear energy and the conventional fuels are highly subsidized irrespective of the environmental concerns and the need to increase the renewable energy sources. Wagner (2014) posits that the subsidies for fossil fuels is approximately six times higher than the renewable energy (Wagner, 2014). Even though there has been substantial reduction in the cost of renewable energy technologies, they remain moderately undeveloped and unable to offer power generation at a competitive cost.

Challenges in the wind energy sector

Technological differences present a unique challenge in the wind energy industry. In construction of the wind turbine, manufacture of the tower by local firms would be a challenge. Even though manufacturing of the wind tower does not differ with other forms of metalwork, it is not similar in size, quality and site. Therefore, transportation, welding and treatment of the surface should be the main focus. The quality of manufacturing is crucial. Consequently, very few manufacturers have the capacity to produce the required wind turbines (IRENA, 2012; IEA,

2012).

Challenges in the solar energy sector

There are various risks associated with technological advancement in solar energy. As technologies advance, the prices for solar reduces. To the consumers, this is good news. However, investment firms end up bearing the cost due to swift reduction of prices. In cases where time between energy generation system developed earlier and the new technology is small, the consumers usually dismantle the earlier technologies and replace them with the new ones (Tour, Glachant and Meniere, 2011). Therefore, if a local firm had invested in the earlier technology, it bears huge risk of the project it implemented earlier on.

Regional conflicts expose domestic investors to various challenges. Countries that start manufacturing of certain technologies might face risks associated with conflict between different regions' interests; a move that significantly impedes the transfer of technology to other countries. For instance, china increasingly became the largest solar PV exporter across the globe. This hampered the domestic sales of manufacturers in the United States, India and Europe. The dispute endured to the extent that this led to a situation whereby the United States and Europe instituted antidumping investigations against solar PV modules imported from China. Similarly, when India instituted Domestic Content Regulation to protect its domestic solar industry, the United States was against such regulations (Kuntze and Moerenhout, 2013; Tour, Glachant and Meniere, 2011).

Cross-cutting challenges

Ideally, not all policy interventions offer support to the energy sectors. Professionals have isolated some setbacks in the implementation of local content policies. Key among them include resource misallocation, ineptitudes, misalignment between the policy objectives instituted and the instruments, international guidelines and institutional structures (Levett and Chandler, 2012). In the upstream exploration activities, various countries end up setting very ambitious local content targets and margins for indigenous firms' preferences as the key strategies for enhancing local industrial capacities. At the end, the gap between monitoring measures and regulation of the local content grows. Apparently, there are no clear policies on monitoring and evaluation of transfer of technologies in the energy sector. The Energy Act 2019, Draft Local Content Bill 2018 and Petroleum Act 2019 only stipulate the parties responsible for M&E, with no clear requirements regarding the process.

Limited financial access and inadequate infrastructures remain the main challenges that impede effective implementation of local content in most resource-rich

countries. Most local firms face financial constraints to engage in oil extraction activities (Tour, Glachant and Meniere, 2011). This impedes their participation in the complex operations especially in acquisition of the emerging equipment and technologies necessary to compete with multinational suppliers.

Similarly, insufficient infrastructural development substantially hampers the implementation of local content. Energy installations necessitate development of infrastructures to facilitate effective operations across the energy sector value chain. To put up effective infrastructure, huge capital outlay is required. In most cases, infrastructure such as electricity grid, water, road and communication network is not available in remote areas where the natural resources are discovered. As a result, indigenous operators withdraw their participation. For the companies that produce electricity, their stations need connection to electricity grids. Equally, the firms engaged in fuel production require connection to the distribution network. IRENA (2012) argues that features of renewable fuels sometimes warrant new distribution networks. As a result, local firms should have the capacity to invest in the distribution of resources. For instance, those engaged in distribution of ethanol-heavy fuel mix requires a specific type of vehicle.

Unsatisfactory partnership agreements is a major challenge that restrains effectiveness of local content. Scholars have discovered that the resource field owners complicate their agreements, which makes it difficult for projects to kick off. With the nature of high capital intensiveness in the energy sector, local investor participation is limited. In addition, investors' capability is paramount. The local content requirements provide a leeway for inefficient local firms to act as commission agents to their international partners. Such firms do not have prospects for developing manufacturing industry with value addition facilities (Tour, Glachant and Meniere, 2011). Instead, they provide their principals with an opportunity to by-pass local policies in disguise of importing foreign inputs. As such, the partnership prearrangement fails to enhance the interest of the country.

Some governments provide prescriptive local content and they exhibit unwillingness to engage the industry players in pinpointing shared value prospects. Consequently, international firms view local content as a compliance exercise, and perhaps a risk to be mitigated rather than considering it as an opportunity to craft shared value. In addition, host governments sometimes set unrealistic targets, which surpass the local resources' capacity with a view to accelerating retained value (Semykina, 2015). Notwithstanding, the requirements inadvertently result in undesirable outcomes. For instance, they may establish uncompetitive firms and incentivize fronting activities. In addition, formulated objectives may be feasible in some project stages and not others.

The World Trade Organization's laws and regulations institute measures that impede implementation of local content requirements. Local content is influenced by the prevailing bilateral agreements, trade regulations, and protocols. These laws often provide restrictions, therefore making protection of local firms and labour impossible in some cases (Acheampong, Ashong and Svanikier, 2016). For instance, the Trade-related Investment Measures (TRIM) introduced by the WTO are against protection of local industry through local content. Nevertheless, for developing countries, definite transactional exceptions have been allowed to allow economic development for a certain period. Similarly, the Southern Africa Development Community (SADC) trade protocol calls for equal market access by limiting governments to put in place protectionist measures on the suppliers of services depending on the country's level of development. The General Agreement on Trade in Services (GATS) requires nations to commit to certain objectives that allow market access by foreign investors in the service industry. Failure to comply to such measures would be considered non-compliance, and it would attract punitive measures such as trade bans. All these regulations limit countries from instituting local content requirements since they are considered detrimental to free trade (Mushemeza et al., 2017).

Inadequate capacity especially in human capital and technology is a significant challenge. Studies on the perception and use of advanced energy technology indicate that in most cases, technology adoption is influenced by individual's willingness to pay for the technology based on various socio-economic elements such as knowledge of the technology, education level and environmental concern. The studies indicate that most communities are skeptical on embracing technologies. It is important, therefore, that Kenya focuses on the change of mindset to ensure that communities are aware of the importance of new energy technologies (Stigka, Paravantis and Mihalakakou, 2014). Similarly, in a study by NSW (2015), it was evident that homesteads located close to solar and wind firms did not support the technologies. Capacity, especially in skills, is a critical issue of concern. Most international firms use expatriates since the local communities do not have the requisite skills needed in the energy project, such as oil exploration. The 2017 Human Capital Report obtained from the World Economic Forum (WEF) indicates that Kenya was ranked 101 in terms of know-how and future skills development. The report also placed Kenya in position 74 in terms of specialized skills. This is a clear indication that Kenya does not have adequate technical capacity (WEF, 2017). A report by Adam Smith (2015) indicates that local firms in Kenya do not have access to highly qualified employees for them to win tenders and contracts. WEF (2017) argues that despite Kenyan universities producing over 7,000 graduates per annum in the science subjects, there are few personnel with the necessary technical skills to oversee nuclear energy development.

Kenya has adopted a strategy on international collaboration and assistance on nuclear-related training and education. The government will collaborate with international partners to support education activities such as research visits for scientists, scholarships and financial support for research and development. Currently, the government has a Memorandum of Understanding (MOU) with the prospective vendor countries and organizations on education and training. These countries include Korea, China and the United States through KEPCO, China Guangdong Nuclear Power Holding Co. Ltd. (CGNPC), and Texas A&M University as the respective institutions.

4. Prerequisite for Enhancing Local Content

4.1 Introduction

In the energy sector, technological advancement plays a vital role especially in enhancing efficiency in the energy production processes. Over the years, there have been tremendous changes in the energy sector. For instance, technological advancement introduces better geological methods in oil and gas exploration. Engineers in the oil and gas industry excessively engage in research and development to find better solutions to enhance efficiency in energy production. In this study, emerging technologies have been highlighted and discussed with a view to acknowledging the ongoing dynamics in the industry.

Different countries have adopted local content policies and regulations at different projects' lifespan depending on the time they made discoveries or when they deemed necessary to encourage local content. Interestingly, despite the numerous definitions of local content and formulation of diverse strategies to attain local content, researchers have not concentrated on uncovering the prerequisites that would enhance local content. This section effectively highlights a number of prerequisites necessary for local content development. Additionally, there is an attempt to provide the conditions necessary for formulation of effective local content policies and regulations.

4.2 Prerequisite for Enhancing Local Content

Local content as a widely embraced concept in the resource rich countries requires key attention especially in the design and implementation of local content policies. Apparently, the prerequisite for local content in the renewable and non-renewable energy sub-sectors are similar. They cover similar scope especially in enhancing sourcing of local goods and services, skills and transfer of technologies in various sub-sectors. The only disparity arises in the application of the requirements to specific sectors, which gives rise to differences in outcomes. The following are the major prerequisites for enhancing local content in the energy sector.

4.2.1 Legal and institutional framework

Existence of rule of law and institutional framework that regulate and manage local content is a crucial aspect of enhancing local content. Local regulations and policies create an enabling environment for indigenous firms to participate in the extractive industries. Such regulations create incentives for companies to register with the relevant authorities, enforce agreements and align the development

of infrastructure with the local content objectives. Kazzazi and Nouri (2012) suggest that local content policies and regulation should encourage collaboration between the state and international companies in enhancing strategies that would secure various opportunities for growth of an indigenous industry. The policies should consider how various regulations would affect the respective sector. Most protectionist regulations potentially encourage local industry growth; however, they might undesirably affect trade.

Local content policies offer incentives to promote effective business practices, increase reliability of the legal system, and improve social structures which in turn enhance participation in the industrial activities. The laws on local content can create an enabling environment for development of skills, technology transfer, market development, and value capture which are the necessary conditions that would lead to the emergence of local firms (Ovadia, 2014).

Defined regulatory framework, monitoring and oversight mechanisms are substantial in enhancing effective execution of local content policies. The responsibilities of the companies involved in extractive industries should be clearly spelt out and communicated to the firms as they make investment decisions. Maintaining a sound regulatory and institutional framework is key to the execution of local content initiatives. Nevertheless, creation of an assortment of legal instruments and numerous institutions creates confusion and conflicting responsibilities, which might lead to disorganized coordination. Angola is an example of countries that have manifold legislation instruments necessitating local workers' inclusion and procurement of indigenous goods and services.

4.2.2 Local infrastructure

Infrastructure development is necessary for augmenting local content by enhancing local competitiveness. This infrastructure includes information technology; indigenous firms' needs; social and education infrastructure; institutional infrastructure, among others. Information technology is imperative especially in disseminating vital information and supporting effective business processes. Schmidt and Huenteler (2016) posit that information technology is imperative in building local capacity, training and spearheading R&D.

Public utilities such as roads, railway networks, telecommunication, water supply and electricity are crucial business development infrastructures that provide a conducive environment for growth of local firms in the extractive industry. Social infrastructure entails the social cohesion prevailing between diverse social groups with the potential to maintain social order. With such stable climate, effective

collaboration between foreign companies and local firms leads to development of skills and transfer of technologies (Schmidt and Huenteler, 2016).

4.2.3 Local capacity

To a large extent, local capacity entails education and skills, available technology, expertise development, R&D and the available local firms. Growth in an industry requires an interplay between established and developing capabilities. A country's technology level and its industrial base play a crucial role in enhancing local content policy development (Mushemeza et al., 2017; Heum et al., 2011). Therefore, successful plans define the prevailing products and services that a state can produce profitably. Industrial growth is subject to learning processes whereby capacity develops through a process of finding solutions to challenging tasks and through a concerted collaboration between foreign and indigenous firms.

Learning is an imperative component in the industrial growth and its impact benefits both the local and international firms (Kazzazi and Nouri, 2012). The education system plays a vital role in refining the learning capacity in a country. Industrial infrastructure is important in building indigenous skills, capacity and bridging technology gap between foreign and local firms. In a country such as Ghana, the government and foreign firms substantially support the indigenous technical and training institutions to develop sufficient capacity to train the locals on the necessary skills required in the petroleum industry. Local firms' absorption capacity is substantial in the transfer of technology.

4.2.4 Investment climate

Many countries have recognized the need to create an enabling investment climate to support the extractive industries. Columbia Centre for Sustainable Investment posit that in the extractive energy industries, there is need for prudent management and investments to foster enduring sustainable developments. In the current global competition, it would be difficult for countries to compete without adequate foreign direct investment (FDI), considering the accrued benefits of skill development, employment creation, technology transfer and economic growth.

With the intensified focus on local content development among the resource-rich nations, it has become prudent for governments to create incentives that would entice the private firms (both local and international) to participate effectively in the energy sector. Research has shown that countries that have encouraging investment climate succeed more in enhancing local content compared to those deterrents investment policies (Denis and Joerg, 2013). Best practice demands

that countries design investment incentives that are basically legislative measures that promote investment. Such incentives include providing privileged tax rates, infrastructure access, tax exemptions, tax holidays, grants and loans, among others. Mauritius and Lebanon are countries that offer reduced corporate tax rates to encourage investment in the energy sector. Developing countries such as Angola, Nigeria, Ghana, Brazil and Colombia have preference for tax exemptions and tax holidays (Denis and Joerg, 2013). Some of these developing nations offer financial incentives such as subsidized credit and services, grants, among others.

4.2.5 Good governance and political will

Local content development is largely dependent on the policy making processes and a country's governance structure. It has been proven that for local content policies to achieve their objectives, they must be effectively designed, achievable and simple to administer (Caxton-Martins, 2015). Effective administration of LCPs necessitates adequate institutional structure that brings on board various stakeholders. Good governance of these policies requires effective measurement and standard systems of reporting that would gather adequate data which would be essential in evaluating commitment and compliance of different actors. In addition, a governance structure that is simple, transparent, substantive and just offers an effective operational climate in the energy sector. In this regard, putting in place a committed agency with an effective governance structure is a prerequisite for enhancing local content policies.

Political will is a major prerequisite for enhancing local content in the extractive industries. Countries with weak executive and legislative influences, frail democracy, and devoid of independent oversight bodies are more prone to corruption and mismanagement of the extractive industries. In countries where local content failed, studies revealed that absence of good governance led to creation of shell firms, selection of unqualified bidders, bribery and bending of procurement procedures. In contrast, successful nations have in place workable systems of governance, political support for the industries and effective leadership that has created value for local content (Mushemeza et al., 2017). Such systems deter the elite from engaging in misconduct and in turn enforcement of the local content is considered vital.

4.2.6 Effective monitoring of local content policies

Local content policies tend to achieve their objectives in regimes that enhance good governance (Tordo et al., 2013). Despite having well-designed and feasible local content policies, adequate institutional and administration structures are

paramount. There is need for modest and consistent measurement and reporting mechanisms that gather adequate information to check on private firms' compliance while reducing unwarranted constrains that would discourage foreign investors. Therefore, the governance structure adopted for this purpose should be simple, transparent, applicable, accessible and should address the current concerns. Such framework provides a just and competitive environment and it institutes a culture of best practices in the industry. It becomes easier for the law makers and other independent actors to monitor the implementation of the local content policy.

Intermittent review of the governance structure through a concerted effort of all the key stakeholders increases the credibility of the system. In this perspective, it is advisable to have a committed agency that coordinates and spearheads the review process. Nevertheless, political factors, to a large extent, determine the success of the local content policies. In the absence of appropriate democratic space, strong independent oversight authorities, strong legislative power and powerful executives, an environment is created where elite capture and corruption thrives (UNCTAD, 2013). Studies have shown that in cases where failure in local content implementation has been witnessed, politicians are the greatest beneficiaries. They manipulate the tendering procedures, create shell firms, and in some cases request for bribes.

4.3 Prerequisite for Development of Effective Local Content Requirements and Policies

Development of local content requirements is an imperative towards shared value creation in the extractive industries. Different countries have developed their local content requirements at different times depending on the time the resources were discovered or the incentives of the country to develop them. In addition, the local content requirements are embedded in various legal structures; some countries have drafted local content laws and bills while others have formulated decrees for local content requirements (Ovadia, 2014; Nwapi, 2016). Some of the aspects that should be considered in formulating local content regulations and policies are as follows:

4.3.1 Defining local content concept

The legal framework on local content needs to explicitly define the concept of local content from a country's perspective. The literature on local content definition has revealed that the concept is very broad and dynamic. Generally, local content is an initiative of the resource-rich countries to create value from various resource

utilization projects with an aim of maximizing community benefits. The definition of local content allows a clear design of realistic policies and formulation of measurable objectives (REN21, 2014).

There are various mechanisms and aspects embedded in the concept of local content. The most common are integration of local firms in the extractive industries, sourcing of local goods and services, employment creation, development of local skills, technology transfer, social programmes, among others. Adoption of all or a combination of these aspects varies from one nation to another depending on the country's objectives. Some countries use the term national content, which to some countries means sourcing of inputs within the country while to others it focuses on local firms sourcing inputs from other resource-rich countries. Similarly, some countries use local ownership to define local business while others define it based on the country where the business is registered. Comprehending such specialties is critical in designing policies and execution plans. Consequently, the outcome of implementation of local content policies differs subject to a country's objectives, policy strategies, and targets.

4.3.2 Evaluating critical issues

Understanding global, local and development environments is an imperative to the design of local content policies. Policy makers need to gain insightful understanding and fair evaluation of the global and local environment. Local content instruments should be coherent with the global and local realities to enhance their applicability. Therefore, policy makers should evaluate global actors' strength, their inter-relations and competition level between them, macroeconomic stability, infrastructure, education, financial systems, ease of doing business, available skills, cost of labour and the host country's prevailing capabilities, among other factors.

Succinctly, internal and external environment might constrain a companies' tactics and determines the host country's policy flexibility and the potential mechanisms that would derive maximum benefits from the extractive industries. For instance, countries in their early phases of development do not have the necessary infrastructure, resources, skills and macroeconomic stability (UNCTAD, 2013). Therefore, if such countries put more restrictive measures in their local content requirements, it may deter international firms interested in operating in a certain sector. Without sufficient competitive advantage and the necessary prerequisites, restrictive local content requirements in developing countries would be detrimental and they may fail to realize the desired outcomes.

4.3.3 The sectors' structure and the energy projects' elements/ lifecycles

For a local content policy to be successful, there is need to have a thorough understanding of the sectors, their global and local structures, and requirements. With such understanding, policy makers would align the country's objectives and capacities with the stakeholders' expectations. Therefore, they would understand if the country provides international firms with the prerequisites that validate implementation of certain local content requirements. Failure to understand these dynamics may result to unbalanced regulations and mechanisms that detach from the local and global sectorial realities. Subsequently, this would render the sector projects' unattractive and the existing operations of the firms would be relegated (Tordo et al., 2013).

It is imperative to put into account the size, location, lifecycles and location of the energy projects when formulating regulations. This substantially determines the choices of local content targets and mechanisms. Through an analysis of the host nations' ecosystem and the global actors, it is possible to identify gaps that a country seeks to fill. This informs the policy makers of the necessary local content requirements that would promote growth of the local industry.

4.3.4 Local content models and the stakeholders' role

A country that has a defined vision and understands its internal, external, short-range and long-standing variables still faces a subtle decision that would effectively influence the formulation of local content policy. This is actually the challenge of selecting a policy model. In connection to this, past experience indicates that policy makers are inclined towards adoption one of three common methods: requirements, incentives or the do-nothing.

The requirements approach entails formulating targets that are legally binding. In such formation foreign firms are obliged to comply with the requirements. The major benefit of this arrangement is that it spells out what is expected from various stakeholders, thus there is little room for misinterpretation or uncertainty. Nonetheless, the strategy has a defect in that it is not simple to implement. Certainly, requirements setting infers that the host government has the appropriate human capital, strong ecosystem and provides an enabling environment where foreign firms can scarcely find in other areas (Ovadia, 2014). This would mean that the country has sufficient skills, developed infrastructure, political stability, competitive fiscal management, indispensable institutional framework and mechanism to manage foreign firms' operations, among others. The approach presupposes that the foreign firms have been engaged and would be

willing to take up their responsibilities. Such government-led approach has been used in Africa by countries such as Kenya, Angola, Ghana and Nigeria.

The incentive model is reasonably flexible and entails using incentives to embolden foreign firms to participate in local content initiatives. In this formation, the government gives incentives (mostly fiscal) to firms that procure inputs locally, create local jobs, transfer skills and technology, and empower indigenous firms with a view to encouraging sustainability of such engagements. The approach assumes that foreign firms are responsible, devoted and have the capacity to espouse self-regulation. The model requires high trust level and commitment from various stakeholders and a concerted effort. Examples of countries using this model is Canada and Australia.

The do-nothing tactic is the most flexible strategy. It focuses on private sector-led and deliberate approach to local content policy. The state might choose to adopt a more liberal method to encourage foreign firms, which could emanate from its understanding of the prevailing constraints in finance, legislation, institutional framework or a simple decision to use such an approach. Under this structure, there prevails no explicit local content requirements and private firms are left to decide the mechanisms they consider appropriate in their operations (Tordo, Tracy, and Arfaa, 2011). The logic behind such a move is that by operating in unrestricted and encouraging business environment, foreign actors would be encouraged to expand their operations and the spillover effects would be appropriate for the growth of a country's economy. Nevertheless, policy makers should take into consideration various trade-offs while using this model. Indeed, efficient and productive energy sectors require responsible practices, impeccable ethics, and articulate judgement among all stakeholders. Consequently, without proper oversight, there is likelihood of attracting deceitful conduct, resources over-exploitation, environmental harms or uneven local value retention. Botswana is an example of countries using this model in Africa.

It should be noted that there is no superior approach compared to the other. Achievement or failure of an approach is not guaranteed. A model that works in a certain environment given an array of conditions might not essentially work in others. Therefore, in the formulation of rules and regulations on local content, a nation should customize its viewpoint, and become flexible for adjustment when need arises.

4.3.5 Appropriateness of the current legal and institutional framework

With a decision on the necessary local content for the country, the policy makers should evaluate the prevailing legal and institutional framework. Literature indicates that most unsuccessful nations do not strike the right balance and they end up with policies that do not offer favorable conditions to the extractive industries (Tordo et al., 2013). To avoid disappointments, the regulations should be adjusted to suit the local content model. Regulations that provide a level ground for entry and fair competitive advantage to all actors has been proven fruitful. With such legal environment, a country attracts sufficient FDI levels necessary for the growth of the extractive industries.

5. Conclusion and Policy Recommendations

5.1 Conclusion

Local content is a concept that has gained popularity among resource-rich nations. The definition of the concept has not been universally agreed upon. Nevertheless, it widely focuses on the local capture in terms of local sourcing of goods and services. Although the energy sector all over the globe focuses on efficient provision of energy at low cost, local content is embedded in the operations to ensure that the indigenous people benefit from the use of their local resources. Unlike other areas where one would expect uniformity in the application of policies, local content policies vary widely among the resource-rich nations.

Even though various resource-rich countries are enacting an array of local content laws and policies, there are no established best practices to guide countries that are in the formulation processes. This paper avails necessary information in developing local content laws that would suit a country's context. The paper established that workable local content elements applied in one country may not necessarily work for another. Legislations with explicit targets required in a small industrial base with low technical capacity could result to inefficiency. Research needs to concentrate more on providing empirical evidence on the effectiveness of different local content policies and regulations applied across nations. It is imperative to assess the factors that foster success of LCPs, and how government could establish fiscal arrangement mix to derive maximum local benefit from energy sector operations.

There are numerous opportunities and challenges that arise in the energy sector operations. Essentially, governments enact local content laws and policies to encourage growth of local industries, create employment and enhance a possibility of technology transfer. The energy sector's operations create opportunities through backward and forward linkages. Both the renewable and non-renewable sources of energy provide an opportunity for growth of local industry. In China, for instance, local content played a vital role on the growth of manufacturing of solar and wind turbines. In oil and gas, the local content requirements could offer local firms an opportunity to participate in the upstream operations. These stages require highly sophisticated services. Through joint venture, foreign firms could offer local firms an opportunity to gain effective technical and technological capacity to compete in international markets.

Besides the sector having opportunities, several challenges have been identified. One huge challenge especially in the developing resource-rich countries is the widened skills gaps. Foreign companies have had to hire expatriates with technical skills to handle oil and gas industry operations. In addition, local firms lack the

financial muscle to invest in the capital-intensive energy sub-sectors. Essentially, the financial institutions do not offer the much-needed support to the local firms in the energy sector due to its complexities. Some government policies and bureaucracy significantly impede entry of local firms in the industry. Government tax policies could also hamper the operations of the firm especially if they do not offer incentives to the participating firms. The new technologies are capital-intensive, and this limits the number of indigenous firms that would be willing to invest in the energy sectors. It is important to note that each energy sub-sector has its unique challenges; nevertheless, there are cross cutting challenges

Research and Development (R&D) has led to emergence of novel technologies in the energy sector. This has resulted to better data capturing, efficiency and effectiveness in the energy sector operations. With the rising demand for energy, these technologies offer an opportunity for increased energy production, development of local skills and development of local industries. Nevertheless, as technology advances, the skills gap widens. Therefore, countries aspiring to build a strong local capture through local content polices require effective strategies.

Generally, during enactment of local content laws, it is paramount to understand the prerequisites for local content. The most fundamental prerequisite is the legal and institutional framework that defines local content for a country and lays down elements and requirements that foreign firms should adhere to while promoting local participation. Other vital prerequisites entail local infrastructure, local capacity, investment climate, good governance, and effective monitoring mechanisms.

In essence, local content regulations could be mandatory or sometimes voluntary in nature. Usually, the LCPs vary from one resource nation to another based on their levels of development, sector maturity and resource endowments. Their success substantially depends on ability to enhance compliance, develop functional enforcement, effective monitoring mechanisms and encouraging stable partnerships.

5.2 Policy Recommendations

1. Consideration for short-term and long-term benefit during local content design: Short-term benefits can be captured through strategic mechanisms that entail developing skills in the workforce by stipulating training requirements and procurement quotas. To realize long-term economic benefits, policy makers should enhance measures that build linkages. Establishment of a petroleum fund would be an imperative to promote training and scholarship to locals with the aim of building experts in the

oil and gas industry. In addition, the local content should not be tone down on prescriptive requirements. In most cases, the LCPs end up setting high targets for local content beyond the country's capacity.

2. Encouraging stakeholders' cooperation and collaboration: Decision makers in the energy sector should formulate strategies that integrate all service providers and indigenous suppliers with a view to establishing sustainable indigenous industrial capacity to enhance local content. Collaboration enhances synergies, efficiency and improved coordination in implementation of local content policies.

3. Develop metrics for measuring local content: During the development of local content policies, it is paramount that policy makers consider metrics that would effectively measure local content. This would enhance prompt feedback on the progress of their implementation.

4. To foster skills and development, resource-rich countries such as Kenya and Tanzania could consider establishing enterprise centre that will train on specialized skills needed in the energy sector. In addition, Kenya should support local learning institutions to develop effective skills to enhance technology transfer. There should be university programmes that orient students to the energy technologies. The government should regularly conduct surveys in all the energy sub-sectors to identify the energy gap that exists.

5. Strategies should be put in place to encourage localization of industries. Manufacturing of energy equipment in the host country necessitates speedy transfer of skills and technology to the country's workforce.

6. It is important to develop legislation that would effectively guide different sources of energy. The legislation needs to offer guidelines on production, distribution and use of energy from all the different sources. In addition, the legislation should offer solutions to acquisition of technologies and skills transfer.

7. Transparency and information sharing plan: For the LCPs to be substantially effective, indigenous firms and professionals need to be aware of diverse prevailing opportunities in the energy sector. It is imperative to establish a capability and skills database of the indigenous firms and their competencies. This database of information should be shared with foreign firms in a transparent manner.

8. There is need to create sturdy monitoring and evaluation standardized measurement plans by the respective authorities: In cases where there

are no or exist weak mechanisms, it would be a noble move to create an institution with clear focus on the assessment of the achievements of local content policies. The reporting plan can be considered to foster monitoring and evaluation of performance. In addition, this would lead to enhanced compliance.

9. Encouraging financial institutions to increase funding to indigenous firms: Due to their nature, some energy sub-sector operations such as oil and gas are capital-intensive. Besides, before development of oil, it is difficult to establish economic viability of the project or whether the project would materialize. Consequently, in most developing countries, financial institutions lack capacity and sometimes caution themselves from financing such projects. As a result, local companies lack financial capacity to participate in the upstream activities.

10. Inclusion of clauses supporting transfer of technology: Developing nations specifically require a laid down strategy for transfer of technology to the local firms. This is an effective way of ensuring foreign firms engage the local firms; consequently, this fosters growth of the local industries.

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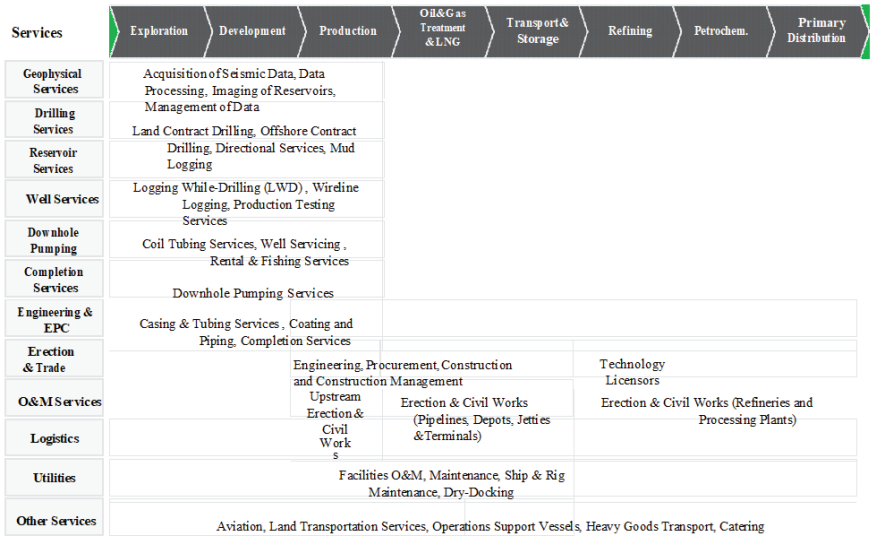
Appendices

Appendix A: Opportunities for supply of goods in oil and gas industry

Source: Tordo et al. (2012)

Appendix B: Opportunities for supply of services in oil and gas industry



Source: Tordo et al. (2012)

Appendix C: Potential domestic value creation based on the stages of industry development

Potential for domestic value creation	Stage of development		
	Beginning of wind and solar energy development	**First projects realized, local industries suitable for participating**	**Many projects realised, national wind/ solar industry developing**
Lifecycle phase			
Project planning	Low	Medium	High
Manufacturing	Low	Medium	Medium/High
Installation	Low	Medium	High
Grid connection	High	High	High
Operation and maintenance	Medium	High	High
Decommissioning	Low	Low	Medium
Supporting processes			
Policy making	High	High	High
Financial services	Low/Medium	Medium	High
Education and training	Low/Medium	Medium	Medium/High
Research and Development	Low	Low/Medium	Medium
Consulting	Low	Low	Medium

Source: IRENA (2014)

Appendix D: Skills and occupational needs in the renewable energy value chain

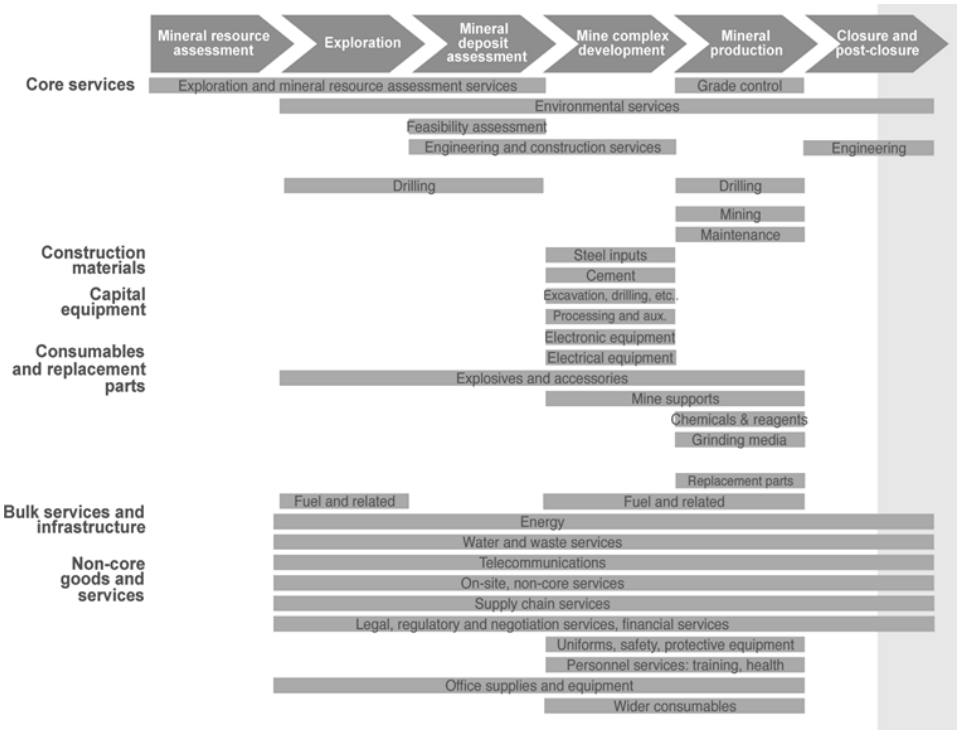
Hydropower				
Equipment Manufacture and Distribution (only for active solar)	**Project Development**	**Construction and Installation**	**Operation and Maintenance**	• Policy-makers and government office workers
• Design engineers (civil, mechanical, electrical, hydropower) • Modellers • Software developers • Manufacturing engineers • Manufacturing technicians • Manufacturing operators • Quality assurance specialists • Marketing specialists • Sales personnel	• Project designers (engineers) • Environmental engineers • Sustainability specialists (environmental planners, social scientists, cultural consultants) • Economic/ financial/risk specialists • Physical and environmental scientist (hydrologists, geologists, ecologists) • Market analyst • Environmental lawyers • Commercial lawyers • Land development advisor • Land use negotiator • Commercial specialists • Procurement specialists • Lobbyists • Mediator • Archeologists • Environmental and social NGO representatives • Public relations officers • Procurement professionals	• Engineers (civil, mechanical, electrical) • Technicians (civil, mechanical, electrical) • Project managers • Skilled construction workers (heavy machinery operators, welders, pipe fitters etc.) • Construction labourers • Business developers • Commissioning engineers • Transport workers	• Engineers (civil, mechanical, electrical) • Operations and maintenance technicians • Physical and environmental scientist (hydrologists, ecologists) • Tradespersons	• Policy-makers and government office workers • Trade associations and professional society staff • Educators and trainers • Management • Administration • Publishers and science writers • Insurance representatives • IT professionals • Human resources professionals • Financial professionals (accountants, auditors & financiers) • Health and safety consultants
Wind Energy				
Equipment Manufacture and Distribution (only for active solar)	**Project Development**	**Construction and Installation**	**Operation and Maintenance**	**Cross-Cutting/ Enabling Activities**

• R&D engineers (computer, electrical, environmental, mechanical, wind power design) • Software engineers • Modellers (prototype testing) • Industrial mechanics • Manufacturing engineers • Manufacturing technicians • Manufacturing operators • Manufacturing quality assurance experts • Certifiers • Logistics professionals • Logistics operators • Equipment transporters • Procurement professionals • Marketing specialists • Sales personnel	• Project designers (engineers) • Environmental impact assessments specialists • Economic/financial/ risk specialists • Atmospheric scientist • Social impact specialists • Lawyers • Planners (permit monitoring, amendment and application) • Land development advisor • Land use negotiator • Lobbyist • Mediator • Environmental and social NGO representatives • Public relations officers • Procurement professionals • Wind resource assessment specialists • Geographers	• Project managers • Electrical, civil, and marine engineers • Small wind turbine installers • Construction electricians • Power line technicians • Construction workers • Quality control inspectors • Instrumentation and control technicians • Business developers • Commissioning engineers (electrical) • Transportation workers	• windsmith/ millwright/ mechanical technician or fitter/ wind services mechatronic technicians • operations and maintenance specialists • Power line technicians • Wind service mechatronics • Wind service mechatronics • Field electricians	• Policy-makers and government office workers • Trade associations and professional society staff • Educators and trainers • Management • Administration • Publishers and science writers • Insurance representatives • IT professionals • Human resources professionals • Financial professionals (accountants, auditors & financiers) • Health and safety consultants
Solar Energy (photovoltaic, ST,CSP,PS)				
Equipment Manufacture and Distribution (only for active solar)	**Project Development**	**Construction and Installation**	**Operation and Maintenance**	**Cross-Cutting/ Enabling Activities**

• Researchers (chemists, physicists, engineers with specialization in electrical, mechanical, chemical, materials, system design or processing engineering) • Chemical laboratory technicians and assistants • Software engineers • Modellers • Manufacturing engineers • Manufacturing technicians • Manufacturing operators • Building system specialists • Manufacturing quality assurance experts • Logistics professionals • Logistics operators • Equipment transporters • Procurement professionals • Marketing specialists • Sales personnel	• Project designers (engineers) • Architects • Atmospheric scientists and meteorologists • Resource assessment specialists and site evacuators • Environmental consultant • Lawyers, government program • Debt financiers' representatives • Developers/ facilitators • Land development advisors • Land use negotiator • Lobbyist • Mediator • Environmental and social NGO representatives • Public relations officers • Procurement professionals	• *Solar Thermal*: • System designers • Plumbers specializing in solar • *Small photovoltaic*: • System designers (electrical engineers or technologists) • Electricians specializing in solar • *Small photovoltaic, solar thermal:* • Roofers specializing in solar • Large photovoltaic: • System designers (electrical/ mechanical/ structural engineers) • Installers • Concentrated solar (CSP): • Welders • Pipe fitters • *Small photovoltaic, large photovoltaic, ST, CSP:* • Electricians specializing in solar • Project designers • Project and installation evaluators • Construction professionals • Installers • Software engineers • Quality assurance specialists • Business developers • Commissioning engineer (electrical) • Transportation workers	• Photovoltaic maintenance specialist (electricians specializing in solar) • ST maintenance specialists (plumbers specializing in solar) • CSP and PS maintenance specialist • Inspectors • Recycling specialists	• Policy-makers and government office workers • Trade associations and professional society staff • Educators and trainers • Management • Administration • Publishers and science writers • Insurance representatives • IT professionals • Human resources professionals • Financial professionals (accountants, auditors & financiers) • Health and safety consultants

Source: International Labour Organization (2011)

Appendix E: Coal mining opportunities across the value chain



Source: World Bank and Kaiser Economic Development Partners (2015)

Appendix F: Employment, training, skills development, and technology transfer

Country	Local content in the quantity and quality of employment	Local training, skills/capacity development, and education	Technology transfer
Angola	Number of jobs created through Centro de Apio Empresarial (Brazilian Business Support Centre) programme: 4,809. 70% of BP's employees are Angolans 78% of Exxon Mobil personnel are Angolan, 24% of whom are women. 75 Angolans in leadership positions, including 16 offshore supervisors as at the end of 2013 More than 88% of Chevron workforce in the country is Angolan Overall, of 77,000 people working directly in the oil industry, some 60,000 are Angolans	BP is funding a fully accredited postgraduate programme, in partnership with the Faculty of Law of Agostinho Neto University, leading to the award of a Masters of Law Degree (LLM) in Oil and Gas. Launched in April 2007, over 100 have graduated from the programme. The engineering and science faculties at Agostinho Neto University also receive support from BP Chevron invested more than US$ 16 million in workforce training programmes in 2013. 500 scholarships were awarded for the attendance of university abroad in the areas of Geosciences, Engineering and Technology by Sonangol in 2013	In 2013, the Chevron scholarship programme provided support for 14 Chevron employees to attend universities in the USA Chevron's Horizons programme, a five-year programme implemented in 2008, to accelerate the technical competencies of employees in the beginning of their careers with the company, has had 202 employees in career development training. 35 employees have graduated and 20 more were expected to graduate in 2014
Brazil	875,000 new positions created Average local content ratio has increased from 57% to 75% since PROMINP was launched Employment in ship building industry increased from 5,000 jobs in the year 2000 to around 68,000 workers by 2013	101,000 scholarships at a cost of US$ 2 billion (75,000 Brazilian government, 26,000 private sector) in five years from 2012 through the 'Science Without Frontiers Programme. Participation of 80 educational institutions in 17 states of Brazil. 78,000 workers graduated in early 2011	The National Professional Qualification Plan, a component of PROMINP, offers free professional qualifications in 185 categories considered of importance to the oil and gas industry, in particular in the engineering segment. 97,509 qualifications achieved by 2013

Ghana	87% of Tullow Oil employees are locals	Tullow has sponsored 8 technicians to achieve International Vocational Qualification Level 2. These technicians are now working as production technicians. Four graduate trainees from Tullow have been sponsored to undertake Masters degrees in petroleum engineering at Heriot-Watt University (UK) US$ 23 million invested in training and development by Tullow in 2013. In 2013, the Jubilee Partners invested over US$ 5 million in the Jubilee Technical Training Centre. The centre is the first vocational training polytechnic in West Africa to offer National Vocational Qualification-accredited courses in technical subjects such as instrumentation, process, and mechanical and electrical engineering. 16 students were studying full-time courses in 2014 Expro, an international well services company, has invested US$ 140,000 in national capacity development programmes since 2011. Over half of their employees are Ghanaian nationals Tullow established its Group Scholarship Scheme in 2011. The scheme sponsors postgraduate students on courses at universities in the UK, France, and Ireland, which are related to the oil and gas industry and other sectors that will help promote economic diversification. By 2015, the scheme had invested US$ 7.7 million in sponsoring 121 Ghanaian scholars	14 GNPC staff were placed on a two-year secondment to Tullow's Ghana and international offices. 10 of these secondees were sponsored as part of a scholarship scheme, to achieve Master's degrees. The remaining four were coached by experts, who provided on-the-job training. Other GNPC secondees are being trained on the Tweneboa, Enyenra, Ntomme (TEN) project so that they can develop the required skills to fully participate in their country's oil and gas industry.

Nigeria	92% of Exxon Mobil employees are local, 14% of whom are women; 17% of local staff are in supervisory and managerial positions. 30,862 jobs created. The number of Nigerians occupying managerial positions in operating companies was put at 2,143.	Over 6,000 candidates captured on JQS Platform. Over 1,500 attached to oil and gas projects. More than 12,400 students have benefited from Chevron's Agbami Medical and Engineering Professionals Scholarship since 2009. Annual scholarships from other oil companies include: Agip Oil Company, Mobil, Shell, Nigeria LNG, Total and Addax Petroleum, focusing on the Engineering and Sciences sectors in Nigeria and outside Nigeria.	In 2012, Exxon Mobil completed the first of three floating platforms developed entirely in Nigeria. To complete the project, 30 locals were trained to NCDMB standards in technical skills such as welding and fitting. 49 students graduated from the pilot geosciences training programme in 2014. By the end of 2013, the number of Chevron Nigeria employees on foreign assignment was 110

Source: Kayizzi-Mugerwa and Anyanwu (2015)

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