



Energy Transitions and the Future of the African Energy Sector

Law, Policy and Governance

Edited by Victoria R. Nalule

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*To the African Youth, may you be inspired by this book to actively take part
in shaping the future of the African energy sector*

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Abbreviations

AETR	Average Effective Tax Rate
BAU	Business As Usual
BEP	Break-Even Price
BITs	Bilateral Investment Treaties
BOO	Build- Own- Operate
BOPD	Barrels of Oil Per Day
BSC	Brussels Supplementary Convention
BSCF	Billions of Standard Cubic Feet of Gas
CAPEX	Capital Expenditure
CCS	Carbon Capture Storage
CDM	Clean Development Mechanism
CES	Conventional Energy Sources
CFRN	Constitution of the Federal Republic of Nigeria
COAG	Council of Australian Government
COP	Conference of the Parties
COVID-19	Coronavirus Disease 2019
CPF	Central Processing Facility
E&P	Exploration and Production
EBRD	European Bank for Reconstruction and Development
EC	European Community

EDB	Ease of Doing Business
EEHC	Egyptian Electricity Holding Company
EETC	Egyptian Electricity Transmission Company
EG	Embedded Generation
EGAS	Egyptian Natural Gas Holding Company
EGPC	The Egyptian General Petroleum Corporation
EgyptERA	Egyptian Electric Utility and Consumer Protection Regulatory Agency
EIA	Energy Information Administration
EPA	Environmental Protection Agency
EPC	Engineering and Procurement Contract
EPS	Embedded Power Scheme
EPSRA	Electric Power Sector Reform Act
ERGP	Economic Recovery and Growth Plan
EU	European Union
FIPs	Feed-in-Premiums
FITs	Feed-in-Tariffs
FY	Financial Year
GHG	Green House Gas
GHI	Global Horizon Irradiation
GW	Gigawatt
GWh	Gigawatt hour
IAEA	International Atomic Energy Agency
IANEC	Inter-American Nuclear Energy Commission
ICRP	International Commission on Radiological Protection
IEA	International Energy Agency
IEDN	Independent Electricity Distribution Network
IET	International Emissions Trading
IHA	International Hydropower Association
INDC	Intended Nationally Determined Contribution
INES	International Nuclear Event Scale
IOCs	International Oil Companies
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
ISES	Integrated Sustainable Energy Strategy
JI	Joint Implementation
LEPSRL	Lagos State Electric Power Sector Reform Law
LESB	Lagos State Electricity Board
LGA	Local Government Area

LNG	Liquefied Natural Gas
M/S	Meter per Second
M ²	Square Metre
MJ	Megajoule
MOERE	Ministry of Electricity and Renewable Energy
MOP	Ministry of Petroleum and Mineral Resources
MTOE	Million Tonnes of Oil Equivalent
MW	Megawatt
NACOP	Nigeria National Council on Power
NDCs	Nationally Determined Contributions
NDPHC	Niger Delta Power Holding Company Limited
NERC	Nigerian Electricity Regulatory Commission
NESI	Nigerian Electricity Supply Industry
NESP	Nigerian Energy Support Programme
NIPP	National Integrated Power Project
NIREDA	National Renewable Energy Development Agency
NREA	New and Renewable energy Authority
NREAP	National Renewable Energy Action Plans
NREEEP	National Renewable Energy and Energy Efficiency Policy
OECD	Organization for Economic Co-operation and Development
PC	Paris Convention
PCCA	Paris Climate Change Agreement
PPA	Power Purchase Agreement
PSAs	Production Sharing Agreements
PSRP	Power Sector Recovery Programme
RE	Renewable Energy
REA	Rural Electrification Agency
REF	Rural Electrification Fund
REL	Renewable Energy Law
REMP	Renewable Energy Master Plan
RES	Renewable Energy Sources
RESIP	Rural Electrification Strategy and Implementation Plan
RET	Renewable Energy Target
SDGs	Sustainable Development Goals
SDR	Special Drawing Rights
SE4ALL	Sustainable Energy for All
SEC	Supreme Energy Council
SSA	Sub-Saharan-Africa
TCF	Trillion Cubic Feet

TEPCO	Tokyo Electric Power Company
TPES	Total Primary Energy Supply
TWh	Terawatt-hours
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNIDO	United Nations Industrial Development Organization
USA	United States of America
USAID	United States Agency for International Development
WTE	Waste-to-Energy

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Part I

Introduction



1

How to Respond to Energy Transitions in Africa: Introducing the Energy Progression Dialogue

Victoria R. Nalule

1.1 Introduction: Aim of the Book

The world is transitioning to a low-carbon economy. How are African countries responding to this transition? The book, ‘Energy Transitions and the future of the African Energy Sector: Law, Policy and Governance’, aims at addressing the key concerns for African countries with respect to energy transitions. There have been initiatives on the African continent to embrace this transition as evidenced in not only these countries’ commitment to the 2015 Paris Agreement on Climate Change, but also various efforts in deploying renewable energy and energy efficiency technologies. The transition is already happening in other parts of the globe, including Europe and North America, and it is also partly visible in some African countries. However, many African policymakers are concerned about the decline in investments in fossil fuels. Fossil fuels undoubtedly have a crucial role to play in these countries’ economic

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development. Additionally, fossil fuels are vital for tackling energy access challenges on the continent. Goal 7 of the United Nations Sustainable Developmental Goals (SDG) advocates for access to affordable and clean energy for all.¹

Although access to modern energy such as electricity is crucial to addressing other global challenges such as poverty, famine and gender inequality²: data shows that 3 billion people which is more than 40% of the world population, are still relying on polluting and unhealthy fuels for cooking.³ The figures are worrying in Africa as reports show that 600 million people do not have access to electricity, and around 900 million people lack access to clean cooking facilities.⁴ Although the African continent is endowed with massive renewable energy sources including wind, solar and hydropower: the anticipated urbanisation and population growth will necessitate the utilisation of all the available energy resources, including fossil fuels. The International Energy Agency (IEA) data reveals that the African continent will become the most populous region by 2023, as one-in-two people added to the world population between today and 2040 are set to be African.⁵ The anticipated boom in population growth, urbanisation and industrialisation will necessitate an increase in energy demand and consumption on the African continent. Albeit, energy, especially fossil fuels, are the main contributor to climate change as it produces around 60% of greenhouse gases.

African policymakers are therefore faced with the dilemma of addressing the energy and economic challenges on the continent and at the same time addressing the climate change challenges. As evidenced in the data, by 2040 the continent will require more energy including fossil

¹SDGs UN. United Nations Sustainable Development Goals, 2015.

²Nalule, V.R., 2018. *Energy Poverty and Access Challenges in Sub-Saharan Africa: The Role of Regionalism*. Springer.

³United Nations Development Programme: SDG 7 on Clean Energy. Can be accessed at, <https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-7-affordable-and-clean-energy.html>.

⁴IEA. 2019. *Africa Energy Outlook 2019*, IEA, Paris <https://www.iea.org/reports/africa-energy-outlook-2019>.

⁵Ibid.

fuels to meet the growing energy demand, and yet, the UN Intergovernmental Panel on Climate Change (IPCC) issued a warning in 2018 that humanity had just twelve years to limit global warming to below 2 °C.⁶

Energy transitions are, therefore focused on the need to address climate change by shifting from fossil fuels to renewable energy sources. There is no doubt that fossil fuels have powered the industrialisation and economic development of many developed countries, and it would only be fair for developing countries such as those in Africa to benefit from these resources.⁷ However, it is no longer a question of fairness but rather preparedness. The global efforts to transition to a low-carbon economy is associated with both positive and negative impacts, and African policymakers have to be well-equipped with effective policies and strategies to respond to the energy transition and its associated effects. Positively, a transition to a low-carbon economy presents an opportunity for us to tackle climate change; new jobs will also be created. However, negatively, the transition is likely to escalate energy access challenges and poverty on the African continent, mostly due to reduced levels of finance for fossil fuel energy projects.⁸

The need to tackle climate change and the lowering costs for renewable technology have in recent years made many companies and financial institutions to question their investment plans in fossil fuels. In Norway, for instance, there has been a halt in fossil fuel investments. In June 2020, the Norwegian parliament recommended that the Sovereign wealth fund sells off more than \$10 billion of stocks in companies related to fossil fuels.⁹ This, in practice, implies that the country is shifting from fossil fuels to clean energy. In this respect, the Wealth Fund can no longer

⁶Intergovernmental Panel on Climate Change (IPCC). 2018. Global Warming of 1.5 °C—A Special Report. <https://www.ipcc.ch/sr15/>.

⁷Nalule, V.R., 2020. Transitioning to a Low-Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels? In *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions* (pp. 261–286). Palgrave Macmillan, Cham.

⁸Olawuyi, D. 2020. 'Energy Poverty in the Middle East and North African (MENA) Region: Divergent Tales and Future Prospects', in Inigo Del Guayo, Lee Godden, Donald N. United Nations, Transforming.

⁹Forbes: Norway Wealth Fund to Dump Fossil Fuels Stock. 12 June 2020. Can be accessed at, <https://www.forbes.com/sites/davidnikel/2019/06/12/norway-wealth-fund-to-dump-fossil-fuel-stocks-worth-billions-in-environmental-move/#4dbb5c9748a3>.

invest in companies that mine more than 20 million tonnes of coal annually or generate more than 10,000 MW of power using coal.¹⁰ Besides Norway, in November 2019, The European Investment Bank (EIB), approved a policy to ban funding for oil, gas and coal projects at the end of 2021. Since 2013, the EIB has funded €13.4bn of fossil fuel projects, and in 2018 alone, it funded about €2bn worth of projects. With the ban, however, no more fossil fuel projects will be funded after 2021, although gas projects could still be funded as long as they are utilising clean technologies such as carbon capture and storage, combining heat and power generation, or mixing in renewable gases with the fossil natural gas.¹¹ Besides the reduction in fossil fuel funding, climate activists have also put massive pressure on investors. For instance, in June 2019, Kenya halted the Lamu coal power project due to environmental concerns.¹² Protests against coal projects have also been evidenced in European countries such as Germany.¹³

Besides the decline in fossil fuel investments, a transition to a low-carbon economy is also becoming more attractive due to the lowering costs for renewable energy. Data has emerged that shows that renewable energy is becoming more cost-effective compared to other sources of energy, even in the absence of subsidies.¹⁴ This is mainly due to the decline in the costs of installation and maintenance of renewables.¹⁵ Despite all these developments, we have seen that amid a pandemic such as the Coronavirus disease (COVID-19), countries have taken drastic measures to respond to energy security, including making massive investments in fossil fuels. For instance, in June 2020, China expanded its

¹⁰Ibid.

¹¹BBC News: European Investment Bank Drops Fossil Fuel Funding. 14 November 2019. Can be accessed at, <https://www.bbc.co.uk/news/business-50427873>.

¹²BBC News: Kenya halts Lamu Coal Power Project. 26 June 2019. Can be accessed at, <https://www.bbc.co.uk/news/world-africa-48771519>.

¹³BBC News: Climate Protesters Storm Garzweiler Coalmine in Germany. 23 June 2019. Can be accessed at, <https://www.bbc.co.uk/news/world-europe-48734321>.

¹⁴IRENA: Renewable Power Generation Costs in 2019. Can be accessed at, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jun/IRENA_Power_Generation_Costs_2019.pdf.

¹⁵Ibid.

coal plant capacity to respond to the negative impacts of the COVID-19 pandemic. Statistics indicate that China approved the construction of more coal power plant capacity in the period to mid-June than in all of 2018 and 2019 combined.¹⁶ Additionally, most African countries are still reliant on fossil fuels to meet their energy demand. In South Africa, for instance, most of the electricity is powered by coal. However, the country's coal-fired fleet is ageing, and as such, there are efforts to diversify the power mix by introducing natural gas and renewables, including concentrating solar power (CSP).

Taking stock of the above, we note that there are mixed signals concerning energy transitions. With the global energy transition debate, African countries are not only worrying about a decline in fossil fuel investments; but they must plan for decommissioning. The future of the African energy sector in the Energy Transition era, therefore, requires African countries to set up strategies, revise their energy laws and policies to comply with the energy transition developments. This book, therefore, highlights the key considerations for African countries concerning developing their extractive sector in the energy transitions era. The book also introduces the energy progression discussion as an alternative to energy transitions, especially for African countries.

1.2 The Future and Role of Fossil Fuels in Africa in the Energy Transition Era

One of the main barriers to energy transition lies in the lack of political will to shift from fossil fuels to renewables. Firstly, most African countries do not emit much carbon dioxide, as the Sub-Saharan African (SSA) region as a whole is responsible for just 7.1% of the greenhouse gas emissions. Secondly, as illustrated in Section one, fossil fuels still have a significant role to play in tackling energy access challenges on the continent. Although fossil fuels are associated with various environmental

¹⁶Financial Times: China Expands Coal Plant Capacity to Boost the Post-Virus Economy. 24 June 2020. Can be accessed at, <https://www.ft.com/content/cdcd8a02-81b5-48f1-a4a5-60a93a6ffa1e>.

impacts, what we often ignore is that fossil fuels have a significant role to play in the transition to a low-carbon economy. Firstly, revenues from fossil fuels can be used to finance and invest in clean energy projects. Additionally, the massive natural gas resources on the continent could contribute to climate change mitigation and global energy security.¹⁷

Scholars have identified five key drivers to the global energy transition including addressing climate change; meeting domestic energy demand; tackling energy access challenges; the realisation that oil and gas resources across the region are not infinite and could be depleted within the next few decades; and the fall in oil prices.¹⁸ Some of these drivers are briefly discussed below in as far as they impact on the future of fossil fuels in Africa.

The first one is the need to address climate change as envisaged in the 2015 Paris Agreement. African countries are already subjected to extreme weather conditions, including droughts and floods. A case in point is the El Niño climate event in Southern Africa which left approximately 21.3 million people in the region requiring emergence assistance due to the drought it caused since 2015, hence leading to famine.¹⁹ In this respect, African countries must set targets and strategies to respond to climate change impacts and the global move to transition to a low-carbon economy. Besides setting targets to increase renewables in the energy mix, African countries have already committed, in their intentionally determined contributions (INDCs), to investing in climate-smart energy systems that lower greenhouse gas (GHG) emissions. In Kenya, for instance, the country's INDC includes both mitigation and adaptation. Concerning mitigation, the country commits to invest more in renewables, including geothermal, solar and wind energy production. Additionally, the country also commits to making progress towards achieving a tree cover of at least 10% of the land area of Kenya.²⁰

¹⁷Olawuyi, D.S., 2020. Can MENA Extractive Industries Support the Global Energy Transition? Current Opportunities and Future Directions. *The Extractive Industries and Society*.

¹⁸Ibid.

¹⁹United States Agency for International Development. Southern Africa Drought, Fact Sheet. USAID January 2017. https://scms.usaid.gov/sites/default/files/documents/1866/southern_africa_dr_fs04_01-30-2017.pdf.

²⁰Ministry of Environment and Natural Resources: Kenya's Intended Nationally Determined Contributions (INDC) 23 July 2015.

Besides climate change, another threat to the future of fossil fuels in Africa is the fall in oil prices due to the global energy transition debate and recently, due to the COVID-19 economic crisis. As noted in Section one, various international financial institutions were already banning investments in fossil fuels due to environmental concerns. The COVID-19 pandemic has exacerbated the situation. For instance, on Monday April 20, 2020, the world experienced a drop in the US crude for May turning to negative. This caused a lot of bankruptcy panic among various oil companies, especially US shale companies. The drop in oil prices was mainly due to the March 2020 Russia–Saudi Arabia oil price wars. Additionally, the COVID-19 pandemic, which has reduced oil demand in the transport sector and manufacturing industry, hence leading to the low oil prices. Consequently, there has been massive stress in the oil industry with many companies losing their value including Halliburton, Noble Energy, Marathon Oil and Occidental (OXY)—which have lost more than two-thirds of their value.²¹

One can arguably say that the above developments do favour the energy transitions efforts which advocate for renewable energy. Additionally, for the first time, renewables overtook coal-fired power generation in the Organization for Economic Cooperation and Development (OECD). According to the IEA April 2020 report, electricity produced from natural gas in 2019 increased by 4.8% and was responsible for 29.0% of the total electricity production. Comparatively, coal production in the same year was 13.4% lower than in 2018 contributing to 22.1% of the total electricity production.²² Even though African countries were already embracing renewables, the developments above and the volatile oil prices have spurred stronger political emphasis on diversification on the continent.

In this respect, therefore, the main threats to the future of fossil fuels in Africa include climate change; lowering costs of renewables; pandemic-related economic crises such as COVID-19; pressure from

²¹Egan, M., Oil Prices Turned Negative. Hundreds of US Oil Companies Could Go Bankrupt. CNN Business. 21 April 2020. Can be accessed at, <https://edition.cnn.com/2020/04/20/business/oil-price-crashbankruptcy/index.html>. Last accessed on 22 April 2020.

²²International Energy Agency (IEA), Key Electricity Trends. 14 April 2020. Can be accessed at, <https://www.iea.org/articles/key-electricity-trends-2019>. Last accessed on 20 April 2020.

climate change and energy transition activists; ban on funding for fossil fuel projects just to mention but a few.

African countries, therefore, have to be aware of these threats and respond accordingly through among others embracing more regional cooperation to finance crucial fossil fuel projects in their countries; setting up strategies that embrace renewable energy; investing more in research and technology on the continent; adjusting the institutional and regulatory frameworks to be able to respond to these global developments in energy transitions.

1.2.1 The Brief Situation of Hydrocarbons in Developing Countries

As discussed in the previous section, hydrocarbons still have a crucial role to play on the African continent, especially with respect to tackling energy access challenges and responding to the anticipated boom in population growth, industrialisation and urbanisation. In the Table 1.1, we briefly highlight the hydrocarbon situation in selected African countries. The main question to be considered here is, are hydrocarbons still relevant in these countries? How does the decline in investment in hydrocarbons likely to affect the economic and social situation of developing countries? We also need to pay extra attention to the need for more advanced technology aimed at reducing the negative impacts associated with hydrocarbons.²³ For instance, coal is well known for its massive negative environmental impacts. Nevertheless, just looking at the data, we notice that as of 2018, there were 1,054,782 million tonnes of coal reserves globally of which Asian countries such as India and Indonesia contributed 9.6 and 3.5%, respectively; while African countries such as South Africa contributed 0.9%.²⁴ Countries across the globe

²³Coal, for instance, the technology aimed at reducing emissions include high efficiency, low emissions (HELE) and carbon capture storage (CCS) emissions.

²⁴We note that other parts of the globe are also endowed with massive coal resources. For instance, as of 2018, Europe accounted for 12.8% of the global coal reserves while the Asia Pacific and North America accounted for 42.2 and 24.5%, respectively. See, BP Statistical Review of World Energy, 68th edition, 2019. Can be accessed

Table 1.1 Hydrocarbons resources in developing countries

Country	Resource	Reserves	Key highlights
South Africa	Coal	The country has an estimated 30 billion tonnes of coal representing 3.5% of the world's coal resources Accounts for 3.3% of the world's annual coal production	Coal provides 82% of the power generated by state-owned power utility Esko ^a Sixth largest coal-exporting nation in the world; exports account to 6% of total global exports ^b
Ghana	Oil	Ghana has approximately 2.5bn barrels of proven oil resources; 94% of the oil resources are located offshore and the remainder onshore	There has been an increase in crude oil exports. Consequently, in 2018, from January to August, crude oil exports surpassed cocoa export revenues for the first time
Mozambique	Gas	approximately 204,750 bcf of proven gas resources, of which 90% are located offshore and the remainder onshore	FDI in the country is expected to increase highly
Angola	Oil and gas	Has approximately 17.6bn barrels of oil resources, almost 95% of which are located offshore As of 2017, the country had almost 33,000bcf gas	oil represents one-third of the economy and 95% of exports SSA's second-largest oil producer, with the second most extensive oil resources

^aBesides electricity the other sectors that rely on coal include; the liquid fuels manufacture sector; and the basic iron and steel industry. Together, these three sectors account for more than 80% of domestic coal demand in terms of value and approximately 70% in terms of volumes

^bAdditionally, indirectly, the coal industry is responsible for creating and sustaining over 170,000 jobs outside the industry. See, Chamber of Mines, National Coal Strategy for South Africa, 2018

are also endowed with massive oil and gas resources, as highlighted in the Table 1.1.

As illustrated in the Table 1.1, the hydrocarbon resources are still significant in these countries' economic development. The list above is obviously not conclusive as there are other countries that ought to be considered including Congo-Brazzaville which is SSA's third-largest oil producer and third-largest holder of oil resources with approximately 5.3bn bbl of resources; Equatorial Guinea, which is the second-largest producer of natural gas in SSA; with 14,301 bcf of gas resources as of 2017; Gabon, which holds SSA's fourth-largest oil resources and is also the fourth-largest oil producer in the region—with 4922 m bbl of proven oil resources, of which 87% are located offshore and 13% onshore; Nigeria which is SSA's largest producer of oil and gas with approximately 92,000 bcf of proven gas resources, of which approximately 44% are offshore and 56% onshore. The country also has approximately 30.1bn bbl of proven oil resources, of which almost 70% are located offshore.

Revenues from these resources could be used to finance renewable energy projects which are essential for the energy transition. Besides finances, fossil fuels, specifically natural gas, has been recognized as an environmentally preferable product (EPP) for a low-carbon transition. Basically, 'environmentally preferable' refers to products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose.²⁵ Natural gas is an EPP because compared to coal and oil, and it remains the cleanest, less polluting and most hydrogen-rich of all hydrocarbon energy sources. Furthermore, the increased injection of natural gas in the primary energy mix contributed to over 40% reduction in CO₂ intensity of oil equivalent energy use in the period between 1980 and 2014.²⁶ In this respect, therefore, natural gas can significantly

at, <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-coal.pdf>.

²⁵UNCTAD, 1995. Environmental Preferable Products (EPPs) as a Trade Opportunity for Developing Countries, Report by UNCTAD Secretariat, UNCTAD/COM/70, Geneva.

²⁶Moati, W.H., 2018. The Contribution of Natural Gas to the Sustainable Development Goals (SDGs): Arab Countries Case. In *9th International Forum on Energy for Sustainable Development*, <https://www.unecce.org/energy/welcome/areas-of-work/forum/annual-fora/2018/sessions-of-the-9th-ifesd/14-nov/the-role-of-natural-gas-in-achieving-sdgs.html>.

contribute to not only tackling energy access challenges but also to the global efforts to transition to a low-carbon economy.

In the next section, the chapter will introduce the concept of ‘energy progression’, but before that, the key disruptions in the hydrocarbon sector will briefly be highlighted in the next subsection.

1.2.2 Key Disruptions in the Hydrocarbon Sector in Developing Countries

Although hydrocarbons are expected to play a significant role in the next decade, we have to be aware of some of the key disruptions in the development of this sector in developing countries.²⁷ There indeed common challenges, including the volatile oil price; however, there are some disruptions which are unique to developing countries. These include, among others; lack of necessary infrastructure; corruption and lack of transparency; unreliable regulatory regime just to mention but a few. Some of these disruptions are briefly highlighted below:

- LNG and renewables: the rising global demand for LNG and a transition to a low-carbon economy which favours the deployment of renewables is likely to have long term negative impacts on the hydrocarbon developments in Asia and Africa—since these compete with the same available investment opportunities like for hydrocarbons.
- Corruption and lack of transparency: Corruption not only makes it impossible for local people to benefit from their resources, but it also creates doubt for international energy companies that could consider other investment opportunities in renewables. Some of the most resource-rich countries are also ranked the most corrupt, according to the Transparency International Corruption Perceptions Index (CPI). For instance, out of the 180 most corrupt countries, oil-rich countries were ranked the most corrupt, including Somalia, South Sudan, Guine-Bissau, Equatoria Guinea and Angola which ranked 180, 179, 171, 171 and 167, respectively.

²⁷Africa’s proven oil and gas reserves account for 7.5 and 7.1% of global reserves, respectively.

- Digitalization: digitalization has been a notable feature of the hydrocarbon sector. However, we note that some developing countries in Asia and Africa are still behind concerning digitalization and this, in a way, has the potential of discouraging future investments. For instance, it has been noted that SSA has an extensive portfolio of ‘digitally behind’ assets and these risks being left obsolete if digitalization is not embraced.²⁸

Though fossil fuels have a significant role to play in meeting the continent’s energy challenges, there are some critical disruptions, as discussed above. However, the perception of the hydrocarbon sector, especially in this energy transition era calls for innovative ideas and concepts to redefine the sector to ensure that developing countries are not left behind in this energy transition era. In the next section, a new concept of ‘energy progression’ is introduced.

1.3 Introducing the Energy Progression Dialogue: Energy Progression V Energy Transitions

A discussion on energy transition and energy progression necessitates us to understand the key pertinent facts. These are highlighted in the Table 1.2.

Most of the points in the Table 1.2 have already been discussed in the previous sections. This section analyses why developing countries should consider the term ‘energy progression’ instead of the ‘energy transition’ term relied on by many developed countries. With the energy transition, there is this accepted public pressure on countries to act very fast. This has caused a two-sided protest from both climate change activists who are interested in witnessing a fast transition; and the struggling populations that are concerned about the costs of clean energy.

²⁸Deloitte: Africa Oil & Gas state of Play, November 2018. Can be accessed at, https://www2.deloitte.com/content/dam/Deloitte/xc/Documents/energy-resources/africa_oil_gas_state_of_play_Nov2018.pdf.

Table 1.2 Key facts to consider in the energy transition debate

Goal 7 of the UN SDG is focused on universal access to modern energy: yet 600 M people in Africa lack access to modern energy
2 billion people are likely to live in urban centres by 2040 (one-third of this from Africa)
Population growth estimated to increase by around 1.7 billion to reach 9.2 billion people in 2040 (Africa at the centre of this)
Impacts of climate change are visible in different parts of the globe
Energy transition happening in different phases in developed and developing countries
The immediate effect of the transition is a decline in investments in fossil fuels (financial risks)
Developing countries still need fossil fuels to tackle energy access challenges; and for the anticipated boom in urbanization, population growth and industrialization
African countries are not climate change deniers: there are already initiatives to transition to a low-carbon economy in Africa
New strategies needed to ensure that African countries capitalize on their fossil fuels and at the same time be mindful of the environment
Efforts are taken at the international level likely to negatively impact African countries
African countries contribute less to carbon emissions
The progressive nature of energy use is real, so African countries should be allowed to progress not transition
Need to review policies and contract provisions for fossil fuels: decommissioning might come earlier than expected

The energy transition pressure was evident in Europe in 2018 when protests erupted in France by the ‘gilets jaunes’, who have complained about the sharp increase in diesel taxes—taxes motivated by environmental and climate concerns. A transition in the energy sector is capable of having a significant impact on the ways of life of different people, both socially and economically. This has proved right in France and, in this regard, while suspending the fuel tax increase, the French Prime Minister Édouard Philippe, in a statement noted that he understood the protestors’ anger, ‘...it is the anger of the French who work and work hard, but still have difficulty making ends meet, who find their backs against the wall. They have a sense of profound injustice at not being able to live a

dignified life when they are working'.²⁹ This statement clarifies the realities of not only impoverished people in Europe but also those in African countries, and this, in turn, makes it clear that countries cannot only say goodbye to fossil fuels without finding cheaper alternatives.³⁰ It is one thing to have ambitious policies on paper, and it is another thing to put these in practice and make them acceptable to struggling populations.

On the one hand, we are evidencing an increase in protests by climate change activists, on the other hand, we are seeing struggling populations such of those represented by the 'gilets jaunes' in France also protesting against an increase in diesel prices. On the African continent, besides having over 600 million people lacking access to electricity; data indicates that seven million people die each year due to air pollution including indoor air pollution caused by overreliance on traditional biomass.³¹ In economic terms, data shows that 736 million people lived below the international poverty line of US \$1.90 a day in 2015: and most of these people were in SSA.³² In brief, the reasons to reconsider the 'Energy Transition' term and replace it with 'Energy Progression' include:

- The escalating energy access challenges due to the pressure from the global energy transition debates. Many people are likely to lack access to electricity in 2040.
- The decline in funding for fossil fuel projects. As highlighted in Section one, financial institutions are already banning funding for oil, gas and coal projects.
- The decline in investments in fossil fuels
- Technological barriers to ensure an effective energy transition in Africa.

²⁹Willsher, K. 2018. Gilets Jaunes Protests in France to Continue Despite Fuel Tax U-Turn. *The Guardian Newspaper*, 4 Tuesday. <https://www.theguardian.com/world/2018/dec/04/french-government-to-suspend-fuel-tax-increasesay-reports>.

³⁰Nalule, V.R., 2020. Transitioning to a Low Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels? In *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions* (pp. 261–286). Palgrave Macmillan, Cham.

³¹UNEP, Air Pollution: Africa's Invisible, Silent Killer. 20 October 2016. Can be accessed at, <https://www.unenvironment.org/news-and-stories/story/air-pollution-africas-invisible-silent-killer-1>.

³²United Nations: Ending Poverty. Can be accessed at, <https://www.un.org/en/sections/issues-depth/poverty/>.

- The high costs of renewables.
- The anticipated role of fossil fuels to meet energy demand for the growing population in Africa.
- Role of fossil fuels for economic growth including urbanization and industrialization on the African continent.

The current global energy transition debate does not take into consideration the impacts this is likely to have on the African continent. It is true, there are some visible initiatives such as the establishment of the Green Climate Fund (GCF), however, the financial contribution from the developed countries is not enough to address the social, economic and energy challenges experienced on the African continent. Furthermore, one might ask if the GCF contributions are enough to also cater for an increase in population growth expected on the African continent? According to BP, population growth is estimated to increase by around 1.7 billion to reach nearly 9.2 billion people in 2040. The global boom in urbanization is projected to increase, as almost 2 billion more people are likely to live in urban centres by 2040 and Africa is projected to contribute one-third of this increasing urbanization.³³ All these, therefore, have inspired the need to rethink the concept of ‘energy transition’ especially on the African continent, as discussed in the section below.

1.3.1 Understanding Energy Transition

The word ‘transit’ in general connotes the meaning of moving from one place to another. A basic understanding of the word ‘transition’ is vital in understanding energy transitions. The Oxford dictionary defines ‘transition’ as ‘the process or a period of changing from one state or condition to another’.³⁴ The Cambridge English dictionary, on the other hand,

³³BP. 2018. BP Energy Outlook: 2018 Edition. <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bpenergy-outlook-2018.pdf>.

³⁴Oxford Dictionary. 2019. <https://en.oxforddictionaries.com/definition/transition>.

defines 'transition' as 'a change from one form or type to another, or the process by which this happens'.³⁵

There is no agreed definition of the term energy transition. The International Renewable Energy Agency (IRENA), for instance, defines energy transition as a pathway towards the transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century. According to IRENA, the focus of this transition is to tackle climate change by reducing energy-related CO₂ emissions and thereby increasing renewable energy and energy efficiency measures while at the same time reducing the consumption of fossil fuels.³⁶ Geography is vital in understanding energy transition, for instance, in the post-Communist states of Eastern and Central Europe (ECE), energy developments have focused on the geographical position of these countries between exporting states of the former Soviet Union, on the one hand, and the energy-importing states of Western and Southern Europe, on the other; thus, the energy transition has in the past focused on introducing competition in the energy sector through liberalization.³⁷

The energy transition is therefore influenced by various factors including geography; social and economic situation; political climate; availability of energy resources; the country's energy strategy. Recognizing the differences in societies, literature has flourished discussing terms such as energy justice, climate justice and just transition. Climate justice takes into account the need to share the benefits and burdens of climate change from a human rights perspective; energy justice refers to the application of human rights across the energy lifecycle³⁸; and environmental justice aims to treat all citizens equally and to involve them in the development,

³⁵Cambridge English Dictionary, <https://dictionary.cambridge.org/dictionary/english/transition>. Last accessed on 12 April 2020

³⁶International Renewable Energy Agency. 2018. Energy Transition. <https://www.irena.org/energytransition>.

³⁷Bridge, G., Bouzarovski, S., Bradshaw, M. and Eyre, N., 2013. Geographies of Energy Transition: Space, Place and the Low-Carbon Economy. *Energy Policy* 53: 331–340.

³⁸Jenkins, K., McCauley, D., Heffron, R., Stephan, H. and Rehner, R. 2016. Energy Justice: A Conceptual Review. *Energy Research & Social Science* 11: 174–182; Sovacool, B.K. and Dworkin, M.H., 2015. Energy Justice: Conceptual Insights and Practical Applications. *Applied Energy* 142: 435–444.

implementation and enforcement of environmental laws, regulations and policies.³⁹

There is a massive literature on the topic of the energy transition; however, we must ask what the problem is with this ‘energy transition’? The main concern with the energy transition is the streetlight effect the concept has attracted in recent years. The streetlight effect or the drunkard’s search connotes to a situation where people pay extra attention to a topic that is in the limelight. In energy terms, most research is focused on energy transition, which is understandable given the need to tackle climate change. However, this has diverted efforts to tackle poverty on the African continent. Little care is paid to the fact that fossil fuels still have a significant role on the continent. Instead, we are experiencing a ban on funding for fossil fuel projects. Although associated with various advantages, including tackling climate change, the global focus on energy transition has raised some concerns including an escalation of energy access challenges in developing countries; and disruptions in these countries’ economic development.

Nevertheless, in recent years, several countries, including those in Africa, have successfully utilized renewables to meet their energy demand. In essence, the positive impact of the energy transition is the ability to tackle climate change. However, this also has financial consequences, as most banks and international financial institutions are now shying away from investing in fossil fuel projects. This, therefore, brings into question the need to consider energy progression, but before that, it is worth briefly exploring the concept of a just transition.

1.3.1.1 How Just Is a Just Transition to a Low-Carbon Economy?

The Oxford Dictionary defines ‘just’ to mean behaving according to what is morally right and fair.⁴⁰ How fair is it to have over 3 billion people lacking access to modern energy? Is it morally right to introduce strategies that will have an impact on investments in fossil fuels

³⁹Heffron, R.J. and McCauley, D., 2018. What Is ‘Just Transition’? *Geoforum* 88: 74–77.

⁴⁰Oxford Dictionary. 2019. <https://en.oxforddictionaries.com/definition/transition>.

knowing that the number without access to modern energy is anticipated to escalate in developing countries? Data shows that, globally, 1.2 billion people have no access to modern energy such as electricity and nearly 3 billion people rely on traditional biomass (such as wood and charcoal) for cooking and heating. This number is high in SSA despite the region's richness in energy resources with an estimated 65 billion barrels of proven oil reserves, equivalent to around 5% of the world total.

Taking stock of the discussion above, a question arises: as to how we can have a just transition when most scholars, international organizations and financial institutions are focused on cutting down funding and investments in fossil fuels which we know very well are crucial in developing countries. This is, therefore, an indication that we have to revisit the term 'energy transition' to ensure that the global move to transition to a low-carbon economy does not in any way escalate poverty and energy access challenges in developing countries.

1.3.2 Energy Progression

To be able to understand and appreciate this new term 'Energy Progression', we must have a clear understanding of the relevant words, including progress, progression and progressive. The Cambridge English dictionary defines the term 'progress' to mean a 'movement to an improved or more developed state or a forward position'.⁴¹ In this respect, the word 'progression' refers to 'the process of developing or moving gradually towards a more advanced state'.⁴²

Whereas the word 'progression' emphasizes the need to 'improve', the word 'transition' on the other hand focuses on changing. It is possible for someone to change from one condition to another without addressing the critical circumstances. However, for someone to move forward to an 'improved' state, it is essential for that person to be ready and to work towards achieving the 'improved' state. How are these words important in energy terms? Well, we note that the global focus on energy transitions is reducing reliance on fossil fuels, without necessarily addressing

⁴¹Cambridge English online Dictionary. <https://dictionary.cambridge.org/>.

⁴²Ibid.

the factors that are making it hard to ensure this transition. It would take time, more finances, advanced technology and preparation to jump from fossil fuels to renewables on the African continent.

With respect to energy, we are aware that historically all countries across the globe relied on traditional means of energy, including firewood and charcoal. Some of these countries progressed or advanced to modern energy, including electricity, LNG. However, due to the disparities in the social, economic and political circumstances, some countries 'progressed' faster in energy use as compared to other countries. The same holds for urban and rural communities. In this respect, it is common to find that some people in urban areas can readily embrace energy transition compared to people in rural areas. This all points to the progressive nature of energy use as discussed in the next subsection.

1.3.2.1 The Progressive Nature of Energy Use

Energy progression recognizes the differences in societies and the need to consider these differences when shifting from one energy source to another. Understanding and responding to the progressive nature of energy use is crucial in solving the energy access challenges experienced in developing countries.

Europe is an excellent example of the progressive character of energy use, for instance, initially, in the nineteenth century, the focus for European countries was to shift from wood and water power to coal; in the twentieth century the focus was to shift from coal to oil; in the twenty-first century, the focus is to shift from fossil fuels to renewable energy. On the contrary, the focus for most countries in SSA is to shift from wood to electricity grids (even if these are powered by high-carbon intensity energy resources such as coal)⁴³

One of the recognized and celebrated energy progressions in Europe was a historical shift from biomass to fossil fuels. The nineteenth century was characterized by industrialization necessitating the transition from

⁴³Nalule, V.R., 2020. Transitioning to a Low Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels? In *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions* (pp. 261–286). Palgrave Macmillan, Cham.

wood and waterpower to coal in the nineteenth century, or from coal to oil in the twentieth.⁴⁴ On the contrary, in developing countries such as those in SSA, many homes in rural communities are still relying on traditional biomass. With the anticipated industrialization and urbanization, these countries will need massive energy, including fossil fuels, to tackle their energy needs. The importance of fossil fuels in industrialization is evidenced in developed countries and their reaction to disruption in energy supply. For instance, historically, developed countries such as the United Kingdom were heavily reliant on coal to the extent that when faced with a 'coal panic' in the late nineteenth century, robust solutions were suggested including the urging of military strategists to seize control of coal reserves in foreign lands; and the urging of companies to drive their workers harder to increase the domestic production of coal.⁴⁵ These suggested solutions were however rejected not only by unions inside Britain but also other colonial powers.⁴⁶

With energy progression, we note that developing and developed countries face different energy challenges. For instance, whereas in developed countries the use of biomass such as charcoal and firewood is predominantly historical and a topic of the nineteenth century, developing countries such as those in SSA, in contrast, on the other hand, are still struggling with a reliance on traditional energy.⁴⁷ The focus of SSA countries is access to electricity. We note that electricity in its natural form tends to appear as lighting and static, the technological advances have enabled primary sources of energy such as coal, nuclear power, running water and of late renewable energy sources to provide this electricity. In this respect, for a country with more than 80% of the population lacking electricity, the focus will not entirely be on the kind of primary energy used to provide this electricity, but instead on ensuring that people shift from wood and biomass usage.

⁴⁴Bridge, G., Bouzarovski, S., Bradshaw, M. and Eyre, N., 2013. Geographies of Energy Transition: Space, Place and the Low-Carbon Economy. *Energy Policy* 53: 331–340.

⁴⁵Podobnik, B., 2006. *Global Energy Shifts: Fostering Sustainability in a Turbulent Age*. The Energy and Resources Institute, TERI Press.

⁴⁶Ibid.

⁴⁷Nalule, V.R., 2020. Transitioning to a Low Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels? In *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions* (pp. 261–286). Palgrave Macmillan, Cham.

The main aim of energy progression therefore, is recognizing the progressive character of energy use, implying that it has to happen gradually and in different stages. This, in essence, implies that, in all these stages, there should be adequate support at the national, regional and international levels through among others the availability of finances and technology to ensure that countries progress from one form of energy to another. With energy progression, we pay extra attention to the energy access challenges on the African continent; the role of fossil fuels in industrialization; the role of fossil fuels in urbanization; the role of fossil fuels in meeting the domestic energy demand from the anticipated population growth. In this respect, while advocating for clean technology to utilize fossil fuels, we advocate for more funding to support African countries develop and capitalize their fossil fuels. With energy progression, we also call upon climate change activists to be considerate and think of the many people who are relying on less than one dollar a day due to lack of access to modern energy. Most importantly, with energy progression, we ask international financial institutions to reconsider their policies banning funding for fossil fuel projects because at the end of the day, different countries face different energy challenges and they should all be given a chance to progress from one energy use to another. This does not in any way mean that African countries should not embrace renewables, there are already efforts to deploy renewable energy and energy efficiency technologies on the African continent, and these are discussed in the next section.

1.4 Energy Transition Indicators in African Countries: Legal Analysis

SSA is very rich in renewable energy resources, with solar potential totalling about 10,000 GW; wind potential, totalling about 109 GW, mostly in the coastal countries; geothermal capacity estimated at 15 GW especially in the East African Rift Valley; and exploitable hydropower estimated at 350 GW mainly located in Angola, Cameroon, Ethiopia, Gabon and DRC. Despite these enormous resources and the global commitment to increase the percentage of renewables in the energy mix,

there are some basic requirements that need to be fulfilled if the vision is to be attained. These requirements include, among others: policies that incentivize renewable energy deployment; enabling legal frameworks; innovative financing mechanisms; and electricity supply strategies that prioritize the diversity of resources such as dispatchable renewables.⁴⁸

There are initiatives at both the national and regional levels to deploy renewable energy. For instance, at the regional level, the Economic Community of West African States (ECOWAS) Treaty under Chapter 5 expressly mentions the need for cooperation in the energy sector and environment. Regional treaties are often backed by various energy protocols which detail cooperation in the energy sector at a regional level. A case in point is the 2003 ECOWAS Energy Protocol which is elaborative with respect to the governance of the energy sector at the regional level. Besides the various Regional Treaties and energy protocols, there are other instruments that have an impact on not only the renewable energy sector but energy in general. These take the form of master plans and other regional programmes. In SADC, for instance, the Energy Sector Plan (ESP), which is under the auspices of the SADC Regional Infrastructure Development Master Plan, is intended to address four key strategic objectives including ensuring energy security, improving access to modern energy services, tapping the abundant energy resources, and achieving financial investment and environmental sustainability. One of the sectors covered by the ESP includes renewable energy and energy efficiency.⁴⁹

In this section we briefly highlight the initiatives taken in some of the African countries to transition to a low-carbon economy. We note that some countries are not necessarily transitioning but rather progressing from traditional energy to modern energy. This progression doesn't in any way dictate the kind of energy to be advanced to, rather it shows that countries are taking baby steps to progress from one dirty energy

⁴⁸Avila, N., Carvallo, J.P., Shaw, B. and Kammen, D.M., 2017. The Energy Challenge in Sub-Saharan Africa: A Guide for Advocates and Policy Makers. <https://www.oxfamamerica.org/static/media/files/oxfam-RAEL-energySSA-pt1.pdf>.

⁴⁹Nalule, V.R., 2020. Transitioning to a Low Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels? In *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions* (pp. 261–286). Palgrave Macmillan, Cham

source to an improved energy source. In this respect therefore, we note that different countries face different energy challenges and as such they should not be pressured to transition from fossil fuels to renewables, rather, given the historical, social, economic and political situation of some countries, these can progress from one source of energy to another. This progression is on the case by case basis but can be clearly understood from a regional and geographical perspective. This section, therefore, focuses on the legal measures and policies in place to promote renewable energy and energy efficiency.

1.4.1 Legal Measures And Policies to Promote Clean Energy

Having an effective legal framework is key to ensuring the promotion of renewable energy and technologies in the country. This is because the legal and regulatory framework is the basis for not only setting up the necessary renewable energy and energy efficiency institutions in the country but also for the protection of foreign energy investments. In many countries, there are already reliable and efficient laws and policies that are intended to promote the deployment of renewable energy and energy efficiency. Most of these laws have their basis in the national constitutions. For instance, Article 32 of the Constitution of the Arab Republic of Egypt, 2014 emphasizes the ownership of natural resources and exploitation of these resources, including renewables taking into consideration the rights of future generations.⁵⁰ In Sierra Leone, the 1991 Constitution makes provision for efficient use of natural resources which includes energy.⁵¹

Besides the constitution, there are specific renewable energy laws and policies governing the deployment of renewable technologies. These are highlighted in the Table 1.3.

As illustrated in the Table 1.3, there are various laws and policies that support the deployment of renewable energy and energy efficiency

⁵⁰The Constitution of the Arab Republic of Egypt, 2014.

⁵¹See, Article 7(1) (a), Act No. 6 of the 1991 Constitution, Sierra Leone.

Table 1.3 Renewable energy and energy efficiency laws

Country	Sierra Leone	Uganda	Nigeria
Laws and policies	Energy Efficiency of 2016 Renewable Energy Policy 2016 The National Energy Policy 2009 The Medium-Term National Development Plan 2019–2023	Biofuels Act 2018 Renewable Energy Policy 2007–2017; The Atomic Energy Act, 2008 Renewable Energy Policy, 2007; The Energy Policy for Uganda, 2002	The National Renewable Energy and Energy Efficiency Policy (NREEEP) The National Electric Power Policy 2001 The Environmental Impact Assessment Act; Regulations on Feed-In-Tariff for Renewable Energy Sourced Electricity in Nigeria (REFIT); Nigeria Energy Efficiency Action Plan (NEEAP) (2015–2030)

technologies in different countries. For instance, the 2016 Energy Efficiency Policy in Sierra Leone, highlights different objectives including among others: to ensure the development and prudent exploitation of the nation's energy resources, with diversified energy resources options, in order to enhance energy security and self-reliance, as well as to achieve an efficient energy delivery system with an optimal energy resource mix. The 2016 Renewable Energy Policy on the other hand also highlights objectives that are in line with the global energy transition debate including among others: to guarantee an adequate, reliable, affordable, equitable and sustainable supply of renewable energy in a cost-reflective and an environmentally friendly manner.

The above is just an example of the legal initiatives on the African continent with respect to transitioning to a low-carbon economy. It is, however, worth analysing some of the key provisions of these laws. In

this respect, drawing from different case studies, we identify what most of these laws and policies emphasize:

- **Setting renewable energy targets**

The existing renewable energy laws and policies in developing countries, just like in many developed countries do set the future targets to be met by a country with respect to the deployment of renewable energy and energy efficiency. We note that in most of these countries, renewable energies do play a significant role in the energy mix and targets are set to increase their role. In Egypt, for instance, during 2019, the country's total installed capacity of renewables amounted to 3.7 gigawatts (GW), including 2.8 GW of hydropower and around 0.9 GW of solar and wind power. As illustrated in the *Integrated Sustainable Energy Strategy (ISES)*, the Egyptian government has set renewable energy targets of 20% of the electricity mix by 2022 and 42% by 2035. These targets are close to the IRENA renewable energy estimates for the country.⁵²

- **Progressively shift from traditional energy to modern energy: diversification in the energy mix**

These laws also recognize the need for countries to progressively shift from relying on traditional energy sources such as firewood and candles to modern energy sources such as electricity. A good example is the National Energy Policy (NEP) of Ethiopia whose objectives include, among others, 'to ensure and encourage a gradual shift from the use of traditional energy sources to modern energy sources'.

- **Deployment of energy efficiency technologies**

Most laws and policies do promote energy efficiency technologies. In Ethiopia, for instance, under the National Regulatory System to Ensure Conservation of Electricity and Energy Efficiency, interventions such as

⁵²IRENA, Egypt Renewable Energy Outlook, 2018. Can be accessed at, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Oct/IRENA_Outlook_Egypt_2018_En.pdf. Last accessed on 11 April 2020.

energy audit activities will be implemented and will involve the establishment of energy efficiency management sections for selected consumers, particularly high energy-consuming organizations. In South Africa, the establishment of energy efficiency incentive programmes by Eskom led to the saving of over three gigawatts of total cumulative energy.⁵³

- **Production of electricity from renewable energy sources: incentives to renewable energy projects**

The available legal framework in most African countries does encourage the production of electricity from renewable energy resources. To achieve this, several incentives and commitments are made. In Egypt, for instance, Renewable Energy Legislation (REL) was passed in 2014 to encourage the production of electricity from renewable energy resources.

- **Tackling energy access challenges in rural areas through renewable energy**

The presence of renewable energy laws has made it possible to pursue projects aimed at tackling energy access and poverty challenges in Africa, especially in rural areas. For instance, in 2016, Sierra Leone passed the Renewable Energy Policy. The policy is not only posed as a climate change mitigation strategy, but it also emphasizes the need to provide electricity to rural areas that cannot expect grid energy in the near to medium term via mini-grids.

- **Electric Vehicles**

Besides renewable energy and energy efficiency technologies, some African countries have embraced Electric Vehicles (EVs) to transition to a low-carbon economy. The transport sector is one of the largest contributors to GHG emissions, and this has necessitated steps to find alternative transport, thus leading to the introduction of e-transport. In the EU,

⁵³United States Agency for International Development (USAID). 2017. Examining Energy Efficiency Issues in Sub-Saharan Africa. <https://www.usaid.gov/powerafrica/newsletter/dec2014/smarter-power-in-africa>.

for instance, there is an ambitious target to reduce the use of internal combustion engine vehicles by 50% by 2030. Further to this, the alternative fuels directive encourages the Member states to develop systems which enable EVs to feed power back into the grid.⁵⁴

EVs have made their way on the African continent in countries such as South Africa, Kenya, Madagascar and Zimbabwe. In South Africa, electric cars were introduced by Nissan Leaf in 2014. BMW later also entered the market, introducing its i3 and i8 brands. Jaguar Land Rover also has plans to enter the SA electric vehicle market. The brand in partnership with electric vehicle charging authority GridCars, and with an R30-million infrastructure investment plans to invest in EV infrastructure including setting up 82 new public charging stations in the country's major hubs and along frequently travelled holiday routes.⁵⁵

In conclusion, there are indeed numerous initiatives to transition to a low-carbon economy in Africa. Albeit, the crucial role of fossil fuels, as discussed in Sects. 1.1 and 1.2, should not be underestimated on the African continent. The global energy transition moves seem so tough on developing countries, and as such we should consider softer options through energy progression whereby these countries are still given a chance to utilize their fossil fuels in an environmentally sustainable manner.

1.5 Outline of the Book

The book reviews the current developments in the African energy sector and highlights how they are likely to be affected by the ongoing global efforts to transition to a low-carbon economy and tackle climate change. The book consists of four parts, of which Part I contains four chapters introducing the book and Part IV, comprising one chapter, provides an

⁵⁴Leal-Arcas, R., Filis, A. and Nalule, V., 2020. Energy Decentralisation and Decarbonisation. *Natural Resources Journal* 60(1): 117–166.

⁵⁵Jaguar. 2019. Jaguar Launches EV Charging and Powerway Network in South Africa. <https://www.jaguar.co.za/electrification/jaguar-powerway.html>; Nalule, V.R., 2020. Transitioning to a Low Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels? In *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions* (pp. 261–286). Palgrave Macmillan, Cham.

epilogue with overarching conclusions and thoughts on the future of the African energy sector in the Energy Transition era. The rest of the book (Parts II and III) consists of ten chapters setting out these issues in more detail.

This chapter sets out the context and aims of the book. The chapter uniquely examines the progressive nature of global energy use and introduces a new concept which Dr Victoria Nalule christens 'Energy Progression' and opines is the most appropriate pathway for Africa to adopt in order to benefit from its massive energy resources.

Chapter 2 highlights the energy challenges on the African continent and discusses the role of regional cooperation. Dr Macdonald Irowarisima, in this chapter, notes that the global commodity markets have revealed new challenges, especially in the energy market as it relates to African countries. This is peculiar to Africa because most African countries are energy commodity-dependent economies. This makes them more vulnerable to the recent developments in the global energy market. The chapter, therefore, explores how African regional organizations, including the Economic Community of West Africa States (ECOWAS) and Southern African Development Community (SADC), can tackle these energy challenges regionally.

The various concerns of the energy transition in Africa are expounded by Noreen Kidunduhu in Chapter 3. Using South Africa, Kenya and Ethiopia as case studies, the chapter demonstrates the barriers to Africa's energy transition and advocates for blended strategies that would allow African countries to capitalize their fossil fuel reserves while at the same time achieve a path consistent with the Paris Targets.

In Chapter 4, Susan Nakanwagi examines the role of nuclear energy in tackling energy access challenges in Africa in the energy transition era. She notes that, although nuclear energy does not fall within the ambits of renewable energy per se, it is a two-sided sword tackling both the climate change concerns while addressing the access to energy challenges, more so, in Sub-Saharan Africa where a significant portion of the population lacks access to modern and cleaner forms of energy. Effective regulation of the nuclear industry is vital in achieving the broader objectives of the climate change regime and meeting SSA energy needs. However, following the Chernobyl and Fukushima Daichi nuclear power

accident disasters, populations are sceptical in embracing nuclear energy. Further, the utilization of nuclear energy poses questions relating to safety, environmental issues and regulatory inadequacies, among other things. This chapter thus examines the major prospects and challenges of developing nuclear energy in the region while paying specific attention to environmental, safety and nuclear accident liability regulation under international law which should be mainstreamed into national laws for achieving an effective nuclear energy industry.

Part II of the book examines the energy situation at the national level refereeing to different geographical locations in Africa. Part II starts with a discussion on energy legislation and their impact on the industry as explained by Michael Uche Ukponu, Yusuf Sulayman and Kester Oyibo in Chapter 5. The chapter examines Nigeria's electricity laws and off-grid renewable energy developments. This chapter aims to expose and analyse the 'conflict of electricity laws' and how they have caused the slow development of off-grid renewable energy in Nigeria to proffer salient solutions to achieve rapid off-grid renewable Energy development for energy sustainability.

Ms Catherine Nabukalu and Dr Reto Giere, in Chapter 6 analyse the continued reliance on charcoal alongside modern energy in Uganda. This is an essential chapter for the reason that, over 70% of rural populations in Africa are still dependent on traditional biomass energy and may need more time to progress from traditional biomass to fossil fuels.

In Chapter 7, Cosmos Nike Nwedu brings in the Nigerian experience. The main question in this chapter is whether the transition to renewable energy will promote energy security in Nigeria? The chapter argues explicitly that a transition to renewables is of critical importance for a secured and sustainable energy future in the country. The chapter, adopting an analytical method, examines renewable energy prospects for energy security in Nigeria, and how challenges to its exploitation can be overcome through inclusive and effective market policy strategies.

National case studies analysing the deployment of renewables in Africa are discussed. As such, Dr Mostafa Elshazly, in Chapter 7, focuses on Egypt, specifically analysing a transition to a low-carbon economy in the country. The Egyptian Energy sector plays a vital role in the political, economic and social life of the country. The chapter highlights Egypt's

framework to develop renewable energy resources in order to change the energy mix and meet the tremendous increase in energy demand.

In Chapter 8, Mr Marvin Tumusiime also looks at renewable energy developments in Uganda specifically analysing the challenges and opportunities for small-scale renewable energy.

Part III of the book consists of six chapters that explore the various critical thematic issues as they relate to energy transition in Africa. In Chapter 10, local content advancements and their impact on the African energy sector in the energy transition era are discussed by Dr Rukonge Muhongo. The chapter focuses on local content policies in the East African oil and gas sector and draws examples from developed countries such as Norway.

It is no secret that most African countries have not benefited from their energy resources; the book thus considers the different initiatives aimed at promoting local participation. In this respect, Chapter 11 by Wairimu Karanja & Nduta Njenga, examines Social Licence to Operate in the oil and gas sector and how these are likely to be impacted by energy transitions.

Recognizing that women are the significant energy users in Africa, Ms Alaka Lugonzo & Mr Kennedy Chege discuss gender justice in the energy transition in Chapter 12. The chapter looks explicitly at gender justice through the lens of technological advancement in the extractives sector.

Given the continued role of fossil fuels on the African continent, Chapter 13 by Ayebare Tom Rukundo analyses Uganda's upstream fiscal regime in the energy transition era explicitly looking at the viability of the country's upstream projects.

The environmental impacts of fossil fuels and the need to transition to a low-carbon economy are highlighted by Peter Reat Gatkuoth in Chapter 14. Focusing on South Sudan as the case study, the chapter analyses the national and international legal framework to respond to the environmental impacts of oil and gas activities.

Part IV of the book is concluded by Japhet Miano Kariuki in Chapter 15, who analyses the regional efforts to power East Africa specifically looking at the key issues with respect to energy investments and the integrated feed-in-tariff structure for the East African Community.

Part IV of the book offers the epilogue. Victoria Nalule concludes the book in Chapter 16, offering thoughts on the future of the African energy sector beyond extractives.

The foregoing highlights the salient present and future aspects of the African energy sector. With contributions from researchers, academics, practitioners and high-level policymakers, the book brings a unique flavour to the global debate on energy transitions specifically spotlighting the key concerns for African countries. The book is especially relevant to African governments and policymakers, African regional organizations, universities, energy practitioners, international organizations and energy enthusiasts alike.

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2

African Energy Challenges in the Transition Era: The Role of Regional Cooperation

Macdonald Irowarisima

2.1 Introduction

The world is transitioning to a low-carbon economy. However, the energy challenges experienced on the African continent are yet to be addressed. It has become a known fact that energy can be a potent resource for fostering both Gross Domestic Growth (GDP) and economic development in any resource-rich nation. For instance, Britain's energy from coal and Brazil's investment in the biofuel sector has been a landmark contributor to the industrial revolution and economic development of both countries. These cases have shown that adequate provision and use of energy services is an indication of enhanced

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economic development.¹ For example, the total energy consumption in Africa is the equivalent of what an individual consumes in an Organization for Economic Cooperation and Development (OECD-example is the United States) would consume in 25 days.²

Africa is now experiencing positive demographic trends, rapid economic growth, increasing urbanization, improving the political environment and an increasingly better climate for business during the past decades. These indices suggest prospects for development which is creating huge energy demand. A cursory look at the Sub-Saharan Africa (SSA), one would see that energy demand grew by around 45% from 2000 to 2012.³ In fact, some authors have forecasted that electricity demand is going to reach double its value over the period 2010 and 2035 as a result of 3.8% average annual rise in GDP of Africa over the same period.⁴

In all of these factors, Africa has the world's lowest ranking in terms of electricity access rates.⁵ Electricity access for the whole of Africa in 2019 was 43% in comparison to 86%, 95% and 92% for Developing Asia, Latin America, and the Middle East, respectively.⁶ While rural electrification reached as high as over 70–80% in the latter regions, Africa and SSA were below 30%.⁷ With the various energy access challenges

¹N Avila, JP Carvalho, B Shaw, and DM Kammen, 'The Energy Challenge in Sub-Saharan Africa: A Guide for Advocates and Policymakers: Part 1: Generating Energy for Sustainable and Equitable Development', Oxfam Research Backgrounder Series, 2017, <https://www.oxfamamerica.org/static/media/files/oxfam-RAEL-energySSA-pt1.pdf>, accessed February 4, 2020.

²Ibid.

³Ibid., p. 5.

⁴J Morrissey, 'The Energy Challenge in Sub-Saharan Africa: A Guide for Advocates and Policymakers: Part 1: Generating Energy for Sustainable and Equitable Development', Oxfam Research Backgrounder Series, 2017, <https://www.oxfamamerica.org/static/media/files/oxfam-RAEL-energySSA-pt1.pdf>, accessed February 4, 2020.

⁵International Finance Corporation, 'Getting Electricity', Doing Business Report IFC (Washington, DC, 2018).

⁶Tracking Energy SDG7, The Energy Progress Report (2019), <https://trackingsdg7.esmap.org/data/files/download-documents/2019-Tracking%20SDG7-Full%20Report.pdf>, accessed March 15, 2020.

⁷Ibid.

faced on the continent, scholars have questioned the readiness of African countries to bid farewell to fossil fuels in this energy transition era.⁸

The African governments' failure to strengthen energy generation, invest and maintain energy infrastructure, and increase capacity for distribution has further added new challenges to the already existing critical energy situation in Africa. Also, energy affordability is hampered due to low per capita incomes, inefficient and costly forms of energy supply; electricity prices are very high by world standards which in turn, affects major African industries negatively like the mining sectors.⁹

These energy challenges exemplified in access deficit to electricity power is in marked contrast with the huge presence of different energy source in many African regions. For example, across all of Africa, there is an adequate solar energy source. Hydropower capacity that can produce over 300 gigawatts of electricity energy in many African countries.¹⁰ Along with coastal areas in Africa, wind power can be harnessed, and geothermal energy can be exploited in the East African Rift Valley.¹¹ All of these sources of energy can contribute greatly to satisfying the rapidly increasing demand for energy within the continent.

Despite these sources of energy, Africa still grapples with the challenges of achieving energy access for all region. Majority of the people on the African continent especially in rural areas are still relying on traditional energy such as firewood, charcoal and candles.¹² The issue is that energy investments require huge financial capital investments and most African countries cannot shoulder such enormous financial expenditure on their balance sheets due to their low GDP level. It is upon these bases that this work seeks to explore the role of regional cooperation in addressing energy challenges particularly Economic Community of West

⁸VR Nalule, 'Transitioning to a Low Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels?', in *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions* (pp. 261–286) (Cham: Palgrave Macmillan, 2020).

⁹E Gnasounou, H Bayem, D Bednyagin, and J Dong, 'Strategies for Regional Integration of Electricity Supply in West Africa' (2007) 35 *Energy Policy*, 4142–4153.

¹⁰See J Morrissey (n. 4).

¹¹Ibid.

¹²VR Nalule, *Energy Poverty and Access Challenges in Sub-Saharan Africa: The Role of Regionalism* (Springer, 2018).

African States (ECOWAS) and Southern African Development Community (SADC) as regional organizations within each region, to see how and where they ought to cooperate to achieve energy security in their regions.

It was against the background of fostering cooperation that for example, ECOWAS developed an ambitious energy agenda, anchored in the ECOWAS founding treaty of 1975. The early objectives that govern Member States were to engender cooperation and development in all spheres of economic activity, including energy on the one hand. On the other hand, to increase the collective energy autonomy of the subregion.¹³ The seeming materialization of these objectives began to happen after 24 years in the establishment of the West Africa Power Pool (WAPP) and the ECOWAS Energy Protocol in 2003 that sought to foster long-term cooperation, increase complementarity and attract investments to promote regional energy trade in West Africa. The agenda was further broadened with the establishment of the West African Gas Pipeline (WAGP) in 2005 and the ECOWAS Centre for Renewable Energy Efficiency in 2010.¹⁴ Also, to enhance the development of regional electricity and energy trade, the proposed Activity Plan included among others the formation of the Southern Africa Power Pool (SAPP) Pool Plan; SAPP Short Term Energy Market (STEM) and the Regional Electricity Regulators Association of Southern Africa (RERA).

Despite significant investments targeted towards boosting energy production through these regional energy initiatives at both ECOWAS and SADC regions, virtually all of them experienced significant setbacks ranging from delays and/or increased transaction costs. This is not to say that there were no exceptions. However, ECOWAS and SADC energy markets remain inward-looking and highly dependent on expensive thermal power. Nigeria, South Africa, Ghana, Democratic Republic of Congo, and to some extent Cote d'Ivoire are net exporters, primarily through historical bilateral arrangements while most of the ECOWAS and SADC countries majorly depend on imports and fossil fuel for electricity supply. Regional cooperation has a major role to play in addressing

¹³M Bhatia and N Angelou, *Beyond Connections: Energy Access Redefined* (Washington, DC: World Bank, 2015).

¹⁴PowerGen, 'Our Microgrids Are the Building Blocks of Africa's Future Smart Grid', www.powergen-renewable-energy.com/micro-grids-for-the-future-of-power/, accessed February 11, 2020.

these energy challenges because of certain geographical, economic, security, regulatory and capacity factors that often determine the success of the overall energy exploration, exploitation and distribution.

The question at this juncture is how and in what areas should these regional organizations cooperate to tackle the existing energy challenges to bring it to an energy thriving environment for the eradication of poverty. Thus, the remainder of this chapter shall be examining the ideology and philosophy behind their formation, their policy framework and their energy programmes. Section 2.2 shall examine the energy landscape for each region in general. It will further explore the various energy challenges from region-specific context. Section 2.4 will examine the areas that require the role of regional cooperation in the various regions that this work seeks to cover. This work shall draw conclusions in Sect. 2.5.

2.2 Overview of the Character of Energy Resource in Sub-Saharan Africa Through the Lens of ECOWAS and SADC Regions

Both Southern and Western African countries largely depend on thermal power energy source for a generation. These have become obsolete and make electricity costs in these regions among the highest in the world. Transmission and distribution losses are very high, which leads to further problems in the energy market. Large power plants are the most cost-effective way of generating electricity that distributes to a wide population, within and between countries at both SADC and ECOWAS Member States, allowing for economies of scale. However, due to the evolving nature for both region's energy markets and its size, costly small-scale power systems tend to dominate the power generation industry.¹⁵

Although it affords the power systems to connect remote areas to the national grid, they often result in 'higher transmission and distribution

¹⁵A Cartwright, 'Better Growth, Better Cities: Rethinking and Redirecting Urbanization in Africa', New Climate Economy—Working Paper (London and Washington, DC, 2015).

costs, mainly arising from electricity losses'. Thus, affecting potential energy trade in these regions, as canvased by both SADC and ECOWAS energy agenda and the South African Power Plant (SAPP) and West African Power Plant (WAPP), respectively. Both ECOWAS and SAPP are over-reliant on inefficient and under capacitated power systems which are predominantly caused by insufficient financing capacity.

This, in turn, prevents member States in both regions to invest in new technologies and additional capacities. Donor agencies across both regions, led by the World Bank historically have been encouraging for total privatization of state-owned electricity companies. While the call for this privatization move seems to have succeeded in Ivory Coast in the Western region, privatization and energy market liberalization failed to deliver in Senegal, Guinea, South Africa, Namibia, Democratic Republic of Congo, Nigeria.¹⁶ In most SADC and ECOWAS member States, the electricity market remains vertically integrated and majorly subject to state-ownership except Cape Verde and Cote d'Ivoire's power sector that is dominated by foreign private companies.

2.2.1 Resource Potential for Renewable and Fossil Resource for Sub-Sahara Africa

There is virtually any country across the ECOWAS and SADC regions that is without solar energy potential. The solar energy resources in these regions are estimated to be above 10,000gw. The total technical solar resource for photovoltaic alone has been estimated at 6500 Terrawatt Hours (TWh) a year.¹⁷ In terms of wind energy source, most of its coastal countries in the region have one of the top spots wind conditions that can contribute to redefining the energy transformation agenda in Africa. The total wind power resource is about 109 Giga Watts.¹⁸ The East

¹⁶SG Banerjee, FA Moreno, JE Sinton, T Primiani, and J Seong, *Regulatory Indicators for Sustainable Energy: A Global Scorecard for Policy Makers* (Washington, DC: World Bank, 2017).

¹⁷'Africa Clean Energy Corridor: Analysis of Infrastructure for Renewable Power in Eastern and Southern Africa', International Renewable Energy Agency Report (Abu Dhabi, 2015), www.irena.org/DocumentDownloads/Publications/IRENA_Africa_CEC_infrastructure_2015.pdf, accessed February 13, 2020.

¹⁸IEA-International Energy Agency, *World Energy Outlook 2016* (Paris, 2016).

Africa Rift Valley presents an estimated 15 GW of geothermal capacity. Although the larger sum is mainly in Ethiopia and Kenya. More so, the region has the greatest hydropower energy resource in the world because of the Congo and the Nile Rivers. The hydropower energy that can be harnessed is estimated at about 350 GW, situated largely in Angola, Cameroon, the Democratic Republic of Congo (DRC), Ethiopia and Gabon.¹⁹

In terms of its fossil energy resource, the SSA region is rich in its variety ranging from petroleum, coal and gas. Its oil and gas discoveries have been estimated at about 400GW of natural gas potential alone. Whereas, coal resources are estimated at about 300 GW, comprising mainly in Botswana, Mozambique and South Africa.²⁰ More so, there are significant well-developed petroleum production infrastructures that have not translated into affordable, reliable electricity supply for low access countries like Nigeria and Angola. The advantage of the character of SSA is such that, its potential renewable zones are coincidentally close to existing transmission infrastructure and major loads centres.

This suggests that there should be a lower transmission upgrade and extension costs. However, this location advantage enjoyed by countries in SSA is not yet fully harnessed. The only rational argument for this mismatch can be attributed to a lack of strong political will and commitment by the individual governments and regional groups. Lack of proper planning for land use in a dual manner for different energy source is another inhibitor. For instance, if dual-use initiatives, like the combination of wind power development with available agricultural lands, is encouraged massively, it will invariably reduce existing conflicts and challenges associated with land use and access.²¹ Where necessary, solar and wind power generation sites can be located around the same area of land

¹⁹A Castellano, A Kendall, M Nikomarov, and T Swemmer, 'Brighter Africa: The Growth Potential of the Sub-Saharan Electricity Sector', McKinsey Report (2015), <http://www.mckinsey.com/industries/electricpower-and-natural-gas/our-insights/powering-africa>, accessed February 13, 2020.

²⁰E Kebede, J Kagochi, and CM Jolly, 'Energy Consumption and Economic Development in Sub-Sahara Africa', (2010) 32 *Energy Economics*, 532–537.

²¹See SG Banerjee, FA Moreno, JE Sinton, T Primiani, and J Seong (n. 16).

to reduce high costs on the one hand. On the other hand, maximize transmission efficiencies and mitigate environmental impacts.

2.2.2 The Character of Energy Portfolio Specific to West Africa (ECOWAS)

It is important to say straight forward that the data on demand for electricity in SSA are usually highly fluctuating or unavailable and might not be specific. However, what is specific in terms of data is that the demand for electricity is growing enormously and a huge portion remains latent due to low access levels and the dynamic nature of the industry in the region. This is true because the 2018 SSA's population is estimated by the World Bank to be over 1.078 billion, which constitutes 15% of the World population.²² In all of these, less than 4% of the ECOWAS population have access to the total global energy consumed.²³

According to the International Energy Agency (IEA), electricity demand estimates in ECOWAS grew by about 35% from 2000–2012 to reach 352 TWh.²⁴ Presently, the average per capita electricity consumption in ECOWAS is 488 kilowatts hours (KWH) a year which accounts for the lowest consumption rate of any major region in the world. By comparison, in North Africa, the electricity access rate is over 90% and the electricity demand by 80% from 2000–2012 reaching 1500 kWh per capita. In ECOWAS, Nigeria and Ghana have the greatest demand of 40% of the total demand.²⁵

Now from a global perspective, about 78% of people relying on solid fuel source for cooking are based in rural areas.²⁶ This trend is accentuated in the ECOWAS region, such that in every Member State, the proportion of people in rural settlements relying on solid fuels either

²²World Bank Group, 'Report on Sub Sharan Africa Population', <https://data.worldbank.org/indicator/SP.POPTOTL?locations=ZG>, accessed February 17, 2020.

²³Ibid.

²⁴IEA-International Energy Agency, *World Energy Outlook* (Paris, 2016).

²⁵Ibid.

²⁶B McKibben, 'The Race to Solar-Power Africa', *The New Yorker*, June 19, 2017, <https://www.newyorker.com/magazine/2017/06/26/the-race-to-solar-power-africa>, accessed February 18, 2020.

equal or exceed those in urban settlements. More than 30% of Africa's proven recoverable crude oil reserves (3017 Million tonnes) are located scattered across the ECOWAS region. 31% of African natural gas reserves proved recoverable are also scattered across this region.²⁷

In terms of renewable energy source, there are said to be approximately 23,900 MW of hydropower potential. Regrettably, only 16% of such hydropower potential energy resource is exploited. Solar energy source is not left out in the energy resource base in the ECOWAS region. About 5 KWh/m²/day of solar energy renewable source can be exploited by Member State.²⁸ In some locations, wind speed is estimated at 5–6 m/s. Whereas, potential biomass reserve is huge across the ECOWA region.²⁹

However, these energy resources are unevenly distributed across the ECOWAS Member States. 90–95% of hydrocarbon potential is situated in Nigeria, the most populous country in both the ECOWAS region and Africa.³⁰ Despite the high energy potential in the ECOWAS region, it ranks very poorly in relation to other parts of the world in access to modern energy services. No doubt that lack of access to modern energy imposes significant productivity constraints, the provision of social services and the fight against poverty. In this area, some ECOWAS Member States have not been able to achieve even 30% of efficiency level regarding access to affordable energy services despite their enormous energy resource potential.³¹

²⁷SV Lall, JV Henderson, and AJ Venables, *Africa's Cities: Opening Doors to the World* (Washington, DC: World Bank, 2017).

²⁸IEG (Independent Evaluation Group), *Reliable and Affordable Off-Grid Electricity Services for the Poor: Lessons from the World Bank Group Experience* (Washington, DC: World Bank, 2016).

²⁹M Hallward-Driemeier and G Nayyar, *Trouble in the Making? The Future of Manufacturing-Led Development* (Washington, DC: World Bank, 2018).

³⁰Ibid, p. 15.

³¹T Regan, D Nigmatulina, N Baruah, F Rauch & G Michaels, 'Sites and Services and Slum Upgrading in Tanzania', in *The Annual Bank Conference on Africa: Managing the Challenges and Opportunities of Urbanization in Africa* (Oxford, UK, July 13, 2016).

2.2.3 The Character of Energy Portfolio Specific to Southern Africa (SADC)

Although the energy resource base for the SADC region appears diverse, its electricity security looks generally bleak. The region is still undergoing electricity shortages, with significant implications for economic growth and social development. In the recent past, countries like South Africa, Namibia, Tanzania, Zambia, Botswana and Zimbabwe have had to do some load shedding as a stop-gap measure to conserve energy.³² Also, problems of access to modern energy service still exist in the region and are being acutely experienced by people living there.³³ Traditional biomass continues to be used largely in the region in both urban and rural areas, thereby further compounding the existing security of supply challenge.

While the region enjoys an operating surplus of 1507 MW, and there is still a supply deficit based on the SADC data.³⁴ By contrast, at the country level, there is favourable net generation capacity significantly above demand and reserve requirements being hit by only Angola and Mozambique. Other Member States are either in a difficult situation like the Democratic Republic of Congo (DRC), Malawi, Tanzania and South Africa or are with significant supply shortfalls like Botswana, Lesotho, Namibia, Swaziland and Zimbabwe. Nevertheless, these situations have greatly improved quite recently.

Ironically, Mozambique was one of the poorest countries in the world. Now Mozambique has thrived on overcoming the legacies of 15 years of civil war (1997–1992) and has directly placed itself as a primary energy producer in SADC. Mozambique is now an electricity export due to the rapid expansion of the hydropower sector and the vast discoveries of natural gas and coal in its territory. Mozambique's Cahora Bassa dam is one of the largest hydroelectric power schemes on the continent of Africa

³²SADC, 'Regional Indicative Strategic Development Plan 2015–2020', Southern African Development Community Report (Gaborone, 2015), <https://www.sadc.int/about-sadc/overview/strategic-pl/regional-indicative-strategic-development-plan/>, accessed February 15, 2020.

³³Ibid.

³⁴Tanzanian Investment Centre, n.d. [WWW Document], <http://www.tic.co.tz/procedure/275/181?l=en>, accessed February 19, 2020.

comprising an installed capacity of about 2075 MW.³⁵ As a result, it exports electricity to Botswana, South Africa, Zimbabwe and the SAPP. This was made possible due to the favourable investment framework from foreign direct investments in developing countries.³⁶

In terms of natural gas deposits, Mozambique in 2010, the US energy company Anadarko found significant gas reserves off the coast of Mozambique's Cabo Delgado province. The following year too, Italy's ENI also found a massive gas field in the area.³⁷ Ever since Mozambique has seen an influx of foreign energy companies fishing for lucrative contracts. As a result, Cabo Delgado is now base to Africa's three largest liquid natural gas (LNG) projects. This huge natural gas reserves necessitated the likes of Mozambique's LNG (led by US-based Anadarko) in June 2019 to commit \$20 billion on the development of integrated offshore and onshore gas fields. In December 2019, Rovuma LNG (led by Exxon-Mobil and ENI) was anticipating to commit \$30 billion to develop the same.³⁸

Thus, there is a wide complement of both renewable and non-renewable energy resources.³⁹ These resources are distributed across the region, making it a fertile ground to engage in regional trade for the desired energy transformation in the region. There are huge deposits of gas, coal and uranium in the region's energy resource base. Botswana, Mozambique, South Africa and Zimbabwe host large deposits of coal, while Mozambique, South Africa, Tanzania are developing natural gas fields in their respective countries. Huge volumes of uranium deposits can be found in Namibia and South Africa as mining is already

³⁵Ibid.

³⁶UNEP, AfDB, 'Atlas of Africa Energy Resources', *United Nations Environment Programme Report* (Nairobi, 2017).

³⁷Sasha Planting, 'Gas in Mozambique—A \$128bn Opportunity', *Business Maverick*, September 2019, <https://www.dailymaverick.co.za/article>, accessed February 3, 2020.

³⁸Ibid.

³⁹R. Karhammar, 'Regional Energy Cooperation in Africa and Possible Entry Points for the New Regional Results Strategy', *Swedish International Development Cooperation Agency Report* (2016).

taking place. Whereas, for Botswana and Zimbabwe, uranium mining is currently at exploratory phases.⁴⁰

The region has abundant large low-cost hydroelectric dams, especially the Inga reservoir in the DRC and the Kariba Dam on the Zambia–Zimbabwe border, can potentially generate up to 150 GW of electricity, against the present 12 GW of installed capacity. Karhammar speculates that the SADC region has the possibility of generating 1 080 TWh/year of electricity from hydroelectric dams. Regrettably, only 31 TWh/year is being actualized.⁴¹ This, calls for a more robust and aggressive political and economic will among countries in the region.

In terms of its renewable capacity, the region benefits from outstanding solar irradiation of about 2500 hours of sunshine a year which can translate into a generation capacity of 20,000TWh annually. Although, the potential for wind-based renewable source in the region is fair but limited to coastal countries reaching considerable levels of about 800 TWh a year. Geothermal energy is not left out in the region's energy character portfolio. While power generation projects are underway, and there are still large generation potential untapped to put the region on a positive pathway for energy independence and optimal energy access. According to the IEA's, just 1% of the solar and wind potential combined has been harnessed so far.⁴² When looking at the antecedents in the region, it is the postulation of this work that the region still grapple with these issues despite the fact that the abundant energy potentials are that the countries are adopting a national or bilateral rather than a regional initiative built around robust regional cooperation in dealing with an energy security challenge.

⁴⁰A Mikita, and B Merven, 'Southern African Power Pool: Planning and Prospects for Renewable Energy', International Renewable Energy Agency Report (Adu Dhabi, 2015), <https://www.irena.org/documentdownloads/publications/sapp.pdf>, accessed February 20, 2020.

⁴¹SADC, 'Energy and Energy Efficiency Strategy & Action Plan: REEESAP 2016–2030', Southern African Development Community (Gaborone, 2017).

⁴²RERA, 'RERA Publication on Electricity Tariffs & Selected Performance Indicators for the SADC Region 2014', Regional Electricity Regulators Association of Southern Africa (Windhoek, 2016).

2.3 Current Energy Challenges Applicable to ECOWAS and SADC

Having explored the energy character portfolio in both SADC and ECOWAS regions, it is crucial to analyse the dynamic challenges applicable to the energy sector in SADC and ECOWAS region in the SSA. This analysis of the challenges is necessary to really appreciate what each Member States strategic geopolitical interests ought to be while dealing with other Member States.

It is important to say straight forward that the data on demand for electricity in SSA are usually highly fluctuating or unavailable and might not be specific. However, what is specific in terms of data is that the demand for electricity is growing enormously and a huge portion remains latent due to low access levels and the dynamic nature of the industry in the region. This is true because the 2018 SSA's population is estimated by the World Bank to be over 1.078 billion, which constitutes 15% of the World population.⁴³ In all of these, less than 4% of the ECOWAS population has access to the total global energy consumed.⁴⁴

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Also, the IEA forecasts that annual demand for electricity in Africa will increase at an average rate of 4% to reach 1570 TWh, including captive

⁴³World Bank Group, 'Report on Sub-Saharan Africa Population', <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ZG>, accessed February 17, 2020.

⁴⁴Ibid.

⁴⁵IEA-International Energy Agency, *World Energy Outlook* (Paris, 2016).

⁴⁶Ibid.

power estimates.⁴⁷ However, the Mckinsey's power sector report on electricity demand for SSA in 2010 was at 423 TWh but an annual projected growth rate of about 4% through 2040.⁴⁸ These estimates are most likely to be more owing to discrepancies from self-generation and unreliable data on captive power. These features account for the prevailing uncertainty of electricity demand projections in the region.⁴⁹ This sometimes makes it difficult in deciding the region's future power system design.

Nevertheless, the African countries are developing rapidly, and this suggests that the current demand profile estimates are apt to change as industries and factories spring up in their numbers. At the moment, most ECOWAS country's demand for electricity peaks in the evening hours and the peak demand is much greater than average demand. Therefore, to address the challenge of future demand profile projection, will require the installation of more generation capacity, even if that capacity is used for only a few hours a day when peak demand happens. The shape and style of this current demand profile in ECOWAS, mainly the size of peak demand relative to average demand is crucial for capacity planning in any energy system. Hence, the requirement for peak plants in an energy system contributes significantly to the economics of the entire grid.

While to a greater extent, as suggested by some articles that the challenges of SSA's energy system can be categorized into two main components. The first involves the need to increase the region's electricity supply and determining whether new generation capacity will come from fossil or renewable sources. The second component consists of the need to meet electricity demand and determining the role of centralized and decentralized grids in increasing access. In as much as these paradigms are true, there is a more complex phenomenon that characterizes each individual state's energy predicament as they affect the overall regional dynamic. The following identified challenges are a priority for reform

⁴⁷See A Castellano, A Kendall, M Nikomarov, and T Swemmer (n. 19).

⁴⁸A Sanoh, AS Kocaman, S Kocal, S Sherpa, and V Modi, 'The Economics of Clean Energy Resource Development and Grid Interconnection in Africa', (2014) 62 *Renewable Energy*, 598–609.

⁴⁹'SADC Energy Monitor: Baseline Study of the SADC Energy Sector', Southern African Development Community and Southern African Research and Documentation Centre Report (Gaborone and Harare, 2016).

through policy responses and regional cooperative engagements for both region's energy sector, with the aim of attaining affordable energy and sustainability goals.

2.3.1 Planning Deficit for Energy System Capacity

Electricity scarcity for both ECOWAS and SADC region has frustrated economic growth and prevented their ability to attain various goals relating to health, education and manufacturing industry to make a major impact in the world export market.⁵⁰ This can be linked to inadequate capacity for generation for grid-connected regions, absence of proper grid infrastructure to provide generated power, poor maintenance of generation plants, regulatory bottlenecks that inhibit the constant flow of revenue to maintain existing and invest in future generation capacity, and the dispersal of the population in remote areas. This improper energy system planning where either generation capacities would be located quite remotely from the urban and rural population has resulted in high transmission costs and led to distribution losses, and created high reliance on large dams and expensive diesel plants.⁵¹ Each region should undertake a critical analysis of its energy potential and the location of its population before choosing the type of generation capacity that will serve its purpose. As a result, they should take into consideration; environmental impacts, the variable nature of some energy source, the peak demand periods. Electricity energy generation, transmission and distribution involve capital, and strategic planning can go a long way in ramping up the system's productivity.⁵² It is, therefore, the assertion of this work that it is not the lack of capacity rather the absence of a proper strategic energy planning systems that significantly affects access to energy in these regions.

⁵⁰Africa Progress Panel, 'Power, People, Planet: Seizing Africa's Energy and Climate Opportunities', Africa Progress Report (Geneva, 2015), <https://reliefweb.int/report/world/africa-progress-report-2015-power-people-planet-seizing-africas-energy-and-climate>, accessed March 10, 2020.

⁵¹F Ueckerdt and R Kempener, 'From Baseload to Peak: Renewables Provide a Reliable Solution', International Renewable Energy Agency (IRENA)—Working Paper (Abu Dhabi, 2015), www.irena.org/DocumentDownloads/Publications/IRENA_Baseload_to_Peak_2015.pdf, accessed March 20, 2020.

⁵²Ibid.

2.3.2 Poor Regulatory Reforms

To close the electricity gap in SSA, especially in SADC and ECOWAS requires sound reforms that target energy utilities and regulatory frameworks to improve regional cooperation that leads to operational efficiency. It is true that most countries across the region that have the potential to be energy dependent divert billions of dollars of taxpayers' money on utility losses and petroleum subsidies, which end up not achieving the power sector's productivity.⁵³ On the premise that most utilities cannot recover their costs without these subsidies. Regulatory reforms should target liberalizing the entire sector while building a strong regulatory institution to supervise the operations of energy utilities, especially when it comes to setting the price for each unit of electricity consumed by the consumer.

Energy power system development in the world all over is perceived as high capital projects and is being sustained without the assistance of energy subsidies to augment the losses of energy utilities. Why is SSA's case different? When one follows the trend in the state of energy play in these regions, both household and commercial users of energy pay more for running diesel generating sets to power their appliance to provide services than connecting to the epileptic national grids. If businesses are willing to pay more to self-generate what makes anyone think that if the price of energy is set commensurate to where the investor can recoup his investments over a period, people cannot pay.

In all of these, one can only conclude to say that there is a high level of corruption between these multinational energy utilities and the regulatory institutions and the political class regarding how energy regulatory reforms are being managed. Regulatory reforms should be crafted in such a manner that the system will work on its own without interference and interventions from any quarter and allow the forces of demand and supply to regulate the industry. All SSA need is availability, and the rest will take care of itself, just as it has in other climes. People in the government of these regions benefit from subsidy schemes. What they

⁵³IEA-International Energy Agency (n. 24).

don't know is that it is part of a grandmaster plan designed by fraudulent stakeholders to undue the aim for an energy transformation agenda.

2.3.3 Prevalence of System Losses

When compared with the various region's system losses, they double the average world system loss. Losses in electricity could be the result of ineffective maintenance for transmission and distribution networks; and commercial losses from low revenue collection. The region's estimated losses from transmission and distribution value chain is about 18% when excluding South Africa.⁵⁴ Thus, further creates the need for more generation capacity to meet energy demands in the region. Also, power companies are more susceptible to financial risk due to their effort to meet loads, and end-user tariffs are increased which often are a result of either transmission or distribution losses.⁵⁵ A market arrangement whereby policymakers can encourage private individuals to invest in mini transformer systems at various designated locations for the purposes of stabilizing losses from transmission and distribution lines. This will make a difference in revamping the entire system's efficiency. A Build Operate and Transfer (BOT) contractual arrangement will make the arrangements. The private sector will invest, operate it and return the assets to the national utility where they may have recouped their investment and made profits.

2.3.4 Over-Dependence on Renewable Source Energy That Is Highly Variable

This is not to say here that renewable energy source does not play a role in the total transformation of the energy play in these regions. In fact,

⁵⁴A Castellano, A Kendall, M Nikomarov, and T Swemmer (n. 19).

⁵⁵DM Kammen, V Jacome, and N Avila, 'A Clean Energy Vision for East Africa: Planning for Sustainability, Reducing Climate Risks and Increasing Energy Access', A Report of the Renewable and Appropriate Energy Laboratory (RAEL) (University of California, Berkeley, CA, March 2015), <https://rael.berkeley.edu/wp-content/uploads/2015/03/Kammen-et-al-A-Clean-Energy-Vision-for-the-EAPP.pdf>, accessed March 28, 2020.

in some cases, it is the solution because of the geographical placements of each country and the dispersed nature of its population.⁵⁶ However, they should play a complementary role with fossil fuel sources that have more excellent reliability and are not subject to weather conditions and can meet peak demand during evening periods.⁵⁷

For instance, the regions' dependence on large dam construction for hydropower is prone to seasonal variability of output, and the impact of prolonged droughts in the region leads to fragile power systems and creates financial and climate risks in the region.⁵⁸ These increased financial and environmental risks have called for an evaluation of dams being used for power generation while in operation. A recent Oxford investigation reveals that in most cases, even without considering the attendant negative externalities on the environment, the set-up costs for large dams are way too high such that investors do not get a positive return on investments. This comprises of costs incurred for running the dam and implementation delays.⁵⁹ Hence, it was the conclusion of this study that in considering long-term energy strategies for actualizing energy efficiency system, dams do not produce a cheaper source of power.

For example, the Kariba Dam, which holds the world's largest reservoir and for 40% of South Africa's generation capacity, has been incapacitated by ongoing seasonal droughts induced by climate change conditions. This dam which sits on the Zambezi River Basin supplies half of Zambia's electricity and South Africa as mentioned. This vulnerability caused by high-risk weather extremes, both in floods and drought threatens two countries' economic activities.⁶⁰ Supposing this dam happens to supply quite several countries within the SADC region, the threat to energy access will be massive on a regional scale.

⁵⁶Ibid.

⁵⁷IRENA International Renewable Energy Agency, 'Solar PV in Africa: Cost and Markets' (Bonn, 2016), <https://www.irena.org/publications/2016/Sep/Solar-PV-in-Africa-Costs-and-Markets>, accessed March 18, 2020.

⁵⁸A Ansar, B Flyvbjerg, A Budzier, and D Lunn, 'Should We Build More Large Dams? The Actual Costs of Hydropower Megaproject Development' (2014) 69 *Energy Policy*, 43–56.

⁵⁹J Leslie, 'One of Africa's Biggest Dams Is Falling Apart', *The New Yorker*, February 2016.

⁶⁰C Casillas and DM Kammen, 'The Energy-Poverty-Climate Nexus', (2010) 330 *Science*, 1181–1182.

2.3.5 Lack of Predictability in Energy Reforms

It is no doubt that both regions have the sufficiency to bridge the gap is enormous, ranging from fuel, wind, solar, water to geothermal. In fact, it is estimated that Africa has enough potential not just to power Africa but the world.⁶¹ However, there is a lack of predictability in terms of energy reforms and policy that hampers the rapid development of the energy sector despite the increasing demand. The investment must see and perceive that every investment in the sector can yield its projected return. Different countries in the region have different energy reforms and policies capable of affecting the flow of huge capital investment in the sector.

Therefore, there should be a harmonized regulatory framework that governs regional and national regulatory and policy reforms. There must be embedded in the elements of good practice as obtained in other energy sufficient climes. This is not to say there is no predictability of some sort. However, the tide has turned now. What is required at this critical moment is to scale the existing predictability through political will? Politicians and policymakers must not continue to see the job of solving the issue of energy as the exclusive preserve of energy ministers in the region.

Predictability of keeping the price fixed such that the investors see that they will be paid and paid on time for each unit of energy generated, automatically de-risks the chances of attracting capital flow and even reduce the cost of capital in the sector. This is crucial because one of the key things for investors in any economic environment is the issue of political consistency. When politicians arbitrarily change any tier of policy regulation in such a manner that affects their investments adversely, it creates huge risks for future investors. Changes in political leadership should not equal to a change in policy regulation that governs the energy sector. When this happens, it makes investors start all over, and this portrays a lack of security for investments for investors in the sector. Another dimension to these changes that makes it very expensive

⁶¹N Avila, JP Carvalho, B Shaw, and DM Kammen (n. 1).

for investors is that the injected capital becomes short-term reason being that they are not willing to take this long-term arrangement for investments in such an environment.

2.3.6 Insufficient Involvement of Indigenous Entities in the Regional Energy Space

In addition to the need for consistency and predictability of regulatory and policy reforms in the sector. To encourage and drive growth in the sector, governments at various levels need to involve African entities. Primarily to showcase the skills acquired from foreign companies to maintain the people's momentum. These African entities are meant to look after the assets that foreign companies started, like General Electric (GE). These African entities will serve as a conduit to change the dynamics in the sector through the skills that these foreign companies transferred into the continent in order to achieve the energy gap.

Massive involvement of African entities in the energy space creates a sense of ownership towards the project rather than the foreign investors who are primarily involved in the region's energy market. Thus, these indigenous companies will do quite a lot in achieving the various objects of the sector more than just delivering power. Getting the objectives is the significant prerequisites in achieving energy access, it is about getting the means right to achieving the end game, which is powering the region.

Again, all of these cannot be achieved if the region promulgates laws that are targeted towards promoting the indigenous involvement in the certain manufacturing sector of the energy sector which can reduce cost drastically for the overall energy consumption cost. For instance, South Africa, where it forecloses the opportunity for indigenous companies' involvement by levying huge tax on the manufacturing of Photovoltaic solar panels as against imported ones that enjoy tax exemptions. Therefore, such tax regimes further exacerbate the cost implication involved for renewable sources of energy to compete alongside fossil generating capacity in delivering affordable and reliable energy for the region.

Renewable energy is being viewed by many as the panacea to achieve some sort of a leapfrogging success in satisfying the energy demand gap in the region.⁶²

2.3.7 Government's Involvement in Regulating off-Grid Energy Generation Capacities

Off-grid power generation strategies are energy sources that do not have their electricity from the national grid. This could either be due to their proximity to the national grid, or the price of connecting to the national grid is outrageous. As a result, they have decided to generate their own source of energy independently. The region's geographical setting is such that certain population are widely dispersed, and this makes a connection to the national grid through the installation of transmission and distribution line very expensive in the long run. This kind of situation is often the cause of the region's inability to solve the energy access challenge.

One way to get around this is to encourage independent energy generation through companies which produce, for instance, photovoltaic solar panels for households and commercial users who operate during the day when the sun condition is remarkably favourable in the region. Now what is tenable in some countries across the region is that governments are now beginning to be involved through regulation. The government's involvement invariably frustrates the goal of granting more people, access to energy as the cost of energy becomes expensive.

Regulatory agenda calculated at expanding centralized generation capacity is not the only way to electrify the region. Off-grid and distributed energy systems strategies create new opportunities to bridge the electricity access problem in both regions. In the past, these off-grid energy systems were fuelled by diesel, which poses risks while transporting them to remote areas. Currently, the modular nature of renewable energy like solar and small-scale hydropower through research and development has opened new dimensions in mitigating such risks.

⁶²VR Nalule, *Energy Poverty and Access Challenges in Sub-Saharan Africa: The Role of Regionalism* (Springer, 2018).

Therefore, technological advancements in the sector have finally presented new ways of managing electricity distribution systems that will boost distributed energy resource such as rooftop and communal solar photovoltaic panels and battery systems. For an industry that is yet to get its feet, any policy reform should be geared towards encouraging more people getting access to energy and not the other way around.

In sum, attaining the vision for the region's energy gap in the energy space will require policies that incentivize renewable energy deployment and discourage new fossil fuel development, innovative financing mechanisms that allow decentralized solutions to thrive and be integrated into future grid expansion, an enabling framework that attract private investors to the region's energy sector road map and builds human capacity by empowering local entrepreneurs, policies that incentivize and encourage decentralized renewable energy generation through private involvement system that will enable 100% access to affordable and reliable electricity in line with the sustainable development goal agenda number seven, improved organizational procedures and sector management that encourage operational power pools powered by interregional transmission lines, allowing power-sharing and reduced costs through the establishment of power pool fund account, and electricity supply strategies that prioritize diversity of resources such as dispatchable renewables and storage, negate the need for fossil fuels, and ensure supply security.

2.4 Areas of Regional Cooperative Role in Tackling the Energy Challenge

Energy transformation in any country requires huge collaborative strategic efforts, which range from policy formulation, sourcing for sustainable energy sources to sourcing for capital for the deployment of massive power plants—owing to the fact that no one nation has all fuel sources to meet the increasing demand on one hand. On the other hand, there is also the challenge of getting all end-users connected to the limited centralized energy grid in the region. Some countries' geographical placement makes it quite challenging in terms of costs in installing

transmission and distribution facilities to distribute electricity to those rural communities.

This kind of situation calls for a decentralized energy distribution strategy through the deployment of an off-grid system such as solar and mini-hydropower generation capacities. One of the advantages of such decentralized energy distribution system is that it reduces power loss. It addresses the social inequalities reinforced by centralized grids. Currently, existing grids favour wealthier communities located in areas where the limited grid exists and can comfortably afford the fees for connection.⁶³ These inequalities leave rural communities with limited options for access to electricity. Hence, this intraregional electricity gap created by these inequalities hinders the welfare development of those who live in poor rural communities. Therefore, it is the aim of this section to bring to fore the areas such as these social inequalities that require regional cooperation to tackle the growing rate of energy poverty. The regional approach must be deployed synergistically with national energy systems as a solution. Lack of regional cooperation may result in the continued stranded energy projects which will send a negative impression and deter investments in the region's energy space.⁶⁴

Regional cooperation for both ECOWAS and SADC region are vital in addressing the ongoing changes in policy and regulatory reforms that occur at the national level. If there is a regional regulatory policy framework that governs such regional energy projects, it should preclude political class at the national level to arbitrarily change and make policies that will affect the investments in the energy sector. This will scale up the predictability threshold for policy and regulatory regimes in the region. To actualize electricity energy access, both regions must rely on a combination of avenues and strategies ranging from seeking financial support and investment, synergize between centralized and decentralized energy systems to improved institutional capacity and management. All

⁶³ *The Economist*, 'Rise of the Super Grid: Electricity Now Flows Across Continents, Courtesy of Direct Current', *The Economist*, 2017.

⁶⁴ G Montmasson-Clair and B Deonarain, 'Regional Integration in Southern Africa: A Platform for Electricity Sustainability', Trade & Industrial Policy Strategies Working Paper (2017), https://static1.squarespace.com/static/52246331e4b0a46e5f1b8ce5/t/5982f327cf81e0b4f50f7d0e/1501754170654/Parallel+3A_Gaylor+Montmasson-Clair+%26+Bhavna+Deonarain_TIPS.pdf. Last accessed on 30 March 2020.

of these cannot be realized without a robust regional financial, social and political cooperation.

Among other areas, regional cooperation has a role to play in the implementation of structural reforms that will encourage private sector activity and improve the energy business environment. ECOWAS and SADC should play a role in the implementation of fiscal discipline and consolidation that involves a shift in spending from inefficient uses such as subsidy payments that further acts as a temporary solution to the price issue in the sector. Aside, doing away with subsidies in certain countries in the region that reduces the burden on the government budget, liberalizing the energy market can help to correct the allocative inefficiencies in the use of energy in ECOWAS and SADC regions. Having said this, it is pertinent to proceed in the direction of identifying areas that require regional cooperation to achieve the productivity of the energy sector for the overall economic growth of the various countries in Sub-Saharan Africa especially.

2.4.1 The Harmonization of Energy Legal Frameworks, Policies and Regulations

The harmonization of policies, frameworks and regulations that govern the technical operations of energy within the regions of ECOWAS and SADC is key in the transformation of energy access in the region. Although, there are steps taken by both regions in terms regional cooperation in tackling energy challenges in the region, very little has been done in terms of harmonizing the frameworks and policies for all countries within the region.⁶⁵ There is a serious disparity in energy framework, policies and regulations that have continuously hampered energy access. Thus, one would conveniently say that the first area for regional cooperation must revolve around the quick harmonization of policies, regulations and frameworks in the energy sector.

⁶⁵D Santley, R Schlotterer, and A Eberhard, 'Harnessing African Natural Gas: A New Opportunity for Africa's Energy Agenda?', Energy and Extractives Global Practice World Bank (Washington, DC, 2014), <https://openknowledge.worldbank.org/bitstream/handle/10986/20685/896220WP0P1318040Box0385289B00OUO0900ACS.pdf>, accessed March 19, 2020.

Harmonization goes beyond the formation of regional institutions like the Regional Electricity Regulators Association of Southern Africa (RERA) and the Ecowas Centre for Renewable Energy and Energy Efficiency (ECREEE). Instead, harmonization (i.e. compatibility) of national regulatory systems with the development of regulatory and policy guidelines that foster regional cooperation in achieving energy access should be encouraged.⁶⁶ The absence of a harmonized regulatory, policy frameworks constrains efficient cross-border deals. This is because of the unclear or complicated processes that characterize decision-making at the national level's energy landscape. These decisions focus more on large-scale/long-term transaction solutions rather than a medium-scale/short-scale transaction which will help revamp the nascent energy landscape.

The energy design strategy for both SADC and ECOWAS are characterized by numerous bottlenecks that have continuously constrained energy access and efficiency of energy systems. They include: different licensing regimes in terms of the types and content of licenses, and the non-recognition of licenses across borders; huge disparity in rules and standards for metering; the absence of cross-border dispute settlement mechanism; disparity in energy tariffs especially for transmission aimed at ensuring cost-reflective tariffs; no clear mechanisms for managing transmission losses at the regional level; different rules applicable to grid access connection to the available networks; individual countries are saddled with the huge role of coordinating generation and transmission asset development and no uniformity in setting grid code at individual Member State.⁶⁷

From a regional cooperative perspective, the implementation of regional plans and strategies must arise as priorities for the region first, accompanied by a harmonizing framework that reflects great disparities

⁶⁶EC Sichone, *Creation of Multi-National Electricity Markets by Furthering Cross-Border Trading of Electricity*, AFUR Workshop, 2016.

⁶⁷A Scott, 'Building Electricity Supplies in Africa for Growth and Universal Access: New Climate Economy', The New Climate Economy—Working Paper (London and Washington, DC, 2015), <http://newclimateeconomy.report/misc/working-papers>, accessed March 21, 2020.

that undermine the overall regional energy transformation. Policies that focus more on end-users instead of energy access development.⁶⁸

Thus, harmonizing of energy regulatory policy frameworks has the potential of increasing the regional strategy for energy access and efficiency by ensuring that there are improved systems to provide accurate information, especially quantitative data and statistics on energy access; better application of energy objectives with a focus on energy end-users rather than technology development; recognition of the right energy portfolio in the present and projected regional energy balance; a push for a transition to cost-reflective but competitive pricing at national levels; prioritizing energy access objective over consumption subsidies tenable in most national energy landscape; and improving capacity, with the ability and willingness of each state to implement, operate energy access projects and programmes for the total regional energy transformation agenda.⁶⁹

It is crucial to mention at this point for the benefit of critics that harmonization here does not signify a one-size-fits-all solution in fostering regional cooperation. It does not mean too that the architecture of the energy landscape must be identical in every country with each region. Harmonization dictates that there must be common rules that guarantee efficient service delivery at the regional market. However, the issue of the role of state-owned enterprises and independent power producers as market players as well as the electricity tariff structure may vary in different jurisdictions.⁷⁰

⁶⁸M Muller, C Chikozho, and B Hollingworth, 'Water and Regional Integration: The Role of Water as a Driver of Regional Economic Integration in Southern Africa', Report to the Water Research Commission (Pretoria, 2015), searchgate.net/publication/279923706_Water_and_Regional_Integration_The_role_of_water_as_a_driver_of_regional_economic_integration_in_Southern_Africa, accessed March 21, 2020.

⁶⁹A Eberhard, M Shkaratan, O Rosnes, and V Haakon, 'Africa's Power Infrastructure: Investment, Integration, Efficiency-Directions in Development Infrastructure' World Bank Report (Washington, DC, 2011), <http://documents.worldbank.org/curated/en/545641468004456928/Africas-power-infrastructure-investment-integration-efficiency>, accessed March 21, 2020.

⁷⁰F Ueckerdt and R Kempener (n. 51).

2.4.2 The Creation of Linkages

Another area where the energy transformation agenda is facing serious issues pertains to the absence of a significant linkage between the energy and industrial development frameworks for both SADC and ECOWAs regions. The role of regional cooperation is to establish these linkages with the goal of creating a robust regional energy value chain.⁷¹ These value chains must promote the building of local manufacturing and service capabilities from generation to metering value chain of a typical energy market operations. As part of their regional cooperative role (ECOWAS and SADC) in the region, a regional strategy to reap industrial development benefits should be designed taking into cognizance regional markets as priorities from resource extraction to resource distribution.

In addition, the creation of effective linkages is important in addressing the challenges of energy in the region because markets for projects, technologies and services are hugely fragmented due to existing national limitations.⁷² These limitations in local and national economies are often the bane of the rapid development of new national industrial capacities and sustaining the existing capacities in the sector.

The creation of integrated regional linkages as part of the role of regional cooperative effort for the regional energy market must be a priority, rather than have having fragmented national markets. This would serve as a catalyst for the emergence of regional businesses to manufacture the required energy technologies and service the market in a cost-reflective manner.⁷³ To achieve this, governments of various countries should reduce tax drastically, or regional firms should enjoy tax exemptions for certain goods manufactured locally in the region.

⁷¹G Montmasson-Clair, and R Das Nair, 'Channelling Economic Regulation to Stimulate Inclusive Growth: Lessons from South Africa's Renewable Energy Experience', Presented at the Biennial Conference of the Economic Society of South Africa, University of Cape Town, Cape Town, 2015.

⁷²B Hanna, J Drake-Brockman, A Kasterine, and M Sugathan, 'Trade-In Environmental Goods and Services: Opportunities and Challenges', Technical Paper (International Trade Centre, Geneva, Switzerland, 2014).

⁷³C Wood, 'A South African Strategy for Green Trade: Trade & Industrial Policy Strategies and Green Economy Coalition' (Pretoria and London, 2017).

Once this is done through the establishment of common regional rules, it would contribute to achieving affordable, reliable energy access in the regions.

As part of creating linkages in the sector, the regions should design and promote a regional, rather than a local content strategy. By so doing, a strong regional market is created that allows for the cumulation of local content rules for binding regional agreements.⁷⁴ Cumulation here simply refers to rules of origin, the restrictions in trade agreements that allocate how much value a country must contribute to a product for that product to be said to have originated in that country. Cumulation of rules of origin allows for the value added by certain third countries to count as local value added. For example, a product that is made in Nigeria, using components from Ghana, and exported to America could count a portion of those Ghanaian components as 'locally made', because all three are party to an Economic Partnership Agreement that allows for some cumulation of origin.⁷⁵

2.4.3 Establishing Common Institutions and Technical Infrastructure

The complexities of energy issues and challenges differ greatly across the globe. Each continent requires a unique approach in dealing with these challenges. However, one elementary logic that has become a universal best practice in dealing with such issues in any sector is the building of common institutions and technical infrastructures as a role in productive regional cooperative efforts. Although milestone achievements have been made in this regard like the creation of the West African Power Pool and the Southern African Power Pool in the ECOWAS and SADC regions respectively, there is need to make them more functional by devolving more control to regulators that allows for a more liberal trading structure.

⁷⁴C Mathews, 'Western Power Corridor Pact Can Be Revived, Says Reuel Khoza' [WWW Document], *Business Day*, <https://www.businesslive.co.za/bd/companies/energy/2017-02-21-western-power-corridor-pact-can-be-revived-says-reuel-khoza/>, accessed March 23, 2020.

⁷⁵Ibid.

Despite that the WAPP and SAPP are regarded as the most advanced power pools in the Sub-Saharan region in terms of trading structures, the role of regional trading mechanisms remains still limited. Indeed, the desire for regional energy access and sustainability in both regions entails a delicate balance between building common institutions and infrastructures that address national and regional interests. These common institutions at the different value chain of the sector will serve as a check against countries who may attempt to favour the sovereign route to attain national self-sufficiency in situations of severe shortages of resources rather than depend on imports from other countries.

For example, the coal-based Mmamabula Power Station project, situated in Botswana near the South African border, was initially meant as a regional initiative, Botswana decided, in the face of electricity shortages, to build the project on its own rather than wait for the long process of regional dialogues to take place. Initiated by five-member States to draw power from the DRC to Angola, Botswana, Namibia and South Africa, the Westcor Power Project is another illustration of the difficulty in building regional initiatives. The project is now moribund due to various factors, including national concerns over the security of supply.⁷⁶

Also, regional trade in both regions has been constrained hugely by transmission infrastructure deficit. While several projects are being initiated to boost regional electricity grid access, the existing weak and limited electricity grid infrastructure has continued to hamper the role of regional cooperative efforts in the overall energy landscape. For example, within the SADC, Angola, Malawi and Tanzania are not yet connected to the rest of the region because of transmission infrastructure deficit.⁷⁷ When one looks at the nature of energy in the region, it is clear that demand for energy is greater than the supply over the last few years for both ECOWAS and SADC. Put another way, a share of the potential transaction is not met due to infrastructure constraints. This calls for further regional cooperation in promoting regional trade, provided

⁷⁶See C Wood (n. 73).

⁷⁷J Vanheukelom, and T Bertelsmann-Scott, 'The Political Economy of Regional Integration in Africa', The Southern African Development Community Report (ECDPM, Maastricht, 2016), <https://ecdpm.org/wp-content/uploads/ECDPM-2016-Political-Economy-Regional-Integration-Africa-SADC-Report.pdf>, accessed March 23, 2020.

adequate planning is in place to address transmission and distribution infrastructure deficit. Once, this is achieved the essence of allocating available resources will be massively optimized in both regions' energy landscape.

2.4.4 Role of Developing National Techno-Human Capabilities

The nature of the energy regulatory framework and the evolving techno-economic environment of the energy landscape requires adequate techno-human capability development through regional cooperation. Regrettably, a well capacitated and diverse teams of stakeholders with up-to-date knowledge regarding the current and historical architecture of the energy sector is still missing.⁷⁸ What is tenable is a polarized system of foreign human capabilities that deploy energy strategies alien to the regions.

Although these foreign experts have the skills and competences required, they do not have the requisite understanding of the existing challenges like the local stakeholders in the region's energy play. Therefore, cross-fertilization of strategies and information sharing whereby skills will be transferred for the development of indigenous techno-human capabilities, to address the energy challenges should be at the core of successful regional cooperative efforts.⁷⁹ The argument of this work is that when indigenous techno-human capabilities are developed, it gives local participants a sense of ownership that may lead to the effective and efficient management of the energy systems.

⁷⁸G Magombo, 'Update on Regional Regulatory Initiatives', A presentation for the 5th High-Level Meeting of Regional Regulatory Associations of Emerging Markets, Budapest, Hungary, July 11, 2017, https://erranet.org/wp-content/uploads/2017/05/RERA_Update-on-Regional-Regulatory-Initiatives_High-Level-Mtg_Bp2017.pdf, accessed March 24, 2020.

⁷⁹G Montmasson-Clair, 'Governance for South Africa's Sustainability Transition: A Critical Review', Trade and Industrial Policy Strategies Report (October 2017), <https://www.tips.org.za/research-archive/sustainable-growth/green-economy-coalition/item/3463-governance-for-governance-for-south-africa-s-sustainability-transition-a-critical-review>. Last accessed on 24 March 2020.

There are policy mandates to create a regional market for skills and competences as formulated by the SADC and ECOWAS Industrial Policy Framework for a sustainable industrial development agenda across the region. Against this background, experience sharing workshops are regularly hosted in collaboration with international partners. For example, Energy Management and Independent Power Producers Framework workshop in June 2015, a joint IRENA-SAPP workshop on Renewable Energy Zoning in the region (2014), workshops on the integration of renewable energy sources to the interconnected power grid (2014 and 2015), a workshop on Framework for Open Access to the Transmission Grid (2014), a World Bank Workshop on Water and Energy Nexus in the Zambezi Basin and a Training on Equator Principles and Due Diligence in 2014.⁸⁰

However, these policy mandates and initiatives have yielded little progress in the development of national and regional experts. The lack of techno-economic possibilities and the awareness of available energy resources and technologies among nationals is quite notable.⁸¹ Accordingly, the knowledge base of the socio-environmental impacts and acceptability of the various existing technologies of the sector is quite disturbing. These kinds of anomaly are directly linked to the lack of expertise at the vocational and University levels in the region. Thus, the role of regional cooperation is to channel funds towards research training and development to address the national techno-human capabilities deficit in both regions' energy dynamics.

2.5 Conclusion/Recommendation

The ECOWAS and SADC regions are rich with an abundant array of fossil and renewable energy resources capable of transforming the entire

⁸⁰Energy Sector Capacity Building Diagnostic & Needs Assessment Study, Sub-Saharan Power Sector Capacity Building Diagnostic & Needs Assessment (2014) 1 African Development Bank, Tunis, https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Energy_Sector_Capacity_Building_Diagnostic_and_Needs_Assessment_Study.pdf, accessed March 2020.

⁸¹'Energy for a Sustainable Future. Summary Report and Recommendations', United Nations, AGECC Report and Recommendations (New York, April 2010), [https://www.un.org/millenniumgoals/pdf/AGECCsummaryreport\[1\].pdf](https://www.un.org/millenniumgoals/pdf/AGECCsummaryreport[1].pdf), accessed March 23, 2020.

regions. Also, each country is rich in one form of energy source or a combination of two or three; they equally have and are facing unique challenges and circumstances that hampers the potential—harnessing the synergies between the challenges of electricity security, electricity equity and environmental sustainability at their various national energy policy programmes is a key issue for them all. As a result, these dimensions often conflict and impede the energy transformation on a regional scale.

However, to achieve these mutual benefits, it is imperative that regional cooperative efforts must be at the core of national energy policies of each country within these regions. This begins with the urgency to jettison methods that promote a one-size-fit-all approach in tackling the nefarious energy challenges. Rather, nations within the region must understand that there are great benefits that can be delivered through strategic regional interdependent cooperative engagements.⁸² In it, lies the platform to fast-track progress towards electricity sustainability and efficiency.

Nevertheless, there are quite a number of existing initiatives and strategies structured around achieving the set objective for energy security and access deficits in both regions. The establishment of SAPP and WAPP is a ready example in this regard. However, these initiatives lack the requisite political will power in delivering the enabling environment for these programmes to thrive.⁸³ The government of various countries is neither not willing to invest in the maintenance of the existing generation, transmission and distribution capacities nor are they willing to make energy reforms that promote indigenous content development.⁸⁴ Imagine a policy that levies huge tax rates to industry players who are into manufacturing of photovoltaic panels for power generation but

⁸²M Bailey, J Henriques, J Holmes, and R Jain, 'Providing Village-Level Energy Services in Developing Countries', *The Smart Villages*, Malaysian Commonwealth Technical Report, Trinity College, Cambridge, 2012, https://easac.eu/fileadmin/PDF_s/reports_statements/Report_220113_PDF.pdf, accessed March 26, 2020.

⁸³African Union, 'Agenda 2063: The Africa We Want', <https://au.int/en/agenda2063/overview>, accessed March 25, 2020.

⁸⁴R Das Nair, G Montmasson-Clair, and G Ryan, 'Regulatory Entities Capacity Building Project Review of Regulators Orientation and Performance: Review of Regulation in the Electricity Supply Industry', University of Johannesburg and Trade and Industrial Policy Strategies, Johannesburg and Pretoria, 2014.

completely grants tax exemption for the importation of same parts that would be assembled in South Africa.

What this implies is that industry players will definitely prefer to import these parts since it is cheaper to do so. In the long run, the cost of generating a unit of electricity for the final consumer becomes expensive. Supposing the government grants the same tax exemption for manufacturing companies operating in South Africa, the cost of energy generation may be far cheaper. Such an obnoxious policy and regulatory structure ought to be revised because it hampers the emergence of techno-human capabilities and forestalls the potentials for countries to meet their energy challenges.⁸⁵

Again, the peculiar and diverse challenges plaguing the ECOWAS and SADC regions' energy transformation agenda is one that cannot be left to utilities and regulatory bodies alone.⁸⁶ Regional institutions have a role to play in driving and supporting inclusive governance of the sector and create the dichotomy for countries to leverage on and another's vast experiences in terms of resource and technical know-how.⁸⁷ The role of these regional institutions in the energy sector will formulate the right connection policy for distribution companies to avoid energy theft and payment problems being encountered by transmission companies and the distribution companies.

As part of its role as a regional institution, there should be the facilitation of enhanced cooperation between research and development institutions on energy issues through exchange programmes and joint research projects sharing workshops.⁸⁸ Engage and experiment with community-based initiatives such as the roll-out of small-scale power solutions will play a significant pathway in empowering communities in a

⁸⁵A Eberhard, M Shkaratan, O Rosnes, and V Haakon (n. 69).

⁸⁶S Feron, 'Sustainability of Off-Grid Photovoltaic Systems for Rural Electrification in Developing Countries: A Review', (2016) 8, *Sustainability*, 1326, <https://ideas.repec.org/a/gam/jsusta/v8y2016i12p1326-d85561.html>, accessed March 26, 2020.

⁸⁷M Madakufamba, 'Expanding Energy Generation Capacity in SADC: Challenges and Opportunities for Power Sector Infrastructure Development', Energy in Southern Africa Energy Policy Brief Report (2010), <https://www.sardc.net/sadc-energy/poilycy%20brief%20No%201.pdf>, accessed March 26, 2020.

⁸⁸See M Muller, C Chikozho, and B Hollingworth (n. 68).

sustainable manner.⁸⁹ The regional role is to build capacities in countries and provide assistance to national institutions that require assistance to adapt to and implement regional energy standards for the overall system's efficiency.

ECOWAS and SADC in their various regions should champion negotiations for the creation of a regional free trade movement zone, to ease the mobility of local skills and expertise in the region for affordable energy services. Accordingly, the regional institutions should carry out an assessment of the required skills as well as the existing skills in the region. Also, due to the absence of data and information relating to initiatives, there is hardly adequate knowledge for experts in dealing with and improving the state of regional energy dynamics. To this end, there is a need for these regional institutions to keep a database to serve as a one-stop information system for providing incisive insight on planned and potential energy generation projects and improved evaluation.

The rural areas for both ECOWAS and SADC regions are the most affected in terms of energy access deficit issues. Thus, to assist these low-income communities in these regions, it is expedient that more financial schemes should be introduced. In this regard, the regional energy bodies need to play a vital role in effectively mobilizing funding for energy projects in their respective regions. Currently, stakeholders in the industry have limited support for bankable project preparation and a lack of capacity to initiate, implement and manage strategic innovative projects. It is in this respect that these institutions could play a cooperative role in driving fundraising for strategic and/or cutting-edge projects, particularly by consolidating similar smaller projects for funding applications.

To achieve these strategic cutting-edge projects as well as the smaller projects, there is a need to create a regional one-stop-shop for potential project developers and investors; and maintain a database that will capture all existing potential funding source available to the region.

⁸⁹S Mahesh, 'Lists of Environmental Goods: An Overview', Information Note, International Centre for Trade and Sustainable Development (Geneva, Switzerland, 2013), https://www.ictsd.org/sites/default/files/research/2013/12/info_note_list-of-environmental-goods_sugathan.pdf, accessed March 28, 2020.

A regional financing mechanism such as a regional fund would facilitate and ease the implementation of multi-country electricity-related investment projects in their various regions.

This work has demonstrated that the limited role of regional trading mechanisms is equally one of the major factors affecting the energy transformation agenda in these regions. In fact, the pursuit of electricity sustainability in both regions bothers around reaching a balance between national and regional interests. In the face of acute shortages, countries will often favour the sovereign route to attain national self-sufficiency, rather than depending on imports from other countries. (For a detailed discussion on this, see sub-Sect. 2.4.3.) In as much as national interests are important, there is the need to prioritize regional commitments in order to achieve inclusive energy self-sufficiency at both national and regional levels. Legal and contractual frameworks should be crafted to govern regional energy obligations between Member States in Sub-Sahara Africa in general.

In terms of protecting health and environment, the ECOWAS and SADC region should play a role in promoting strategies that will cut down emission levels while harnessing their abundant natural resources in their quest for self-sufficiency. Of what good will it be if the security of supply is achieved yet health and environmental sustainability issues are not taken into account. Steps should be handled through law reforms. Member countries with SADC and ECOWAS should sponsor legislation for environmental protection.

A typical example is a Bill sponsored by the National Assembly of the Federal Republic of Nigeria by one Senator Muhammad Bima from Niger state to prohibit/ban the importation/use of generating sets to curb the menace of environmental air pollution and to facilitate the development of the power sector.⁹⁰ What these kinds of legislations tend to achieve is not only to protect health and the environment but have the potential to distort the energy space by frustrating the industry players who benefit from the value chain of mini self-generator importation business. It is the assumption of this work that as long as these people

⁹⁰'Breaking News: A Bill Seeking to Ban Generators in Nigeria Has Passed First Reading at the Senate', <http://www.newswireng.com>, accessed March 28, 2020.

who benefit from this venture are not stopped, they will always work to sabotage any energy reform initiatives to achieve the desired energy transformation in the region.



3

Energy Transition in Africa: Context, Barriers and Strategies

Noreen Kidunduhu

Video interview by the author discussing this book chapter can be accessed at, <https://www.youtube.com/watch?v=9BCzKoCZleQ>. Last accessed on 1st September 2020.

3.1 Introduction

At the heart of the global response to the climate change threat is the energy transition, which is a term of art in the industry that refers to the adaptation of energy systems to meet the challenges posed by carbon emissions. Often, the energy transition is synonymous with a shift to renewable energy. It is, however, now apparent that countries will need to chart their own energy transition pathways depending on their peculiar circumstances, resources and needs.

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This especially rings true for countries in the African continent. Africa has the lowest energy access rate in the world. The pressing energy priority for countries in Africa is to widen access in order to meet their social and economic development aspirations in line with the United Nations Sustainable Development Goal 7 (SDG 7). In their efforts to scale up energy access, it has become imperative that African countries take due consideration to climate change issues in keeping with SDG 13.

Although a large portion of African energy is produced from renewable sources, this may be outstripped following the recent oil, gas and coal discoveries across the continent. These fossil fuel discoveries suggest an increased volume of carbon emissions. The continent is thus faced with the dilemma of choosing between capitalizing its fossil fuel reserves for development purposes and constraining its carbon emission. This chapter thus discusses Africa's peculiar circumstances, resources and needs as well as the factors that act as barriers to the energy transition in Africa and offers suggestions on how to overcome the same.

This chapter is in five sections. This introduction lays the baseline of the study by briefly discussing the genesis of the energy transition and Paris targets. Section 3.2 analyses the energy landscapes of South Africa, Kenya and Morocco. It looks at the characteristics of their energy production, consumption and outlook and the challenges these pose to the energy transition. Section 3.3 examines the actuality, dilemma and hurdles African countries face in attaining sustainable development within the meaning of the Kyoto Protocol and the Paris Agreement in light of the continent's future industrialization and urbanization plans as well as the capitalization of recent fossil fuel discoveries. Section 3.4 then discusses viable strategies and solutions to the barriers identified in Sects. 3.4 and 3.5 provides a conclusion and outlines the plausible recommendations for Africa's energy transition.

3.1.1 The Genesis of the Energy Transition

The clamour for clean energy stems from a long history of climate activities dating back to 1979 when the World Meteorological Organization (WMO) convened the First World Climate Conference to deliberate on global climate issues and particularly global warming. This conference culminated in the establishment of the Intergovernmental

Panel on Climate Change (IPCC). The IPCC's First Assessment Report (FAR) established that human activities play a part in warming the planet. It is this assessment that served as the basis for the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC is an international environment treaty adopted in 1992. The objective of the treaty is enunciated as to 'stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system'.¹ The treaty laid down non-binding limits on greenhouse gas (GHG) emissions for countries. It also set out how separate agreements/protocols outlining precise action to be undertaken by countries, could be brokered in future in order to meet its objective.² State parties to the treaty meet annually at the Conference of the Parties (COP) to appraise progress in tackling climate change.³

The UNFCCC was the springboard of the Kyoto Protocol. The Kyoto Protocol extended the UNFCCC by providing for binding obligations for the reduction of GHG emissions. Under the Kyoto Protocol, GHG emissions were to be controlled in a manner that reflects the national differences in the GHG emissions as well as the wealth and capacity of nations to make the reductions.⁴ In addition, state parties could use flexibility mechanisms—International Emissions Trading (IET),⁵ Clean Development Mechanism⁶ and Joint Implementation⁷—to meet their targets.

The first commitment period under the Kyoto Protocol for reductions was 2008–2012. In 2012, the Doha Amendment amended the commitment period to 2013–2020. The Doha Amendment builds to the Paris Agreement. The Paris Agreement is a 'global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C'. It goes live in 2020 to pick up from the second commitment period. Additionally,

¹Article 2 UNFCCC.

²Article 17 UNFCCC.

³Article 7 UNFCCC.

⁴Article 10 Kyoto Protocol.

⁵Article 17 Kyoto Protocol.

⁶Article 12 Kyoto Protocol.

⁷Article 6 Kyoto Protocol.

it recommends that Parties should provide financial, technology transfer and capacity building support to developing country Parties to enable them to implement the Agreement.⁸

The global energy sector and particularly the use of fossil fuels has been identified as the largest contributor to GHG emissions.⁹ Accordingly, in a bid to ‘pursue efforts’ to limit global warming, many countries are undertaking a transition from a fossil fuel-dominated energy regime to a clean energy one which is often synonymous with renewables.

In Africa, however, a closer look tells a different story. On the one hand, there is an increased deployment of renewable energy projects across the region. For instance, in East Africa, Kenya in July 2019, launched the Lake Turkana Wind Power (LTWP) farm, which is now the largest wind power farm in Africa. The farm is providing 310 MW of power to the national grid.¹⁰ In West Africa, Senegal in December 2018 launched the Taiba Ndiaye Wind Project which is forecasted to become operational in 2020 and to generate 158 MW of reliable, low-cost energy¹¹ while in Ghana, the planned Nzema Solar Power Station although currently facing development hurdles, is posited to be the largest installation of its kind in Africa. Based on 630,000 solar photovoltaic modules, the Nzema Solar Power Station is expected to increase Ghana’s electricity generating capacity by 6% and power nearly 100,000 homes.¹² In North Africa, Morocco is also on its path to meeting 42% of its energy demand using renewables by deploying 2GW of solar and 2GW of wind capacity across the country¹³ and in the South, South Africa entered into 27 power purchase agreements (PPAs) worth USD4.6

⁸Articles 11(3) and 13(9) Paris Agreement.

⁹Whitesell William *Climate Policy Foundations: Science and Economics with Lessons from Monetary Regulation* (Cambridge University Press 2011).

¹⁰‘Lake Turkana Wind Power’, <https://ltwp.co.ke/>, accessed 9 August 2019.

¹¹‘Taiba Ndiaye Wind Project’, <http://www.taibaeolien.com/news/parc-eolien-taiba-ndiaye-celebrites-groundbreaking-on-west-africas-first-utility-scale-wind-farm/>, accessed 9 August 2019.

¹²Maame Esi Eshun and Joe Amoako-Tuffour Eshun ‘A Review of the Trends in Ghana’s Power Sector’ (2016) Energy Sustainability Society, <https://doi.org/10.1186/s13705-016-0075-y>, accessed 9 August 2019.

¹³G Tazi et al. ‘Estimating the Renewable Energy Potential in Morocco: Solar Energy as a Case Study’ (2018) IOP Conference Series: Earth and Environmental Science, <https://doi.org/10.1088/1755-1315/161/1/012015>, accessed 9 August 2019.

billion with independent power producers (IPPs) to produce 2300 MW of renewably generated power over the next five years.¹⁴

On the other hand, in the last one and a half decades, there has been a swell of oil, gas and coal discoveries across the African continent. In East Africa, Kenya pumped out its first 200,000 barrels of crude oil with a current market value of USD12.6 million in July 2019.¹⁵ In August 2019, the country made its first small-scale export. Kenya has also recently discovered viable coal and offshore natural gas deposits.¹⁶ In West Africa, Senegal is priming itself to become a large-scale oil and gas producer following the productive exploration and appraisal activities of its SNE and FAN fields.¹⁷ Senegal equally has significant recoverable coal reserves and has resorted to coal-fired power as it awaits its offshore gas fields to come online. Ghana too discovered commercial quantities of oil and gas in 2007. It has in the last decade reached first oil and production in numerous oil fields.¹⁸ In 2019, Eni announced further gas and condensate discoveries in offshore Ghana. In North Africa, the Office of Hydrocarbons and Mining (ONHYM) of Morocco indicates that the country has enormous untapped oil and gas potential and has gone ahead to issues onshore and offshore exploration permits for the same.¹⁹ Similarly, in the South, South Africa has also made a significant offshore oil and gas discovery in 2019 through Total.²⁰ Additionally, coal still remains one of its major exports. In essence, many African countries that were formerly net energy importers will in the coming years become

¹⁴Eberhard Anton and Naude Raine 'The South African Renewable Energy Independent Power Producer Procurement Programme: A Review and Lessons Learned' (2018) *Journal of Energy in Southern Africa*, <https://doi.org/10.17159/2413-3051/2016/v27i4a1483>, accessed 9 August 2019.

¹⁵'Tullow in Kenya', <https://www.tulloil.com/operations/east-africa/kenya>, accessed 9 August 2019.

¹⁶'Oil and Gas Exploration History in Kenya', <https://nationaloil.co.ke/upstream/>, accessed 9 August 2019.

¹⁷'Senegal', <https://www.far.com.au/africa/senegal/>, accessed 9 August 2019.

¹⁸Monica Skaten 'Ghana's Oil Industry: Steady Growth in a Challenging Environment' (Oxford Institute for Energy Studies 2018).

¹⁹'Energy Sector Overview', <http://www.onhym.com/en/>, accessed 9 August 2019.

²⁰'Total Makes Significant Discovery and Opens a New Petroleum Province Offshore South Africa', <https://www.total.com/en/media/news/press-releases/total-makes-significant-discovery-and-opens-new-petroleum-province-offshore-south-africa>, accessed 9 August 2019.

energy exporters, and most African countries will face the challenge of balancing their energy-intensive economies with their climate mitigation strategies.

Presently, half of Africa's population does not have access to electricity and around 75% of its population lacks access to clean cooking.²¹ This lack of access not only hampers economic growth but it also negatively impacts life expectancy and quality of life. It is estimated that Africa's current population will double by 2050.²² The growing population coupled with increased urbanization and industrialization in the continent means rapid increase in energy demand which Africa intends to meet using all its available energy resources,

It is on this premise that this chapter calls to question the practicability of African countries meeting their global commitments under the Paris Agreement and advocates for blended strategies that would allow African countries to capitalize their reserves while limiting their emissions consistent with the Paris Agreement.

3.2 Energy Landscape in Africa

While this chapter discusses the energy transition in Africa; all the 54 African states cannot be exhaustively evaluated within the confines of this chapter. Furthermore, the African energy landscape is not homogeneous. The chapter thus lends its focus to three African countries from the South (South Africa), East (Kenya) and North (Morocco) of the continent whose energy mix is predominately made up of renewables but who also have come to oil, gas and coal discoveries in the recent past.

A. South Africa

South Africa (SA) is located in the south most end of the continent. It covers a total surface area of 1,219,090 square kilometres.²³ SA has a

²¹International Energy Agency, 'Africa Energy Outlook 2040', <https://www.iea.org/reports/africa-energy-outlook-2019>, accessed 2 November 2019.

²²Ibid.

²³World Bank, 'South Africa', <https://data.worldbank.org/indicator>, accessed 30 August 2019.

temperate climate. As of 2018, it was estimated to have a population of 57,779,622, 24% of whom live in its rural areas.²⁴

SA's Energy Resources and Supply

SA has limited oil and gas reserves and meets its oil and gas requirements from imports. It, however, has large coal and uranium reserves as well as hydro, solar and wind resources.²⁵ Its energy supply is dominated by coal which accounts for about 77% of the primary energy followed by renewables at approximately 20%.²⁶

SA's Energy Demand and Consumption

The end use of SA's energy is 25% transport, 25% of electricity and 50% heating/cooling.²⁷ SA's economy rests predominantly on energy-intensive industries as such its industrial sector records the highest energy demand (36%) second to its transport and residential sectors, both of which record a 27% demand.²⁸

SA's Energy Outlook

It is forecasted that coal will continue to be the dominant source of energy for the foreseeable future in SA. SA is also the world's seventh largest coal producer and earns approximately USD4.2 Billion in revenue from exporting coal per year.²⁹ Its coal industry employs over 100,000 people in the SA population.³⁰

As regards, its emissions, SA is the 16th largest CO₂ emitter in the world with 80% of its emissions being from energy supply.³¹ The country signed the Paris Agreement and has committed to peak emissions (398–614MtCO₂e) by 2025 before plateauing for ten years and then declining after 2035.

²⁴Ibid.

²⁵Department of Energy, *South Africa Energy Sector Report (2018)*, <http://www.energy.gov.za/>, accessed 30 August 2019.

²⁶Ibid.

²⁷Ibid. (n 23).

²⁸Ibid.

²⁹Ibid. (n 23).

³⁰Ibid.

³¹'The Carbon Brief Profile: South Africa', <https://www.carbonbrief.org/the-carbon-brief-profile-south-africa>, accessed 30 August 2019.

SA's energy landscape is illustrative of African countries that are coal-dependent but also have formidable renewable energy resources. Such countries have an opportunity to utilize their renewable energy sources to diversify their energy mix, particularly by deploying them in the end-use sectors (such as power generation) that hitherto relied on coal, as part of their transition pathway.

B. Kenya

Kenya is located in the east of the continent. It covers a total surface area of 580,367 square kilometers.³² Kenya has a temperate climate in its inland, tropical climate in its coast and an arid climate in its northern region.³³ As of 2018, it was estimated to have a population of 51.4 Million, 73% of whom live in its rural areas.³⁴

Kenya's Energy Resources and Supply

Traditional renewable resources (bioenergy) has been Kenya's chief source of supply accounting for 76% of the total energy supply, followed by oil and oil products at 17%.³⁵

Kenya has remarkable renewable energy sources which it has deployed in electricity generation. As at 30 June 2019, Kenya had an installed electricity generation capacity of 2,712 MW comprising of hydro (826 MW), thermal (808 MW), geothermal (663 MW), wind (336 MW), biomass/cogeneration (28 MW) and solar (51 MW).³⁶

Future ambitions for the sector are detailed in Kenya's Least Cost Power Development Plan (LCPDP), its Vision 2030 document as well as the Power Sector Medium-Term Plan (PSMTP). From the documents, the country has seen an increased demand for electricity over the last few years. The peak demand shot up from 1,236 MW in 2011/12 to 1912 MW in 2019. Additionally, Kenya plans to surpass 5221 MW

³²World Bank, 'Kenya', <https://data.worldbank.org/indicator>, accessed 30 August 2019.

³³Ibid.

³⁴Ibid. (n 31).

³⁵International Energy Agency, Kenya (2019), <https://www.iea.org/countries/Kenya/>, accessed 30 August 2019.

³⁶KPLC Annual Report 2018/2019, <http://kplc.co.ke/category/view/39/annual-reports>, accessed 30 August 2019.

of capacity by 2022 and to connect 5 million new households and 15,739 public institutions to electricity through the Last Mile Connectivity Programme. Demand is expected to reach 2834 MW by the end of 2020 according to the PSMTF.

In July 2019, Tullow Oil announced that Kenya has pumped out 200,000 barrels of crude oil with a current market value of USD12.6 million.³⁷ In August 2019, Kenya exported the barrels pursuant to its Early Oil Pilot Scheme (EOPS).³⁸ Kenya has also recently discovered at least 1 billion metric tonnes of recoverable coal.³⁹

Kenya's Energy Demand and Consumption

Kenya's greatest share of energy use is from burning traditional biomass (wood and coal) for lighting, heating and cooking in the residential sector. Its use has, however, accelerated mass deforestation (which is an important factor in climate change) and has also increased the susceptibility of households to respiratory diseases. Kenya imports all of its petroleum products. Petrol and diesel are predominantly used in the manufacturing and transport sectors while kerosene is used chiefly in rural areas for lighting, heating and cooking.

According to data from the Kenya National Bureau of Statistics, Kenya's consumption of petroleum energy has increased consistently in the past five years and now stands at over 5,044,200 tonnes.⁴⁰ Liquefied Petroleum Gas (LPG) is also used in urban areas for heating and cooking. At present, Kenya is doing its groundwork to realize its 2030 vision of becoming a 'newly industrialising, middle-income country'.⁴¹ Energy is a critical component in the development of the Kenyan economy as it will be vital in the wholly energy-driven agriculture, Information and Communications Technology (ICT), manufacturing and transport sectors.⁴²

³⁷'Tullow in Kenya', <https://www.tulloil.com/operations/east-africa/kenya>, accessed 9 August 2019.

³⁸Ibid.

³⁹Kenya Data Portal, 'Coal Reserves', <http://kenya.opendataforafrica.org/bpiorse/coal-reserves>, accessed 9 August 2019.

⁴⁰Kenya National Bureau of Statistics, *Economic Survey Report 2019*.

⁴¹the Republic of Kenya, Kenya Vision 2030 (2007).

⁴²Ibid.

Kenya's Energy Outlook

With its Vision 2030 programme, the Kenyan government has set ambitious goals for the future economic growth of the nation, which undoubtedly implies that it will be scaling up its energy consumption. Kenya has also just joined the league of oil exporting countries and will now be considered to be increasing its GHG emissions through carbon leakage.

On the other hand, Kenya is committed to ensuring universal access to energy by 2022. The country has also committed to attaining 100% green energy sufficiency by 2022.⁴³ It has also pledged to a 30% reduction in economy-wide GHG emissions by 2030 compared to a business-as-usual (BAU) scenario of 143 MtCO₂e.⁴⁴

The Kenyan energy landscape is an exemplar of African countries where traditional and modern energy systems/practices coexist in their rural and urban areas respectively. This dualism often presents challenges to policymakers when restructuring for the energy transition. Such countries will need to pay special attention to the sustainable management of biomass as a source of energy. They will also need to develop sound policy and set up long-term measures to mitigate its negative consequences on health.

C. Morocco

Morocco is located in the north of the continent. It covers a total surface area of 446,550 square kilometres.⁴⁵ Morocco's climate is largely Mediterranean with Continental and Alpine climates in its mountainous regions and semi-arid climate in its southern parts.⁴⁶ As of 2018, it was estimated to have a population of 36,029,138, 38% of whom live in its rural areas.⁴⁷

⁴³Government of Kenya, *National Climate Change Action Plan 2018–2022*, <https://www.kccckp.go.ke/nccap-ii-2018-2022/>, accessed 30 August 2019.

⁴⁴Ibid.

⁴⁵World Bank, 'Morocco', <https://data.worldbank.org/indicator>, accessed 30 August 2019.

⁴⁶Ibid.

⁴⁷Ibid. (n 42).

Morocco's Energy Resources and Supply

Morocco has no considerable conventional energy resources. It is the largest net importer of energy in Africa. The Office of Hydrocarbons and Mining (ONHYM) of Morocco, however, indicates that the country has enormous untapped oil and gas potential and has gone ahead to issues onshore and offshore exploration permits for the same.⁴⁸

As regards renewable energy resources, Morocco has solar and wind potential estimated at 5-kilowatt hours (kWh) per square metre per day and 5000 terawatt-hours (TWh) per year, respectively.⁴⁹ Morocco's total primary energy supply (TPES) is dominated by primary and secondary oil (12,020 ktoe) followed by coal (4283 ktoe).⁵⁰

Morocco's Energy Demand and Consumption

Morocco's energy consumption is dominated by fossil fuels. Its energy consumption has doubled since the year 2000 and went over 15,000 ktoe in 2016.⁵¹ Morocco's greatest consumer of energy is its transport sector (33.2%), followed by the industry (26%), and the residential and commercial sectors (20.4%).⁵²

Approximately one-third of Morocco's total primary energy consumption is committed to electricity generation.⁵³ Owing to Morocco's population growth, rural electrification projects, infrastructure development, rural–urban migration and economic development, electricity demand has increased speedily.⁵⁴ The electricity demand is met primarily through thermal production (coal, gas and fuel and gasoline). The balance of the demand is satisfied through renewables (wind and hydro) and imports. Morocco's greatest consumer of electricity is its industrial and residential sector (20,082 GWh), followed by its commercial and agricultural

⁴⁸'Energy Sector Overview', <http://www.onhym.com/en/>, accessed 9 August 2019.

⁴⁹Export.Gov, *Morocco- Energy* (2018), <https://www.export.gov/article?id=Morocco-Energy>, accessed 30 August 2019.

⁵⁰International Energy Agency, *Morocco* (2018), <https://www.ica.org/countries/Morocco/>, accessed 30 August 2019.

⁵¹Ibid.

⁵²Ibid. (n 48).

⁵³Neimat Khatib, 'Country Profile: Morocco 2018' Renewable Energy Solutions for the Mediterranean & Africa, <https://www.res4med.org/wp-content/uploads/2018/06/Country-profile-Marocco-2.pdf>, accessed 30 August 2018.

⁵⁴Ibid.

sectors (5368 GWh) and finally its transport sector (332 GWh).⁵⁵ As of 2016, Morocco's installed capacity was 8261.7 MW, 70% of which was based on fossil fuels while the remaining installed capacity was sourced from renewables.

Morocco's Energy Outlook

Morocco has a burgeoning population and has a development plan to grow and diversify its economy. Part of its national strategic objectives is to improve energy security by reducing its energy import dependence on energy imports.⁵⁶

During COP 21, Morocco committed a 52% renewable energy target of installed production capacity.⁵⁷ To this end, in 2016 it launched the Ouarzazate Solar Power Station which has been ranked as the world's largest solar power plant (510 MW). Morocco intends further to increase the use of renewable sources for electricity production.

In 2012, 16% of the world's global GHG emissions were attributable to Morocco. It has set its GHG emission reduction target at 42% below BAU emissions by 2030.⁵⁸ It has also committed to an unconditional reduction target of 17% below BAU levels by 2030, taking into account reductions in Agriculture, Forestry and Other Land Use (AFOLU).⁵⁹

Morocco is an example of African countries that are dependent on imports of petrol and petroleum products and have untapped renewable energy resources as well as natural gas. Such countries will need to base their transition pathway on the increased use of renewable energy, the use of natural gas as a bridge fuel and regional energy integration.

From the foregoing, it is apparent that the energy trajectories of African countries are multiplex and highly differentiated. Further, African countries have a multiplicity of energy systems that simultaneously meet their energy needs, including biomass, modern renewable

⁵⁵Ibid. (n 48).

⁵⁶Ibid.

⁵⁷NDC Registry, Morocco Nationally Determined Contribution Under the UNFCCC, <https://www4.unfccc.int/sites/NDCStaging/Pages/Search.aspx?k=morocco>, accessed 30 August 2019.

⁵⁸Ibid.

⁵⁹Ibid. (n 51).

energy and fossil fuels. Countries such as Kenya where traditional renewable energy (biomass) dominate their energy mix suffer grave environmental drawbacks including air pollution and land degradation. It was also evident that although African countries have considerable renewable energy resources, these barely feature in their energy mix mainly because they are under-exploited. Fossil energy is seen to be pre-eminent in high-income homes and the energy-intensive transport, commercial and industrial sectors except for kerosene which primarily is used in the rural and low-income households for lighting. The non-oil exporting African countries like Morocco are heavily dependent on imports of petroleum products and are thus exposed to the peaks and troughs of energy prices. In contrast, oil and coal exporting countries are heavily dependent on the export earnings from oil and coal trade, and their economies would thus be affected by a transition to a lower carbon economy. Several African countries have also made recent oil, gas and coal discoveries and are looking to capitalize them and expand their economies.

Although consumption of energy is still low, individual African countries have elaborate economic development plans for the next decade as well as energy access commitments. It can thus be surmised that the contribution of African countries to global GHGs will be much higher in the coming years. It is from this perspective that the next section will discuss the problems and barriers such countries will face in transitioning to a low-carbon economy.

3.3 Barriers to the Energy Transition

Domestic emission reductions and flexibility mechanisms are the inevitable choices for countries to combat climate change and global warming and achieve sustainable development under the Kyoto Protocol and Article 4 of the Paris Agreement. The view is not entirely shared by African countries which are primarily engrossed with developing their economies. Currently, African countries only make a small contribution to GHG. However, with the advent of industrialization, urbanization and capitalization of the new discoveries, their contributions are projected to increase.

This section will thus examine the actuality, dilemma and hurdles African countries face in attaining sustainable development within the meaning of the Kyoto Protocol and the Paris Agreement.

3.3.1 Hydrocarbon Reserves

From the statistics in Sect. 3.2, it is evident that the continent is heavily endowed with hydrocarbon reserves.⁶⁰ Oil and gas companies consider Africa to be a frontier continent owing to its huge share of unexplored resources.⁶¹ Indeed, many African countries have recently made discoveries of substantial oil, gas and coal reserves.⁶² Oil, gas and coal are, in fact, the most significant components of Africa's energy demand. Oil remains the major fuel utilized in the transport and petrochemical sectors while gas and coal are utilized for power generation with coal being the cheapest fuel for baseload generation.⁶³ In urban centres, the gas takes the place of biomass for cooking purposes.⁶⁴

Many of the fossil fuel exporting African countries rely on the rents derived therefrom to fund government budgets or supplement budget deficits—there is a considerable public debate about utilizing revenues to meet budget deficit but as long as there is a commitment to responsible public financial management countries ought to have the flexibility to adapt their use of revenues as circumstances change. The countries that have just made discoveries are also looking to employ the income from trading these discoveries in the self-same way. African countries are thus faced with the conundrum of either electing to capitalize their reserves or to sink money in domestic reduction measures. Invariably, the balance of political expediency tilts in favour of the former.

Capitalizing the reserves also averts the risk of stranded assets—resources that prematurely written down or converted to liabilities before

⁶⁰Ibid. (n 10).

⁶¹BP, 'The Future of Oil: Seizing the Advantage', <https://www.bp.com/en/global/corporate/news-and-insights/bp-magazine/james-dupree-interview-bp-upstream-portfolio-advantaged-oil.html>, accessed 2 September 2019.

⁶²Ibid. (n 23).

⁶³Ibid. (n 19).

⁶⁴Ibid.

they are exploited thus resulting in possible market failure—which would not only affect the value, speed and scale of the economic transition but would ‘strand’ jobs and communities.

3.3.2 Developmental Aspirations

According to the United Nations Development Programme’s Human Development Report 2018, 53 out of the 55 African countries are categorized as developing states.⁶⁵ These states are currently pursuing efforts to not only develop and diversify their economies but also improve energy access in line with the sustainable development goals. Moreover, their populations continue to grow and urbanize. Predictably and inevitably, Africa’s energy demand is on an upward trajectory, much of which will be met by expanded use of fossil fuels. Indeed, according to Africa’s Energy Outlook Report, Africa’s energy demand will increase by 80% by 2040 and its demand for primary energy (excluding biomass) of will keep rising by 8.9% p.a, on until 2040 inclusive of energy, transport, industry, agriculture and housing sectors.⁶⁶

The Report also forecasts that the continent will continue to depend on fossil fuels and petroleum products even with the deployment of renewables because as the continent develops, its transport sector will continue to demand for oil (there is little demand and uptake of electric vehicles in Africa) and gas will be widely used as the bridge fuel for coal as renewable energy is developed.⁶⁷ African countries are thus faced with the challenge of whether to develop their economies (invariably through energy-intensive activities) or whether to reduce consumption as part of their climate mitigation strategies.

⁶⁵United Nations Development Programme, *Human Development Indices and Indicators: 2018 Statistical Update*, <http://hdr.undp.org/en/2018-update>, accessed 2 September 2019.

⁶⁶International Energy Agency, ‘Africa Energy Outlook 2040’, <https://www.icafrica.org/en/knowledge-hub/article/africa-energy-outlook-a-focus-on-energy-prospects-in-sub-saharan-africa-263/>, accessed 2 September 2019.

⁶⁷International Energy Agency, ‘Africa Energy Outlook 2040’, <https://www.icafrica.org/en/knowledge-hub/article/africa-energy-outlook-a-focus-on-energy-prospects-in-sub-saharan-africa-263/>, pp. 76–79, accessed 2 September 2019.

3.3.3 Energy Security

Renewable energy is often championed as the panacea for the narrow conception of energy security, i.e. stable supply. From this narrow perspective, renewable energy is indeed the magic bullet for energy security. This is because renewable energy sources are not prone to the risk of exhaustibility and it is therefore possible to secure energy supply over the long term, provided that the renewable energy resources are deployed sustainably.⁶⁸ Contemporary energy security however concerns itself with issues such resource distribution, resource availability, supplier reliability, import dependency, diversity in energy resources and infrastructure reliability. From this perspective, it becomes apparent that renewable energy is not a cure-all because of the issues discussed below:

Diversity

At first, when the infiltration of renewable energy is still low, diversity of sources in the energy mix increases thereby increasing energy security. However, the increased use of renewables leads to the domination of renewables in energy production thus undoing any initial diversity gains. The energy system essentially becomes a monopoly.⁶⁹ As a result, the energy system becomes exposed to the vagaries of a monopoly and particularly high prices which are incompatible with energy security.

Distribution of resources

It is generally assumed that renewable energy is a domestic resource and its utilization will therefore do away with import dependence.⁷⁰ However, the availability and distribution of renewable energy sources is country-specific and even in the countries with considerable renewable resources, the resources are usually sparsely distributed. This coupled with the variability of renewable energy sources already poses a risk to energy security. In order to smoothen this, these countries will have to depend on energy imports. Countries with relatively scarce endowment of renewable resources will also need to import renewable energy to

⁶⁸Ibid. (n 2).

⁶⁹Juoas Augutis and others 'Impact of the Renewable Energy Sources on the Energy Security' *Energy Procedia* Vol 61 (2014).

⁷⁰Ibid. (n 16).

meet demand thereby creating an energy dependence on the supplying countries. Inevitably, the renewables market will become vulnerable to the geopolitics of foreign supply (as in fossil fuels) and the danger of disruptions.⁷¹

Variability

A vast majority of renewable energy sources (i.e. wind, solar, hydro, marine) are associated with seasonal, diurnal or weather changes and even where their variability is predictable, the rate of change is not.⁷² Feedstocks used in the production of biofuels are equally subject to seasonal cycles. The variability of the individual renewable energy sources creates uncertainty as to capability of meeting demand and as such is a constraint to energy security.

Tied to variability is the fact that renewable energy sources are closely related to climate conditions. It is thus expected that climate change will have adverse implications on renewable energy sources. Changes in temperature, wind patterns or cloudiness as a result of climate change will further compound the variability of renewables.⁷³

Infrastructure reliability

The deployment of renewables almost always requires an upgrading of the grid and investment in storage. This requires massive amounts of metals and minerals. These metals and minerals are crucial in the manufacture of equipment to generate, store and distribute renewable energy.⁷⁴ They are however, depletable. Additionally, they are concentrated in a handful of countries. The supply of these minerals therefore affects the production, distribution and storage of renewable energy technologies which in turn has an impact on energy security.

From the above, it is apparent that it will be ineluctable for African countries to continue depending on fossil fuels despite increasingly

⁷¹Ibid. (n 19).

⁷²Godfrey Boyle *Renewable Energy: Power for a Sustainable Future* (3rd edn, Oxford University Press (2012).

⁷³Philipp Mueller 'UK Energy Security: Myth and Reality' The Global Warming Policy Foundation (2014).

⁷⁴Ibid. (n 2).

utilizing renewable energy sources because of the need for affordable, reliable, readily available and sufficient energy supply to meet demand.

3.3.4 Transition Risk

The transition to a lower carbon economy is not without risk for the countries that are dependent on fossil fuels for their energy needs and export ventures. The transition calls for the replacement or retirement of carbon-intensive industries and infrastructure. Companies and investors in these carbon-intensive industries will be impelled to close up shop and in anticipation will attempt to offset costs by passing them on to consumers. Equally, workers in these industries will suffer the risk of redundancy and unemployment. In South Africa, the aggregate impact of a transition to its coal industry and the ripple effect to its entire economy has been costed at USD120 billion.⁷⁵ This is arguably a ‘small’ cost to pay compared to the cost of the effects of climate change, however, when measured using time preference—the cost seems less onerous the further away in the time it has to be borne.

Governments will have to grapple with reduced income on the one hand and on the other, increased expenses from deploying energy systems and financially supporting industries and workers affected by the transition—yet the lower income will have already eroded the ability to offer such support.

These risks will naturally fall on the public balance sheet, thereby overburdening public finances as well as compromising the sovereign credit rating and the state’s capacity to meet its developmental agenda. African countries are thus faced with the daunting responsibility of absorbing and financing a transition risk and yet lack the capacity to do so.

⁷⁵Matthew Huxham et al., ‘Understanding the Impact of a Low Carbon Transition on South Africa’ (2019) Climate Policy Initiative (CPI) Energy Finance Report.

3.3.5 Technological Barriers

Central to domestic emission reductions is the deployment of clean energy systems through the development of both technological and institutional innovation. The overall level of technology in Africa is low while research and development are minimal owing to a combination of factors including lack of capacity/knowledge, colossal research outlays and high costs of investing in technology. For this reason, governments are not only unable but also unwilling to invest or even to commit to investing in technology development.

The UNFCCC and the Kyoto Protocol have explicit provisions on the transfer of technologies to developing countries. The Paris Agreement also enunciates the vision of wholly actualizing technology development and transfer for GHG emissions reduction as well as enhancing climate change resilience. These technologies are, however, only transferrable if they have been developed, to begin with. Further, at the core of the successful diffusion of technologies is the capacity of the developing countries to absorb them, which capacity is presently lacking. There also seems to be a lack of consensus on how Parties can and should undertake the diffusion.

Despite the awareness in the climate negotiations of the need to transfer technology to developing countries and despite developing countries undertaking technology needs assessments (TNAs) to ascertain their mitigation and adaptation and developing technology action plans (TAPs), for the realization of their technology needs, only moderate headway has been made in this regard. It is thus evident that any energy transition in African countries is more dependent on the actions of Annex 1 countries than on the efforts of African countries.

3.3.6 Prohibitive Costs

Although clean energy systems are lauded as being cheaper than fossil fuels since they have no fuel needs, they require much more capital expenditure than fossil-fueled systems. For instance, the cost of putting up an energy plant corresponds to the cost of putting up a fossil energy

plant and purchasing all the fuel that it will consume over its lifetime.⁷⁶ Even after considering the infrastructure costs of fossil-fueled systems, the aggregate cost of research, development, resource mapping, collection of geospatial and economic information, exploration, installation, construction and retooling of energy infrastructure to use variable and unreliable clean energy systems is still higher than that of fossil-fueled systems.⁷⁷

Additionally, the cost of deploying clean energy systems is determined by the cost of financing. Financing institutions generally impose higher interest rates for projects in African countries since the continent is considered high risk because of the rife legal and regulatory uncertainties.

These costs are compounded further by the fact that because most African countries are locked in fossil fuel subsidy schemes originally distributed to eradicate energy poverty and promote economic development by facilitating access to affordable modern energy. Persistence of these subsidies hinders clean energy systems from being competitive.⁷⁸

Intermittency of renewables also imposes additional costs on clean energy systems necessary for smoothening the variability of the resources such as storage costs or in the case of renewably generated electricity—profile costs, balancing costs and grid costs.⁷⁹ The aggregate amount of all these costs thus acts as a barrier for developing African countries to participate in the transition.

3.3.7 Policy Related Challenges

Even though most African countries, in the last decade, have put in place climate mitigation strategies and policies, their legal and regulatory frameworks are still sketchy and incongruous with their climate

⁷⁶David Timmons et al., 'The Economics of Renewable Energy'(2014) Global Development and Environment Institute.

⁷⁷Doug Hoffman, 'Switching to Renewable Energy Is Prohibitively Expensive', *Global Warming (Introducing Issues With Opposing Viewpoints)* (Greenhaven Press, 2012).

⁷⁸Michael Jakob et al., 'Development Incentives for Fossil Fuel Subsidy Reform' (2015) Vol 5 Nature Climate Change

⁷⁹Falko Ueckerdt et al., 'System LCOE: What Are the Costs of Variable Renewables?' (2013) Vol 63 Energy, 63.

change objectives. For instance, while Kenya has committed to attaining 100% green energy sufficiency by 2020, it continues to issue coal mining licenses to investors.⁸⁰ The High Court of Kenya in June 2019 nevertheless revoked one of such licenses holding that the environmental impact assessment (EIA) license issued by the National Environment Management Authority was generic and not specific to the coal project. The judgment, however, only serves to delay the project's development but does not put an end to it.

Implementation of the law is also protracted. In South Africa, for example, although the Integrated Resource Plan (IRP) 2010 is a living plan it is yet to be updated to provide insight as to the development of the country's energy mix and particularly the decision to install additional capacity from renewable energy sources.⁸¹

There is also usually a no distinct separation of roles and responsibilities of the different government agencies involved in climate change mitigation as well as lack of institutional capacity to undertake their responsibility.

3.3.8 Carbon Lock-In

Carbon lock-in refers to industrial economies that begin to be closed into fossil fuel-based technological systems by a 'path-dependent' process caused by technological, industrial and institutional increasing returns to scale so much so that even though alternative sources of energy are more economically viable, they are not embraced.⁸²

The current fossil fuel-based infrastructure, technologies and institutions in Africa will jointly restrict any energy transition due to the fact that they have been tried and tested and found true. This compounded by the colossal capital costs discussed earlier, the longevity of infrastructure and interdependence between governments, energy suppliers and

⁸⁰Ibid. (n 37).

⁸¹Jackie Midlane, 'Energy 2019| South Africa' (Global Legal Insights), <https://www.globallegalinsights.com/practice-areas/energy-laws-and-regulations/south-africa>, accessed 2 September 2019.

⁸²Pia Buschmann and Angela Oels, 'The Overlooked Role Of Discourse in Breaking Carbon Lock-In: The Case of the German Energy Transition' (2019) Vol 10 WIREs Climate Change

status quo technologies, imbed the carbon lock-in further. Equally, the exigency of climate mitigation efforts to avert climate change aggravates the liability of even the small lock-in risks and consequently, the uptake of clean energy systems.

3.3.9 Unactualized Financial Mechanism

The Convention established a Financial Mechanism to assist developing countries financially in meeting their commitments under the Convention. At COP 17 Parties designated the Green Climate Fund (GCF) as the operating entity of the mechanism, and it was commended that developed countries should mobilize climate aid totalling USD100 billion a year by 2020. At COP 21, Parties pledged to continue contributing to the fund and that prior to Cop 25, a new collective quantified goal would be set.

The fund has faced numerous operationalization setbacks.⁸³ There has been a reluctance by the developed countries to contribute to the fund.⁸⁴ There have also been reservations of how the fund is run.⁸⁵ Developing countries have also raised concerns about facing difficulty in having projects approved and receiving disbursements.⁸⁶

Once again, it is evident that any energy transition in Africa will be more dependent on developed countries fulfilling their commitments than on the efforts of African countries. Additionally, it appears the aid will not even be enough. According to the 2018 IEA Energy Outlook, it is projected that mitigation and adaptation costs may range between USD140–USD 175 a year by 2030—well above the pledged/mobilized funds.

Flowing from these, the next chapter will proffer strategies that African countries can adopt to resolve the said competing interests.

⁸³Megan Bowman and Stephen Minas, 'Resilience Through Interlinkage: The Green Climate Fund and Climate Finance Governance' (2018) Vol 19, Climate Policy.

⁸⁴Ibid.

⁸⁵Ibid. (n 17).

⁸⁶Sanjay Kumar, 'Green Climate Fund Faces Slew of Criticism' (2015) Vol 527, Nature.

3.4 Countermeasures and Suggestions

African countries have created time-specific development blueprints setting out aggressive social, economic and environmental targets. Equally, they have made commitments to varied energy-related goals and plans at national, regional and global levels. They have also tendered their Intended Nationally Determined Contributions (NDCs) to the UNFCCC process as immortalized in the Paris Agreement. As seen in Sect. 3.3, various obstacles stand in the way of these countries, achieving their ambitions of economic development and universal access to energy while diminishing GHGs. This section will thus discuss plausible strategies and solutions to those barriers.

3.4.1 Mitigation Strategies

Global economic growth and development over the last two centuries have been powered by fossil fuel-based energy. So vital is modern energy to economic development that it has been included as goal 7 in the Sustainable Development Goals (SDGs). Africa is now in its economic transition, which is heavily dependent on fossil fuels. It also has unexploited and newly discovered fossil fuel reserves.

The extent to which African countries should thus utilize their fossil fuel reserves in the wake of climate change has been a source of great debate with the larger international community calling for the abandonment of the reserves while the African countries question the fairness of such abandonment considering their minimal contribution to the climate crisis.⁸⁷

It is evident that the continent cannot chart the same carbon-intensive growth path that the larger international community did without serious climatic ramifications. On the other hand, any stranding of Africa's fossil fuel reserves will have crippling economic impacts. There is, therefore

⁸⁷Christophe McGlade and Paul Ekins, 'The Geographical Distribution Of Fossil Fuels Unused When Limiting Global Warming To 2 °C' (2015) Vol 517, Nature.

need to find a compromise that will allow African countries to develop their reserves and consequently their economies while simultaneously constraining carbon emissions.

3.4.1.1 Energy Efficiency and Energy Conservation

Carbon emissions are attributed to four factors—the carbon intensity of energy, the energy intensity of economic output, economic output and population growth.⁸⁸ Accordingly, in order to constrain carbon emissions while permitting economic development, countries must either cut back their energy intensity or their carbon intensity or do both.

Energy efficiency and energy conservation are suitable strategies for reducing energy intensity. Although both energy efficiency and energy conservation are energy intensity reducing measures, the former involves the use of technology to reduce energy intensity (reducing the energy used per level of production output) whereas the latter is making behavioural adjustments in order to reduce energy intensity (absolute energy savings).⁸⁹

African governments will thus have to create low carbon consuming habits and lifestyle consciousness through education and training as well as promote technical actions that improve energy efficiency thus allowing fossil fuel expansion albeit tempered to reduce energy intensity.

3.4.1.2 Clean Fossil Fuel Technology

African governments should also consider sustainably deploying fossil fuels using clean fossil fuel technologies. An example of such technologies is Clean Coal Technologies (CCTs). CCTs reduce GHGs when coal is used for heat and power generation either through altering the characteristics of the coal (coal upgrading technologies) or improving

⁸⁸Yoichi Kaya and Keiichi Yokobori *Environment, Energy, and Economy: Strategies for Sustainability* (United Nations University Press 1997).

⁸⁹US Energy Information Agency, 'Use Of Energy Explained' (2019), <https://www.eia.gov/energyexplained/use-of-energy/efficiency-and-conservation.php>, accessed 9 August 2019.

the efficiency of the plant or capturing the carbon emissions (Carbon Capture and Storage).⁹⁰

Other examples of clean fossil fuel technologies that can be deployed to constrain carbon emissions during power generation are conventional turbine technologies (e.g. Combined Cycle Gas Turbines [CCGT]), co-firing systems (combining coal with other fuels) and Combined Heat and Power (CHP) systems (using coal, oil or gas).⁹¹

It is worth noting that the economic viability of clean coal technologies and particularly CCS has been widely debated with critics arguing that the deployment of CCS on a global scale will greatly be contingent on the value and price that society places on the sustainability of the environment and the ecosystem and that CCS will only be scalable if there is a carbon price (the higher the price, the more the incentive for CCS and the quicker it becomes economically viable).⁹² Carbon price or not, the utilization of these technologies in Africa even at a smaller scale is restricted by the high investment and operation costs they require as well as lack of expertise. Suggestions on how to tackle these two issues will be dealt with later on in the chapter.

3.4.1.3 Utilizing Fossil Fuels as Building Blocks for Petrochemicals

The demand for petrochemicals is reported to have increased twofold since 2000.⁹³ Currently, the petrochemicals sector utilizes 14% and 8% of daily global use of oil and gas, respectively.⁹⁴ Research shows that coal can also be used as a feedstock for the sector.⁹⁵

⁹⁰International Energy Agency, 'Energy Technology Perspectives—Catalysing Energy Technology Transformations' (2017), <https://www.iea.org/etp2017/>, accessed 9 August 2019.

⁹¹Ibid.

⁹²Leigh A Hackett, 'Commercialisation of CCS What needs to happen?' (2016) IChemE Energy Centre.

⁹³International Energy Agency, 'The Future of Petrochemicals: Towards More Sustainable Plastics and Fertilisers' (2018), <https://www.iea.org/petrochemicals/>, accessed 9 August 2019.

⁹⁴Ibid.

⁹⁵Tao Ren And Martin Patel, 'Basic Petrochemicals from Natural Gas, Coal and Biomass: Energy Use and CO₂ Emissions' (2009) Vol 53 (9), Resources, Conservation and Recycling.

Petrochemicals have wide range utility including making up critical components of turbines, solar panels, batteries and electric vehicle car parts. Such application is both non-energy intensive and also low carbon-intensive. Petrochemicals are thus a way for African countries to not only sustainably exploit their fossil fuel reserves but also to develop both their economies and technology.

The disposal of petrochemicals, however, presents environmental pollution challenges and countries will, therefore, need to complement their production with waste management practices such as recycling.

3.4.1.4 Emissions Management for Exports

Historically, carbon emissions referred to the domestic emissions produced within the territory of a country. Over time, it became apparent that this narrow definition of carbon emissions failed to consider carbon-intensive imports consumed within the territory of that same country or the inverse—carbon-intensive exports are taken out of that country's territory. Indeed, empirical research has shown that net fossil fuel exporters such as Australia and Russia have relatively low territorial emissions but very high extraction-based emissions.⁹⁶ As such carbon emissions are now considered to be the total carbon emissions from using or producing products and services to satisfy annual national consumption.

African countries looking to capitalize their discoveries and exporting them must thus bear this in mind. African countries do not have binding commitments. It is however evident that emissions from their nascent discoveries would certainly take the world beyond the 1.5C warming above pre-industrial levels target and yet African countries cannot mitigate this because they are not eligible for emissions trading.

In order to offset their extraction-based emissions, African countries would need to participate in emissions trading. To this end, African countries should consider accepting binding commitments and thereby

⁹⁶Fakhri Hasanova et al., 'The Impact of International Trade on CO₂ Emissions in Oil Exporting Countries: Territory vs Consumption Emissions Accounting' (2018) Vol 74 Energy Economics.

obtain assigned units which they can transfer (when their emissions are lower than their target) or acquire (when their emissions are higher than their targets) to meet the objectives of the Paris Agreement.

3.4.1.5 Use of Biofuel in the Transport Sector

Increased urbanization and economic growth in the continent will prompt transport infrastructure development which will, in turn, lead to rapid motorization and increased petro-dependency even with the proliferation of renewables because of the continent's heavy reliance on fossil fuels for its transport sector.

There is currently very little uptake of electric vehicles in Africa primarily because of limited electricity access, high import taxes and the absence of infrastructure (charging facilities).⁹⁷ As the continent works on ensuring universal access, building charging points and developing battery storage options, it can reduce its emissions from fossil powered vehicles by fuel substitution in favour of biofuels produced from energy crops.

The production of biofuels, however, has key sustainability issues with great implications on the structure of agriculture, food security, biodiversity and climate change.⁹⁸ African countries will, therefore, need to put in place carefully designed biofuel policies beforehand.

3.4.2 Improving Energy Security of Renewables

As seen in Sect. 3.3.3, renewable energy is not a cure-all for energy security unless various strategies are employed to deal with the inherent variability of renewable energy sources and their interactions with all the components of an energy system. To this end, as deployment of renewable energy increases, African countries will need to preclude the domination of renewables in energy production and the probability of

⁹⁷Liu Xinying et al., 'Environmental Impacts of Electric Vehicles in South Africa' (2012) Vol 108 South Africa Journal of Science.

⁹⁸Jianliang Wang, 'Sustainability Assessment of Bioenergy from a Global Perspective: A Review' (2018) Vol 1 Sustainability.

creating a monopoly from such domination by developing an energy mix made up of the various renewable energy sources (geothermal, wind, hydro and solar). The countries will also need to further diversify sources by including conventional energy sources such as natural gas and charcoal in the energy mix. It will therefore be necessary to invest in the clean fossil fuel technologies discussed in Sect. 3.4.1.2 to complement their deployment.

Increased reliance on electricity generated from renewable energy will lead to high levels of grid penetration by renewables. African countries will need to develop new strategies for absorbing increasing amounts of intermittent energy into the power system while maintaining profitable and reliable operation of the grid. This can be done through modeling, system integration studies and assessments at both the transmission and distribution levels as well as dealing directly with utilities to ensure adoption of best practices. The countries will also need to consider demand-side management options as well as investing in energy storage technologies.

Although most African countries are richly endowed with renewable energy sources their uneven geographic distribution and variability will require smoothening through regional collaboration and grid interconnection with neighbouring countries.⁹⁹ In this regard, countries will need to invest in resource mapping and collection of geospatial and economic information on its renewable energy sources in order to pave way for renewable energy zoning and integration.

Finally, in order to deal with the issue of supply of minerals and other critical inputs that could limit the production of some renewable energy technologies, the continent should incentivize research and development of readily available substitutes. It will also need to develop efficient recycling systems so as to extend the life of the currently accessible metals and minerals.

⁹⁹Nalule VR, Regional Cooperation in the Establishment of Regional Energy Infrastructure. In *Energy Poverty and Access Challenges in Sub-Saharan Africa* (pp. 143–168) (Cham: Palgrave Macmillan 2019).

3.4.3 Mitigating the Transition Risk

Although the energy transition in Africa will be delayed, it is inevitable. It, therefore, behoves African countries to plan for it and its attendant risks. From Sect. 3.2, it is apparent that the transition risk(s) will fall on public balance sheets which balance sheets have little or no capacity to bear such risk(s) without disturbing other public services or having a ripple effect on the larger economy and ultimately the country's development agenda.

Accordingly, African countries will need to devise strategies of mitigating the transition risk or de-risking the transition. These could include early retiring of assets; accelerating exploitation of the new discoveries in order to capture revenues which can then be saved or invested and later used to compensate those affected by the transition early asset retirement; optimizing the public balance sheet for resilience and flexibility in preparation for the transition; encouraging economic diversification in anticipation of the energy transition and developing labour market policies to assist the employees who will suffer the risk of redundancy or unemployment.

3.4.4 Cost Recommendations

The prohibitive costs of renewable energy systems have stagnated their widespread deployment, and these costs are compounded by various factors, including the fact that, historically, fossil fuels in Africa have been the beneficiaries of subsidies. Other than in power generation, renewable energy sources have not benefited from this kind of leverage. Thus, African countries should first phase off fossil fuel subsidies so as to ensure the competitiveness of renewables. The governments should then offer financial and economic incentives (subsidies, reduced taxes or rebates) to encourage private sector investment in research, development of renewables and manufacture of renewable energy technology. It will be imperative for the incentives to be targeted and not just general, conditional on performance and revised periodically so as to ensure that they are effective.

Governments should collaborate with international financial institutions to develop the capacity of local banks to assess and fund renewable energy projects and thus grow investment funds from domestic financial resources. Morocco is a good example in this regard with its Morocco Sustainable Energy Finance Facility (MorSEFF), launched jointly by the European Bank for Reconstruction and Development (EBRD) which has now channelled 80 Million Euros through local participating banks into energy projects in the country.¹⁰⁰

3.4.5 Policy Recommendations

Although African countries have international climate change commitments, their national laws either contradict or are at odds with their international goals. There is, therefore, need for African countries to align their national plans and policies with their international commitments as well as to synchronize the national policy across all the government departments.

The continent also needs to address its administrative deficiencies by building capacity for the different technical, economic and market commercialization aspects of the transition. This can either be through using resource revenues for training or by putting in place local content drivers that ensure knowledge transfer from international investors.

African countries should consider developing policies on cleaner cooking to replace traditional biomass such as charcoal and fuelwood, which, dominates Africa's energy mix. Countries such as Ghana and Rwanda are already leading examples in this regard having collaborated with the Global Alliance for Clean Cookstoves to promote the diffusion of clean cooking stoves.

In order to invite new investments and sustain the notable growth of renewables in the continent, African countries should also institute fair and stable tax policies. The United State's Production Tax Credit (PTC) is a good example of such a policy. It essentially offers the necessary financial support for the first decade of a renewable energy facility's

¹⁰⁰European Bank for Reconstruction and Development, 'Morocco SEFF' (2015), <https://www.ebrd.com/work-with-us/projects/psd/morocco-seff-morseff.html>, accessed 9 September 2019.

operation.¹⁰¹ Although it is now being phased out of the United States and being replaced by a separate initiative that will promote renewable energy storage and transmission, it is a good starting point for African countries.

Other policies necessary for the energy transition include policies on; the energy efficiency of buildings in anticipation of the continent's imminent and rapid infrastructural development; modelling and system integration of renewable energy to ensure its maximum absorption into the energy mix, decommissioning of coal mines and oil wells as well as policies on social aid for employees affected by the transition.

3.4.6 Technological Recommendations

Only moderate headway has been made in the 'North–South' technology transfer. Moreover, African countries lack the capacity to absorb any technology transferred. To resolve this, African countries could consider joining technology collaborative networks such as IEAS's Networks of Expertise in Energy Technology (NEET) initiative which seeks to assist energy-consuming countries to develop expertise and experience in clean and advanced technologies. Thereupon through practices such as reverse engineering, incremental learning and prototyping the continent can build manufacturing competence.

African governments can also take part in coordinating university–industry collaborations and improving science education so as to meet the technological needs of the transition. This has proved useful in other countries like Malaysia, where its ministries of finance and higher education are jointly working with its ministry of energy to build technological capacity.¹⁰²

¹⁰¹Amy Myers Jaffe, 'A New Dawn for Wind Energy Infrastructure After the Production Tax Credit Sunset' (*Energy Realpolitik*, 15 July 2019), <https://www.cfr.org/blog/new-dawn-wind-energy-infrastructure-after-production-tax-credit-sunset>, accessed 9 September 2019.

¹⁰²Mar Hudin et al., 'Renewable Energy Investment in Malaysia: An Integrated Model in Evaluating Public Decision Making Process' (2017) Vol 5(4) *Journal of Clean Energy Technologies*.

3.5 Conclusion

As seen in Sect. 3.3, African countries are faced with the dilemma of whether to capitalize their newly discovered resources and develop their economies or whether to abide by their commitments under the Paris Agreements. Other factors that were observed that stand in the way of the continent's energy transition include; energy security—African countries are impelled to continue depending on fossil fuels despite increasingly utilizing renewable energy sources because of the need for affordable, reliable, readily available and sufficient energy supply to meet demand. Additionally, the transition calls for the replacement and retirement of carbon-intensive industries and infrastructure. The burden of the aggregate impact of such action and its contagion effect on the wider economy falls on the public balance sheet, which often is unable to bear it. Africa also lacks the technical know-how and expertise required for the deployment of clean energy systems and the 'North–South technology transfer envisioned by the Paris Agreement has been of no help. The cost of research, development, resource mapping, collection of geospatial and economic information, exploration, installation, construction and retooling of renewables and renewable clean energy systems is well beyond the reach of many African countries, and the Financial Mechanism enshrined in the UNFCCC to assist developing countries in this regard has been met with several operationalization challenges including a lack of commitment by developed countries and contests on how the fund is managed and how projects are approved. It was also observed that the legal and regulatory framework of most African countries were at cross purposes with their Paris Agreement objectives or were simply not conducive for investment.

To surmount these hurdles, the chapter in Sect. 3.4 makes a number of propositions outlined hereinafter. First, African countries should embrace energy efficiency and energy conservation measures. Particularly, they should use education and training to create awareness of low carbon consuming habits and lifestyles. They should also push for technical actions in the energy sector and industries to improve energy efficiency, thus resulting in reduced utilization of fossil fuels. Second, African countries should look into ways of sustainably deploying fossil

fuels. One way to do this is by using clean fossil fuel technologies. Most of these technologies have high investment and operation costs and will, therefore, require African countries to source funds for their installation and management. Proffered ways in the chapter for African countries to raise funds include—private sector engagement, green bonds, bilateral development cooperation and from multilateral development banks.

Another way for African countries to exploit their fossil fuels while reducing their carbon footprint is by using fossil fuels as building blocks for petrochemicals. They will, however, need to complement such use with waste management practices; otherwise, it will be a zero-sum game as pollution of the environment will negate the very gains made from converting fossil fuels into petrochemicals. Additionally, total carbon emissions now include carbon-intensive exports taken out of that country's territory. As such, fuel exporting countries will need to find ways to offset their extraction-based emissions. The most common way of offsetting extraction-based emissions is through emissions trading, African countries would, therefore, need to participate in emissions trading. To this end, African countries could consider accepting binding commitments and thereby obtain assigned units which they can transfer (when their emissions are lower than their target) or acquire (when their emissions are higher than their targets) in order to meet the objectives of the Paris Agreement. African countries will also need to moderate their emissions from fossil powered vehicles. In the build-up to the uptake of electric vehicles, they could reduce their vehicular carbon emissions by substituting fossil fuels for biofuels produced from energy crops. The production of biofuels, however, has key sustainability issues with great implications on the structure of agriculture, food security, biodiversity and climate change and African countries will thus need to put in place carefully designed biofuel policies to ensure that the utilization of biofuels is both viable and sustainable.

Other strategies discussed in Sect. 3.4 are—African countries should come up with transition mitigating and transition de-risking plans such as early retiring of assets plans or economic diversification plans in anticipation of the energy transition, in a bid to mitigate and de-risk the transition. The countries should also fine-tune their legal and regulatory framework to accord with their global climate mitigation strategies.

Equally, they should pass laws issuing financial and economic incentives so as to encourage foreign investment in their renewable energy sectors. They should also make an effort to build technological capacity through collaborations among government, industry and universities or through collaborative technology networks.

Summarily, therefore, African economies are experiencing a transformative era. Africa's energy sector and particularly its fossil fuel reserves hold great promise to stimulate Africa's economy and to empower expansion and development. The continent cannot, however, follow the same carbon-intensive development route that the rest of the world took without serious implications on climate change. African countries must therefore adopt a blend of creative strategies that will allow them to exploit their resources but in a manner that does not jeopardize the climate or their commitments under the Paris Agreement.

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4

Nuclear Energy & Energy Transitions: Prospects, Challenges and Safeguards in Sub-Saharan Africa

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Video interview by the author discussing this book chapter can be accessed at, <https://www.youtube.com/watch?v=bt3n-sgpgjI&t=2868s>. Last accessed on 1st September 2020.

4.1 Introduction

The 2030 Agenda for Sustainable Development¹ under goal seven calls for concerted efforts in ensuring access to modern and cleaner forms

¹The concept of sustainable development and sustainability as it appears today was first established by the Brundtland Commission in 1987. It is currently recognised as the standard definition, and it espouses that sustainable development is 'a development that meets the needs of the present without compromising the ability of future generations to meet their own needs.' See 'Transforming Our World: The 2030 Agenda for Sustainable Development, 2015,' http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E. See also the 2000 Millennium Development Goals, <http://www.un.org/en/mdg/summit2010/pdf/List%20of%20MDGs%20English.pdf>.

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of energy while goal 13 provides for taking action to combat climate change. Moreover, the 2015 Paris Agreement² puts in place measures and conditions for all Member States to mitigate climate change by reducing emissions to '*hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognising that this would significantly reduce the risks and impacts of climate change*',³ with access to clean energy being key in the cause. The world is, therefore, looking for cleaner forms of energy as compared to the traditional fossil fuels which are considered detrimental to the environment for their far-reaching consequences on the climate.

In the fight against climate change, therefore, all measures which alleviate the problem must be explored. Although nuclear energy was widely shunned and a significant part of the population remains sceptical about its use, it stands as one of the cleanest forms of energy with little emissions as compared to the widely used fossil-based fuels. It thus offers a bigger platform for mitigating climate change and meeting electricity demands of the world,⁴ especially in the least developed countries like those in the SSA region. Nuclear energy is a form of energy produced by an atomic reaction, capable of producing a cleaner alternative source of electrical power to that produced by traditional fossil fuels.

However, the use of nuclear power energy is not immune to criticism. Following the Chernobyl nuclear accident of 1986 and the Fukushima Daiichi accident of 2011 in Japan, many countries and people are cynical about the use and production of nuclear energy.⁵ This is because it has many adverse related consequences if things go wrong, including environmental degradation, social and economic loss and damage, *inter alia*. These hazards have raised the global action, especially with an

²See the Paris Agreement, 2015, United Nations, https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.

³Ibid., Article 2.

⁴OECD, *Risks and Benefits of Nuclear Energy*, 2007, Nuclear Agency, Organisation for Economic Cooperation and Development pp. 19, 20.

⁵Patricia Birnie, Alan Boyle and Catherine Redgwell, *International Law and the Environment*, 2009, Third Edition, Oxford University Press p. 488.

increased focus on nuclear safety, environmental protection and comprehensive liability regimes in determining how nuclear victims are to be compensated or who bears the burden of compensation.⁶

Moreover, there exists an active nuclear science and technology sector in Africa, and this includes several research reactors, and with many governments expressing interest in starting commercial nuclear programmes.⁷ Several States in SSA are currently exploring or investing in the use of nuclear energy to meet the enormous demands of power for their populations. Such countries include Uganda, Ethiopia, Tanzania, Namibia, Rwanda and Zambia, among others, with South Africa being the only country in the region which already has a commercial nuclear power plant. Globally, there are some countries like France which are heavily reliant on nuclear energy, and these are used as benchmarks by the rest of the world in determining how they can manage the nuclear industry successfully.

The author acknowledges that the development of nuclear power energy requires several safeguards like proper technology, sound financing sources, skilled workforce, and goodwill of the people, among others. However, this chapter is majorly limited to legal and policy safeguards on nuclear safety, social and environmental protection. It tackles one major question: What are the critical legal and regulatory issues to be addressed for the active development and management of the nuclear energy power industry in SSA? This chapter thus argues that aligning Africa's policies with the global nuclear legal regimes is crucial in determining the region's energy future. Further, that effective policy choices can guide the continent to a more inclusive and sustainable energy future and accelerate its economic and industrial development⁸ while meeting the objectives of the climate change regime.

⁶See Abigail Sah, Jessica Lovering, Omaro Maseli and Aishwarya Saxena, *Atoms for Africa: Is There a Future for Civil Nuclear Energy in Sub-Saharan Africa?* 2018, CGD Policy Paper. Washington, DC: Center for Global Development, <https://www.cgdev.org/publication/atoms-africa-there-future-civilnuclear-energy-sub-saharan-africa>.

⁷Ibid., at p. 5.

⁸International Energy Agency, *Africa Energy Outlook 2019*, 2019, World Energy Outlook Special Report, p. 18.

It tackles the significant challenges posed by the use of nuclear energy ranging from social, economic and environmental aspects. Section 4.2 examines the relationship between nuclear power, access to electricity and climate change. It also examines the major social, economic, ecological and regulatory concerns around nuclear use and reflects on the nuclear power accidents of Chernobyl and Fukushima Daichi. Section 4.3 discusses the international nuclear legal regime on matters of safety, nuclear accident liability, environmental and social protection, *inter alia*. Through a comparative analysis, Sect. 4.4 analyses the status of the nuclear sector in the European Union (EU) with a focus on France and draws success lessons for guiding policy in SSA for the emerging industry. It also examines the energy challenges of SSA and the status of nuclear activity and its regulation. Chapter 6 makes recommendations and conclusions.⁹

4.2 Nuclear Energy: Access to Energy and Climate Change

This section discusses the nexus between nuclear energy, access to electricity and climate change. It also highlights both the pros and cons of the use of nuclear power and why public perception has remained low.

4.2.1 Nuclear Energy and Access to Energy

Energy is key to the achievement of economic growth and development. As such, under Goal 7 of the Sustainable Development Goals (SDGs), there are global commitments to ‘*Ensure access to affordable, reliable, sustainable and modern energy for all*’. This also includes increasing

⁹For a full discussion on nuclear energy, watch the video featuring the author and other experts. Nuclear Energy Developments in Africa. Link, <https://www.youtube.com/watch?v=bt3n-ssgpJl&t=136s>.

the use of renewable energy worldwide.¹⁰ SSA countries are still struggling with energy access and energy poverty challenges. Moreover, Sub-Saharan Africa experiences energy insecurity due to some crucial changes such as population growth, fast-tracked urbanization, economic development and relative price changes of other energy options. These make the region more susceptible to the effects of climate change.¹¹ The people therefore mainly depend on wood-based biomass for their energy needs, with approximately 81% of households relying on it.¹² Most energy in Sub-Saharan Africa, with South Africa being the exception, is used for cooking, which accounts for around 70% of the total final consumption as compared to less than 10% globally.¹³ Therefore, taking into account the energy access challenges in SSA, there is potential for nuclear energy to contribute in tackling these challenges.

4.2.2 Nuclear Energy and Climate Change

Nuclear energy can play a significant role in not only tackling energy access challenges in SSA but also the fight against climate change. There is also a global movement to transition to a low-carbon economy and

¹⁰See SDG 7.2; Many NDCs currently feature renewable energy which shows its role in addressing climate change. Out of the 194 parties to the UNFCCC which adhered to the Nationally Determined Contributions (NDCs) under the 2015 Paris Agreement, for instance, 145 referred to renewable energy as being key in the mitigation of climate change. In addition, 109 parties have incorporated some form of quantified targets for renewables. Several sub-Saharan African States have either ratified, accepted, approved or accented to the Paris Agreement. The Agreement is in force in the countries including Botswana, Cameroon, Burundi, Democratic Republic of Congo, Ethiopia, Ghana, Nigeria, Kenya, Uganda, Malawi, South Africa, Rwanda, and Zimbabwe *inter alia*. They are thus enjoined to meet their own NDCs as well as adhering to objectives and targets of the Agreement. See IRENA, *Untapped Potential for Climate Action: Renewable Energy in Nationally Determined Contributions*, 2017, p. 7, International Renewable Energy Agency, Abu Dhabi, http://irena.org/-/media/Files/IRENA/Agency/Publication/2017/Nov/IRENA_Untapped_potential_NDCs_2017.pdf; See Also the UN Report of the Secretary-General, *Special Edition: Progress Towards the Sustainable Development Goals*, 2019, Economic and Social Council.

¹¹World Bank, *Wood-Based Biomass Energy Development for Sub-Saharan Africa: Issues and Approaches*, at p. 8, 2011, Energy Sector Management Assistance Program (ESMAP); World Bank, Washington, DC. © World Bank, <https://openknowledge.worldbank.org/handle/10986/26149>, License: CC BY 3.0 IGO.

¹²World Bank, 2011, *ibid.*, at p. v.

¹³IEA, *Africa Energy Outlook 2019*, *supra*, at p. 86.

fight climate change by reducing reliance on fossil fuels. This presents an opportunity for the development and utilization of Nuclear energy. Nuclear energy is a form of energy produced by an atomic reaction. A nuclear reactor produces energy through a chain reaction that splits a uranium nucleus, releasing energy in the form of heat. The collision of one neutron with one nucleus of uranium leads to the production of electricity, among others. Many SSA countries such as South Africa, Zimbabwe, Namibia, Botswana, Malawi and Zambia have got large uranium deposits, and this makes the region a fertile ground for the growth of the nuclear industry.¹⁴ Namibia alone has got the potential of providing 10% of the world's mining output due to its substantial uranium deposits and mines.¹⁵

Nuclear energy is capable of producing an alternative source of electrical power to that supplied by the traditional sources—coal, gas, or oil which are considered unclean.¹⁶ This is especially important in a world where the focus is shifting from the conventional energy sources to other forms with a less carbon footprint in a bid to mitigate climate change—the ‘energy transition’.¹⁷ Nuclear energy, although not renewable per se, is a clean source of power considering its tiny carbon footprint.

With respect to the nexus between nuclear energy and climate change, it is worth briefly exploring what climate change means. The Intergovernmental Panel on Climate Change (IPCC) defines climate change as those changes in the state of the climate which persist for an extended period whether due to natural causes or because of human activity.¹⁸ The adoption of the Paris Agreement in 2015 which focuses a lot on

¹⁴Further information at, <https://www.world-nuclear.org/information-library/country-profiles/others/uranium-in-africa.aspx>; See also OECD Nuclear Energy Agency and International Atomic Energy Agency, *Uranium 2018: Resources, Production and Demand (Red Book)*—A Joint Report by the Nuclear Energy Agency and the International Atomic Energy Agency, <https://www.oecd-neo.org/ndd/pubs/2018/7413-uranium-2018.pdf>.

¹⁵See World Nuclear Association, ‘Nuclear in Namibia,’ <https://www.world-nuclear.org/information-library/country-profiles/countries-g-n/namibia.aspx>.

¹⁶See OECD, *Risks and Benefits of Nuclear Energy*, 2007, *supra*.

¹⁷Nalule, V.R.,. Transitioning to a Low Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels? In *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions*, 2020 (pp. 261–286). Palgrave Macmillan, Cham.

¹⁸IPCC, *Fourth Assessment Report: Climate Change 2007*, 2007, https://www.ipcc.ch/publications_and_data/ar4/syr/en/mains1.html.

reducing greenhouse gas (GHG) emissions has seen a surge in the efforts for a global transition to a low-carbon economy by advocating for a shift from fossil fuels to cleaner sources. However, much focus has always been on renewable energy.¹⁹

Besides, one of the significant ways through which climate change can be mitigated is by reducing the amounts of carbon emitted through the use of clean energy.²⁰ This is because a lot of pollution is proven to occur from the use of traditional fossil fuels and from the use of wood-based fuels in many developing countries where there is limited access to modern fuel means.²¹ About 78% of the total global GHG emissions between 1970 and 2010 resulted from CO₂ emissions from fossil fuel combustion and industrial processes, with the trend continuing for proceeding years.²²

There is no universally agreed definition of the term ‘clean energy’. However, it is usually defined descriptively by referring to energy sources by the level at which they emit pollutant substances to the environment. The Environmental Protection Agency (EPA) for instance defines clean energy as those resources which meet energy demand needs with less pollution compared to the conventional fossil-based sources—in essence; they have a low carbon footprint.²³

¹⁹Ibid., p. 261.

²⁰See Mark Maslin, *Climate: A Very Short Introduction*, Oxford University Press, 2013 at p. 120.

²¹In fact, about half of the world's population and 80% of Africans rely on wood-based fuels for their energy needs. See World Bank, *Wood-Based Biomass Energy Development for Sub-Saharan Africa: Issues and Approaches*, at p. 8, 2011, Energy Sector Management Assistance Program (ESMAP); World Bank, Washington, DC. © World Bank, <https://openknowledge.worldbank.org/handle/10986/26149>, License: CC BY 3.0 IGO.

²²IPCC, *Climate Change 2014: Synthesis Report*, 2014, Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, RK Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, pp. 45–47.

²³US Environmental Protection Agency (EPA), *Assessing the Multiple Benefits of Clean Energy: A Resource for States*, 2011, at p. 2, https://www.epa.gov/sites/production/files/2017-06/documents/epa_assessing_benefits_ch1.pdf.

4.2.3 Nuclear Energy: Merits and Challenges

While nuclear energy is an attractive option in terms of being clean, reliable and cost-effective for the developed world, in Africa, nuclear power could be the answer to the continent's energy deficiency.²⁴ Other advantages of nuclear energy include the low emission of carbon dioxide and other greenhouse gases and low operating costs.

There is also a direct link between SDG 7 on access to energy and SDG 13, which requires taking action on combating climate change and its impacts. Studies also show that access to modern forms of energy is closely intertwined with and has got a direct bearing on other SDGs. For instance, SDG 7 on affordable and clean energy has a direct impact on the SDG goals on the eradication of poverty²⁵; eradication of hunger, food security and sustainable agriculture²⁶; healthy lives²⁷; and gender equality,²⁸ among others.²⁹

However, the nuclear energy industry is a complex one, and it has got potential grave negative impacts on the environment if not properly managed. By their nature, nuclear activities produce solid, liquid and gaseous waste with some being radioactive. Besides, atomic installations have a lifespan, and even when they are no longer in operation, they must stay in a satisfactory safety condition following the proper standards of dismantling installations. Even so, dismantling operations produce radioactive waste which has to be managed to avoid the resulting consequences on both people and the environment.

Furthermore, the risks posed have got the potential to cause trans-boundary harm or pollution damage to other states. These perils are graver when it comes to the issue of accidents occurring from nuclear operations as can be seen from the Chernobyl and the Fukushima

²⁴Laura Gil, *Is Africa Ready For Nuclear Energy? Economic Growth Puts Pressure on Countries to Go Nuclear, But Hurdles Remain*, September 2018, IAEA Office of Public Information and Communication, <https://www.iaea.org/newscenter/news/is-africa-ready-for-nuclear-energy>.

²⁵See SDG 1.

²⁶See SDG 2.

²⁷See SDG 3.

²⁸See SDG 5.

²⁹See Nalule, V.R., *Energy Poverty and Access Challenges in Sub-Saharan Africa: The Role of Regionalism*, 2018. Springer.

Daiichi incidents. The world first awoke to the gruesome menaces of the nuclear power accidents following the explosion at the Chernobyl nuclear power plant on April 26, 1986, in Ukraine (formerly the Soviet Union).³⁰ This caused adverse effects such as damage to the atmosphere environment, urban environment, agriculture, forestry and the aquatic environment, the contamination of the environment with radioactive substances, evacuation and relocation of more than 300,000 people as well as transboundary impacts.³¹

The Fukushima Daiichi nuclear power accident of 2011 in Japan presents yet another shocking face of the nuclear energy industry.³² The accident resulted from a 9.0 magnitude earthquake which triggered a 15-meter tsunami, causing damage at the Fukushima Daiichi Nuclear power plants operated by the Tokyo Electric Power Company (TEPCO). The plant experienced hydrogen explosions and a meltdown, leading to the releasing of radiation into the environment. This led to contamination of soil and groundwater, and today, there is still evidence of contamination of the Pacific Ocean. Although no deaths or cases of radiation were recorded, over 85,000 people were evacuated from their homes following the accident.³³

In conclusion, the use of nuclear energy presents many opportunities for SSA's energy access and security challenges as well as fostering the

³⁰See Nuclear Monitor, 'Chernobyl: Chronology of a Disaster,' A publication of the Wise Information Service on Energy (WISE) and the Nuclear Information and Resource Service (NIRS), March 2011 issue No. 724 pp. 2–4, <https://www.nirs.org/wp-content/uploads/mononline/nm724.pdf> (accessed on 10/4/2020).

³¹See, IAEA, *Environmental Consequences of the Chernobyl Accident and Their Remediation: Twenty Years of Experience/Report of the Chernobyl*, Forum Expert Group 'Environment'.—Vienna: International Atomic Energy Agency, 2006. p.; 29 cm.—(Radiological assessment reports series, ISSN 1020-6566) STI/PUB/1239 ISBN 92-0-114705-8, https://www-pub.iaea.org/MTCD/publications/PDF/Pub1239_web.pdf (accessed on 10/4/2020).

³²Stephen L. Kass, 'International Law Lessons from the Fukushima Nuclear Disaster,' *New York Law Journal* April 29, 2011, www.clm.com/publication.cfm?ID=324; World Nuclear Association www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-accident.aspx; World Nuclear Association <www.world-nuclear.org/focus/fukushima/fukushima-accident.aspx> (all accessed on 10/4/2020).

³³Eri Osaka, 'Corporate Liability, Government Liability, and the Fukushima Nuclear Disaster, 21 PAC,' *RIM L & POL'Y J.* 433 (2012): 433–459, <https://digitalcommons.law.uw.edu/wilj/vol21/iss3/3> (accessed on 10/4/2020).

mitigation of climate change. As such, the region can meet its sustainable development targets under Goals 7 and 13. This is because nuclear is a more reliable and cleaner form of energy compared to traditional energy sources. However, the associated risks to human health, society and environment and the disastrous magnitude of the accidents, for instance, Chernobyl and Daiichi make many people opposed to the development of the industry. These perils necessitate the setting up of a robust regulatory regime on global, regional and national scales to establish common legal and regulatory standards.³⁴ In so doing, a generally accepted minimum level of social and environmental protection is set.³⁵

4.3 The International Legal Order on Nuclear Energy

There are currently four broad areas where global and regional regulation of nuclear energy is focused, and these include liability and compensation for nuclear damage, environmental protection, nuclear safety and emergency response, and Non-proliferation and nuclear security. International and regional institutions on nuclear use include the International Atomic Energy Agency (IAEA)³⁶; International Commission on Radiological Protection (ICRP)³⁷; Euratom Treaty³⁸; the OECD Nuclear Energy Agency; and the Inter-American Nuclear Energy Commission (IANEC).

³⁴Ibid., at p. 493.

³⁵Ibid.

³⁶The IAEA is a creation of the Statute of the IAEA which was approved on October 23, 1956, by the Conference on the Statute of the International Atomic Energy Agency.

³⁷Created in 1928, the ICRP is a non-governmental organisation responsible for assessing the knowledge of States on the effects of radiation and advising on the most appropriate radiological protection rules to adopt.

³⁸See Article 2 of the 1957 Eurotam Treaty.

4.3.1 Liability and Compensation for Nuclear Damage

In any accident arising from nuclear operations, the pressing issue is guaranteeing that there are proper measures for compensating the resulting damage.³⁹ The compensation relates to loss of life or personal property and any resultant economic loss, costs for repairing the environment and the financial loss resulting from the use of the environment thereof and the cost of preventative measures, among other things. The Paris Convention on Nuclear Third-Party Liability (The Paris Convention)⁴⁰ establishes a liability regime for the compensation of victims arising out of nuclear accidents. It relies on principles like the exclusive liability—‘strict liability’—of the operator of a nuclear installation.⁴¹ There exists the Brussels Supplementary Convention on Third Party Liability in the Field of Nuclear Energy (Brussels Supplementary Convention) which covers incidents arising out of nuclear activities of the contracting States, including those causing transboundary harm.⁴² Others include the Vienna Convention on Civil Liability for Nuclear

³⁹Raphael J. Heffron, Stephen F. Ashley and William J. Nuttall, ‘The Global Nuclear Liability Regime Post-Fukushima Daiichi,’ *Progress in Nuclear Energy* 90 (2016): 1–10 at pp.6–8.

⁴⁰Convention on Third Party Liability in the Field of Nuclear Energy, 1960, as amended by the Additional Protocol of January 28, 1964, and by the Protocol of November 16, 1982, https://www.oecd-neo.org/law/nlparis_conv.html.

⁴¹See Article 3 of the Paris Convention. See Heffron et al. (2016) *supra.*, at pp. 3–4 on the channelling principle.

⁴²Brussels Supplementary Convention, Convention of January 31, 1963, Supplementary to the Paris Convention, 1960, as amended by the additional Protocol of 1964 and by the Protocol of 1982 (‘Brussels Supplementary Convention’), <https://www.oecd-neo.org/law/nlbrussels.html>. See also Philippe Sands and Paolo Galizzi, ‘The 1968 Brussels Convention and Liability for Nuclear Damage,’ 1999, *Nuclear Law Bulletin*, NEA, OECD, No. 64, December 1999 at pp. 7–27. See also Novotná Marianna and Varga Peter, *The Relation of the EU Law and the Nuclear Liability Legislation: Possibilities, Limits and Mutual Interaction*, 2014, Societas et Iurisprudentia, Vol. 2. pp. 96–123; Shirley S. Ho, Jiemin Looi, Agnes S.F. Chuah, Alisius D. Leong, and Natalie Pang, “I Can Live with Nuclear Energy If...”: Exploring Public Perceptions of Nuclear Energy in Singapore”, 2018, *Energy Policy*, Elsevier Publishers.

Damage—(The Vienna Convention)⁴³; Convention on Supplementary Compensation for Nuclear Damage (CSC)⁴⁴ and several Protocols.⁴⁵

4.3.2 Environmental Protection

Nuclear activities raise severe social and environmental concerns, mainly due to the ever-looming threat of radiation from atomic substances and waste throughout the entire project lifecycle. The areas covered include the transboundary ecological harm, protection of the marine environment and environmental justice, among others, in line with the principles of sustainable development.⁴⁶ Firstly, the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention)⁴⁷ obligates the contracting States to ensure the environmental impact assessment of nuclear activities during the early stages of planning. Secondly, under the Convention for the Protection of

⁴³Vienna Convention on Civil Liability for Nuclear Damage (Vienna Convention), 1963. See also the 1997 Vienna Convention on Civil Liability for Nuclear Damage; 1999 Optional Protocol Concerning the Compulsory Settlement of Disputes to the Vienna Convention on Civil Liability for Nuclear Damage; 2000 Vienna Convention on Civil Liability for Nuclear Damage; and Optional Protocol Concerning the Compulsory Settlement of Disputes; 2002 Vienna Convention on Civil Liability for Nuclear Damage; and the Optional Protocol Concerning the Compulsory Settlement of Disputes.

⁴⁴Convention on Supplementary Compensation for Nuclear Damage (CSC), 2015, 5.

⁴⁵See the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (1997 Vienna Protocol); the Protocol to Amend the Paris Convention on Nuclear Third Party Liability (2004 Protocol to the PC); Protocol to Amend the Brussels Supplementary Convention on Third Party Liability in the Field of Nuclear Energy (2004).

⁴⁶See Report of the World Commission on Environment and Development: Our Common Future (United Nations General Assembly [“Brundtland Report”]), 1987, p. 43), <http://www.un-documents.net/our-common-future.pdf>; The World Summit on Sustainable Development, *Johannesburg Declaration on Sustainable Development and Plan of Implementation*, 2002, <http://www.un-documents.net/jburgdec.htm>.

⁴⁷The Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention), 1991. See OECD, ‘The Application of the Espoo Convention on Environmental Impact Assessment in a Transboundary Context to Nuclear Energy-Related Activities,’ October 2016, *Nuclear Law Bulletin* 97, pp. 63–69, Semi-annual ISSN: 16097378, <https://doi.org/10.1787/16097378>; See also the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) of 1992.

the Marine Environment of the North-East Atlantic (OSPAR Convention),⁴⁸ the EU and other 15 governments undertake to cooperate in the prevention and elimination of pollution as well as the protection of the maritime area against the adverse effects of human activities to preserve human health. Others include the Protocol on Strategic Environmental Assessment to the Espoo Convention (Kiev Protocol)⁴⁹ and the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention)⁵⁰

4.3.3 Nuclear Safety and Emergency Response

The global regime has established mechanisms for addressing safety challenges as well as setting tools to respond to emergencies arising out of nuclear activities. This regime has mainly developed following the nuclear power accidents of Chernobyl and Fukushima Daichi, which had grave impacts on both the environment and human life. The effect of a nuclear accident can be momentous considering the range and nature of harm and the resources and technology required to deal with the damage. The Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency of 1986⁵¹ provides for cooperation and assistance; while the Convention on Early Notification of a Nuclear Accident of 1986⁵² provides for notification in case of a nuclear accident. Other issues include the management of waste and radioactive materials from the activities. The Joint Convention on the Safety of Spent Fuel

⁴⁸See the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) of 1992.

⁴⁹The Protocol on Strategic Environmental Assessment to the Espoo Convention (Kiev Protocol), 2003.

⁵⁰The Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention), 1998. See also, Sam Emmerechts, 'Environmental Law and Nuclear Law,' *Nuclear Law Bulletin* 2008 (2) (2009): 91–110 at p. 91.

⁵¹Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency (1986). It is under the auspices of the Director-General of the International Atomic Energy Agency, <https://www.iaea.org/sites/default/files/infirc336.pdf>. See also the Convention on Nuclear Safety, 1994, <https://www.iaea.org/sites/default/files/infirc449.pdf>.

⁵²See Art. 1 of the Convention on Early Notification of a Nuclear Accident (1986), <https://www.iaea.org/sites/default/files/infirc335.pdf>.

Management and the Safety of Radioactive Waste Management (Joint Convention)⁵³ aims to achieve and maintain, among others a high level of safety in spent fuel and radioactive waste management.

4.3.4 Non-proliferation and Nuclear Security

The devastating effects of the use of nuclear weapons such as the USA's atomic bombing of Hiroshima-Japan at the end of World War II on August 6, 1945, awakened the world to the need for non-proliferation and nuclear security safeguards.⁵⁴ Scholars have concluded that the nuclear threat is real as long as there still exists stockpiles of atomic weapons, and the only solution lies in the establishment of strict international control of all fissile materials.⁵⁵ The Treaty on the Non-proliferation of Nuclear Weapons of 1968 aims at preventing the spread of nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices and weapons' technology as well as the promotion of peaceful uses of nuclear energy.⁵⁶ Other treaties relate to the physical protection of nuclear materials and nuclear facilities used for peaceful purposes⁵⁷; the suppression of terrorist bombings and acts

⁵³Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention), 1997, <https://www.iaea.org/sites/default/files/infocirc546.pdf>.

⁵⁴See Eiichiro Ochiai, 'Devastation Caused by the Atomic Bombs: Hiroshima and Nagasaki,' in *Hiroshima to Fukushima*, August 2014, Chap. 5, https://doi.org/10.1007/978-3-642-38727-2_5 See also Aljazeera News- Japan, Hiroshima Atomic Bomb: The Us Nuclear Attack That Changed History...As Japan Marks the 74th Anniversary of the World's First Nuclear Bomb Attack, We Examine The Events That Shaped History, January 6, 2019, <https://www.aljazeera.com/news/2019/08/hiroshima-atomic-bomb-nuclear-attack-changed-history-190806100602771.html> (accessed on 25/04/2020).

⁵⁵See Ira Helfand, Lachlan Forrow and Jaya Tiwari, 'Nuclear Terrorism,' *BMJ*. 2002 February 9; 324(7333): 356–359, <https://doi.org/10.1136/bmj.324.7333.356>.

⁵⁶The Treaty on the Non-proliferation of Nuclear Weapons (Non-Proliferation Treaty), 1968, <https://www.un.org/disarmament/wmd/nuclear/npt/text>. See also Laura Rockwood, 'The Nuclear Non-Proliferation Treaty: A Permanent Commitment to Disarmament and Non-Proliferation,' *Nuclear Law Bulletin* No. 56 (1995) at pp. 9–18 at 9.

⁵⁷See Convention on the Physical Protection of Nuclear Material (CPPNM) of 1979, <https://www.oecd-nea.org/law/multilateral-agreements/convention-protection-material.html>; See also the Amendment to the Convention on the Physical Protection of Nuclear Material (Amendment to the CPPNM), 2005, <https://www.oecd-nea.org/law/multilateral-agreements/amendment-convention-protection-material.html>. See also RB Pope, 'Packaging and Transport of Radioactive

of terrorism and punishment of the perpetrators⁵⁸; and the suppression of the financing of terrorist activities.⁵⁹

4.4 The Development and Regulation of Nuclear Energy in Sub-Saharan Africa: Lessons from the EU and France

As SSA looks at developing nuclear energy power, there are vital lessons to learn from some regions and countries which have established strong nuclear sectors, more so through reliable and effective regulation. This chapter draws lessons from the EU nuclear experience, particularly France and South Africa as the leading nuclear user in SSA.

4.4.1 Nuclear Energy in the European Union

France is one of the few countries in the world which has posited nuclear success stories over the years. France is a member of the European Union (EU) and abides by its regulations and guidelines. The EU has got a total of 27 countries. Currently, several EU countries like Spain, France, Germany, Luxembourg, Romania, Belgium, Hungary, Slovakia, Finland, Sweden are operating or constructing nuclear power installations. The EU has got directives and measures in place to guide the nuclear industry, and these include the 2012 Energy Efficiency Directive and the 2015 Framework Strategy for a Resilient Energy Union. Further, the EU's nuclear energy mainly governed by the European

Material in the Nuclear Fuel Cycle,' 2012, *Nuclear Fuel Cycle Science and Engineering*, Woodhead Publishing Series in Energy 2012, pp. 558–598, <https://doi.org/10.1533/9780857096388.4.558>.

⁵⁸International Convention for the Suppression of Terrorist Bombings (Terrorist Bombings Convention), 1997.

⁵⁹International Convention for the Suppression of the Financing of Terrorism (Terrorist Financing Convention), 1999; see also the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT or Nuclear Terrorism Convention), 2005; the Comprehensive Nuclear-Test-Ban Treaty (CTBT), 1996, Art. 1 (Not yet in force); and the Treaty on the Prohibition of Nuclear Weapons (TPNW or Nuclear Weapon Ban Treaty), 2017 (Not in force).

Atomic Energy Community (EURATOM) Treaty. These provide for safeguards, for example, on nuclear safety, cooperation in nuclear-related activities, environmental protection, and decommissioning.

France's nuclear energy accounts for approximately 75% of the total electricity in the country, with the country being the most extensive global net electricity exporter as a result of the low cost of generation, realizing over 3 billion Euros yearly. France invested heavily in nuclear waste management and what does stand out is the nation's remarkable ability to recycle nuclear fuel, and this accounts for about 17% of France's electricity.⁶⁰

One of the reasons why France has managed to maintain a vigorous nuclear power industry and from which SSA could learn is its focus on the regulation of the environmental impacts of nuclear activities.⁶¹ There are two categories of control, and these include radioactive waste management and decommissioning. This regulation extends to nuclear power plants, National Defence activities, nuclear fuel cycle facilities, research centres, medical activities and industrial activities. On the national arena, there were two chief Acts passed in 2006 to deal with waste management: the 'Transparency and Security in the nuclear field Act'⁶²; and the Planning Act on the sustainable management of radioactive materials and waste.⁶³

In addition to the EUROTAM Treaty, France is also a signatory to several international instruments on the regulation of the use of nuclear energy. The country signed and ratified the Joint Convention on the safety of spent fuel management and the safety of radioactive waste management, in 1997 and 2000, respectively. Other agreements

⁶⁰World Nuclear Association, 'Nuclear Power in France,' <https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/france.aspx> (Accessed on 3/3/2020).

⁶¹See Andra—SN—CEA—IRSN, Radioactive Waste Management and Decommissioning in France, March 2013, https://www.oecd-neo.org/rwm/profiles/france_report.pdf (accessed on 7/4/2020).

⁶²Transparency and Security in the nuclear field Act (June 13, 2006). The Act is available in English at, <http://www.frenchnuclear-safety.fr/index.php/English-version/Asn-s-publications> (accessed on 7/4/2020).

⁶³Planning Act on the sustainable management of radioactive materials and waste (June 28, 2006). Act is available in English at, http://www.andra.fr/index.php?id=edition_1_5_2&recherche_thematique=all&global_id_item=387 (accessed on 7/4/2020).

to which France is a party include—the Convention on Early Notification of a Nuclear Accident (1986); Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency (1986) and the London Convention.

The country also has robust institutional and regulatory frameworks on nuclear energy. These are in charge of operationalizing and overseeing the activities of the nuclear industry, with the management of the different types of atomic activities placed under various departments and bodies. They include the General Directorate for Energy and Climate under the Ministry of Ecology and Energy; the Nuclear Safety Authority; National Institute for Radiation Protection and Nuclear Safety (IRSN); the National Radioactive Waste Management Agency (ANDRA); National Institute for Radiation Protection and Nuclear Safety (IRSN) and the High Committee for Transparency and Information in Nuclear Safety (HCTISN), among others.

There are several lessons that SSA countries can learn from France with respect to nuclear energy development. These will be discussed after a brief overview of nuclear energy in SSA as highlighted in the next section.

4.4.2 Nuclear Energy in Sub-Saharan Africa

Many countries in Sub-Saharan Africa such as Uganda, Kenya, Ethiopia, Nigeria, Namibia, Ghana and Sudan are exploring avenues for venturing into the production of nuclear power in a bid to meet their ever-growing electricity demands—energy access and energy security.⁶⁴ Nuclear power generation is a way of meeting the climate change mitigation targets of the countries since nuclear is a cleaner form of energy compared to traditional fossil fuels. Although there are many pressing issues like nuclear technology and financial costs, a significant challenge lies in establishing an adequate legal and regulatory regime for the sector.⁶⁵ Save for South

⁶⁴Chiponda Chimbelu, *African Countries Mull Nuclear Energy as Russia Extends Offers*, October 22, 2019, Business and Human Rights Centre- Deutsche Welle (DW), https://www.dw.com/en/african-countries-mull-nuclear-energy-as-russia-extends-offers/a-50872702?utm_source=Media+Review+for+October+23%2C+2019&utm_campaign=Media+Review+for+October+23%2C+2019&utm_medium=email (accessed on 29/4/2020).

⁶⁵Ibid.

Africa, which is already generating electricity from nuclear energy, the rest of the countries are mainly still at the preparatory stages. However, a few of them already have some form of regulation for the industry in place.

In Uganda, for instance, efforts are underway to establish a functioning nuclear industry. The country enacted the Atomic Energy Act⁶⁶ in 2008 and also set up a Nuclear Energy Unit and an Atomic Energy Council. The Act in particular addresses issues concerning the peaceful application of radioactive material, social and environmental protection, management of radioactive waste, development of nuclear energy power generation, and general compliance with international laws and standards. The country also promulgated the law in 2012 in particular ‘*to specify the minimum requirements for the protection of individuals, society and environment from the dangers resulting from ionising radiation*’⁶⁷ and ‘*to provide for the safety and security of radiation sources...*’⁶⁸

In Kenya, nuclear energy is also being considered for electricity supply across the country, and the state already has in place a Nuclear Power and Energy Agency, established under the Energy Act of 2019.⁶⁹ It is responsible for promoting and implementing Kenya’s Nuclear Power Programme, carrying out research and development for the energy sector.⁷⁰

South Africa is the only country in the SSA region which already generates power from nuclear energy. It began commercial nuclear power operations in 1984, and it currently has two nuclear reactors, accounting for about 6% of its entire energy⁷¹—the country set in place a robust legal and regulatory system to cater for the nuclear industry. The major laws are the Nuclear Energy Act of 1999⁷²; the National Radioactive

⁶⁶Atomic Energy Act, 2008, <https://ulii.org/ug/legislation/act/2015/24>.

⁶⁷Ibid., Regulation 2(a).

⁶⁸Atomic Nuclear Regulations, 2012, <https://ulii.org/ug/legislation/statutory-instrument/2012/4>.

⁶⁹The Energy Act No. 1 of 2019, https://www.nuclear.co.ke/images/downloads/EnergyAct_No.1%20of%202019.pdf.

⁷⁰Ibid., s.54, also Ss.54–71.

⁷¹Information available, http://www.energy.gov.za/files/esources/nuclear/nuclear_back.html.

⁷²Nuclear Energy Act 1999, Act 46 of 1999.

Waste Disposal Institute Act of 2008⁷³; and the National Nuclear Regulator (NNR) Act of 1999,⁷⁴ and they are all under the auspices of the Department of Energy. There also exists a Chief Directorate which has the mandate to administer all nuclear energy-related matters both under the national and international legislations. The Chief Directorate has got subsidiaries, and these include the Nuclear Safety Directorate, Nuclear Technology Directorate and the Nuclear Non- Proliferation Directorate.

Other relevant laws in South Africa include the Hazardous Substances Act,⁷⁵ the Non-Proliferation of Weapons of Mass Destruction Act,⁷⁶ the National Strategic Intelligence Act, the National Water Act and the Dumping at Sea Control Act, the Mine Health and Safety Act, the National Key Points Act, the Mineral and Petroleum Resources Development Act, the Protection of Constitutional Democracy Against Terrorist and Related Activities Act, and the National Environmental Management Act, among others. The country is also party to several international and regional treaties such as the 1970 Non-Proliferation Treaty, Safeguards Agreement 1991, Additional Protocol 2002, the Pelindaba Treaty of 2009, the Zangger Committee of 2000 and the Nuclear Supplier Group of 2011, *inter alia*.⁷⁷

4.5 Recommendations and Conclusions

Nuclear energy has the potential of solving Sub-Saharan Africa's energy access and security problems while contributing to climate change mitigation targets as per the Sustainable Development Goals and the Paris Climate Change Agreement. The lessons from the Chernobyl (1986) and the Fukushima Daichii (2011) nuclear power accidents, however, demonstrate the inherent disastrous nature of the nuclear industry on

⁷³National Radioactive Waste Disposal Institute Act of 2008; Act 53 of 2008.

⁷⁴National Nuclear Regulator (NNR) Act 1999, Act 47 of 1999.

⁷⁵Hazardous Substances Act 1973, Act 15 of 1973.

⁷⁶Non-Proliferation of Weapons of Mass Destruction Act 1993, Act 87 of 1993.

⁷⁷Information available at the Republic of South Africa, Department of Energy website, http://www.energy.gov.za/files/policies_frame.html (accessed on 20/04/2020).

human health, economies, societies at large and the environment. Questions thus arise regarding nuclear safety, environmental protection and the liability burden should an accident occur. Also, the Hiroshima Bombing of 1945 and the increased global terrorist activities raises questions of nuclear security and non-proliferation. Moreover, the intense regulation of nuclear energy in France has led to the country being a worldwide leading example of how the industry can yield positive results through efficient management.

Despite there existing several fears regarding nuclear energy use, this chapter shows that these can be kept in check if countries develop proper mechanisms. These include (1) Adherence to international laws, regulations and standards; (2) Establishing stable domestic regimes on nuclear through sound policy and legal enactments; and (3) Setting up effective implementation and regulatory bodies to monitor the nuclear activities to ensure that there is maximum social and environmental protection. Significant features from both the global and France's legal regime also indicate the role of cooperation, multistakeholder engagement, accountability and access to information as well as adherence to the principles of sustainable development in establishing legal systems. Like the European Union, SSA should also consider putting in place a regional body and regulations to provide guidance and streamline the activities of the nuclear industry.

This chapter highlights key areas of nuclear regulation. These include safety, spent fuels and waste radioactive materials management, accident liability, transboundary harm, pollution as well as security and non-proliferation. Therefore, as a more significant section of Sub-Saharan African States braces itself for nuclear energy use, particular focus should be directed towards establishing clear, secure and effective regulatory approaches. The assertion is that proper regulation is vital in mitigating and addressing the challenges associated with the use of nuclear energy on both the society and environment in line with the principles of sustainable development.

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Part II

Geographies of Energy Transition: Managing the Decline of Fossil Fuels in Africa

5

Role of Law in the Energy Transitions in Africa: Case Study of Nigeria's Electricity Laws and Off-Grid Renewable Energy Development

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*Video interview by the author discussing this book chapter can be accessed at,
<https://www.youtube.com/watch?v=58X2kbtt-V8&t=1065s>. Last accessed on 1st
September 2020.*

5.1 Introduction

Development Law is an interdisciplinary concept that evaluates the nexus between law and development and identifies bespoke ways of applying the law as a strategic instrument for engendering sectoral, industrial

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or general development.¹ Although the concept is still emerging,² the broad understanding is that law is a fundamental catalyst for socio-economic development.³ The instrumentality of a strategic regulatory framework that drives state and non-state actors to engender industrial development⁴ is also applicable to the electricity industry.⁵ A fundamental catalyst for the development of off-grid/rural renewable energy (RE) would be viable, strategic laws for that purpose.⁶

No doubt, Nigeria's electricity regulatory framework consists of several electricity laws, regulations and policies for the governance of on-grid and off-grid REs and non-REs. Nigeria is blessed with vast but largely

¹Yong-Shik Lee, 'General Theory of Law and Development' (2017) 50 *Cornell International Law Journal* 415, 416–418; Mamman Lawan, 'Law and Development in Nigeria: A Need for Activism' (2011) 55 (1) *Journal of African Law* 59, 66; Olisa Agbakoba, 'Development Law Policy as Magic Wand to Transform Nigerian Economy' *BusinessDay* (Lagos, 22 September, 2019), <https://businessday.ng/opinion/article/development-law-policy-as-magic-wand-to-transform-nigerian-economy/>.

²Yong-Shik Lee (n 1) 416–417; Olisa Agbakoba (n 1).

³Other fundamental catalysts include institutional frameworks, capacity to implement laws, socio-cultural orientations, corruption, political stability and security, leading to a considerable level of economic certainty. See Yong-Shik Lee (n 1) 471. See also: Yemi Oke, 'Energy Resources Governance for National Development: Options for Socially Sustainable Electricity Generation, Transmission and Distribution in Nigeria' (2015) 3 (1) *UNILAG Journal of Humanities* 134, 135 and 141, <http://ir.unilag.edu.ng:8080/bitstream/handle/123456789/3898/Energy%20Resources%20Governance%20for%20National%20Development%20Options%20for%20Socially%20Sustainable%20Electricity%20Generation%2C%20Transmission%20and%20Distribution%20in%20Nigeria.pdf?sequence=1&isAllowed=y>.

⁴Yong-Shik Lee, *Law and Development: Theory and Practice* (Routledge, March 2019) xv.

⁵Yemi Oke, (n 3) 134.

⁶Hugh Corder and Terhemmen Andzenge, 'Regulation as a Catalyst for the Electrification of Africa' in Yinka Omorogbe and Ada Ordor (eds), *Ending Africa's Energy Deficit and the Law: Achieving Sustainable Energy for All in Africa* (Oxford University Press, 2018) 71, 76–85; Yinka Omorogbe, 'Promoting Sustainable Development Through the Use of Renewable Energy: The Role of the Law' in Donald N Zillman and others (eds), *Beyond the Carbon Economy: Energy Law in Transition* (Oxford University Press, 2008) 39, 40, https://www.researchgate.net/publication/290836523_Promoting_Sustainable_Development_through_the_Use_of_Renewable_Energy_The_Role_of_the_Law/link/575f30cb08aed884621baec6/download; Tatjana Tupy, 'The Importance of the Legal and Regulatory Framework for the Development of Renewable Energy' (Paper presented at the 10th Baku International Congress on Energy, Ecology, and Economy, Baku, 23 September, 2009) 5–8, <https://www.osce.org/baku/41263?download=true>; Kouame David Zaucyn, 'Impacts of Regulations on the Diffusion of Renewable Energy in Africa: The Case Study of the Republic of Benin' (Master's Degree thesis, Pan-African University Institute of Water and Energy Sciences 2019) 27–28, <http://repository.pauwes-cop.net/bitstream/handle/1/366/Final%20Version%20Thesis%20Kouame%20David%20ZAUCYN.pdf?sequence=1&isAllowed=y>.

unharnessed sources of RE.⁷ This situation can be blamed on the purpose-defeating nature of the extant electricity regulatory framework, an examination of which reveals a myriad of conflicting, contradictory or inconsistent provisions. These conflicting electricity laws are largely responsible for the slow pace of development of Nigeria's vast RE sources. Among others, the major contradiction is that while extant constitutional provisions vest the thirty-six State Governments with the power to regulate off-grid electricity, the Nigerian Electricity Regulatory Commission (NERC)—Nigeria's federal electricity regulator—has been relying on certain provisions of its establishment law⁸ empowering it to 'license and regulate **persons** engaged in the generation, transmission, system operation, distribution, and trading of electricity',⁹ whether in rural and urban areas,¹⁰ and have gone ahead to further buttress its stance through the creation and implementation of NERC Regulations for off-grid electricity.

Nigeria's electricity laws, which ought to serve as the springboard for the development of the Nigerian Electricity Supply Industry (NESI), seem to be its fundamental albatross due to this and other conflicting, contradictory or inconsistent provisions. Thus, this chapter refers to the conflicting, contradictory or inconsistent state of Nigeria's electricity laws as the 'conflict of electricity laws'.¹¹ The fact that the Constitution of the Federal Republic of Nigeria (CFRN)¹² allows the States to embark on the development and regulation of off-grid electricity within their respective territories,¹³ yet the Electric Power Sector Reform Act (EPSRA) vests NERC with the exclusive¹⁴ power to promote and regulate off-grid/rural

⁷Nigerian Electricity Regulatory Commission (NERC), 'Renewable Energy Sourced Electricity', <https://www.nerc.gov.ng/index.php/home/operators/renewable-energy>.

⁸Electric Power Sector Reform Act 2005 (EPSRA), cap E7, Laws of the Federation of Nigeria (LFN) 2004.

⁹EPSRA, s 32 (2) (d).

¹⁰EPSRA, s 32 (1) (b).

¹¹This phrase is not exactly borrowed from the concept of conflict of laws in Private International Law.

¹²Constitution of the Federal Republic of Nigeria (Promulgation) Act 1999 ("CFRN"), cap C 23, Laws of the Federation of Nigeria (LFN) 2004.

¹³CFRN, 2nd sch, pt II, para 14 (b).

¹⁴While it is debatable that NERC has the 'exclusive' power under EPSRA to license and regulate electricity activities, the activities of NERC within NESI over the years appear to

electricity by giving licenses to ‘persons’¹⁵ so interested is a classic case of giving a thing with the right hand and simultaneously taking it back with the left hand. This triggers the question, which this chapter attempts to answer, as to whether the Federal Government’s regulation of off-grid electricity supersedes the State Governments’ power to regulate off-grid electricity.

Off-grid electricity is a massive window for the States to develop their respective ‘state grids’, mini-grids and off-grid RE infrastructures, especially in rural communities which lack adequate access to energy, pursuant to the recurring global discourse on climate change and transitioning to a low-carbon economy.¹⁶ RE has the potential to improve access to energy, leading to significant positive impacts on the socio-economic life of all Nigerians,¹⁷ especially rural and remote dwellers. Unfortunately, the extant electricity regulatory framework appears to

affirm this position. However, in 2017, the Minister of Power admitted that State Governments have the constitutional right to regulate electricity within their domains, but he stopped short of saying whether or not the States or their contractors would still be required to apply to NERC for licenses and permits. See Babatunde Raji Fashola (SAN), ‘Communiqué Issued at the 18th Monthly Meeting with Operators of the Power Sector’ (18th Monthly Power Sector and Stakeholders’ Meeting, Kano State, 14 August 2017), www.tundefashola.com/archives/news/2017/08/14/20170814N01.html; Ken Etim, Akindeji Oyeboode and Habitat Adeniran, ‘Nigeria: The Electricity Supply Industry—Recent Developments and Prospects’ *Mondaq* (11 March 2019), <https://www.mondaq.com/Nigeria/Energy-and-Natural-Resources/788550/The-Nigerian-Electricity-Supply-Industry-Recent-Developments-And-Prospects>.

¹⁵In fairness, there is no express inclusion or exclusion of the States from the category of persons engaged in the electricity supply chain to be licensed and regulated. However, this gives room for interpretation to the effect that the States must also obtain licenses to engage in the electricity supply chain. Section 100 (1) of the EPSRA provides that “‘person’ includes any individual, company, partnership or any other association of individuals, whether incorporated or not.” See also Interpretation Act 1964, s 18, cap I 23, Laws of the Federation of Nigeria (LFN) 2004: “‘person’ includes any body of persons corporate or unincorporated.”

¹⁶Yinka Omorogbe (n 6), 42; United Nations Secretary-General’s Advisory Group on Energy and Climate Change (AGECC), ‘Energy for a Sustainable Future’ (2010), [https://www.un.org/millenniumgoals/pdf/AGECCsummaryreport\[1\].pdf](https://www.un.org/millenniumgoals/pdf/AGECCsummaryreport[1].pdf). The role of sub-nationals (States, provinces and cities) in global efforts towards attaining a low-carbon and sustainable future cannot be overemphasized. See generally United Nations, *Transforming Our World: The 2030 Agenda for Sustainable Development* (2015), <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>.

¹⁷The socio-economic and environmental impacts of RE include access to clean and affordable energy; health and sanity; lower CO₂ emission levels; economic liberation of cottage industries, micro, small and medium-scale enterprises (MSMEs) and rural/remote communities; and environmental sustainability.

approve and reprobate, i.e. give the States the power to regulate electricity and simultaneously take it back from the States through EPSRA and its subsidiary regulations. Federalism expects that the States as component units would promote and regulate electricity within their respective territories albeit in a manner that will not impede on the central government's power to promote and regulate electricity¹⁸.

At this point, it is pertinent to identify and address these area(s) of conflict by stating the legal parameters as provided in the CFRN and EPSRA, and making recommendations for resolving these conflicts.

The main objective of this chapter is to provide a comprehensive exposé into the conflict of electricity laws and how it has contributed to the slow pace of development of RE in Nigeria. We argue that the fundamental implication of the conflict of electricity laws is that it ultimately defeats the purpose of achieving rapid access to clean, affordable and efficient energy through the simultaneous efforts of both the Federal and State Governments. Section 5.2 of this chapter gives an overview of Nigeria's regulatory framework, with particular reference to REs. Section 5.3 delves deeply into the issues surrounding the conflict of Nigeria's electricity laws and how they contribute to stifling rapid development of RE with particular reference to the area of off-grid and rural electrification. Section 5.4 analyses, in the Nigerian context, the propriety or otherwise of separating RE regulation from non-REs and the application of cooperative federalism by the Federal and State Governments in the governance of REs as contemporary approaches to actualizing rapid RE development, drawing from relevant experiences in Australia, Germany, Kenya and South Africa. Section 5.5 concludes the chapter by proffering salient recommendations to resolve these legal conflicts, which if properly implemented, will improve energy access, especially in rural communities. Thus, the authors call for the amendment of the CFRN to clearly stipulate that all electrification outside the national grid rests within the competence of the States to the exclusion of the Federal Government.

¹⁸CFRN, 2nd sch, pt II, paras 13 and 14.

5.2 Overview of Nigeria's Renewable Energy Regulatory Framework

5.2.1 Constitution of the Federal Republic of Nigeria (CFRN)¹⁹

The CFRN is the supreme law of the land with its provisions having binding force on all authorities and persons throughout Nigeria.²⁰ Where any enactment is inconsistent with any provision of the CFRN, such enactment automatically becomes ineffective and inoperative to the extent of that inconsistency.²¹ For clarity of functions, every matter of the polity is categorized under either the Exclusive Legislative List²² or the Concurrent Legislative List²³ by the CFRN. The electric power sector is a matter under the Concurrent Legislative List. While the Federal Government regulates electricity in all or any part of the federation,²⁴ the states are explicitly put in charge of regulating electricity that is not covered by the National Grid system (off-grid).²⁵

The intendment of the CFRN is to empower the Federal Government to generally promote and regulate electricity throughout the federation and the States to exercise regulatory functions with regard to off-grid electricity, which is a major turf for rural electrification, in order to provide access to electricity for people living in rural and remote areas of the country. However, this intendment is deduced only on the surface. A deeper interpretation and analysis of the relevant constitutional provisions, as attempted in Sect. 5.3 of this chapter, would reveal certain

¹⁹See (n 12) for the long title and full citation.

²⁰CFRN, s 1 (1); *Attorney-General of Abia State v Attorney-General of the Federation* (2006) 16 NWLR (pt 1005) 265.

²¹CFRN, s 1 (1) and (3).

²²Matters upon which only the National Assembly can regulate. See CFRN, 2nd sch, pt II.

²³Matters upon which both the National Assembly and the States Houses of Assembly can competently legislate. Note that under the doctrine of covering the field, state law must not be inconsistent with a Federal Act for it to be valid and enforceable. See generally, CFRN, 2nd sch, pt II.

²⁴CFRN, 2nd sch, pt II, para 13 (b).

²⁵CFRN, 2nd sch, pt II, para 14 (b).

lacunae or conflicts that defeat the purpose of the constitutional intentment to empower the State Governments to promote and regulate off-grid electricity.

5.2.2 Electric Power Sector Reform Act (EPSRA)²⁶

EPSRA is the principal sectoral statute governing electricity in Nigeria, subject to the CFRN. EPSRA established NERC primarily to oversee the licensing and regulation of generation, transmission, distribution and supply of electricity in rural and urban communities²⁷ and the Rural Electrification Agency (REA) to promote off-grid, RE and rural electrification and manage the Rural Electrification Fund (REF).²⁸

A community reading of the provisions of the EPSRA will reveal that its major objective is to provide a solid framework for the achievement of the overall reform objectives of the National Electric Power Policy 2001 and the NESI in meeting current and future electricity demand in the country. It defines the roles and functions of NERC in the overall regulation of the electric power sector. It equally mandates the REA to work with NERC towards the progress and achievement of the Rural Electrification Strategy and Implementation Plan (RESIP)²⁹ which includes the provision of rural communities with access to electricity, promotion of renewable energy generation and the expansion of main and mini-grid systems.

It is observed that despite the fact that the EPSRA excludes captive generation,³⁰ an off-grid electric system, from licensing requirements, NERC still regulates captive generation in diverse ways. Although EPSRA was drafted in a manner that almost completely depletes the constitutional competence of the States to regulate electricity,³¹ few states

²⁶See (n 8) for the full citation.

²⁷EPSRA, preamble and ss 31 (1), 32 and 62 (1) and (2).

²⁸EPSRA, s 88 (1), (4), (5), (9) (11) and (13).

²⁹Ibid., s 88 (5).

³⁰EPSRA, s 62 (1) (a).

³¹On this point, see EPSRA, s 62.

are beginning to play their constitutional roles. As highlighted below, one of such States—Lagos State—has gone ahead to enact its state electricity law.

5.2.3 Lagos State Electric Power Sector Reform Law (LEPSRL)³²

By virtue of the EPSRA³³ empowering the Federal Government to regulate on-grid and off-grid across both urban and rural communities, what is left for States Governments to regulate is captive and embedded electricity generation. Consequently, the Lagos State House of Assembly enacted the LEPSRL to boost electricity supply within the state through embedded generation and supply.³⁴ The law establishes the Lagos State Electricity Board (LSEB) to implement the Embedded Power Scheme (EPS).³⁵ The LEPSRL empowers LSEB to generate, transmit and distribute electricity to areas within the state not yet covered by the National Grid (“the grid”)³⁶ and to establish power stations in areas not covered by the EPS.³⁷ The Lagos State Government would work with electricity generation and distribution companies who are already licensed by NERC.

It is observed that the law mandates LSEB to liaise with NERC and other relevant bodies and stakeholders to create an enabling environment for the EPS and rural electrification projects within the state. After obtaining a license from NERC, the licensee is required to obtain the approval of LSEB before operating a power plant.³⁸ As is discussed in Sect. 5.3 of this chapter, the LSEB’s referral to NERC and the issue of double licensing (regulation) from NERC and LSEB appears to weaken Lagos State’s regulatory independence of off-grid electricity regulation.

³²Lagos Electric Power Sector Reform Law (LEPSRL) 2018, <https://laws.lawnigeria.com/2019/05/06/lagos-state-electricity-sector-reforms-law-2018/>.

³³EPSRA, s 62 (1)(a) and (2).

³⁴LEPSRL, s 32 (1)(b) and (2)(d); LEPSRL, s 62 (1), (2) and (9)(b)–(c).

³⁵LEPSRL, s 5.

³⁶LEPSRL, s 17 (o).

³⁷LEPSRL, s 17 (s).

³⁸LEPSRL, s 17 (w).

5.2.4 NERC Regulations

NERC is generally empowered to make regulations prescribing all matters necessary for the actualization of the objectives of the EPSRA and to regulate the NESI.³⁹ These regulations have the force of law as subsidiary legislation.⁴⁰ They contain provisions such as those setting out the criteria for unlimited customer eligibility status and trading licenses,⁴¹ as well as those requiring isolated mini-grids or stand-alone systems operators to first obtain a license from NERC.⁴² Even more are the provisions subjecting RE generations above 1 MW,⁴³ embedded power generation,⁴⁴ independent electricity distribution networks,⁴⁵ and captive power generation⁴⁶ to the prior approval of NERC. These requirements have far-reaching implications on NESI, the implementation of which raise key questions about whether NERC is competent to make such regulations in the first place in the face of relevant constitutional and statutory provisions highlighted above.

³⁹EPSRA, s 96.

⁴⁰EPSRA, s 96 (1), (2), (3) and (4); Interpretation Act, s 18 (1). See also *Amusa v. The state* (2003) 4 NWLR (pt 811) 595.

⁴¹Nigerian Electricity Regulatory Commission (Eligible Customer) Regulations 2017 (“ECR”) (Regulation No: NERC-R-111), <https://nerc.gov.ng/index.php/component/remository/Regulations/orderby,7/page,1/?Itemid=0>.

⁴²Nigerian Electricity Regulatory Commission Regulations for Mini-Grids 2016 (Regulation No: NERC/R-110/17) (“Mini-Grid Regulations”), <https://nerc.gov.ng/index.php/component/remository/Regulations/orderby,7/page,1/?Itemid=0>.

⁴³Nigerian Electricity Regulatory Commission Regulations on Feed-in Tariff for Renewable Energy Sourced Electricity in Nigeria 2015 (“REFIT Regulations”) (Regulation No: NERC-XXXX), <https://www.nbet.com.ng/wp-content/uploads/2018/05/REGULATIONSONFEEDINTARIFFFORRENEWABLEENERGYSOURCEDELECTRICITYINNIGERIA.pdf>.

⁴⁴Nigerian Electricity Regulatory Commission (Embedded Generation) Regulations 2012 (“EGR”), <https://nerc.gov.ng/index.php/component/remository/Regulations/orderby,7/page,3/?Itemid=0>.

⁴⁵Nigerian Electricity Regulatory Commission (Independent Electricity Distribution Networks) Regulations 2012 (“IEDN Regulations”), <https://nerc.gov.ng/index.php/component/remository/Regulations/orderby,7/page,3/?Itemid=0>.

⁴⁶Nigerian Electricity Regulatory Commission (Permits for Captive Power Generation) Regulations 2008 (“CPGR”), <https://nerc.gov.ng/index.php/component/remository/Regulations/orderby,7/page,2/?Itemid=0>.

5.2.5 Renewable Energy Policies

Nigeria has a population of about 200 million, 60% of which are mostly rural dwellers and lack access to the grid, while even the available electricity is largely insufficient to meet the energy demands of the remaining 40% who have access to the grid.⁴⁷ To address this challenge, the Renewable Energy Master Plan (REMP) was drafted in 2005 and revised in 2012, but the same was not approved by the Federal Government.⁴⁸

However, the Federal Government approved the Nigerian Renewable Energy and Energy Efficiency Policy (NREEEP)⁴⁹ in 2015 aimed at developing Nigeria's diverse energy resources; guaranteeing RE supply; accelerating investment in RE development; guaranteeing energy efficiency; and ensuring effective coordination and collaboration among all RE stakeholders.⁵⁰ It also seeks to remove the barriers that put RE at a disadvantage relative to other energy options.⁵¹ RE sources targeted by the Policy are hydropower, biomass, solar, wind and geothermal, wave and tidal energy for both on-grid; largely for urban areas, and off-grid; largely for an estimated 70% of rural dwellers.⁵² The Policy also encourages NERC to introduce tariff-related incentives and regulations to support RE adoptions.

In furtherance to the NREEEP, the Economic Recovery and Growth Plan (ERGP) seeks to increase power generation by optimizing non-operational capacity, encouraging small-scale projects and pursuing long-term capacity, and ultimately improving energy efficiency by diversifying

⁴⁷Federal Ministry of Power, *Nigerian Renewable Energy and Energy Efficiency Policy* (Policy Paper, 2015) [iv], <http://www.power.gov.ng/download/NREEEP%20POLICY%202015-%20FEC%20APPROVED%20COPY.pdf>.

⁴⁸Priscilla Offiong, 'Nigerian Renewal Energy and Energy Efficiency Policy (NREEEP)' (*Climate Scorecard*, 28 February 2019), <https://www.climatescorecard.org/2019/02/nigerian-renewal-energy-and-energy-efficiency-policy-nreeep/>.

⁴⁹NREEEP is divided into and implemented through the National Renewable Energy Action Plan (NREAP) and the National Energy Efficiency Action Plan (NEEAP). See Federal Ministry of Power, (n 74) 3.

⁵⁰Federal Ministry of Power, (n 47) 9.

⁵¹*Ibid.*, [iv].

⁵²*Ibid.*, 2–19.

the energy mix through greater use of RE. The ERGP seeks to consolidate on the NREEEP by mobilizing investment into executing off-grid RE.⁵³

Having highlighted the above RE laws, it is pertinent to discuss the conflicts existing among them in Sect. 5.3 below.

5.3 A Critical Analysis of the Conflict of Electricity Laws

5.3.1 Theoretical Background to the Conflict of Electricity Laws

Conflict of laws, as understood in Private International Law, pertains to the settlement of disputes relating to the interpretation and application of the domestic law of a country dealing with a foreign element, i.e. a contact with a foreign system of law other than the domestic law.⁵⁴ In conflict of laws, three elements exist—the domestic law, the law area/country and the foreign element.⁵⁵

Interestingly, conflict of laws sometimes exists in Municipal Law, in which case the foreign element may not be present.⁵⁶ This is where there is a clash of different legal systems within a country, such as a clash between customary law and the received English law in disputes concerning inheritance, succession and the interpretation and execution of wills. Similarly, there may be a conflict between Federal law and State

⁵³Ministry of Budget and National Planning, *Economic Recovery and Growth Plan (ERGP)* (Policy Paper, 2017) [75]–[77], <https://smedan.gov.ng/images/NECR.pdf>.

⁵⁴*Halsbury's Laws of Australia* (vol 4) para 85; *Halsbury's Laws of England* (5th edn) para 302.

⁵⁵Remigius N Nwabueze, 'The History and Sources of Conflict of Laws in Nigeria, With Comparisons to Canada' (Master's Degree thesis, University of Manitoba 2000) 1, <https://www.collectionscanada.gc.ca/obj/s4/f2/dsk2/ftp01/MQ53117.pdf>.

⁵⁶Nwamaka Iguh, 'Conflicts of Laws in Nigeria' in Greg C Nwakoby, Kenn C Nwogu and Meshach N Umenweke (eds), *Fundamentals of the Nigerian Legal System* (Bekaam Printers PVT Ltd, 2011) 91, https://www.researchgate.net/publication/317751965_CONFLICTS_OF_LAWS_IN_NIGERIA. However, Iguh seems to argue that where there is a clash of municipal laws, there is no conflict of law *stricto sensu* due to the absence of the foreign element. Nevertheless, the use of the 'conflict' here, concerning Nigeria's electricity laws, is in terms of contradictory or inconsistent laws and regulations that govern NESI.

law or between two Federal laws.⁵⁷ In this case, the conflict is based on inconsistencies between such laws and which of them should take precedence.

Admittedly, it is easier to resolve conflicts between a federal law and a State law or between two federal laws where a federal law is the organic or primary law. In the face of such conflict, legal tools such as legal principles/doctrines, domestic laws, rules of courts and case law come to the rescue. The CFRN provides that ‘if any other law is inconsistent with the provisions of this Constitution, this Constitution shall prevail, and that other law shall to the extent of the inconsistency be void’.⁵⁸ The conflict of electricity laws at the federal level, which portends significant implications for the governance of off-grid electricity by the States, is the focal point of this chapter. This conflict consists of different dimensions, which this chapter seeks to analyse in order to expatiate the view that the conflict of electricity laws is fundamentally responsible for the slow pace of development of the NESI.

5.3.2 Conflict of Electricity Laws Hampering off-Grid Renewable Energy Development

Figure 5.1 indicates the ‘intra-conflict’ of law and ‘inter-conflict’ of laws as two dimensions to the conflict of electricity laws in Nigeria. We define ‘Intra-conflict’ of law as a concept to indicate conflicting provisions within a law or regulation. An example of such ‘intra-conflict’ is conflict among certain provisions of the CFRN about the respective powers of the Federal and State Governments to promote and regulate electricity operations. On the other hand, ‘Inter-conflict’ of laws is defined herein as conflicts between or among certain laws or regulations, in this case among the CFRN, EPSRA and certain NERC Regulations and even conflicts between EPSRA and NERC Regulations.

⁵⁷Conflict of laws can also exist between two state laws.

⁵⁸CFRN, s 1 (3).

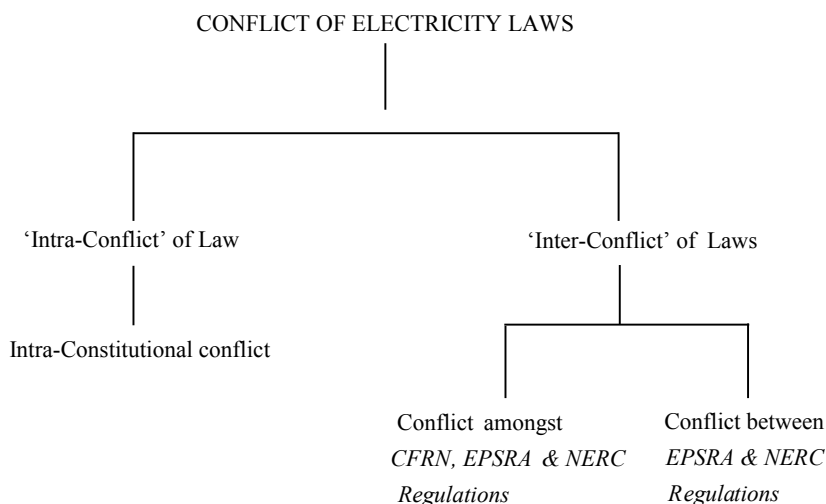


Fig. 5.1 A mnemonic illustration of the conflicts existing within Nigeria's electricity regulatory framework

5.3.2.1 Intra-Constitutional Conflict

- i. Paragraph 13 (a) vis-à-vis Paragraph 14 (a) of the Concurrent Legislative List

Paragraph 13 (a) gives the National Assembly the power to make laws with respect to 'electricity and the establishment of electric power stations'.⁵⁹ Interestingly, Paragraph 14 (a) gives the Houses of Assembly the power to make laws concerning electricity and the establishment in that State of electric power stations.⁶⁰ On the surface, these two provisions simply state that both the Federal and State Governments can regulate electric power stations (the GenCos),⁶¹ in line with federalist principles and a positive for rapid RE transition and development. However, the difficulty with the interpretation of these provisions is that it appears that all power stations, whether or not established by a State,

⁵⁹CFRN, 2nd sch, pt II, para 13 (a).

⁶⁰CFRN, 2nd sch, pt II, para 14 (a).

⁶¹Most electric power stations are operated by the electricity generation companies (GenCos).

will be subject to both Federal and State electricity laws. The danger here is that Federal and State electricity laws may mandate GenCos to meet divergent statutory requirements on a particular technical issue. This divergence can lead to bureaucratic bottlenecks,⁶² confusion, and uncertainties⁶³ for the electric power station operators while attempting to meet those divergent requirements under both Federal and State electricity laws.

The intendments of these two constitutional provisions are understandable, but their interpretation can lead to ambiguities and uncertainties in the governance of electricity by both Federal and State Governments. These constitutional provisions ought to have been drafted in clearer wordings that would comprehensibly define the Federal and State Governments' regulatory boundaries within NESI. In essence, Paragraphs 13 (a) and 14 (a) of the Concurrent Legislative List are ambiguous and conflicting and require amendment.

ii. Paragraphs 13, 13 (b) and 13 (f) vis-à-vis Paragraph 14 (b) of the Concurrent Legislative List

The combined effect of Paragraphs 13, 13 (b) and 13 (f) are that the National Assembly has powers to enact laws for the whole or any part of the federation,⁶⁴ including 'the generation and transmission of electricity in or to any part of the Federation'⁶⁵ and 'the regulation of the right or authority of any person to use, work or operate a plant, apparatus, equipment or work designed for the supply or use of electrical energy'.⁶⁶ In essence, the Federal Government can regulate electricity distribution by any person or authority. However, Paragraph 14 (b) gives the State

⁶²The fulfilment of statutory requirements/obligations can be quite cumbersome for GenCos, especially as most of them are private sector-owned/run. This situation is inimical to the need to create an enabling environment for private sector participation in the various industries, including NESI.

⁶³There would be confusion and uncertainties for the GenCos as to which law to obey, especially when it is impossible or impracticable to obey divergent Federal and State electricity laws on a particular issue.

⁶⁴CFRN, 2nd sch, pt II, para 13.

⁶⁵CFRN, 2nd sch, pt II, para 13 (b).

⁶⁶CFRN, 2nd sch, pt II, para 13 (f).

Houses of Assembly to enact laws for 'the generation, transmission and distribution of electricity to areas not covered by a national grid system' within their respective states.⁶⁷

Fundamentally, there is a challenge associated with the interpretation of Paragraph 13 of the Concurrent Legislative List empowering the National Assembly to make laws for regulating electricity in or to **any part** of the Federation vis-à-vis the power of the Houses of Assembly under Paragraph 14 to make laws for the distribution of electricity in their respective States. Both provisions lead to conflicting interpretations in the sense that although the States can regulate electricity in areas within their territories that are uncovered by the grid, the Federal Government under Paragraphs 13 and 13 (b) of the Concurrent Legislative List can still proceed to enact laws for all urban or rural areas, whether covered by the grid or otherwise.

The preceding analysis begs the question: does the Federal Government's regulation of off-grid electricity supersede the State Governments' power to regulate off-grid electricity? If the answer is in the affirmative, then the purpose of allowing the States to promote and regulate off-grid electricity in rural communities which have inadequate access to grid-tied electricity⁶⁸ is defeated. Electricity utility operators would be torn between the clash of Federal and State electricity laws regulating off-grid areas where the States ordinarily have the competence to regulate.

These provisions pose a difficult challenge because while the States have the power to regulate electricity within their respective domains, it may be expedient for the public interest that the Federal Government enacts electricity laws for a particular area, such as areas where the Federal Government is embarking on-grid expansion projects. In such situations, it may be more appropriate for the Federal and State Governments to collaborate in the spirit of cooperative federalism so that the ultimate goal of achieving access to adequate electricity for Nigerians is realized. Nevertheless, applying the legal doctrine of **expressio unius est exclusio alterius** (the expression of a thing excludes the other), we believe the intendment is that State Governments be vested with the

⁶⁷CFRN, 2nd sch, pt II, para 14 (b).

⁶⁸Federal Ministry of Power, (n 47) 3.

jurisdiction over off-grid electrification, having expressly vested them with such powers. Majority of rural communities are not connected to the grid⁶⁹ and this is a turf for the States to promote off-grid RE infrastructure in rural communities within their domains.

5.3.2.2 Conflict Among the CFRN, EPSRA and NERC Regulations

Paragraphs 13 and 14 of the Concurrent Legislative List are to the effect that the Federal and State Governments have concurrent powers to regulate electricity. However, State Governments can only regulate off-grid electricity. It is on this premise that NERC's statutory authority to issue licenses for the off-take of off-grid electricity projects is queried. Sections 32 (1)(b), 32 (2)(d) and 96 (1) and (2)(l) of EPSRA are instructive on this point.

Section 32 (1)(b) states that NERC has the power to regulate consumer connections to distribution systems in both rural and urban areas while 32 (2)(d) allows NERC to license and regulate persons engaged in electricity services. Interestingly, s 96 (1) gives NERC omnibus powers to make regulations for NESI as it deems fit, while s 96 (2)(l) mandates NERC to regulate rural electrification programmes. Thus, by the community reading and combined effect of ss 32 (1)(b), 32 (2)(d) and 96 (1) and (2)(l) of EPSRA, NERC reserves the exclusive power to regulate and issue licenses to **persons** engaged in the generation, transmission and distribution of electricity in both urban and rural areas.

Firstly, the challenge with these statutory provisions⁷⁰ is that apart from the fact that NERC usurped the State Governments' powers to regulate off-grid electricity,⁷¹ the States are also required to obtain

⁶⁹Ibid.

⁷⁰Particularly EPSRA, ss 32 (2)(d) and 96 (2)(l).

⁷¹Associate Professor Yemi Oke referred to the usurpation of the constitutional powers of the States concerning electricity regulation in their respective domains as a 'National Greed', a sarcastic pun on what is known as the National Grid. See Yemi Oke, 'Beyond Power Sector Reforms: The Need for Decentralized Energy Options (DEOPs) for Electricity Governance in

licenses from NERC before they can execute rural electricity projects. NERC seems to rely on the definition of **person**⁷² to include the State Governments. Thus, under EPSRA, the power of the States to regulate and promote rural and off-grid electricity can be overridden by the Federal Government, a clear contradiction of Paragraph 14 of the Concurrent Legislative List which empowers the State Houses of Assembly to legislate for the promotion and regulation of off-grid electricity.

Secondly, the authors cautiously question the rationale for the establishment of the REA to embark on off-grid rural electrification projects⁷³ vis-à-vis the States' constitutional jurisdiction in off-grid electrification. REA was created to execute the Rural Electrification Strategy and Implementation Plan (RESIP) to guide grid expansion projects and RE generation in rural communities.⁷⁴ In carrying out these objectives, both on-grid and off-grid (mini-grid and stand-alone) electrification projects would be explored.⁷⁵ REA is further mandated to manage the Rural Electrification Fund (REF), among other purposes,⁷⁶ to promote grid expansion and develop off-grid electrification.⁷⁷ It suffices to say that REA's statutory powers to engage in off-grid electrification in rural communities is in conflict with the intendments of the CFRN which puts off-grid electrification within the purview of the States.⁷⁸ Thus, a more purposeful approach would be to amend s 88 of the EPSRA to the effect that the REF would be utilized as assistance grants or loans to help the States develop their off-grid RE projects.

Nigeria' (*Scribd*, 9 January 2014) 8, <https://www.scribd.com/document/197752848/Beyond-Power-Sector-Reforms-the-Need-for-Decentralised-Energy-Options-DEOPs-for-Electricity-Governance-in-Nigeria>.

⁷²EPSRA, s 100; Interpretation Act, s 18.

⁷³EPSRA, ss 88 (1) and (10).

⁷⁴EPSRA, s 88 (9).

⁷⁵Federal Ministry of Power, Works and Housing and Rural Electrification Agency, *Rural Electrification Strategy and Implementation Plan (RESIP)*, (July 2006) 1–2, <https://rea.gov.ng/download/rural-electrification-strategy-implementation-plan-resip/>.

⁷⁶EPSRA, s 88 (13); Rural Electrification Agency (REA), 'About Us', <https://rea.gov.ng/theagency/>.

⁷⁷EPSRA, s 88 (13)(c).

⁷⁸CFRN, 2nd sch, pt II, para 14.

Thirdly, NERC relied on its omnibus powers⁷⁹ to make certain regulations for off-grid and stand-alone electrical systems such as EGs,⁸⁰ IEDNs⁸¹ and mini-grids.⁸² These regulations appear to have general application to EGs, IEDNs and mini-grids throughout the federation⁸³ without taking into consideration the powers of the States to regulate off-grid electricity. NERC issues licenses to IEDN units to operate in areas where there is no distribution system.⁸⁴ Such areas could be rural communities that are not connected to the grid⁸⁵ which would naturally fall under the purview of the States to regulate. Similarly, NERC issues permit for the operation of EG⁸⁶ and mini-grid units.⁸⁷ NERC is expressly empowered to regulate all mini-grid stakeholders, including institutions and agencies of the States that interact with mini-grid operators.⁸⁸

There are three types of IEDNs—isolated off-grid rural IEDNs, isolated off-grid urban IEDNs and embedded IEDNs.⁸⁹ With respect to mini-grids, there are isolated mini-grids and interconnected mini-grids⁹⁰ The regulation of isolated off-grid urban IEDNs, embedded IEDNs and interconnected mini-grids by NERC appear to be proper because, although they are stand-alone electricity systems, they are appropriate stand-alone systems to support or balance the service of generated electricity into the grid, which in turn transmits electricity to distribution

⁷⁹EPSRA, s 96 (1).

⁸⁰EGR, preamble.

⁸¹IEDN Regulations, preamble.

⁸²Mini-Grid Regulations, preamble.

⁸³EGR, s 2; IEDN Regulations, s 2; Mini-Grid Regulations, s 4.

⁸⁴IEDN Regulations, s 6 (2).

⁸⁵An IEDN is a distribution network that is not directly connected to a transmission system (grid lines). See IEDN Regulations, s 25. For the definition of a transmission system, see EPSRA, s 100.

⁸⁶IEDN Regulations, s 28.

⁸⁷Mini-Grid Regulations, ss 7, 8, 9 and 10.

⁸⁸Mini-Grid Regulations, s 4.

⁸⁹EGR, s 3 (1)(a), (b) and (c).

⁹⁰—mini-Grid Regulations, s 5 (1).

networks to serve grid-connected urban and rural consumers.⁹¹ Notwithstanding, NERC is acting *ultra vires* by regulating isolated off-grid rural IEDNs and isolated mini-grids because these are essentially off-grid electricity systems for rural and remote communities, which fall under the regulatory purview of the States.

Lastly, EPSRA provides a narrow definition of the power to promote transmission systems by putting the same under NERC's exclusive control.⁹² It is submitted that under the CFRN, the States are allowed to promote their own transmission systems outside the grid. Thus, any interpretation under EPSRA that only the Federal Government can promote a grid system to the exclusion of the States is faulty when Paragraph 14 of the Concurrent Legislative List is brought into consideration. By virtue of s 1 (3) of the CFRN, the provisions of EPSRA to the extent that they impede on the States' constitutional powers to exclusively promote and regulate off-grid electricity, is unconstitutional. EPSRA cannot purport to centralize electricity regulation where same, albeit unsatisfactorily stipulated, has already been decentralized by the CFRN.

5.3.2.3 Conflict Between EPSRA and NERC Regulations

Interestingly, there are some conflicts existing between EPSRA and some subsidiary NERC regulations, which this chapter has described as an example of the 'Inter-conflict' of laws. This 'inter-conflict' is of negative significance because it creates regulatory risks in terms of uncertainty and confusion in the electricity regulatory processes for NERC, operators and even private sector investors. This is unhelpful for NESI as there is an increasing need to access private sector financing and investment for electricity projects in order to boost access to electricity and alleviate energy poverty. These regulatory risks potentially scare private investors away because they tend to consider regulatory risks as one of the indices for evaluating investment risks within a capital-intensive industry such

⁹¹For the definitions of isolated off-grid urban IEDN, embedded IEDN and interconnected mini-grids, see IEDN Regulations, s 25 and Mini-Grid Regulations, s 3.

⁹²EPSRA, s 32 (1)(b) and (2)(d).

as electricity. This chapter will focus on conflicts existing among EPSRA and CPGR as an example to buttress this point.

EPSRA defines captive power generation as the generation of electricity for the purpose of consumption by the generator and not sold to an off-taker,⁹³ but 16 of the CPGR defines captive power generation as the generation of electricity exceeding 1 MW for the purpose of consumption by the generator and not sold to an off-taker. Section 62 (1) of the EPSRA provides that licenses shall be obtained by energy utilities electricity generation, transmission, distribution and trading. It is worthy to note that captive power generation is excluded from electricity generation requiring licensing.⁹⁴ An 'inter-conflict' of laws arises where EPSRA expressly excludes captive power generation from licensing, yet CPGR prohibits captive power generation operations without a permit.⁹⁵ The regulation further provides that a permit holder of a captive power generation facility must obtain the written consent of NERC before supplying surplus power not exceeding 1 MW to an off-taker and would require a license to supply surplus power exceeding 1 MW to an off-taker.⁹⁶

It is pertinent to place in proper perspective that captive power is virtually an off-grid electricity system, which naturally falls within the purview of the States to explore for rural electrification.⁹⁷ However, captive power as off-grid electricity could be utilized by the electricity utilities in urban areas under the purview of the Federal Government for the purpose of supporting or balancing the grid. In essence, off-grid electricity systems where operated in urban areas are properly within the powers of the Federal Government to regulate. Therefore, the CPGR would be unconstitutional to the extent that it regulates for captive power generation in rural communities. For captive power generation in rural areas, the use of the words 'permit', 'written consent' or 'license'

⁹³EPSRA, s 100.

⁹⁴EPSRA, s 62 (1)(a).

⁹⁵CPGR, s 1.

⁹⁶CPGR, s 8 (a) and (b).

⁹⁷Yemi Oke, Conflicting Laws Keep Nigeria's Electricity Supply Unreliable (*The Conversation*, 24 August 2017), <https://theconversation.com/conflicting-laws-keep-nigerias-electricity-supply-unreliable-81393>.

by the CPGR connotes a sense of regulation by NERC, whereas no such provision exists in the EPSRA. The ‘exceeding 1 MW’ qualifier in the definition of captive power in the CPGR runs contrary to the provisions of EPSRA. It is unclear why NERC, with the instrumentality of subsidiary legislation, would arrogate regulatory powers over captive power generation to itself when the primary statute excludes such regulation. Consequently, this ‘regulatory gymnastics’ leads to uncertainties for RE investors and operators within NESI. A major barrier to sectoral investment is the uncertainty created by the regulatory regime, and there is a need for a holistic review of Nigeria’s electricity regulatory framework in order to upscale access to energy.

5.3.3 Doctrine of Covering the Field vis-à-vis the Conflict of Electricity Laws

The doctrine of covering the field and questions about the superiority between Federal Acts and State Laws are bound to arise and call for determination in many situations. Based on this doctrine, it is arguable that the conflict of electricity laws can be easily determined. As EPSRA vests NERC with powers to regulate on-grid and off-grid electricity operations in both urban and rural areas,⁹⁸ any State Law that purports to regulate rural electricity within its territory is inferior to EPSRA and therefore ineffective by virtue of s 4 (5) of the CFRN. The doctrine can be applied where the National Assembly or a State House of Assembly enacts a Federal Act or State Law on a subject that the CFRN has already made provisions thereof. Here, the CFRN is said to have covered the field, and that Act or Law is ineffective.⁹⁹ Also, where a State Law is enacted on a subject for which a Federal Act has already been done, the Act supersedes such law.¹⁰⁰ However, the Court of Appeal has held that this provision

⁹⁸See the combined effect of EPSRA, ss 32 (1)(b); 32 (2)(d), (f) and (g); 96 (1); 96 (1)(b); 96 (2)(i), (o) and (q).

⁹⁹CFRN, s 1 (3); *Attorney-General of Ogun State v Attorney-General of the Federation* [1982] 2 NCLR 166.

¹⁰⁰*Attorney-General of Lagos State v. Eko Hotels* (2017) LPELR-43713 (SC).

does not have automatic effect as a Federal Act¹⁰¹ can only be invoked on this doctrine where the tenets, intendments or purposes of both laws are exactly the same and not merely alike.¹⁰²

From the foregoing, which legislative authority between the National and State Houses of Assembly has the legal superiority to regulate electricity in Nigeria? A good answer would be that the National Assembly's powers are of general application and the State Houses of Assembly's powers to regulate off-grid electricity is an exception to the general rule with regard to the National Assembly's powers. The CFRN has covered the field with respect to electricity regulation on and off the grid. Thus, LEPSRL¹⁰³ cannot be inferior to EPSRA because the law regulates captive and embedded electricity generation,¹⁰⁴ which are essentially off-grid power systems contemplated by the CFRN. In addition, as stated in Sect. 5.2 above, s 62 (1) (a) of the EPSRA expressly excludes NERC from regulating captive generation. Thus, as far as EPSRA purports to regulate off-grid electricity, particularly within rural areas not covered by the grid, it remains a conflict and an unconstitutionality.

5.3.4 Conflict of Electricity Laws: Implications for Off-Grid Renewable Energy Development

The fundamental implication of the conflict of electricity laws is that they ultimately defeat the purpose of achieving rapid access to clean, affordable and efficient energy through the simultaneous efforts of both Federal and State Governments. Since the military intervention

¹⁰¹The CFRN is also a Federal Act of the National Assembly. See (n 11).

¹⁰²*Chikelue v Ifemeludike* (1997) NWLR (pt 529) 390 at 403 (CA) (Tobi JCA).

¹⁰³The LEPSRL requires that a licensee obtains a license from both NERC and LESB: LEPSRL, s 17 (s). Considering the provisions of the CFRN, this requirement is superfluous at best because there is no such requirement under the CFRN. This bureaucracy amounts to double regulation and is a major disincentive to would-be investors.

¹⁰⁴LEPSRL, s 17. See also EPSRA, s 62 (1)(a) and (2).

into Nigerian politics in 1966,¹⁰⁵ the tendency to centralize sectoral regulation has remained in the psycho-political mindset of successive governments, despite the return to democratic governance twenty years ago.¹⁰⁶ Centralizing electricity regulation potentially slows down the pace of rapid RE transition and development as the Federal Government is overburdened with the Herculean task of meeting high electricity demands throughout a vast country like Nigeria. The Federal Government cannot do this alone, hence the essence of the States' participation in the promotion and management of electricity. But for these conflicts, as the Federal Government is focusing on promoting geothermal, hydro and solar power,¹⁰⁷ the States would have been actively complementing such efforts by harnessing more solar power and other RE sources¹⁰⁸ such as biogas for off-grid rural electrification.

These conflicts further create a discord between the Federal and State Governments regarding electricity regulation. A situation where the NERC plans to expand the grid to a hitherto unserved rural community wherein a State Government has concluded plans to promote off-grid electricity could lead to protracted litigations that would continue to hamper electricity development. The Federal Government could even apply its federal might to takeover electricity infrastructure installed by

¹⁰⁵On 17 January, 1967, Major General Johnson Aguiyi-Ironsi succeeded the Alhaji Abubakar Tafawa Balewa-led democratic civilian government after a coup d'état. On 24 May, 1967, Aguiyi-Ironsi promulgated the Unification Decree Number 34, dissolving Nigeria's federal structure into a unitary entity. The unitary system of government saw a centralized governance arrangement that ensured the central government was politically and economically stronger than the regional (sub-national) administrations. Six months later, his government was ousted through a counter-coup d'état and the federal system was restored (at least in theory).

¹⁰⁶It is a debate within political science circles that Nigeria is not practising democratic governance in its idealistic sense; rather Nigeria practices 'civil rule' system of government, which is largely a centralized government system without the involvement of the military.

¹⁰⁷Chijioke Mama, 'On-Grid Solar in Nigeria: Two Years After The PPAs' (*The Solar Future*, 22 February, 2018), <https://nigeria.thesolarfuture.com/news-source/2018/2/22/on-grid-solar-in-nigeria-two-years-after-the-ppas>; Detail Commercial Solicitors, 'Prospects of Solar Power in Diversifying Nigeria's Energy Mix' *Financial Nigeria*, (10 August 2016), <http://www.financialnigeria.com/prospects-of-solar-power-in-diversifying-nigeria-s-energy-mix-feature-67.html>.

¹⁰⁸The States would have ably focused on developing other RE sources that are not the primary focus of the Federal Government for their off-grid rural electrification programmes.

the States.¹⁰⁹ To forestall such occurrences for a secured energy future, the Federal and State Governments must find ways to collaborate, in line with the concept of federalism, to ensure that the purpose of achieving a rapid transition to and development of RE is realized.

Regulation of any sector is usually an avenue for a government to generate revenue that can be channelled towards economic and social infrastructure development. Due to the conflict of electricity laws and the usurpation of their powers to promote and regulate electricity within their respective domains, the States are being denied a viable avenue to generate revenue to inject into the development of economic and social infrastructure, including electricity. The States become less economically viable due to the inability to appropriately regulate electricity resources within their respective territories. This also leaves NERC with the uphill task of promoting and regulating energy throughout Nigeria. It is difficult for NERC to substantially monitor energy development in every urban and rural community in a vast country like Nigeria, and this accounts for the slow pace of electricity development in Nigeria.

Even as Lagos State decided to exercise its powers under the CFRN to regulate off-grid electricity in rural areas where NERC has claimed regulatory authority, the conflict of laws would create unnecessary bureaucracies for electricity investors and operators. They may be required to secure licenses from both NERC and the State electricity agencies before they can embark on electricity development and operations. For example, NERC is expressly empowered to regulate all stakeholders in mini-grid power, including institutions and agencies of the States that interact with mini-grid operators.¹¹⁰ This now becomes a case of double regulation. Especially for investors, double regulation creates uncertainties about the regulatory framework as Federal and State electricity laws could require them to perform two opposite obligations. Regulatory uncertainty within a sector tends to scare away investments, and that is a major revenue loss for both the Federal and State Governments.

¹⁰⁹There is an unconfirmed report that in the early 2000s, relying on the EPSRA as the regulators of NESI, NERC gave an ultimatum to the Rivers State Government to feed all electricity generated from its gas turbine to the National Grid.

¹¹⁰Mini-Grid Regulations, s 4.

5.4 Contemporary Approaches to Actualizing Rapid Renewable Energy Development from Legal and Governance Perspectives

RE development is critical to achieving rapid electrification and sustainable electricity supply as well as the transition to a low-carbon economy. Nigeria, being a signatory to the Paris Agreement, is expected to strategically contribute to actualizing a global net-zero carbon economy.¹¹¹ However, despite Nigeria's RE policies, plans and targets, little progress has been witnessed in RE projects development when compared with some other large African economies. According to a recent Bloomberg report, Nigeria did not perform well among Sub-Saharan African countries such as Kenya and South Africa in terms of attracting a substantial volume of RE investments in 2019.¹¹² This situation clearly indicates the need for more incentives to attract and escalate private sector financing of RE projects.

As more investments are required to drive the development of RE projects at national and sub-national levels, a viable and strategic regulatory framework is needed to ensure a secure environment for RE investments.¹¹³ REs are characterized by high-cost technologies, which makes fossil fuel technologies easily preferable for energy investors in most instances. Therefore, any government that is serious about actualizing its RE objectives will do more than set RE targets but proceed to create a viable and strategic RE regulatory framework in order to stimulate RE investments.

¹¹¹Signatories to the Paris Agreement are expected to contribute to achieving global net-zero carbon emissions targets through their respective Nationally Determined Contributions (NDCs). See the Paris Agreement 2015, art 4 (2), <https://unfccc.int/resource/docs/2015/cop21/eng/109r01.pdf>.

¹¹²Bloomberg NEF, *ClimateScope: Sub-Saharan Market Outlook* (2020) 4–5, <http://global-climate-scope.org/assets/data/docs/updates/2020-02-06-sub-saharan-africa-market-outlook-2020.pdf>.

¹¹³Kola O Odeku, 'An Analysis of Renewable Energy Policy and Law Promoting Socio-economic and Sustainable Development in Rural South Africa' (2012) 40 (1) *Journal of Human Ecology* 53, 54, [http://www.krepublishers.com/02-Journals/JHE/JHE-40-0-000-12-Web/JHE-40-1-12-Abst-PDF/JHE-40-1-053-12-2304-Odeku-K-O/JHE-40-1-053-62-12-2304-Odeku-K-O-Tx\[6\].pdf](http://www.krepublishers.com/02-Journals/JHE/JHE-40-0-000-12-Web/JHE-40-1-12-Abst-PDF/JHE-40-1-053-12-2304-Odeku-K-O/JHE-40-1-053-62-12-2304-Odeku-K-O-Tx[6].pdf).

It is worthy to note that the RE regulatory frameworks of various countries making massive strides in RE development differ in form. While some countries enacted a separate RE law to drive special focus on RE development, other countries expanded their extant electricity law to substantially provide for the development and integration of RE. This section of the chapter analyses the value of creating a separate RE legislation vis-à-vis the integration of substantial RE provisions in an all-encompassing electricity law in the Nigerian context (law), as well as the role of cooperative federalism (governance), as contemporary approaches to achieving rapid electrification and sustainable electricity in Nigeria.

5.4.1 Separating the Regulatory Framework for Renewable Energies from Non-Renewable Energies?

Regulatory inconsistencies and uncertainties continue to constitute a major barrier to RE investments and development in NESI. Nigeria lacks a clear and reliable regulatory framework for RE. While the NREEEP seeks to articulate broad objectives for RE development, the duplicity of roles and conflicting electricity laws have contributed to inhibiting RE investments. Regulation can have positive impacts on the development of energy services, markets and stakeholders, but the nature and extent of these impacts are dependent on the quality and efficacy of a relevant regulatory framework. Thus, it is advocated that increased investments and development in REs would be achieved through the enactment and implementation of a RE legal framework. However, in creating a viable and strategic RE legal framework for Nigeria, there are generally two plausible alternative pathways. The first pathway stems from the view that it would be more valuable to enact a RE law separate from EPSRA. The second pathway leads towards the amendment of the EPSRA to integrate substantial provisions relevant to the development and regulation of REs.

5.4.1.1 Enacting a Separate Renewable Energy Legislation

The main justification for the enactment of a RE law separate from EPSRA would be that EPSRA is heavily concentrated on the regulation of non-REs. It would be cumbersome for EPSRA, a single law, to simultaneously regulate both REs and non-REs in detail. Although EPSRA mandates NERC to regulate and promote Nigeria's vast energy sources, including REs,¹¹⁴ EPSRA places heavy reference on the development and regulation of non-RE sources and only makes scant provisions for RE regulation which are not far-reaching enough. However, NERC largely exercises its competence to regulate RE through subsidiary regulations.¹¹⁵ These subsidiary legislations are susceptible to sudden changes by NERC as they are not required to have the input or pass through the legislative crucibles of the National Assembly law-making process in order to become effective. These sudden changes are viewed as regulatory and investment risks by private investors as they create a sense of an unfriendly investment climate and regulatory uncertainty, making them sceptical about investing in electricity development, especially REs.¹¹⁶ Without a distinct RE legislation, regulatory risks and uncertainties will continue to make Nigeria an investor's landmine as risks of abrupt discontinuity of RE incentives will inhibit investments as witnessed in Australia's wind energy sub-sector.¹¹⁷ Therefore, a distinct RE legislation would be needed to address this regulatory imbalance.¹¹⁸

There are clear advantages of having a separate RE law that harmonizes different RE objectives and targets and incorporates relevant incentives to promote the growth of RE investments in the country. Such a law could take the form of framework legislation which sets measurable targets and

¹¹⁴Ifenyinwa Ufodu and Ike C Ibeku, 'The Legal Framework for Renewable Energy in Nigeria' (*Lexology*, 23 September 2019), <https://www.lexology.com/library/detail.aspx?g=5c0acacf-88a2-47ae-a1a2-dd5c29009cd6>.

¹¹⁵NERC is empowered to make regulations for all matters covered under the Act. See EPSRA, s 96 (1) and (2).

¹¹⁶Tatjana Tupy (n 6), 8 and 12; Shayle Kann, 'Overcoming Barriers to Wind Project Finance in Australia' (2009) 37 *Energy Policy* 3139, 3144–3145.

¹¹⁷Kann (n 116), 3144–3145.

¹¹⁸Lawrence Atsegbua, Vincent Akpotaire, and Folarin Dimowo, *Environmental Law in Nigeria: Theory and Practice* (Ambik Press, 2010) 290.

create or designate a regulatory body to drive the implementation of the law. Australia and Germany are typical examples of countries that have enacted separate RE laws.¹¹⁹ Through a total of AU\$20 billion in investments at the end of 2019, Australia achieved a 24% RE integration into its energy mix, surpassing its policy target of 23.5% by 2020.¹²⁰ This remarkable feat is largely due to the government's successful implementation of its Renewable Energy Target (RET) which had been enjoying substantial background support from Australia's RE law.¹²¹ Similarly, the enactment of an RE law in Germany is heralded as a milestone in the transition to low-carbon energy known as *Energiewende*. This move has helped the German government to set legal and policy mechanisms in place to stimulate capital raising and substantial investments in RE infrastructure through auction schemes and the capital market.¹²² Other positive outcomes achieved in Germany through its RE law includes an average of 80% RE generation rate with 100% electricity generation from REs in May 2018.¹²³

The aim of enacting a separate law to regulate REs, just like any other sector or industry, would be to ensure regulatory certainty and perhaps draw special focus and attention of all relevant stakeholders to play well-defined statutory roles for RE development. A RE law would ultimately send the right signals to investors about the government's special focus on RE development. It presents an opportunity for the government to fully

¹¹⁹Renewable Energy (Electricity) Act (Cth) (Australia); Renewable Energy Sources Act 2017 (Germany).

¹²⁰Clean Energy Regulator, Renewable Energy Target Annual Statement 2018–2019, <http://www.cleanenergyregulator.gov.au/DocumentAssets/Documents/Clean%20Energy%20Regulator%20Annual%20report%202018%E2%80%932019.pdf>; Clean Energy Regulator, 'The 2018 Renewable Energy Target Annual Statement—Progress Towards the 2020 Target' (4 April 2019), <http://www.cleanenergyregulator.gov.au/About/Pages/Accountability%20and%20reporting/Administrative%20Reports/The-2018-Renewable-Energy-Target-Annual-Statement-%E2%80%932019-Progress-towards-the-2020-target.aspx>.

¹²¹Renewable Energy (Electricity) Act (Cth) (Australia), s 3.

¹²²Markus Bohme and Carsten Bartholl, 'Germany' in Karen B Wong (ed), *The Renewable Energy Law Review* (Law Business Research, 2019) 45.

¹²³Jeremy Berke, 'Germany Paid People to Use Electricity Over the Holidays Because Its Grid Is So Clean' *Business Insider* (29 December, 2017), <https://www.businessinsider.com/renewable-power-germany-negative-electricity-cost-2017-12?IR=T>; Giles Parkinson, 'Germany Reaches 100% Renewables for a Few Hours, 42% So Far This Year' *Renew Economy* (4 May, 2018), <https://reneweconomy.com.au/germany-reaches-100-renewables-hours-42-far-year-30642/>.

incorporate and implement broad fiscal mechanisms for RE development in a separate legal document as the EPSRA in its present form is cumbersome. Achieving a successful energy transition, as seen in Australia and Germany would largely depend on a RE-specific law to guide that cause. Taking a cue from the RE laws of Australia and Germany, Nigeria can take advantage of its RE law to set strategies and mechanisms in detail for the implementation of investor-friendly fiscal mechanisms and incentives for private financing of RE projects¹²⁴ such as feed-in tariffs, tax holidays (due to the initial high costs of REs), priority dispatch for RE transmission, host community issues and definite dispute resolution mechanisms.

5.4.1.2 Integrating Specific Renewable Energy Provisions into a Holistic Electricity Legislation

The other view that the EPSRA should be amended to integrate substantial provisions relevant to the development and regulation of REs is equally considered here. Some experts have advocated the essence of creating an enabling environment for RE investments and overall RE development through ‘a simple and efficient renewable energy law’.¹²⁵ However, with reference to this second pathway, a simple and efficient RE law does not necessarily translate to a separate RE law. An electricity law can encompass substantial and efficient provisions to regulate both REs and non-REs. In Kenya, REs and non-REs are efficiently governed by a single electricity legislation.¹²⁶ This law, which enjoys heavy government support, substantially incentivizes RE investment through carbon

¹²⁴The States can model their State electricity laws to create an enabling environment for Results-Based Financing (RBF), which international development organizations use to finance rural electrification projects in order to mitigate off-taker credit risks. This is a valuable source of project finance for state RE laws to cover especially as Nigeria is yet to record a project-financed RE infrastructure. See Dolapo Kukoyi, Nnenda Hayatuddini and Victor Samuel, ‘Nigeria’ in Karen B Wong (ed), *The Renewable Energy Law Review* (Law Business Research, 2019) 116, 128.

¹²⁵Tatjana Tupy (n 6), 8 and 12; E L Efurumibe, ‘Barriers to the Development of Renewable Energy in Nigeria’ (2013) 2 (1) *Scholarly Journal of Biotechnology* 11, <http://www.scholarly-journals.com/sjb/archive/2013/jan/pdf/Efurumibe.pdf>.

¹²⁶Energy Act 2019 (Kenya), https://kplc.co.ke/img/full/o8wccHsFPaZ3_ENERGY%20ACT%202019.pdf.

credit schemes, net metering, feed-in tariffs, and 0% import duty and tax exemptions.¹²⁷ Consequently, Kenya is reported to have achieved unprecedented milestones including 70% RE penetration into its energy mix; access to electricity for 9 million homes through off-grid RE; and attracted up to US\$4.1 billion in RE investments.¹²⁸ Furthermore, due to the government's policy focus to harness the country's RE potentials, especially geothermal energy, Kenya ranks 1st in Africa and 9th globally for geothermal power production.¹²⁹

This second pathway trivializes the position of the first pathway—the enactment of a separate RE law in Nigeria—as being superfluous at best. The fact that the EPSRA contains scant provisions on RE regulation merely provides an opportunity for its amendment to expand on the statutory regulation of various RE options within the same statutory document. The Kenyan example shows that a single electricity law which encompasses far-reaching provisions for the efficient regulation of both REs and non-REs significantly aids a regulator to better manage the development and integration of REs into an energy mix that is already serviced by non-REs. Particularly, Kenya's electricity law made specific reference to the implementation of the National Energy Policy, which contains even more specific details for harnessing geothermal, solar, wind, hydro and biofuels resources.¹³⁰ This should be the pathway for Nigerian legislators to follow in order to achieve adequate and efficient electricity supply from both RE and non-RE sources.

It does not necessarily follow that a separate RE law would be necessary in order to achieve energy transition targets. The advantage of the regulation of all energy options within a single holistic legislation, as seen in Kenya, is the double opportunity of integrating REs into the energy

¹²⁷Energy Act 2019 (Kenya), ss 75 (2)(g), 91 and 162.

¹²⁸International Energy Agency (IEA), *Africa Energy Outlook* (2019) 232–235, https://africa.check.org/wp-content/uploads/2019/12/Africa_Energy_Outlook_2019.pdf; UNEP/Bloomberg NEF, *Global Trends in Renewable Energy Investment* (2019) 51, <https://wedocs.unep.org/bitstream/handle/20.500.11822/29752/GTR2019.pdf>.

¹²⁹REN 21, *Renewables Global Status Report* (2019) 217, https://www.ren21.net/wp-content/uploads/2019/05/gsr_2019_full_report_en.pdf.

¹³⁰See generally: Energy Act 2019 (Kenya); Ministry of Energy, *National Energy Policy 2018*, https://kplc.co.ke/img/full/BL4PdOqKtxFT_National%20Energy%20Policy%20October%20%202018.pdf.

mix to improve access to electricity while simultaneously implementing strategies for a gradual yet steady energy transition. President Kenyatta, basking on the success of achieving 70% penetration of REs into the energy mix, stated that Kenya will aim for a 100% RE penetration by the end of 2020.¹³¹ Kenya did not need to achieve these feats by separating the regulation of REs from non-REs. Rather, a careful examination of the Kenyan experience would reveal that achieving a successful energy transition is dependent on a successful integration of REs into an energy mix already heavily served by non-REs.

5.4.1.3 The Propriety of Either Pathway in the Context of the NESI

The first point to note here is that the respective reasoning of both pathways is plausible. While Australia and Germany are testament to the tenability of separating the regulation of RE from non-REs as a strategy for energy transition by focusing on diversifying the energy mix through RE development, Kenya remains a shining example of how a single holistic electricity law can effectively lead to the integration of REs into the energy mix and eventual energy transition. It can be said that both pathways are different highways that ultimately lead to the same destination of affordable, clean and sustainable energy as envisaged in Goal 7 of the Sustainable Development Goals (SDGs).¹³² The rationale for the adoption of either pathway to arrive at the said destination depends on varying factors, including country-specific dynamics.

The second point to note is that whether either pathway is adopted or otherwise, the goal of arriving at the said destination also depends on the level of government support for either pathway. As highlighted above, the goal of achieving affordable, clean and sustainable energy through RE integration and energy transition in Australia, Germany and Kenya enjoys substantial support from their respective governments through

¹³¹Johnny Wood, 'Kenya is Aiming to be Powered Entirely by Green Energy by 2020' (*World Economic Forum*, 5 December, 2018), <https://www.weforum.org/agenda/2018/12/kenya-wants-to-run-entirely-on-green-energy-by-2020/>.

¹³²United Nations (n 16).

careful planning, policy implementation and effective regulation. Understandably, the heavier developmental focus is directed towards Nigeria's oil and gas potentials because they account for 80% of the government's revenue base and 90% of foreign exchange earnings,¹³³ from which public funds are derived to develop other economic sectors. However, in our view, the fallout of this situation is that NREEEP appears not to be receiving the level of government support required to significantly improve RE access within set timelines, hence the continuous low access to electricity in Nigeria. The Nigerian experience is reflective of the United Nations' projection that many African countries are unlikely to meet the SDG7 targets by 2030 due to the quality of their policies and their level of implementation.¹³⁴

Both points are quite instructive in the Nigerian context because it could be counter-argued that an RE legislation (separate or integrated) for Nigeria is not entirely necessary, the rationale being that although EPSRA makes scant provisions for the regulation of RE, that regulatory gap is covered by an array of RE-related NERC Regulations created by virtue of EPSRA, e.g. CPGR, EGR, IEDN Regulations and Mini-Grid Regulations. Therefore, Nigeria's RE policies and regulations, devoid of a uniform RE law, are already sufficient to cater for RE development. This situation is not peculiar to Nigeria. For example, South Africa has no separate or integrated RE legislation but the government's commitment to the implementation of the Renewable Energy Independent Power Production Procurement Programme (REIPPPP), South Africa's RE policy, has been yielding increased rural electrification and stimulated RE investments.¹³⁵ We observe that the case is so in South Africa

¹³³Chijioke Nwaozuzu, 'Dwindling Oil Revenues: Economic Implications for Governance, Business and Development' (*Energy Mix Report*, 2018), <https://www.energymixreport.com/dwindling-oil-revenues-economic-implications-governance-business-development/>; PwC, *Nigeria: Looking Beyond Oil* (March 2016), <https://www.pwc.com/ng/en/assets/pdf/nigeria-looking-beyond-oil-report.pdf>.

¹³⁴United Nations, *Achieving SDG 7 Targets: Policy Brief in Support of the First SDG7 Review at the UN High-Level Political Forum 2018*, https://sustainabledevelopment.un.org/content/documents/18041SDG7_Policy_Brief.pdf.

¹³⁵Lido Fontana and Sharon Wing, 'South Africa' in Karen B Wong (ed), *The Renewable Energy Law Review* (Law Business Research, 2019) 145.

due to the strong support that the REIPPPP receives from the government as South Africa tries to roll back on coal development and scale up the installation of RE systems to achieve access to sustainable electricity for rural communities.¹³⁶ Government support for RE in Nigeria is not aggressive due to the heavy focus and reliance on fossil fuels for revenue generation. Thus, where either pathway of a separate or integrated RE law are followed, the main emphasis should be laid on a viable and strategic law that focuses on the extensive promotion and governance of REs, and this would require strong government support and commitment to successfully implement the RE law for sustainable impact.

This summary analysis does not trivialize the position that a RE law is necessary to drive RE development. Depending on the structure and intendment, a RE law would ideally ensure government accountability and mandate government to pay closer attention to harnessing RE sources even where the political will to do so may be lacking. In their own unique ways, both pathways can ensure regulatory certainty where the structure and provisions of the RE law are strategically set. Notwithstanding, the propriety of a separate or integrated RE law or otherwise in the Nigerian context is an issue that requires extensive legal research and analysis beyond this chapter.

5.4.2 Achieving off-Grid and Rural Electricity Development Through Cooperative Federalism

Federalism entails the devolution of governmental powers between the Central/Federal Government and the component units (State and Local Governments) to be exercised within certain limits. Federalism, as Elazar notes, ensures that ‘the constituting elements in a federal arrangement share in the process of common policy-making and administration by right’ to be done in a manner that respects the respective integrities, existence and authority of all constituting elements.¹³⁷ Federalism

¹³⁶Bloomberg NEF (n 112) 22; IEA (n 128), 248.

¹³⁷Daniel J Elazar, *Exploring Federalism* (University of Alabama Press 1991) 5–6, <https://www.jstor.org/stable/pdf/2131811.pdf?seq=1>.

helps to stimulate healthy competition among the component units in various economic sectors, potentially resulting in sectoral and/or general development through the competitive efforts of the component units.¹³⁸

Paradoxically, there has been minimal or no healthy competition among the States with respect to exercising their constitutional powers to engage in off-grid/rural electricity development in line with Nigeria's federal structure. As laudable as RESIP is, it is apparently driven by 'regulatory centralism'—a situation where a particular sector is organized in a way that everything flows from the centre with little room for the component units to exercise any authority or powers. Regulatory centralism is antithetical to cooperative federalism. In Sect. 5.3, this chapter referred to s 4 of the Mini-Grid Regulations empowering NERC to regulate all mini-grid stakeholders, including institutions and agencies of the States that interact with mini-grid operators, with no indication of a prior express acquiescence by the States. Were the States allowed to promote off-grid/rural electricity in concert with the Federal Government, then rural electrification through mini-grid solutions would have been much faster than the status quo. Apparently, the Federal Government has not substantially engaged with the States in off-grid/rural electricity programmes, a situation Bulman-Pozen and Gerken may term 'uncooperative federalism'.¹³⁹

Rapid electrification and energy transition can be achieved through cooperative federalism, enabling cooperation between the Federal and State Governments to promote these shared objectives, subject to constitutional delineations. The REA, statutorily mandated to promote rural electrification, is an appropriate platform to explore cooperative federalism for the purpose of driving faster outcomes in rural electrification through both on-grid and off-grid solutions. To achieve a coordinated approach to implementing rural electrification, it is suggested that the

¹³⁸This healthy competition was exemplified during the pre-independence and early post-independence eras. In a federated state, the Western region blazed the trail in education and the media; the Northern region set the pace in agriculture, and the Eastern region promoted industries and commerce. In these various sectors, each region tried to emulate, and out-pace the other and this regional competition contributed to the economic boom that Nigeria experienced during those eras.

¹³⁹Jessica Bulman-Pozen and Heather K Gerken, 'Uncooperative Federalism' (2008–2009) 118 *Yale Law Journal* 1256.

States (desirably represented by their ministries or boards in charge of electric power) should be co-opted into the membership of the Governing Board of REA.

There could be situations where REA plans to electrify a rural community having proximity to the grid, while the State has made plans to execute electrification projects for that rural community. In such situations, a compromise approach would be expedient.¹⁴⁰ The Federal Government can reasonably embark on connecting rural areas to the grid, but considerations should be had to various factors including population density, proximity to the grid, feasibility and cost-effectiveness of the expansion project. Where there is no proximity to the grid, and the connection would be unfeasible and/or cost-ineffective, it would be more appropriate for the States to embark on the project. The States would then have to decide between executing ‘state grid’ or off-grid RE projects in such rural communities.

Nigeria could adopt Australia’s cooperative federalism experience to suit her purposes. The Council of Australian Governments (COAG), consisting of the Prime Minister, Premiers/Chief Ministers of the States/Territories and the President of the Australian Local Government Association, is a high-level forum to address matters of national significance that require a coordinated approach by the Commonwealth, State/Territory and Local Governments.¹⁴¹ Its agenda focuses on broad-ranging issues touching on the present and future well-being of Australians,¹⁴² including energy. COAG Energy Ministers, under the aegis of the COAG Energy Council, meet to work together to ensure efficient energy supply throughout Australia.¹⁴³ The COAG Energy Council

¹⁴⁰The Federal Ministry of Power admitted in the RESIP document that off-grid electrification and grid expansion projects in rural communities would be difficult to achieve without a “coordinated” plan at the Federal, State and Local government levels. However, the use of the word “coordinated” still creates an impression of a centralized rural electrification plan, whereby although the States may have their say, the Federal Government still has its way. Rather than a coordinated plan, a collaborative or cooperative plan would be a better presentation. See generally: Federal Ministry of Power, Works and Housing (n 75), 11–12.

¹⁴¹Council of Australian Governments (COAG), www.coag.gov.au.

¹⁴²COAG decisions drive sectoral reforms through communiqués, statements of cooperation and intergovernmental agreements. See generally COAG, www.coag.gov.au.

¹⁴³COAG Energy Council, *Our Role*, www.coagenergycouncil.gov.au/about-us/our-role.

was instrumental to the successful negotiation of the Australian Energy Market Agreement by the Commonwealth, State/Territory and Local Governments in 2004, aimed at ensuring reliable supply and improving the investment climate in Australia's electricity industry.¹⁴⁴ In Nigeria, we have the National Economic Council headed by the Vice President with the thirty-six State Governors as members, to advise the President on economic matters,¹⁴⁵ including collaborative efforts towards improving electricity supply in Nigeria. The National Integrated Power Project (NIPP) was conceived in 2004 as a fast-track government-funded initiative to improve electricity supply in Nigeria.¹⁴⁶ The Niger Delta Power Holding Company Limited (NDPHC), whose entire shares are fully subscribed to by the Federal, State and Local Governments, was incorporated as a limited liability company to serve as the special purpose vehicle to implement the NIPP.¹⁴⁷ The NDPHC Board is headed by the Vice President with six Governors representing the six geo-political zones of Nigeria and the Ministers of Power, Petroleum Resources, Finance and Justice/Attorney-General as members.¹⁴⁸ NDPHC has successfully delivered on various NIPP electricity generation, transmission and distribution projects across Nigeria.¹⁴⁹

¹⁴⁴Ibid.

¹⁴⁵CFRN, s 153 (1); CFRN, 3rd sch, pt I, paras 18 and 19.

¹⁴⁶The Council of State and the National Assembly approved the initial funding of US\$2.5 billion for the NIPP which was drawn from the Excess Crude Oil Account and continues to approve funding for the NIPP from this account. Because this account is jointly owned by the three tiers of government, we presume that approval for the commencement of the NIPP must have witnessed extensive engagement between the executive and legislative arms of the Federal and State Governments in accordance with the principle of cooperative federalism. See generally NDPHC, 'Company History', <http://www.ndphc.net/ndphc-company-history>; NDPHC, 'Funding and Incorporation', <http://www.ndphc.net/ndphc-funding-incorporation>; Kenneth E Okedu et al., 'Impact of the Independent Power Producers and National Integrated Power Projects on the Deregulation of the Nigerian Electricity Sector' (2018) 20 (1) *Journal of Sustainable Development in Africa* 147, 155–160; Stanley Opara, 'Leveraging NIPP for Nigeria's Power Sector Development' *The Guardian* (9 January 2019), <https://guardian.ng/energy/leveraging-nipp-for-nigerias-power-sector-development/>.

¹⁴⁷NDPHC, 'Company History', <http://www.ndphc.net/ndphc-company-history>.

¹⁴⁸NDPHC, 'Board of Directors', <http://www.ndphc.net/board>.

¹⁴⁹NDPHC, 'Company History', <http://www.ndphc.net/ndphc-company-history>; Opara (n 146); Udemé Akpan, 'NPDC Completes 8 NIPP Power Plants Worth Billions of Naira' *Vanguard* (8 January 2019), <https://www.vanguardngr.com/2019/01/nphc-completes-8-nipp-power-plants-worth-billions-of-naira/>; Ahmed M Murtala, Chikiezie Nwaoha, and Oladokun

The NIPP is a laudable initiative, but its performance over the years has generated two major concerns. Firstly, NDPHC/NIPP projects are largely for the delivery of on-grid electricity generation, transmission and distribution infrastructures powered by fossil fuels. Less attention has been paid to off-grid electricity, resulting in poor outcomes with regard to securing energy access in rural communities. Secondly, even under its side solar energy programme tagged ‘NDPHC Beyond the Grid’,¹⁵⁰ there are criticisms that it has been entirely executed in Northern Nigeria,¹⁵¹ excluding other parts of the country in non-compliance with the principle of federal character.¹⁵² Thus, in accordance with cooperative federalism, the Federal, State and Local Governments should align the NDPHC to focus more on holistic off-grid rural electrification programmes to improve energy access across Nigeria.

In summary, regulatory requirements mandating investors and operators to obtain NERC licenses for off-grid RE investments and operations in rural communities is not in tandem with the spirit of cooperative federalism. The component units which are closer to the geographical locations where off-grid electric systems are to be implemented are better placed to promote electricity development in those locations. Cooperative federalism suggests a willingness (or at least an acceptance) between relevant levels of government to work together to solve problems that are their constitutional responsibility.¹⁵³ The challenges facing rural electrification are regional in scope, and there is value in preserving State and

A J Olagoke, ‘Potentials of Sustainable Electricity Generation from Natural Gas in Nigeria towards Economic Growth’ (2013) 3 (2) *International Journal of Emerging Trends in Engineering and Development* 617, 624–627, https://www.researchgate.net/profile/Chikezie_Nwaoha/publication/285744229_Potentials_of_sustainable_electricity_generation_from_Natural_Gas_in_Nigeria_towards_economic_growth/links/580eb42c08ae47535247b880/Potentials-of-sustainable-electricity-generation-from-Natural-Gas-in-Nigeria-towards-economic-growth.pdf.

¹⁵⁰The Cable, ‘Niger Delta Power Holding Company Ltd: Boosting Electricity Supply, Infrastructure Capacity’ (20 November 2019), <https://www.thecable.ng/niger-delta-power-holding-company-ltd-boosting-electricity-supply-distribution-infrastructure-capacity>.

¹⁵¹E O Diemuodeke and T A Briggs, ‘Policy Pathways for Renewable and Sustainable Energy Utilisation in Rural Coastline Communities in the Niger Delta Zone of Nigeria’ (2018) 4 *Energy Reports* 638, 639–640.

¹⁵²See CFRN, s 14 (3).

¹⁵³Stephen Jones, ‘The Future of Renewable Energy in Australia: A Test for Cooperative Federalism?’ (2009) 68 (1) *The Australian Journal of Public Administration* 1, 2.

local voices in policymaking decisions.¹⁵⁴ Therefore, the importance of cooperative federalism in rural electrification projects cannot be overemphasized because access to energy for all is a common objective of all levels of government.

5.5 Conclusion

In evaluating the significance of law in stimulating energy development, questions as to whether a regulatory framework has improved or impeded energy development and how best a regulatory framework can be strategically positioned to stimulate energy development would have to be determined.¹⁵⁵ This chapter has shown that the conflicts existing among Nigeria's electricity laws has led to the slow pace of off-grid RE development, and there is a need for urgent legal reforms. A situation where both Federal and State Governments regulate off-grid electricity amounts to duplication of responsibilities, bureaucratic bottlenecks and uncertainty for RE operators and investors. It is worrisome when there are conflicting provisions between two laws for the regulation of a sector. It is even more worrisome when there are conflicting provisions within a particular law. The effect of such 'intra-conflict' is a tendency towards the suicidal—the purpose or intendment for which the CFRN was enacted has been defeated by the conflicting provisions of that law itself, rather than extraneous law(s) or factor(s).

These conflicts can be foundationally resolved by amending Paragraphs 13, 13 (a), 13 (b), 13 (f), 14 (a) and 14 (b) of the Concurrent Legislative List to clearly stipulate that all electrification outside the grid rests within the competence of the States to the exclusion of the Federal Government. Similarly, in line with the second pathway as espoused in Sect. 5.4, the EPSRA should be amended to the effect that the powers of NERC and REA to the extent that they promote and regulate rural

¹⁵⁴Daniel A Lyons, 'Federalism and the Rise of Renewable Energy: Preserving State and Local Voices in the Green Energy Revolution,' (2014) 64 (4) *Case Western Reserve Law Review* 1619.

¹⁵⁵Yinka Omorogbe, 'Universal Access to Modern Electricity Services: The Centrality of the Law' in Yinka Omorogbe and Ada Ordo (eds), *Ending Africa's Energy Deficit and the Law: Achieving Sustainable Energy for All in Africa* (Oxford University Press, 2018) 1, 25.

and off-grid electricity is given back to the States. Furthermore, drawing from the Kenyan example, EPSRA should be expanded to contain a detailed regulatory structure and processes for REs. In the alternative, if the legislators decide to follow the first pathway by enacting a separate RE law, such law should contain far-reaching provisions for the governance of REs as we have seen in Australia and Germany. However, the spirit of cooperative federalism should guide compromises in grid expansion projects vis-à-vis off-grid power installations in rural communities. As rural electrification is a socio-economic issue, it is suggested that the National Economic Council's mandate be extended to driving sectoral reforms through intergovernmental agreements as it occurs in Australia. The Council could drive cooperative arrangements between the Federal and State Governments¹⁵⁶ in solving the plausible grid expansion imbroglios espoused in Sect. 5.3. These, no doubt, would require constitutional amendments. NERC can engage in expansion projects where proximity to the grid is close and direct, while State agencies can handle off-grid installations in areas where proximity to the grid is unfeasible. Alternatively, NDPHC as a joint venture between the three levels of government can embark on-grid expansion projects in such circumstances. Furthermore, the Federal and State Governments should leverage the NDPHC as a viable vehicle to deliver on improving access to electricity in rural areas by focusing more on off-grid rural electrification programmes in a balanced manner. These measures will go a long way to ensure certainty in RE governance and stimulate more investments in RE.

¹⁵⁶The National Economic Council headed by Yemi Osinbajo (the Vice President) set up an ad hoc committee on Power Sector Reforms and Distribution Company Ownership headed by Nasir El-Rufai (the Governor of Kaduna State). However, President Muhammadu Buhari also set up a Power Sector Reforms Coordination Working Group headed by the Vice President with the Kaduna State Governor among the members. The idea of having two power sector reform groups at the presidential level appears superfluous and not to be a viable strategy to drive power sector reforms through the cooperation of the Federal and State Governments. See generally Aza Msue, 'Osinbajo Heads Presidential Working Group on Power Sector Reforms' (*Leadership*, 8 March 2020), <https://leadership.ng/2020/03/08/osinbajo-heads-presidential-working-group-on-power-sector-reforms/>. See also Innocent Oweh, 'DisCos Underinvested in Power Sector by N164bn, Owe N230bn—FG' (*Independent*, 20 March 2020), <https://www.independent.ng/discos-underinvested-in-power-sector-by-n164bn-owe-n230bn-fg>.

Having said the above, it appears that most States are either oblivious of their constitutional powers regarding the promotion and regulation of off-grid electricity or lack the capacity to do so. If the former is the case, this chapter serves as a wake-up call to the States to take charge of those constitutional powers. It is, however, likelier that the latter is the case. Several options are open to the States, such as engaging in collaborative efforts with the Federal Government (as with the NDPHC) or engaging in public–private partnerships and other sources of private finance. They should be bold to challenge any perceived usurpation of their constitutional obligations. Lagos State, as well as Kaduna and Nasarawa States, is trying to exercise their constitutional powers through the implementation of various off-grid/rural RE projects¹⁵⁷ but they are still required to seek certain permits/licenses under relevant NERC Regulations. The Federal Government (and/or its relevant agencies), in coalition with State Governments, should exercise the political will to repeal any conflicts in our electricity laws in order to ensure access to clean, affordable and efficient electricity for all. After all, the essence of a federalist approach to electricity regulation involving the States is to bring socio-economic development closer to the people through sustainable energy systems.

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6

The Status and Future of Charcoal in the Energy Transition Era in Sub-Saharan Africa: Observations from Uganda

Catherine Nabukalu and Reto Gieré

Video interview by the author discussing this book chapter can be accessed at, <https://www.youtube.com/watch?v=NW13jvtexXg&t=2079s>. Last accessed on 1st September 2020.

6.1 Introduction

While the world is transitioning to a low-carbon economy, many countries in Africa are still reliant on traditional energy such as solid biomass (Nalule, 2018). Goal 7 of the United Nations (UN) Sustainable Development Goals emphasizes access to modern energy for all. However, many people in sub-Saharan Africa remain without access to

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modern energy. As such, over 70% of people in rural Africa rely on traditional energy such as charcoal and firewood—this has made scholars question the readiness of African countries to effectively achieve Goal 7 on energy access and Goal 13 on climate action (Nalule, 2020).

Several projections into the energy-consumption future of sub-Saharan Africa indicate that charcoal, among other forms of biomass, such as firewood, will continue to be a significant source of energy in households for cooking for a very long time (Owen, van der Plas, & Sepp, 2012). According to the World Bank (2018), dependence on this fuel type will continue well into the 2030s. In several African nations, including Liberia, Uganda, Nigeria, Tanzania, Mozambique and Kenya, biomass contributes to at least 80% of the energy consumed for cooking, especially in urban settlements (Alfaro & Jones, 2018; Government of Uganda [GoU], 2015; Okello, O'Connor, & Young, 2001; Cotton, Kirshner, & Salite, 2019; Ben-Iwo, Manovic, & Longhurst, 2016; Branch & Martiniello, 2018). The U.N. Food and Agricultural Organization (FAO) also demonstrated that from 1993–2017, Africa produced the largest annual average amount of charcoal in the world (24.6 Million tons), corresponding to more than 57% of the total global production (FAO, 2019).

In many ways, charcoal consumption and the significant dependence on this fuel has framed the contemporary understanding of energy in sub-Saharan Africa. For instance, significant side effects of its use, including indoor air pollution and carbon monoxide poisoning, both linked to high mortality (Fullerton, Bruce, & Gordon, 2008; de Koning, Smith, & Last 1985), form the basis for putative notions, such as, 'energy poverty' and 'energy insecurity', in the development discourse about the state of energy in the sub-Saharan region (Kaygusuz, 2011; Khellaf, 2018). In national development plans and regional aspirations for economic progress, African nations, such as Mozambique, Nigeria, Rwanda, Tanzania and Kenya, have prioritized centralized infrastructures, such as hydropower dams, nuclear and geothermal power plants for long-term generation and continuous supply of electricity (Africa Oil and Power, 2018; Cotton, Kirshner, & Salite, 2019; Owen, van der Plas, & Sepp, 2012; Power Africa, 2019). The primary aim of decoupling societies from biomass combustion is reinforced through rigorous rural electrification priorities because biomass use is more intense in

rural areas (GoU, 2015; Szabó, Moner-Girona, Kougias, Bailis, & Bódis, 2016; Alfaro & Jones, 2018; Rural Electrification Agency [REA], 2020; Cotton, Kirshner, & Salite, 2019; Kihwel, Hur, & Kyaruzi, 2012).

Despite increased electricity generation and more grid connections, however, the production, trade and consumption of charcoal have prevailed in sub-Saharan Africa. For instance, in the urban centres of Mozambique, Burkina Faso and Zambia, charcoal consumption is still intensive according to Cotton, Kirshner and Salite (2019), Khellaf (2018), and Pesa (2017). Pesa (2017) further stated that people with access to electricity maintain charcoal braziers as a backup to their modern energy alternatives for cooking. Further North, in Egypt, where sources of electricity are diverse, and most of the population is connected to the grid, charcoal is still an important part of residential energy consumption, sustaining the excessive local production, and the country's imports, which have been increasing over the past decade to serve local demand (International Renewable Energy Agency [IRENA], 2018; FAO, 2019).

The main objective of this study is to evaluate the status of charcoal as an energy source and examine its role in the energy-consumption mix of informal economies. The energy-supply mix in sub-Saharan Africa is diversifying through increased electrification to curb energy-related forest loss. We explore the production of charcoal, its trade as a commodity, and the role of middlemen involved in its delivery to local and international markets. Critical questions of adaptation from the use of charcoal, especially in areas where consumers have access to 'modern' alternatives and charcoal as fuel for cooking, are also examined to make a holistic assessment of, and provide conclusions on, the future of charcoal in sub-Saharan Africa.

6.2 Environmental and Health Implications of Charcoal Production and Consumption

Most of the stringent regulations against charcoal production in Africa are based on reducing its impact on the environment. However, despite

recommended practices, such as felling trees by observing a minimum harvestable diameter (Namaalwa, Hofstad, & Sankhayan, 2009), indiscriminate tree cutting is common. The destruction of young vegetation when high-powered motor vehicles access remote production sites for charcoal pickup also leaves fewer trees to naturally sequester carbon. Moreover, pyrolysis, the chemical process of transforming tree trunks into charcoal under low-oxygen conditions, releases large amounts of various gases and pollutants, which are highly concentrated around the earth-mound kilns (Nabukalu & Gieré, 2019).

Upstream, one of the most significant occupational hazards of charcoal production using earth-mound kilns is that the highly manual processes create risks of back straining, wounding and bruising not only from the tools used but also from the massive logs or raw materials that have to be lifted or rolled on the uneven ground and then piled to set up the kiln. For example, we observed that a single kiln is typically set up by only one or two workers, to their shoulder height, to make monitoring pyrolysis manageable. Moreover, workers do not wear protective equipment such as gloves, overalls, masks or fire-proof footwear while producing charcoal.

Pyrolysis in earth-mound kilns generally registers very low-efficiency rates, between 8 and 11% (Namaalwa, Hofstad, & Sankhayan, 2009; Alfaro and Jones; 2018), depending on a burner's skills (Chidumayo & Gumbo, 2013). Some logs are not fully transformed into charcoal, but still, release poisonous gases. Because nomadic producers set up their tents in very close proximity to monitor the kilns, they face high risks of inhaling toxic gases (e.g. methane, carbon monoxide), which may harm their health.

At the remote production sites in the Nwoya and Mityana districts (Fig. 6.1), we observed that nomadic workers did not have access to clean piped water for the 4–6-month duration of their work. Moreover, there was high dependence on medicinal herbs, although this largely depends on pre-existing knowledge of plant species. Alternatively, workers carried over-the-counter drugs for relief of symptoms, such as headaches, during work, with risks of spoilage from poor storage conditions.

Because of handling practices, the risks of inhaling charcoal dust occur for most stakeholders along the supply chain. In their study of Namibia's charcoal factories, Hamatui, Naidoo, and Kgabi (2016) found that workers involved in packaging, sieving and weighing processes were

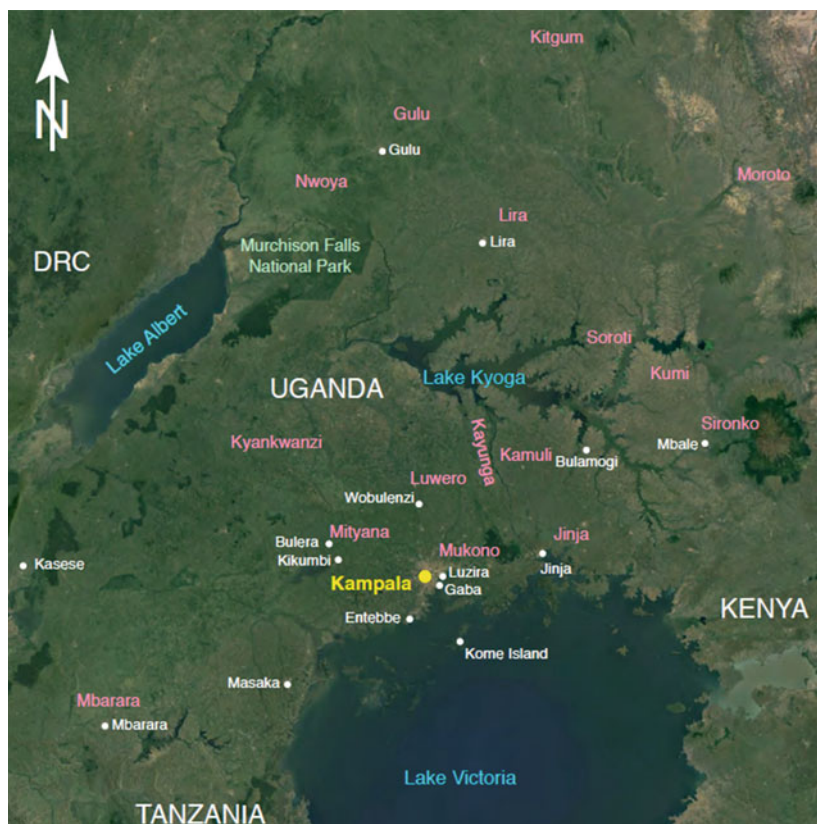


Fig. 6.1 Satellite image showing the location of Uganda's capital Kampala and of other major towns as well as the districts mentioned in the text (labelled in pink) and/or some of the sites investigated during the field work. Image from Google Earth 2018 (Image Landsat/Copernicus). DRC = Democratic Republic of the Congo

at high risk of exposure to charcoal dust, which causes discomfort through coughing and shortness of breath, with risks of adverse respiratory outcomes, such as reduced lung capacity, bronchitis and asthma, especially where workers had a medical history with respiratory diseases.

Charcoal also contains trace metals, including mercury and lead, which vary in concentration depending on raw materials and production techniques (Kabir, Kim, & Yoon, 2011), and which are released

into the air during its combustion, thus representing an inhalation hazard for exposed humans (Susaya, Kim, Ahn, Jung, & Kang, 2010). During combustion of charcoal as a barbecue fuel, the emitted mercury is also deposited onto foodstuffs, because mercury vapour is highly trans-ferrable to other items and therefore, especially with indoor cooking, lurks around homes or verandas for months to years (Pandey, Kim, Kang, Jung, & Yoon, 2008). Exposure to lead causes neurodevelopmental delay, intellectual deficits and cognitive disorders, whereas excessive manganese, iron and copper can cause neuronal damage (Cusick et al., 2018). Among other sources of heavy metal exposure, such as drinking water and proximity to landfills, Cusick et al. (2018) studied charcoal use as a potential source of blood poisoning among children in the Katanga settlement of Kampala (Fig. 6.1). Their findings revealed a high blood lead level in their sample of over 100 children, but their study was incon-clusive with respect to the link between charcoal use and heavy metal poisoning. It is crucial to note, however, that 97% of the participating households primarily used charcoal as a fuel for cooking, with over 53% engaging in indoor cooking, which should be avoided due to its partic-ularly high potential to harm human health. Other side effects, such as visible eye irritation and general air pollution, depend on the charcoal quality and presence or absence of ventilation. Generally, the consid-erable side effects of charcoal combustion are still widely unknown to consumers in sub-Saharan Africa, yet the informal nature of the trade leaves no opportunities to record and share information on the material's qualities that may be known by producers.

6.3 Methodology

This book chapter is based on an extensive review of the literature on charcoal as well as on data that were collected in Uganda through field-work, interviews and observations in October of 2017. On the supply side, 18 study participants were producers, 3 were loaders/off-loaders, 3 final traders at market stalls and 4 logistics personnel. All interviews were informal and designed to document the common practices in the char-coal supply chain, from production to its licit trade in final markets. The

subjects of this study were regular participants in the trade, and some had been working in it for more than two decades. Some urban traders at the market stalls in Kampala and in Gaba, at the shore of Lake Victoria (Fig. 6.1), were primarily middlemen that had no direct participation in production but knew rural producers and had well-coordinated logistics to secure steady supply. All photographs are original and our own. The people featured are actual participants in the trade.

6.3.1 Fieldwork Sites

A combination of rural and urban sites was visited in Uganda, with locations shown in Fig. 6.1. Upstream activities such as tree felling, production, transportation and wholesale trade at the kiln were studied in rural sites: Naminato Bridge in the Northern Nwoya district; Bulera-Busaana, Kikumbi and Namiwunda in the Mityana district; and Nsero, Wobulenzi and Kigoloba in the Luwero district.

Urban sites in the Kampala district included: Along the Wakaliga and McKay roads near the Nateete market and the Gaba market, along the shore of Lake Victoria. Furthermore, the role of middlemen was discussed along the highway between the Kampala and Gulu districts, and with traders at the shore that linked Kome island in the neighbouring Mukono district to Kampala's urban consumers.

6.4 The Status of Raw Material Procurement for Charcoal Production in Africa

The rudimentary methods of rural charcoal production through pyrolysis in single-use earth-mound kilns were discussed in detail by Andreas, Magnus, Hans, and Gerard (2017), Nabukalu and Gieré (2019), and Alfaro and Jones (2018). Briefly, producers cut trees with hand tools, such as axes and pangas (Fig. 6.2a), or oiled machinery, such as chain saws, to obtain the raw materials. The logs are then piled (Fig. 6.2b) near their parent tree stumps and covered with damp soil, leaving openings to set them alight with matches, vent moisture and gases (Fig. 6.2c), and



Fig. 6.2 Rudimentary charcoal production in Uganda. **a** A hand tool (panga) used in manual tree-felling; **b** A pile of logs ready to be covered with damp soil; **c** Active pyrolysis process showing the release of moisture from the earth-mound kiln; **d** Tree regeneration in the open forest near a charcoal production site (a–d were taken near Naminato bridge in the Nwoya district); **e** Manual harvesting using a rake near Kikumbi, Mityana district; **f** Harvesting with bare hands while packaging near Bulera, Mityana district

to control internal kiln temperatures by regulating oxygen conditions. Pyrolysis transforms the logs into charcoal under oxygen-deprived conditions without burning them to ashes. Harvesting charcoal is also manual, involving the use of rakes (Fig. 6.2e) to separate silt from the charcoal, which is then handpicked and typically packaged in flexible sacks

(Fig. 6.2f) to ease handling and prepare it for sale. Because most trees can be turned into charcoal, tree felling is indiscriminate, and various species can be put through a single pyrolysis cycle. However, in the downstream marketplaces, traders highly associate the quality of charcoal with original tree species, and therefore, some charcoal is perceived as more valuable depending on where the charcoal was sourced (Nabukalu & Gieré, 2019).

6.4.1 Forest and Land Degradation from Charcoal Production

To eliminate the financial costs and the burden of transporting logs to a single production point, these highly manual processes of charcoal production take place in open forests (Fig. 6.2c) and at random locations, such as the Miombo woodlands of Tanzania (Chidumayo & Gumbo, 2013) and the Laikipia plateau in Kenya (Okello, O'Connor, & Young, 2001). Charcoal production tends to occur sporadically, and is still rampant, even in scant-forest areas (World Bank, 2017), such as the Gonja and Sere districts of Western Ghana (SERVIR, 2018) and the Central Rift Valley district of Arsi Negele in Ethiopia (Mikias, 2015). To a greater extent, tree cutting and charcoal production are done on private land (Alfaro & Jones, 2018; Nabukalu & Gieré, 2019; Ministry of Energy and Mineral Development [MEMD], 2015), where landowners have the autonomy to determine land use and bear the sole responsibility to reconditioning of their land. When production occurs primarily from cutting new trees, the risks of losing vegetation are high, especially where replanting is minimal or non-existent (Namaalwa, Hofstad, & Sankhayan, 2009). In the Nwoya district of Northern Uganda (Fig. 6.1), we observed that charcoal producers were not owners of the private land where they worked, which minimizes both their rights and their obligations to re-plant trees at the production sites. Their nomadic engagement in production leads to forest loss where landlords have limited interest in or resources for afforestation. Indeed, some producers explained that they had moved northwards to work in the Nwoya and Gulu districts (Fig. 6.1) because trees were becoming scarce in the Central and

Southern parts of the country. Branch and Martiniello (2018) further observed that charcoal is increasingly produced in Northern Uganda, which was not the case a decade ago, leaving vast areas of land and forests degraded. During our fieldwork, however, we did not find clear-cutting as a means of obtaining trees for charcoal. At some sites, the land was being repurposed for small-scale agriculture, and thus, the primary goal of cutting trees was to sustain the low-laying cash and food crops, such as rice, which cannot thrive under shade (Kome island, Mukono district, Fig. 6.1), or cassava, which was protected by removing habitats for pests, e.g. monkeys (from the neighbouring Murchison Falls National Park, Nwoya district).

The above observations, however, do not mean that charcoal production does not occur over large areas. In their spatial study of a range of various scenarios for Uganda, Namaalwa, Hofstad, and Sankhayen (2009) found that charcoal production is occurring faster than the regrowth of the vegetation, which thus may lead to an environmental crisis. Even so, Chidumayo and Gumbo (2013) were reluctant to link this practice to deforestation, because they stated that charcoal production takes up less than 7% of tropical forests in Africa. Highlighting the natural regeneration of trees as a critical factor in the replenishment of vegetation, Chidumayo and Gumbo (2013) further suggested that good post-harvest management sustains forests and, whereas charcoal production may degrade ecological systems, deforestation was not a consequence of the practice. For charcoal production as a *primary activity*, deforestation, as defined by Bromley and Reis (1999), i.e. the intentional and permanent transformation of forests to other uses, or clear-cutting with plans to regenerate them, may not occur at a large scale. However, during our fieldwork, we found that in some locations, deforestation may occur in order to use the land for agriculture, thereby creating opportunities for charcoal production as a *secondary activity*, which uses disposed logs rather than trees felled specifically as charcoal resources. Moreover, the continuous supply of charcoal (Ekpo & Mba, 2020), which floods the urban markets, represents a high vegetation loss, since most of it is produced from trees.

Nonetheless, despite the fact that we observed tree regeneration (Fig. 6.2d) near the Naminato bridge of the Nwoya district (Fig. 6.1), tree-harvesting practices were unsustainable and included the use of oiled

chain saws. A typical pyrolysis cycle also involves leaving the earth-mound kilns burning nonstop in the open forests for at least two weeks (see Sedano et al., 2020). Charcoal production heavily relies on burner's skill (Chidumayo & Gumbo, 2013), and there is a lack of standardized or best practice burning that includes safety procedures, which raises serious concerns about risks of wildfires that can wipe out vegetation extensively.

6.4.2 Regulation and Informality Along the Charcoal Value Chain

The procurement of trees for charcoal is, in fact, highly regulated in some parts of Africa. For instance, Nigeria banned cutting trees for charcoal production in 2017 (WWF, 2018). In some countries, production bans are more common at decentralized or district levels, e.g. in Engikareti, the Northern Maasai village of Tanzania, or in Bulamogi in Eastern Uganda (Fig. 6.1; Butz, 2013; Tabuti, Dhillion, & Lye, 2003). Owing to the fast depletion of trees when they are cut with machines, the use of chain saws by charcoal burners was banned in the Nwoya district of Northern Uganda to slow the energy-related forest loss (Nabukalu & Gieré, 2019). However, the highly complex informal dealings within the trade make it difficult for local governments to track illegal activity, and therefore, charcoal producers and traders can easily thrive independently or as cartels (Pesa, 2017; Sander, Gros, & Peter, 2013). Moreover, the producers operate under secrecy to prevent fines and arrests from local authorities over forest degradation (Butz, 2013; Tabuti, Dhillion, & Lye, 2003). In urban centres, traders are sometimes reluctant to share information about their suppliers or producers when it bears no competitive advantage and to sustain inventory supply (Nabukalu & Gieré, 2019).

Even though Pesa (2017) showed that the charcoal value chain in Zambia is organized efficiently, we observed that, in Uganda, the most upstream part of this supply chain does not exist as a highly structured or organized process. For instance, we found at our study sites that in some cases, charcoal is produced as a source of secondary income by farmers on their land when agricultural products are off-season or

when land productivity is failing (see also Ghilardi, Mwampamba, & Dutt, 2013; Branch & Martiniello, 2018; Doggart & Meshack, 2017; Ekpo & Mba, 2020). Participation by some traders is also voluntary and highly random, based on their need for cash flow. However, charcoal can be a primary source of income and, in such cases, informal companies recruit charcoal burners and truck drivers to produce consistently and maintain inventory levels in final markets. Suppliers also seek out entrepreneurial landowners who are willing to cut trees or allow production and, depending on negotiations, may retain sole ownership of the goods for sale (Nabukalu & Gieré, 2019).

There is increasing support for formalizing the charcoal value chain in sub-Saharan Africa, as reported for instance by Owen, van der Plas, and Sepp (2012), Mugo and Ong (2006), and Schure, Ingram, Sakho-Jimbira, Levang and Wiersum (2013). Even though Schure, Ingram, Sakho-Jimbira, Levang and Wiersum (2013) discussed that when formalities, such as production or transportation permits, are used to regulate a widely informal charcoal sector, there are some disadvantages, such as the disproportionate benefits of the trade to urban populations, corruption and loss of taxes. Nonetheless, Owen, van der Plas, and Sepp (2012) showed that any African energy policy that completely perceives biomass as a critical problem rather than a potential solution for energy supply is futile, because electricity is not a substitute for biomass, further suggesting that fuel switching is unrealistic, as Alfaro and Jones (2018) also concluded in their study of Liberia.

Despite claims that the informal charcoal trade leads to revenue loss to central governments, as reported for Tanzania by Sander, Gros, and Peter (2013), our observations in Uganda revealed that it is not a zero-sum trade, with absolute gains to traders and losses to governments, because charcoal is sold in decentralized markets, where rents are collected for the continuity of microeconomic development, mainly where traders operate in a well-established, but not necessarily formal, infrastructure (Fig. 6.3b–d) (Nabukalu & Gieré, 2019).



Fig. 6.3 a Charcoal displayed for sale along the Kampala-Gulu highway; b A bulk delivery of charcoal and manual unloading; c Stockpiling by final traders at a market stall; d Charcoal displayed in plastic measuring instruments ('debe') for final trade to the consumer. (b–d taken along Wakaliga road along the Nateete market, Kampala district); e Charcoal transportation by boat; f Short-distance transportation by bicycle. (e–f were taken at Gaba market, along the shore of Lake Victoria)

6.4.3 Charcoal Production as a Mechanism for Waste Management

While raw material procurement for charcoal in sub-Saharan Africa is primarily done by cutting fresh trees, the unwavering pursuit of this

fuel has also led to increased attention to various types of waste as secondary raw materials. For example, where stringent laws prohibiting tree harvesting are enforced, other industries can provide raw materials to sustain production. Around Liberia's Firestone rubber plantation, charcoal producers use scrap rubberwood from organizations that cut trees for rubber manufacturing as raw materials in the earth-mound kilns (Alfaro & Jones, 2018). In Zambia, Pesa (2017) reported on the production of charcoal pellets from sawdust, which was obtained from commercial factories. These pellets were marketed as the newer and more sustainable charcoal to be used on Improved Cook Stoves (ICS), and they were intended as an alternative for cooking in order to radically displace charcoal made from fresh trees.

In Kenya and Uganda, agricultural waste such as bagasse, banana peelings and coffee husks, is being used to produce charcoal, thus leading to the emergence of a new waste management industry and youth entrepreneurship (Mugo & Ong, 2006; Stassen, 2015; Oluka, 2016). For instance, Uganda's Green BioEnergy Ltd (GBE) attains an average monthly production of over 35 tons of charcoal briquettes from household food waste (Oluka, 2016; Beard, 2014). Similarly, the use of agricultural waste to produce charcoal briquettes, alongside other energy alternatives like biogas, was also observed at a small scale in Egypt, where an equivalent of up to 5 Megatons oil equivalent (Mtoe) per year of the country's agricultural waste is channelled to energy production (IRENA, 2018).

When land is cleared for other economic activities, such as agriculture, Uganda's charcoal producers channel waste logs to charcoal production, which thus became a secondary form of land use (Nabukalu & Gieré, 2019; Muzaale, 2013). Charcoal briquettes from waste are often traded alongside ICS in the interest of cleaner, and more efficient cooking (Pesa, 2017; Beard, 2014; Mwampamba, Owen & Pigaht, 2013). Although increasingly common, the production of charcoal from waste materials has not been taken advantage of at a large scale, partly due to lack of financial capital to start or expand small-scale waste-to-charcoal enterprises (Pesa, 2017; IRENA, 2018; Alfaro & Jones, 2018). Moreover, charcoal production continues to prevail inexpensively due to informal practices that make taxation hard, thus attaining lower market prices for

charcoal from trees and sustaining its competition with newer charcoal briquettes from waste, especially among price-sensitive consumers (*The Independent*, 2016; see also Pesa, 2017)

6.5 Charcoal in the Final Market

Charcoal is so widely recognized that advanced branding and advertising hardly exist. Indeed, because it is brittle but indestructible, limited sophistication exists in its packaging to attract buyers or provide warnings about its side effects. Some traders measure and value charcoal by the sack, 120–300 centimetres high (Fig. 6.3a), with price variations depending on its perceived quality, and through using old repurposed plastic (Fig. 6.3d) and metallic equipment (see also Tabuti, Dhillion, & Lye, 2003). The charcoal value chain in Uganda is also characterized by cross-district trade, where urban traders are not necessarily involved in upstream production (Nabukalu & Gieré, 2019). With over 56 legally recognized ethnic groups and 41 languages (Uganda Bureau of Statistics [UBOS], 2006), the deep-seated linguistic diversity of Uganda's native population (Mpuga, 2003; Nakayiza, 2016; Mugerwa, 2016) warrants a high level of involvement by middlemen that are predisposed to communicate in common languages of the urban centres as well as dominant languages in the rural areas where upstream procurement is done. When middlemen choose to trade charcoal within the existing market infrastructure (Fig. 6.3b–d), they contribute to the microeconomic development where they operate through paying occupancy fees. However, such opportunities can either be diminished by direct deliveries to customers that order through mobile phones for home deliveries, or are nonexistent in rural regions, such as Bulamogi (Fig. 6.1), because charcoal producers sell at the kiln and there is more dependence on firewood, the cheaper and more ubiquitous fuel competitor.

6.5.1 Middlemen as Stakeholders and Enablers of the Charcoal Trade

As with the trade of many other tangible products, numerous stakeholders are involved in the trade of charcoal (Sander, Gros, & Peter, 2013). In rural areas, such as Nsero in the Luwero district (Fig. 6.1), we observed that there are cases where producers move charcoal from the kilns and deliver it directly to customers' homes, where charcoal is preordered, and the customers are already known. However, as Tabuti, Dhillion, and Lye (2003) observed, consumption of charcoal in rural areas is generally lower than that of firewood because of the low purchasing power of the local population. Charcoal is, therefore, moved to urban markets, which are more lucrative (Alfaro & Jones, 2018; Nabukalu & Gieré, 2019; Ekpo & Mba, 2020). Middlemen, or traders, are responsible for the value-adding role of transportation to make charcoal consistently available in final markets. The role and the degree of involvement of middlemen occur in different ways based on factors, such as market knowledge, size of capital resources to conduct logistics, and knowledge of producers. For example, we observed in the Nwoya district (Fig. 6.1) that the informal companies are the primary middlemen because they purchase charcoal directly from their contracted nomadic producers, based on their employment agreements, and access production sites with high-powered vehicles to load charcoal after harvesting.

Along the Kampala-Gulu highway (Fig. 6.1), we observed that some middlemen move charcoal from kilns to busy roadsides (Fig. 6.3a), where charcoal is sold either by the sack to final consumers, or in bulk to other downstream traders. This has implications for the procurement of charcoal upstream. For example, higher-tier traders tend to have a deeper knowledge of the local native languages in the region where they buy charcoal, more geographical knowledge of the rural areas, and more connections to charcoal burners that may lack resources, such as trucks to move charcoal further downstream. Even though Branch and Martiniello (2018) stated that middlemen merely take advantage of higher prices in urban centres and pay producers the minimum, thus keeping them poor, it is essential to note that the higher-tier middlemen,

or traders, are often multilingual, usually buying from rural regions that speak fewer languages, and trading in urban centres, such as Kampala. In fact, without the multilingual middlemen, upstream producers may not otherwise have access to important buyers, since the rural populations where they produce depend on cheaper or free alternatives, such as firewood, from their private land (Tabuti, Dhillion, & Lye, 2003).

Upstream, charcoal is often bought by traders who own trucks, or those that can arrange for bulk transportation, i.e. through renting from truck owners, and hiring drivers, loaders and off-loaders (Fig. 6.3b) or through regular transportation of smaller amounts by commuter boats from Lake Victoria's islands (Fig. 6.3e). Transportation often takes place overnight, to reach urban markets by dawn, where further bulk purchases are made by middlemen that organize short-distance transportation, for example, with bicycles (Fig. 6.3f), to reach their smaller market stalls or to deliver directly to the premises of customers that may have pre-ordered. We observed during our fieldwork that some middlemen own trading spots in final markets, e.g. along Wakaliga road in Nateete, Kampala (Fig. 6.1), where they ensure continuous availability of inventories for final buyers by making upstream connections with producers and transporters. Moreover, business owners stockpile inventory (Fig. 6.3c and d) to ensure supply security for final consumers.

In final markets, we found during our fieldwork that the role of the middleman evolves based on various factors, including market conditions and trader's preferences. For example, those middlemen with extensive knowledge of strategic locations, such as the Gaba market along Lake Victoria's shore, or along the Wakaliga and McKay roads near the Nateete market, set up stalls (Fig. 6.3c and d) and trade within the existing market infrastructure. However, knowing final buyers means that charcoal trade can also take place over the phone upon delivery from rural sites. Where it is the primary source of income, middlemen, or traders, in final markets tend to have more strategic knowledge of upstream producers and transporters, and are reluctant to share this knowledge due to strict legislative bans on the upstream production, which can cause producer arrests, artificially constrict inventory supply and toughen logistics processes (WWF, 2018; Nabukalu & Gieré, 2019; Butz, 2013). However, where market bans exist on the trade of charcoal, traders hoard

it and create black markets, thus selling charcoal at higher prices due to market dynamics of artificial scarcity and high demand in urban centres, as observed in Tanzania (Malimbwi & Zahabu, 2008).

6.5.2 Inventory in Final Markets

Because charcoal is not a perishable product, i.e. its properties do not deteriorate, chemically decompose or allow fungi to develop while being stored over long periods of time, it does not require sophisticated storage practices to extend its shelf life. Even though water does not damage it, charcoal is preferred dry by consumers, because in its dry state it releases less smoke during use, and therefore traders try to keep out moisture. Compared to firewood, charcoal takes up less storage space at market stalls because of its lower volume (Malimbwi & Zahabu, 2008). Charcoal's lightweight nature invites overloading beyond legal limits on trucks, which move charcoal through the night to avoid detection by traffic authorities, and therefore, peak supply and deliveries in urban centres often occur very early in the morning (Nabukalu & Gieré, 2019). Similar observations were made in Tanzania, Liberia and Ethiopia (Malimbwi & Zahabu, 2008; Alfaro & Jones, 2018; Alem et al., 2010). According to Malimbwi and Zahabu (2008), most middlemen use very old vehicles in poor mechanical condition, which increases the risks of road accidents. The peak supply often leads to storage of inventory, and sacks are stacked at market stalls (Fig. 6.3c), where consumers can conveniently find and purchase charcoal.

6.5.3 Factors That Affect Charcoal Prices

Even though some charcoal producers and traders reported that they tend to scale back their involvement or leave the trade during the rainy seasons to focus on agriculture, the supply of charcoal in the final markets is constant throughout the year, due to stockpiling or inventory stocking (Fig. 6.3c). This is similar to the stockpiling of dry firewood in anticipation of wet seasons, which Tabuti, Dhillon, and Lye (2003) observed in the rural households of Bulamogi (Fig. 6.1). The motive of stockpiling

is ensuring supply security for business continuity regardless of seasonal variations. Indeed, Kambewa, Mataya, Sichinga, and Johnson (2007) observed in Malawi that firewood is often wet, and power outages are more frequent during the rainy season, which increases the demand for and consumption of charcoal as an alternative. The ubiquity of charcoal and the relative assurance of its supply in all seasons often means that the fuel is economically accessible or affordable to people at varying income levels (Mwampamba et al., 2013; Bailis, Rujanavech, Dwivedi, Chang, & de Miranda, 2013). In sub-Saharan urban centres, such as Kampala, Dar es Salaam, Bagamoyo, and Lusaka (Alfaro & Jones, 2018; Cotton, Kirshner, & Salite, 2019; Namaalwa, Hofstad, & Sankhayan, 2009; Pesa, 2017; Malimbwi & Zahabu, 2008), where purchasing power is higher and the charcoal trade is more viable, prevailing market conditions dictate what consumers ultimately pay for this fuel.

Unlike in the case of other energy commodities, such as electricity and liquefied petroleum gas (LPG), there is no centralized economic regulation for price-setting or subsidization to consumers for the purchase of charcoal. The production of charcoal is also usually not economically incentivized, for example, through government grants or loans. Furthermore, even though producers are paid meagre prices by middlemen, thus leaving them impoverished (Branch & Martiniello, 2018), the fact that charcoal production is illegal in some areas (WWF, 2018; Butz, 2013; Tabuti, Dhillon, & Lye, 2003) makes direct involvement of the government to financially support its stakeholders immensely complicated. These setbacks make gauging of charcoal's true market or financial value challenging (see also Sect. 6.8).

Nonetheless, government intervention through policies that affect the trade can have a direct impact on market prices of charcoal. For instance, declaring production illegal through environmental protection regulation means that producers in rural areas, under secrecy, may be prone to selling at very low prices because they do not trade openly in legal markets. During our fieldwork, we observed that prices were meagre at the kiln, yet the same charcoal was sold for drastically higher prices in urban centres where trade is more conspicuous and legal (see Nabukalu & Gieré, 2019). The illegalization of charcoal can interrupt typical market dynamics of demand and supply, further driving up prices when

supply is artificially constricted, i.e. by arresting skilled producers, or withdrawing their labour from the trade, despite the high demand in urban centres. In Tanzania, for example, the national charcoal ban of 2006 led to steady price increases, which persisted well into 2010, even though the ban lasted only two weeks, because of the emergence of black markets for the illegal charcoal (Malimbwi & Zahabu, 2008). What applies to other commodities is also true for charcoal: when demand for charcoal exceeds its supply, charcoal prices rise, as was observed, for example, in Tanzania (Malimbwi & Zahabu, 2008; Sander, Gros, & Peter, 2013; World Bank, 2010).

In final markets, quality is a major differentiator in what consumers ultimately pay for charcoal. However, because the supply chain is informal, quality is judged very subjectively in a number of unstandardized ways depending on the stakeholder. For example, even though charcoal is not typically weighed with scales in these markets, 'lightweight' charcoal is deemed to be of lower quality than denser types, and it is generally sold at lower prices because it depletes faster on stoves (see Nabukalu & Gieré, 2019). Malimbwi and Zahabu (2008) discussed that charcoal ranges in its calorific content, depending on the tree species burned, which determines consumer preference and ultimately its price. Indeed, our observations in Uganda showed that charcoal produced from tree species that tend to grow in the North were perceived to be of higher quality than those produced from trees with softer stems growing in the South or in the Central districts and the islands in Lake Victoria. Where consumers are knowledgeable of these variations, for example, through experience with smoky and non-smoky types, they actively pursue better quality and pay higher prices to traders to obtain 'value for money'. Still, as stock is mixed up in final markets to obtain full-sack inventories (Fig. 6.3c and d), charcoal quality is immensely challenging to establish (Nabukalu & Gieré, 2019).

6.6 Optionality in the Energy Mix: When Consumers Choose Charcoal Over Modern Alternatives

The demand for any source of energy depends on the function desired by the consumer. One does not pay for electricity for its own sake. Rather, one spends money to obtain light, mobility or food (Lovins, 1976). For this reason, energy sources compete as free or traded commodities within the same market, and consumers choose one fuel over another for the same purpose. Energy consumption, thus, depends on differentials in the desired usefulness between fuel types. For instance, in cooking, one may choose between electricity, LPG or biomass, depending on factors, such as availability, convenience, price and reliability. Khellaf (2018) observed that in 84% of all sub-Saharan residences, biomass use outweighs all other alternatives combined. The use of charcoal is often linked to a lack of modern alternatives. However, in markets where consumers have various options (Owen, van der Plas, & Sepp, 2012; Akpalu, Dasmani, & Aglobitse, 2011), charcoal consumption persists even when alternatives, such as LPG and sawdust briquettes, were cheaper. This means that for any energy alternative, the consumption does not depend on its availability and price alone.

It has been shown that in Zambia, Mozambique and Rwanda, increased electricity generation has not decoupled the societies from the intensive use of charcoal (Owen, van der Plas, & Sepp, 2012; Sedano et al., 2020). Indeed, Owen, van der Plas, and Sepp (2012) recommended that African energy policy should have provisions that acknowledge and sustain biomass as a fuel, owing to its importance to local economies and the failure of electricity to successfully supplant biomass. In their assessments of energy in South Sudan and Tanzania, respectively, Mugo and Ong (2006) and Lokina and Mapunda (2015) discussed the notion of an 'energy ladder', where households switch from biomass to modern alternatives as their income increases, further suggesting that poor consumers are often left out of the commercial energy ladder because they turn to options like dung and leaves as wood and charcoal become scarce. Asfaw and Demissie (2012) made

similar observations in Ethiopia, following inflation of charcoal prices and currency devaluation. Mukwaya (2016) also suggested that poor consumers would prepare fewer meals per day when charcoal becomes unaffordable, although Tabuti, Dhillion, and Lye (2003) showed that those with less disposable incomes would turn to firewood, which is abundant and typically free in rural areas. Even though wealth is a major factor in the energy transition from biomass to 'modern' alternatives (Maria de Fatima, Zahran, & Bucini, 2010), some consumers choose to use charcoal regardless of income levels, as a backup to electricity and also because charcoal is often linked favourably to the taste of food (Pesa, 2017; Bailis, Rujanavech, Dwivedi, Chang, & de Miranda, 2013; Mukwaya, 2016).

The capability and willingness of a household to invest in electric appliances is a major determinant of fuel choice. When contrasted with charcoal, consuming electricity requires more investment in sophisticated technology, such as cookers, microwave devices and ovens (Maria de Fatima, Zahran, & Bucini, 2010), which are often imported and manufactured in standardized sizes. LPG requires access to gas cookers (Akpalu, Dasmani, & Aglobitse, 2011), which are often inaccessible to rural consumers. Moreover, maintaining gas cookers necessitates compatible spare parts, which may be scarce in the local markets. Where the number of people living together in a household is high, a regular oven may be too small to accommodate daily cooking needs. Moreover, food that takes a long time to cook, such as beans (Mukwaya, 2016), may affect overall electricity or gas consumption and thus energy expenditure because the supply of these energy resources is metered, and charges accrue for the duration of use. Charcoal, on the other hand, is not metered. It requires essential equipment, such as portable stoves made from clay or sheet metal, which are painted to eliminate risks of rusting thereby diminishing repair and maintenance costs for the consumer (see Nabukalu & Gieré, 2019). In Zambia, consumers favoured charcoal made from trees over charcoal pellets made from sawdust and designed for use in ICS, partly because the ICS were more expensive than regular charcoal stoves, despite subsidies and possibilities to pay in instalments (Pesa, 2017). In general, the infrastructure on the consumption side of biomass is more accessible than that of electricity because it is far more

basic (Fig. 6.4), and inexpensive, if not free, as we found during our fieldwork in the Nwoya and Mityana districts (Fig. 6.1). These realities enhance the use of biomass, and therefore, combustion of biomass surpasses by far electric consumption as a resource for cooking.

According to Alfaro and Jones (2018), charcoal consumption is so ingrained in the energy lifestyle of some countries, such as Liberia, that it may be impractical to plan for or create energy transitions without it. The high supply of charcoal in sub-Saharan Africa is therefore sustained by the correspondingly high and unrestrained demand and consumption. By contrast, the rate of consumption of electricity, despite its increasing supply, has so far not been studied extensively. In Uganda, Drazu, Olweny, and Kazoora (2015) found that most consumers used electricity only for light tasks, such as ironing and watching television, turning to charcoal for cooking because electricity is relatively expensive and its availability erratic. Incidentally, Maria de Fatima, Zahran, and Bucini (2010) and Asfaw and Demissie (2012) found that biomass sources were more expensive per unit of energy than electricity in Mozambique and Ethiopia, respectively, but that did not increase consumption of electricity or reduce biomass consumption. Such circumstances led Girard (2002) to suggest that the technical solutions, however efficient and successful during trials or some contexts, must be applied around socio-economic realities.



Fig. 6.4 Simple materials for the consumption of biomass: **a** A set of stones near Naminato bridge in the Nwoya district; **b** basic sticks in Kikumbi, Mityana district

The supply of electricity is less dependable (Drazu, Olweny, & Kazoora, 2015; Pesa, 2017; Goswami, 2018) because its highly centralized generation involves high capital costs for equipment and infrastructure for its distribution and, despite the fact that it is subsidized in final markets, equipment failure on the supply side leads to unplanned power outages or blackouts. By contrast, in informal enterprises, within Uganda's charcoal trade, we observed that one could freely cut trees on one's private land and venture into the charcoal trade, despite regulatory bans. Charcoal production requires minimal access to financial capital because entrepreneurial middlemen play a significant role in locating and paying landowners and skilled producers, and in trading their goods to final markets, which contributes to charcoal's continuous supply and trade alongside electricity, as a competing fuel choice in the market, especially in urban centres.

6.7 Beyond Market Dynamics: Infrastructural Barriers to the Consumption of Modern Energy Alternatives in Africa

Over the past three decades, the energy-supply mix of the sub-Saharan region has increasingly moved towards centralized electric generation. In many African development policies, the future of energy supply is strategically planned to revolve around more electrification. In 2019, Power Africa confirmed 126 projects for 10,470 MW capacity, valued at USD 20 billion, to power over 60 million homes and businesses by 2030. These include, for example, solar, wind, natural gas and hydropower, mostly in West, East and Southern Africa. Of all countries, Nigeria's planned generation is one of the most ambitious ones (3034 MW), second only to South Africa (3180 MW). Other key charcoal-producing countries, such as Tanzania, Namibia and Ghana are at the forefront of these developments, with planned generation at 672 MW, 107 MW, 550 MW, respectively (Power Africa, 2019). Gridline infrastructure extends increasingly to rural areas for the rigorous pursuit

of decoupling them from the deep-rooted dependence on biomass (GoU, 2015; Owen, van der Plas, & Sepp, 2012; Ghilardi, Mwampamba, & Dutt, 2013).

However, most new generation of electricity in Africa is preceded by many older existing projects. (REA, 2020; Kihwel, Hur, & Kyaruzi, 2012). The low consumption rates of electricity in Africa's households, overshadowed by charcoal, as a fuel for cooking, are the main concealer of both the existence and the increasing availability of electricity, hence the pretext of the notion of 'energy poverty' (see Nabukalu & Gieré, 2019). Indeed, charcoal's dominance over electricity in household energy consumption misleads energy policy, where the basis of investment strategies is that more electricity will supplant biomass (see Owen, van der Plas, & Sepp, 2012). Where grid connections exist, some of the reasons for low electricity consumption include:

- Consumer preference for inexpensive, although not necessarily better, alternatives such as charcoal and firewood.
- End-user equipment, such as ovens and microwaves that require electricity, have limited capacity to serve large households, and they require costly maintenance and spare parts
- Charcoal is more ubiquitous and, unlike electricity, is not susceptible to outages and blackouts
- Charcoal is preferably linked to the taste of food (see also Drazu, Olweny, & Kazoora, 2015; Bailis, Rujanavech, Dwivedi, Chang, & de Miranda, 2013)
- An abundance of primary energy alternatives, such as sunlight, which may adequately perform specific tasks (e.g. drying of agricultural products or linen) without being transformed into secondary energy or electricity.

The increasing demand for electricity in Africa should, therefore, be critically assessed alongside barriers to its sustainable consumption because of the impending futility, such as economic indebtedness of these nations, where they borrow money from international reserves to produce more electricity, which may not be consumed. Besides electricity's failure to compete with existing energy commodities based on

the desired service, the barriers to its consumption in Africa are mainly infrastructural.

In the logistics of electricity, failure to deliver reliably to consumers manifests itself in unplanned power outages and blackouts (Cotton, Kirshner, & Salite, 2019; Kihwel, Hur, & Kyaruzi, 2012). Pesa (2017) demonstrated that consumers keep charcoal as a backup to counter this issue in Zambia. Mukwaya (2016) also showed that Uganda's electricity supply is highly erratic, which makes consumers rely on charcoal. In Africa's highly scattered settlements, grid connections are few and far between (Khellaf, 2018). In fact, connection to the electricity grid may require payment from customers, which in some cases may be evaded through illegal connections, as observed in Tanzania (Cotton, Kirshner, & Salite, 2019). Even though Khellaf (2018) suggested that 60% of Africa's population is rural and gridlines are fewer there, the Rural Electrification Authority of Uganda (2020) registers several completed projects connecting rural areas to the grid in various Northeastern districts, e.g. Moroto, Kitgum, Sironko and Kayunga (see Fig. 6.1). However, the sustenance of biomass demand over electricity in these areas can still be attributed to the unreliability of the existing modern infrastructure and the preference for firewood as an affordable alternative.

In Tanzania, demand for electricity is increasing along with additional generation infrastructure (Power Africa, 2019; Kihwel, Hur, & Kyaruzi, 2012). However, as over 49% of the country's electricity generation is based on hydropower, which is weather-dependent, drought highly affects system capacity, thus increasing unreliability to deliver power to the country's urban populations of Arusha, Dodoma and Bagamoyo. Moreover, the country's imbalance in generation and grid infrastructure causes inefficiency, leaving Tanzania with one of the highest transmission losses in the world and aging technology, thus sustaining unaffordable tariffs that cannot be collected to recuperate costs of supply and increased generation, despite subsidized electricity tariffs and deregulation to allow competition with the state's former monopoly in the electricity market (through the Tanzania Electric Supply Company, TANESCO) (Kihwel, Hur, & Kyaruzi, 2012).

6.8 Charcoal in International Markets and Africa's Role as a Major Exporter

The charcoal trade within Africa's local markets has been discussed at length by Nabukalu and Gieré (2019) and Shively et al., (2010), using Uganda as an example. Even though local markets consume most charcoal produced in Africa, inter-Africa trade exists. For instance, Ladu (2018) and Branch and Martiniello (2018), highlighting the growth in the Uganda-to-South Sudan charcoal exports, showed that in order to avoid return trips without cargo, after delivery of consignments, truck drivers transport charcoal to South Sudan's capital Juba, as middlemen to make additional income. Zimmermann and Joubert (2002) also documented the export of Namibia's charcoal to South Africa, where it is used for silicon smelting. While an illegal process, large amounts of charcoal are still traded from Ethiopia to Somalia (Bekele & Girmay, 2013), and from Nigeria to Cameroon, Niger and Benin (Goswami, 2018).

Despite the persistent presence of charcoal as a legally traded commodity in international markets, the unsustainable production processes of its supply chain, as well as Africa's role as a significant exporter to the rest of the world are not widely studied or documented. The amount of charcoal exported by Africa is hard to gauge for various reasons:

1. Informality in the trade leads to limited record-keeping upstream or downstream, and often to a lack of measurement of material inputs and outputs.
2. As an export commodity, charcoal is often classified with other 'wood products' (Trading Economics, 2020), and its true quantity and monetary value are difficult to distinguish from other wood, but non-energy commodities.
3. Illegal and without-permit production also means that the product is often smuggled across borders (Bekele & Girmay, 2013), thus bypassing standard valuation, customs and tracking procedures.

The international trade of charcoal is sustained by demand in countries that do not necessarily lack electricity or alternatives, such as LPG

(Hilse, 2017). This means that the relevance of, and subsequent demand for charcoal as an energy resource can be decoupled from the notion of 'energy poverty', which suggests that charcoal consumption results from the deficiency in electricity supply. Nabukalu and Gieré (2019) assessed the realities of charcoal as a commodity and documented that limited local production of charcoal does not mean low demand, as charcoal can be traded on the informal, yet well-established international market. For example, after Oceania, Europe produced the least average annual amounts of charcoal (0.5 Million tons) between 1993 and 2017. Nevertheless, demand for charcoal is still high in the European countries, despite the wide access to, and reliable presence of electricity. The demand for and the consumption of charcoal in more industrialized regions, especially in Europe and North America, are mainly for leisure in warmer seasons (Bailis, Rujanavech, Dwivedi, Chang, & de Miranda, 2013; WWF, 2018), yet its quantities are significantly high, and primarily supplied by tropical wood from Africa, Asia and South America.

Africa's role as a significant exporter of charcoal from tropical and other forests to the rest of the world is very significant, yet often absent from the discourse in international energy procurement. The most prominent exporters on the continent are Nigeria, Namibia and Somalia, which feature in the world's top 10 for the highest average annual amounts of charcoal exported over the past two decades (FAO, 2019; Hilse, 2017; Nabukalu & Gieré 2019). Nigeria exports most of its charcoal to Europe and Asia (mainly Germany, Poland, Belgium, Luxembourg, United Kingdom, Lebanon, Turkey). Namibia exports charcoal to the USA and Europe (Zimmermann & Joubert, 2002; The Forest Trust, 2018) and, according to Stassen (2015), up to 70% of its trade is with Europe. Despite the ban in 1969, charcoal exports from Somalia have continued, especially via the Southern port of Kismayo, where the product is traded by sea to Iran (United Nations Environmental Program [UNEP], 2018, 2019; Nichols, 2018). Indeed, over 4.8 million sacks of charcoal are produced annually in the country's Northeastern region, which sustains local conflict over the proceeds from the international trade (UNEP, 2018). Furthermore, Somalia's *Acacia bussei* and various *Commiphora* species are strongly preferred as trees for charcoal production, and are thus over-exploited, with the very slow-growing *Acacia*

bussei now appearing on the International Union for the Conservation of Nature's Red List of Threatened Species (Contu, 2012). In 2017, charcoal from Egypt, one of the world's top 10 producers (1993–2017), was mainly exported to Israel, Palestine, Cyprus and Saudi Arabia (Observatory for Economic Complexity [OEC], 2020; Nabukalu & Gieré, 2019).

According to The Forest Trust (2018), over 40% of charcoal in Europe is derived from Africa. In the United Kingdom, for example, South Africa, Namibia and Nigeria were among the top 5 contributors to the 87,000 tons of charcoal in the domestic market in 2017, alongside Spain and Paraguay. However, because Spain also imports a large portion of its charcoal from Nigeria, it is difficult to determine how much of its exports to other European countries, e.g. United Kingdom, are secondary exports, and not produced locally (The Forest Trust, 2018). Along with South Africa and Namibia, Nigeria has sustained its steady position as a top supplier to additional European countries, such as Belgium, France, Poland and Germany, despite increasing pressure on its local forest resources. In 2017, Nigeria supplied 25% of charcoal on France's local market, and 21% of charcoal sold in each Germany and Poland (WWF, 2018; The Forest Trust, 2018).

Several attempts have been made to estimate both the quantity and the value of Africa's charcoal exports. Because of high opacity in the operations of this trade, Africa's trade of charcoal is not necessarily beneficial to its people: first, because it depletes forest resources, with difficulty of tracing its origin, and secondly, the valuation of charcoal does not follow well-established market rates, which would otherwise pay for pollution as an externality from its sourcing. The FAO (2019) estimated that Africa exported a total of 501,619 tons in 2018 alone, a marked increase from the 53,450 tons exported in 1993. This charcoal was valued at USD 19,153 in 1993 and USD 148,568 in 2018. In 2017 alone, the export market of wood charcoal was valued at USD 1.16 billion globally (OEC, 2020).

On international markets, the preference, and thus relentless demand for Africa's charcoal, despite receding forest and bush densities where it is sourced, can be attributed primarily to its usefulness as a barbecue fuel (Bailis, Rujanavech, Dwivedi, Chang, & de Miranda, 2013; WWF,

2018) and its low price. For example, a standard 3-kilogram (kg) bag of charcoal costs as little as €1.99 in Germany (WWF, 2018). Even when prices fall, producers continue to export depending on marginal profits and contractual terms imposed by exporters to sustain supply. Conversely, price increases by exporters make the trade attractive, thus increasing the number of local producers, and adding pressure to existing vegetation (Zimmermann & Joubert, 2002). The influence of foreign exchange rates on charcoal prices was briefly discussed by Asfaw and Demissie (2012) in their study of Ethiopia.

Our comparison of the most recent export data for the same years within the past decade showing the valuation of ‘wood charcoal’ from Africa revealed that there are enormous discrepancies in the estimated money value of this commodity in international markets. The discrepancies are generally two orders of magnitude, but in some years, more than three orders of magnitude (Table 6.1).

This comparison documents that the operations and the general practices of the charcoal trade make it very difficult to estimate the actual value of this product (The Forest Trust, 2018). In Europe, for instance, whereas charcoal bags may state the product weight for pricing purposes, many do not show the origin of the product (The Forest Trust, 2018; WWF, 2018), despite the fact that origin is a major determinant of price

Table 6.1 Estimated export value of wood charcoal from Africa, as reported for the same years by two different sources (FAO, 2019; OEC, 2020)

Year	FAO (2019) Global export value	OEC (2020)
	US\$	US\$ M
2017	129,838	106.0
2016	113,317	130.0
2015	107,555	103.0
2014	112,901	117.0
2013	98,334	147.0
2012	119,169	107.0
2011	125,428	110.0
2010	109,626	97.7
2009	103,305	98.6
2008	68,760	106.0
2007	81,661	85.2

and market value (Nabukalu & Gieré, 2019). This fact also holds in local markets, where African governments simply estimate the 'foregone revenue' from the highly informal standard practices within this trade, as Sander, Gros, and Peter (2013) discussed for the case of Tanzania. Depending on the market, valuation methods for charcoal are highly arbitrary because markets may set prices in non-standardized ways, using either volume, weight and other factors, such as quality, which become apparent only when charcoal is burnt by final consumers, through properties such as the release of visible smoke and length of time it takes for charcoal to deplete on stoves (Nabukalu & Gieré, 2019).

6.9 Summary and Conclusions

Even as investments in alternative energy options continue to grow, charcoal has persisted as one of the most common sources of energy in sub-Saharan Africa. However, its consumption, along with that of other forms of biomass, has led to the notions of 'energy poverty' and 'energy insecurity'. Increased supply of electricity has not led to a decline in charcoal consumption in the region nor can the secure supply of energy be attained by more electricity (Owen, van der Plas, & Sepp, 2012). Charcoal is often maintained as a backup for 'modern' or 'improved' alternatives (Pesa, 2017). Its demand has sustained a continuous supply for decades and has left a recognizable trail of environmental damage upstream due to unsustainable tree harvesting and production practices.

Owing to the detrimental effects of charcoal production to the environment, such as the increasingly noticeable forest degradation and loss as well as risks of wild fires (Branch & Martiniello, 2018), restrictive charcoal policies, such as bans on production from freshly felled trees, export quotas and bans, and limitations to the tools used in tree harvesting (Mugo & Ong, 2006; Nabukalu & Gieré, 2019; WWF, 2018; UNEP, 2018, 2019), have been put in place by formalized institutions to limit or completely curb its production. Where charcoal production is still legal but highly restricted, little is done to increase afforestation or improve production practices to attain increased efficiency, better quality outcomes and reduced pollution, and therefore, most of the upstream

work depends entirely on burners' skills (Chidumayo & Gumbo, 2013). The earth-mound kilns still attain below-optimum levels of efficiency, between 8 and 11% (Namaalwa, Hofstad, & Sankhayan, 2009), which further degrades air quality, and leads to inadequate solid waste management, as semi-burnt logs (Fig. 6.2e) are often abandoned at production sites in the open forests (Nabukalu & Gieré, 2019). Where production is illegal, upstream processes are supported by secrecy (Tabuti, Dhillion, & Lye, 2003; Butz, 2013), which further complicates attempts to attain sustainable forest management.

Incidentally, the level of stringency in the downstream supply chain departs distinctly from the realities that are common during production. For example, despite strong bans on production (WWF, 2018), charcoal transporters are often issued permits to move it downstream to roadsides or decentralized trading centres or granted the right to exports into international markets where it is traded openly and legally (Akpalu, Dasmani, & Aglobitse, 2011). Despite being legal and permitted, transportation of charcoal occurs in the night because of illegal practices (e.g. overloading of trucks; see Nabukalu & Gieré 2019). Demand in final markets sustains upstream production. As observed by Owen, van der Plas, and Sepp (2012), biomass is such an engrained source of energy in sub-Saharan Africa that energy policy must plan for it to be both present and still popular in the future.

Even though forest areas are receding (World Bank, 2017; Branch & Martiniello, 2018), with charcoal shortages due to forest loss (Asfaw & Demissie, 2012), we found during our fieldwork that some charcoal producers in the Mityana district (Fig. 6.1) believed they could continue to travel as nomads to sustain the charcoal supply for the future. Similarly, Owen, van der Plas, and Sepp (2012) reported ubiquity of biomass supply and the absence of risks to its supply in the coming decades. As with many products, scarcity may occur artificially, e.g. when induced by market practices such as hoarding, resulting from stringent regulation. Firewood, the cheaper alternative to charcoal, is also widespread and mostly free in rural areas, as also observed by Tabuti, Dhillion, and Lye (2003) in Bulamogi, in eastern Uganda (Fig. 6.1).

However, the environmental impacts of producing charcoal through the current upstream processes are largely unknown to both producers

and consumers. Even though our interviewees in Nsero (Luwero district) were able to explain the significant loss of trees over the 20 years of their involvement in the trade, the producers are not well-equipped to make scientific assessments of the far-reaching consequences of charcoal production. The cost-friendliness of setting up earth-mound kilns has increasingly made nomadism a more realistic and accessible approach for rural producers than setting up stationary production points, such as those seen in, e.g. Brazil and Kenya (Bailis, Rujanavech, Dwivedi, Chang, & de Miranda, 2013; Nogueira, Coelho, & Uhlig, 2010), which lead to higher logistical expenses in moving logs from where trees are felled.

Degradation and/or loss of forests, wood- and bush-lands, wooded savannas and even semi-arid landscapes are associated with the pursuit of charcoal as a critical source of energy, and therefore are fundamental issues of the global charcoal supply chain, which require an understanding of charcoal as a commodity that aggressively competes with modern energy sources. Moreover, technological innovation should be geared towards alternatives for safer cooking with less pollution in order to curb the devastating health impacts of heavily relying on charcoal fuel. This goal can be attained through targeted consumer education about the side effects of charcoal to human health and related supply chain issues, such as the origin of trees and risks of deforestation, in local and international markets.

In energy development, in contrast to the advancement of other common commodities, 'demand' and 'consumption' mean two very different things, in that demand constitutes energy that the population may require to satisfy a given purpose. On the other hand, consumption is what is used by that population. The disconnect between the interpretation of these phenomena often leads to increased electricity generation in sub-Saharan Africa, where consumption is not studied, but the investment is based on demand forecasts. In fact, when high demand forecasts do not align with actual consumption, electricity as a commodity becomes expensive, despite subsidies, as operators produce more and then price highly, grappling with recuperating costs of investing in the supply infrastructure. This reality further pushes consumers to the more available and affordable competitor, charcoal, for cooking purposes, thus

leaving “modern” alternatives relevant only for purposes that charcoal cannot serve, such as lighting, cooling or refrigeration.

By contrast, the charcoal supply chain presents a very different reality: High consumption does, in fact match, if not surpass, high demand projections. This makes charcoal production attractive, increasing its ubiquity as well as its reliability for consumers, thus undercutting electricity’s share as an energy alternative in the market. The idea that more electricity generation would reduce charcoal demand and consumption, and therefore ‘energy poverty’, in Africa is grossly unfounded. As sub-Saharan economies continue to pursue and heavily invest in more electrification, directing this goal to the aim of supplanting solid biomass fuels is futile, because electricity faces stiff competition from charcoal on the basis of functionality, value and reliability where grids exist, despite the increasing ability of the populations to afford it. Moreover, increasing the availability of any energy commodity is, by itself, not a sufficient cause for its consumption over existing alternatives, especially because consumers compare alternatives based on critical factors such as functionality, price or convenience as they determine everyday energy choices.

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7

Will a Transition to Renewable Energy Promote Energy Security Amid Energy Crisis in Nigeria?

Cosmos Nike Nwedu

7.1 Introduction

The economic growth and industrial development of several countries have over century depended on energy resources, of which conventional energy such as oil, gas and coal primarily characterized early production and supply of such resources.¹ This scenario of an overly dependence on conventional energy sources (CES) and its revenue is still a typical tendency of most countries in transition to economic prosperity today and can be seen well in African countries such as Nigeria. Although there are various efforts on the African continent to embrace clean energy, the anticipated increase in demand for fossil fuels to meet the estimated increase in population growth and boom in urbanization cannot be

¹Dieter Helm, *Burn Out: The Endgame for Fossil Fuels* (Yale University Press 2017).

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ignored.² There is, however, a growing shift from over-reliance on fossil fuels-oriented economies to very low-carbon economies as a remarkable development worldwide. This development recognized as energy transition and defined as a structural move from the production and use of predominant energy sources and technologies to more energy sources,³ is now at the mainstream national, regional and international policy agendas.

Essentially shaped by 'socio-economic development, technological innovation, and policies',⁴ energy transition has provided most countries with potential opportunities to promote energy security, mitigate climate change, and foster sustainability-related goals. Most of it all, it is perceived as a promising solution with pathways to fast-track fossil fuel decarbonization, using new regulation and policy-based new technologies and business models. Thus, if it is increasing decarbonization of the energy systems,⁵ and support for utilizing cleaner and affordable renewable energy sources (RES) such as wind, hydro, biomass and solar. Likewise, advancement in technologies has sufficed to support carbon capture, floating solar photovoltaic, electric cars, hydrogen fuels for refining oils, and bio-refineries for processing quality-based biofuels. The development is also accompanied by a paradigm transition in energy governance and has been mainly spurred by declining social and political acceptance of fossil fuels.

The idea of energy transition supporting energy security is beginning to attract attention and support in Nigeria. This is true given existing ambitious government policy objectives aimed at power generation from renewables. Nigeria's renewable energy transition efforts are, however,

²Nalule, V. R., 'Transitioning to a Low Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels?' In *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions* (pp. 261–286) (Cham: Palgrave Macmillan, 2020).

³Frauke Urban, 'Sustainable Energy for Developing Countries: Modeling Transitions to Renewable and Clean Energy in Rapidly Developing Countries' (Doctoral thesis, University of Groningen 2009).

⁴Ahmad O. Al Khowaiter and Yasser M. Mufti, 'An Alternative Energy Transition Pathway Enabled by the Oil and Gas Industry' (2020) OIES Paper 121, Oxford University.

⁵Kathleen J. Hancock and Vlado Vivoda, 'International Political Economy: A Field Born of the OPEC Crisis Returns to Its Energy Roots' (2014) 1 *Energy Research & Social Science*, 206–216.

more transparent in principle rather than as a practical reality. The existence of untapped abundant renewables spotted in every part of the country is axiomatic of her dysfunctional renewables-based energy transition. Nevertheless, substantial progress can be seen in the exploitation of hydropower to support the national grid system. The reality, in any case, is that power generation in Nigeria is still at a trifling point, indicating a short capacity for the country. Therefore, it has become a critical issue of concern as to whether transitioning to renewable energy can promote energy security to abate Nigeria's regular power crisis.

The primary aim of this chapter is to examine the potential of renewables for sustainable power generation in Nigeria. The rationale for it has arisen given the need for a transition from an overly reliance on fossil fuels to renewable-sourced electricity (RES-E), as a way of mitigating power crisis to ensure energy security in particular. The study, following an introduction, provides background information on Nigeria's renewable energy-based transition. This understanding is followed by a discussion of renewable energy prospect for energy security in the country. The next section examines how renewables development challenges can be overcome, using inclusive and effective policy measures. Overall, a summary has been provided in the conclusion section.

7.2 Energy Security in Energy Transition Regime: The Case of Nigeria

The idea of energy security which has expanded from a mere supply of oil to a relatively broad range of global issues,⁶ underpinning various conditions from a technical and theoretical perspective,⁷ and embracing 'availability, affordability, accessibility, and acceptability'⁸ is now typically

⁶Daniel Yergin, 'Ensuring Energy Security' (2006) 85(2) *Foreign Affairs*, 69–82; Jonathan Elkind, 'Energy Security: Call for a Broader Agenda'. In C. Pascual and J. Elkind (eds), *Energy Security: Economics, Politics, Strategies, and Implications* (Brookings Institution Press, 2009) 119.

⁷Felix Ciuta, 'Conceptual Notes on Energy Security: Total or Banal Security?' (2010) 41(2) *Security Dialogue*, 123–144.

⁸Alicia Altagracia Aponte (ed), *A Quest for Energy Security in the 21st Century: Resources and Constraints* (APEREC 2007).

a global concern. However, in Nigeria, it is more a great, unique challenge cutting across upstream, midstream and downstream issues. The power sector has either been confronted by regular low performance or a complete failure to deliver desired capacity,⁹ mainly due to related economic and political barriers. This does not, in any sense, translate to having little or no energy resources in Nigeria. There are both abundant CES and renewables. The major problem remains that oil and gas are a dominant source of power generation and national income.¹⁰ The effect of which has been manifest in energy crisis and economic losses of different proportions.¹¹ The condition of power crisis is characteristically now unsurprising a lifestyle to which many Nigerians are accustomed.

There are relative, differing accounts on power generation capacity in Nigeria. This divergence can be attributed to the typically dynamic nature of power itself, and most often generation-supply-connected technicalities. However, a most recent report from Nigerian Electricity Regulatory Commission (NERC) indicates that power generation, as at the third quarter of 2019 was 5093 MW at a peak per day, with an increase of the average generation up to 6709 MW during the same period.¹² This figure is well below a hypothetically estimated daily requirement of roughly 180,000 MW of electricity.¹³ The current daily electricity generation has also been anecdotally confirmed to reflect last year's average daily figure of the quarter in view. But gas alone accounted for 74.63% of the total generation, which implies its dominance in the

⁹Gbeminiyi M. Sobamowo and Sunday J. Ojolo, 'Techno-Economic Analysis of Biomass Energy Utilization through Gasification Technology for Sustainable Energy Production and Economic Development in Nigeria' (2018) *Journal of Energy*, 1–16.

¹⁰Abubakar Sadiq Aliyu, Joseph O. Dada and Ibrahim Khalil Adam, 'Current Status and Future Prospects of Renewable Energy in Nigeria' (2015) 48 *Renewable and Sustainable Energy Reviews*, 336–346.

¹¹Sunday Olayinka Oyedepo, 'Energy and Sustainable Development in Nigeria: The Way Forward' (2012) 15(2) *Energy, Sustainability and Society*, 1–17.

¹²Nigerian Electricity Regulatory Commission (NERC), Quarterly Report (Third Quarter, 2019) 24.

¹³Roseline Okere, 'Nigerians Require 180,000 mw of ELECTRICITY' *The Guardian* (20 September 2017), <https://guardian.ng/energy/nigerians-require-180000mw-of-electricity/>, accessed 20 April 2020.

power generation and supply mix.¹⁴ To put it in a more mathematical perspective, electricity generated from gas in the third quarter of 2019 was approximately 3801 MW of the total 5093 MW per day. The NERC, in effect, has expressed a concern that gas dominance in power generation heralds a grave security implication of energy supply for Nigeria. Gas prioritization is unsurprising because of its comparative efficiency and low-carbon emissions,¹⁵ richness and cost-effectiveness in terms of gas-fired power plants, but such dominance reveals a weakness in the power generation structure.¹⁶

Though unsurprisingly, demand for power currently exceeds supply as the majority of Nigerians lack access to electricity, even amid predominant conventional energy resources exploitation. The United States Agency for International Development (USAID) in its fact sheet indicates that about 45% of Nigerians have access to the national power grid, with a lack of unequal access among rural and urban dwellers.¹⁷ This population also faces persistent power outage in unequal real times. Besides, it has been shown that about 20 million people are unconnected to the national electricity grid.¹⁸ The increasing population growth in Nigeria, and the ongoing global coronavirus disease (COVID-19) pandemic¹⁹ are likely to impact her electricity generation efforts adversely to perceptible slower progress.

¹⁴NERC Quarterly Report (n 11) 29.

¹⁵Martin Lambert, 'Decarbonization of Gas' (2020) OIES Paper 121, at 29, Oxford University.

¹⁶Chukwueyem S. Rapu and others, 'Analysis of Energy Conditions in Nigeria' (2015) CBN Occasional Paper No. 55, <https://www.cbn.gov.ng/out/2017/rsd/analysis%20of%20energy.pdf>, accessed 20 April 2020.

¹⁷USAID, 'Nigeria: Power Africa Fact Sheet', https://www.usaid.gov/sites/default/files/documents/1860/Nigeria_-_November_2018_Country_Fact_Sheet.pdf, accessed 9 April 2020.

¹⁸Ibid.

¹⁹The usual practice by which Nigeria translates her crude oil into usable economic product focuses on exportation-re-importation cycle process. Therefore, Nigeria's electricity sector efforts are likely to be affected by the ongoing COVID-19 pandemic if the country is unable to export her crude oil for refinement and re-importation for local use due to containment lockdown measures of overseas governments or countries especially in countries where such refinement is usually done. Besides, production contracts and supply chain-related contracts in the energy or electricity sector are also likely to be impacted if performance is rendered impracticable, as either contracting party may raise a force majeure excuse. The impact may be short-term, depending on how long the pandemic lasts.

There have been different efforts made by Nigeria, and in some cases with international support for the renewable energy-based transition. The government, both present and past have, in different policy instruments acknowledged the increasing role of renewables especially in overcoming national power crisis and supporting global agendas such as climate change mitigation and sustainable development goals (SDGs). Through ambitious National Renewable Energy and Energy Efficiency Policy (NREEEP) and National Renewable Energy Action Plans (NREAP), both of which were approved in 2015 and 2016, respectively, Nigeria set robust objectives to diversify energy resources choices, achieve national energy security and energy efficiency, ensure ‘adequate, reliable, affordable, equitable and sustainable’ development and supply of renewables in an environmentally sound manner. The NERC has a target for at least 2000 MW of renewable electricity by the end of 2020, and in 2015 established a feed-in-tariff (FIT) mechanism.²⁰ As part of international supports, the European Union (EU) and the German Federal Ministry for Economic Cooperation and Development (BMZ) co-financed Nigerian Energy Support Programme (NESP), launched in 2013 to support renewable energy investments.²¹ The World Bank, in addition, financed renewable-based rural electrification under the Power Sector Recovery Programme (PSRP).²² The government efforts also reflect in the international initiative, seeking to address equitable and affordable access to modern energy resources, particularly agenda 7 of the United Nations (UN) SDGs. A true reflection of which is the adoption of sustainable energy for all (SE4All) Action Agenda by the Nigeria National Council on Power (NACOP) in July 2016. These efforts have either shown little or no result. Thus, energy security issues in Nigeria

²⁰NERC, ‘Renewable Energy Sourced Electricity’, <https://www.nerc.gov.ng/index.php/home/operators/renewable-energy>, accessed 7 April 2020.

²¹Déborah Giusy Londoño Londoño, ‘Human Security and Nigeria’s Energy Crisis’ (IAI Commentaries 18–49, September 2018), <https://www.iai.it/sites/default/files/iaicom1849.pdf>, accessed 20 April 2020.

²²World Bank, *Upscaling Mini-grids for Low Cost and Timely Access to Electricity. Energy Sector Management Assistance Program* (Washington: World Bank Group, 2017).

are primarily at the heart of availability, affordability, sustainability²³ and acceptability. The SDG 7 on affordable and clean energy emphasizes the need to enhance energy access through equitable use of clean renewables. Thus, energy access is a correlative function of energy security because availability, affordability and sustainability create a condition for energy access, which is a major priority to be addressed at all levels²⁴ just like energy security itself. Therefore, Nigeria lacks the bedrock for achieving SDG 7 on energy access, given its level of energy insecurity.

Nigeria's intended nationally determined contribution (INDC) within the framework of the 2015 Paris Climate Change Agreement (PCCA) is centred on greenhouse gas emission reduction, of which 20% reduction is unconditional and 45% conditional with international support. The key measures for achieving which include efforts to end gas flaring well into 2030, promote 13 GW off-grid solar photovoltaic equivalent to 13,000 MW, and reinforce reforestation-based climate-smart agriculture. However, it is not clear how such contribution can be achieved in the face of heavy reliance on fossil fuels, and undue disregard to logical exploitation of modern energy resources. Thus, Nigeria's INDC primary objective of promoting access to electricity for all, economic and social development, and standard of living is highly likely to be impacted by a lack of adequate deployment of renewable energy to support national energy mix. There is no doubt that actions taken to drive INDCs by nations such as Nigeria, will count as an all-first significant step towards a low-emissions trajectory.²⁵

²³Fubara Susan Amiesa, Omowumi Iledare and Onyije Israel, 'Assessing the Economic Implication of Energy Insecurity in Nigeria' (IAEE 40th International Conference, Singapore, June 2017).

²⁴Victoria R. Nalule, *Energy Poverty and Access Challenges in Sub-Saharan Africa: The Role of Regionalism* (Palgrave Macmillan 2019)

²⁵Jim Herbertson, 'The Oil and Gas Industry, Low-Emission Pathways, and the Energy Transition' (2020) OIES Paper 121, at 9, Oxford University.

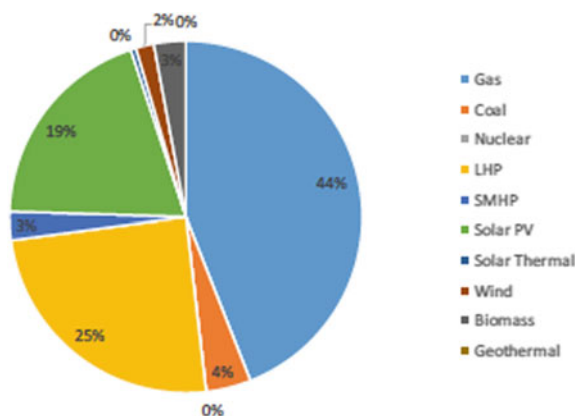


Fig. 7.1 Nigeria's energy mix in 2020: 10 GW on-grid (Source Nigeria Electricity Hub)

7.3 Forms and Prospects of Renewables for Energy Security in Nigeria

There are various forms of RES in Nigeria. The potentials of such resources have become a subject of great interest in several efforts and studies from both government and individual investigators. Though findings indicate axiomatic evidence of substantial share of RES, most of which have only made a tiny fraction of energy mix in the country, as represented in Fig. 7.1.

The foregoing evidence of low utilization of renewables lends credence to an earlier finding that natural gas dominates Nigeria's power mix. This makes for an assumption to argue that government power generation efforts have focused on increasing investments in natural gas development and gas-fired plants increase. The government perhaps relies on gas as a convenient low-risk approach to energy security, especially as a growing market for liquefied natural gas (LNG) alongside technological improvement, has become a trend.²⁶ This is despite potential investments and market demand opportunities for renewables in Nigeria.

²⁶Occhiali Giovanni and Falchetta Giacomo, 'The Changing Role of Natural Gas in Nigeria: A Policy Outlook for Energy Security and Sustainable Development' (2018) Fondazione Eni

Ominously, over-reliance on gas-fired power, and as noted in page 4 by NERC does not only raise resource monopoly concern but also even intensifies energy insecurity. Therefore, ensuring a well-balanced sustainable national grid system operation, which fosters an acceptable degree of energy security requires a good deal of energy mix, including different forms of renewables. For Nigeria, renewable energy has a promising solution to the energy crisis for energy security, and such primary potential energy sources are examined hereunder.

7.3.1 Hydro Power

The location of Nigeria in Africa and on the world map offers good environmental conditions for harnessing sufficient hydropower. There exist several exploitable big and small rivers, including streams dispersed in most states.²⁷ The most exciting thing is that the available rivers offer good sites for large and small hydropower projects, which are likely to serve urban dwellers and the most often isolated rural inhabitants.²⁸ Nigeria is also typically characterized by regular incidences of significant natural rainfall. This can be harnessed with support from modern technology to generate electricity.

The potential of hydro sites in the country has attracted both policy and research attention. Existing research shows enormous opportunities in most states for unexploited small hydropower, with a predictable overall capacity of 3500 MW, of which only about 64.2 MW is currently exploited.²⁹ The evidence further indicates that both rivers and streams in Nigeria have a potential to provide 70 micro dams, 126 mini dams and 86 small sites for generating an estimated capacity of 11,250 MW, but only about 17% is exploited under the prevailing energy regime.³⁰ The

Enrico Mattei Working Paper No. 010.2018, <http://hdl.handle.net/10419/177262>, accessed 18 May 2020.

²⁷Ismaila Haliru Zarma, 'Hydro Power Resources in Nigeria' (International Centre on Small Hydro Power 2nd Hydro Power for Today Conference, Hangzhou, 2006).

²⁸Ibid.

²⁹GET.invest, 'Nigeria: Renewable Energy Potential', <https://www.get-invest.eu/market-information/nigeria/renewable-energy-potential/>, accessed 5 April 2020.

³⁰Ibid.

Table 7.1 Current hydropower plants in operation

S/N	Name	Installed capacity (MW)	Completion year	Location
1	Kainji Dam	960	1968	Niger State
2	Jebba Dam	540	1984	Niger State
3	Shiroro	600	1990	Niger State

Source Constructed by the author

total installed hydropower capacity is, nonetheless, around 2380 MW.³¹ Besides, one research evaluated hydro potential in Nigeria to be as much as 8824 MW, with a yearly electricity generation potential in excess of 36,000 GWh, of which large hydropower makes up 8000 MW and small hydro technology accounts for 824 MW.³² Electricity from hydro in the third quarter of 2019 accounted for about 25.37% of the total daily national power generated.³³ Based on available statistics, about three major hydropower plants are currently in operation in Nigeria, as represented in Table 7.1.

There are yet different ongoing hydropower projects in Nigeria, apart from the represented hydropower stations currently in full operation. The Mambilla hydropower project, located in Kakara village in Taraba State with an estimated 3050 MW of electricity is in progress. This project is expected for completion in 2030, as Nigeria's largest and one of Africa's biggest hydropower stations. There also exists for completion, a Zungeru hydropower dam located on the Kaduna River in Niger State, which is projected to have a capacity of 700 MW. The Zungeru hydro project started in 2013 but has been adversely delayed for commissioning due to unaddressed social-legal issues, and a new date for commencement is expected in 2021. There are further under-developed Gurara I and Gurara II projects in Kaduna State, and Kashimbila in Taraba State. These hydropower projects have expected capacities of 30 MW, 360 MW, 40 MW and 40 MW, respectively.

³¹USAID (n 16).

³²John-Felix K. Akinbami, 'Renewable Energy Resources and Technologies in Nigeria: Present Situation, Future Prospects and Policy Framework' (2001) 6 Mitigation and Adaptation Strategies for Global Change, 155–182.

³³NERC Quarterly Report (n 11).

The history of power generation may see hydro to have contributed significantly to electricity supply in Nigeria. But in reality, hydro resource availability has not as possible been fully exploited as visible, especially when considering an increased demand for electricity in the country. Thus, much investment is needed in hydro technology, at least, small hydropower systems. The Federal Government of Nigeria is poised to continue to increase a share of power from hydro, with a target to generate roughly 6156 MW by the end of 2020.³⁴ This will require robust institutional, technological and financial commitments, in addition to addressing related critical investment barriers.

7.3.2 Solar Energy

The sun may be considered the world's greatest sky-based natural power plant, especially for some countries well-positioned geographically. Though solar energy appears to be the oldest source of power,³⁵ technology for harnessing it is not as old as the resource itself. Technology has only recently emerged to support solar energy utilization, and a wide range of it including photovoltaic, solar heating, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis provide humanity with a great opportunity to fully maximize solar potential. The sun, however, can be felt naturally on human health and livelihoods without any technological processes of capturing and conversion. This can also have wide natural implication for different agricultural purposes.³⁶

There is the presence of radically aggressive sunlight in Nigeria, replete with the huge solar energy potential of relatively daily distributed radiation circa 19.8 MJ m² on average.³⁷ The average sunlight at interval

³⁴IHA, 'Nigeria: Nigeria Statistics', <https://www.hydropower.org/country-profiles/nigeria>, accessed 9 April 2020.

³⁵UI Ndaceko and others, 'Solar Energy Potential in Nigeria' (2014) 5(10) International Journal of Scientific and Engineering Research, 594–598.

³⁶JK Yohanna and VI Umogbai, 'Solar Energy Potentials and Utilisation in Nigeria Agriculture' (2010) 2(3) Journal of Environmental Issues and Agriculture in Developing Countries, 10–21.

³⁷GET.invest (n 25).

is 6 hours per day, and possible concentrated solar power and photovoltaic is roughly 427,000 MW.³⁸ More evidence shows that Nigeria's entire solar energy landmass coverage is 120,000 times electricity generated for consumption in the country in 2002.³⁹ The use of solar modules or collectors to cover, at least, 1% would potentially generate 1850×10^3 GWh of solar energy yearly, a capacity which is 100 times electricity consumed currently in the country.⁴⁰ The geography of Nigeria is generally solar promising, yet a function of seasonal weather as is relatively likely elsewhere. The country at large relatively experiences solar intensity. The northern part, for example, experiences the extreme intensity of the sun, with longer daily hours of sunlight. The following Fig. 7.2 shows Nigeria's level of global horizon irradiation (GHI), which by critical analysis, offers substantial evidence of exploitable solar energy in the country.

The use of solar for power generation is visibly slow in Nigeria, despite her proven solar energy potential. This situation, in addition to an overall poor power generation, has seen individuals struggling to adapt to off-grid solar power. Thus, more progress can be seen in the deployment of photovoltaic technology among some corporate institutions and households able to afford any associated costs. This scenario is a reflection of government's unwinding political will and commitment.

The availability of exploitable solar in Nigeria, even amid government's indifference has become a great subject of interest in several studies.⁴¹ Fagbenle assessed the desirability or otherwise of applying solar energy to air, road, sea, rail, including military transportations.⁴² The economic benefits of solar apart from power generation can be widely felt in several other sectors such as agriculture, engineering, medical sciences

³⁸Ibid.

³⁹GENI, 'How is 100% Renewable Energy Possible for Nigeria?', <http://geni.org/globalenergy/research/renewable-energy-potential-of-nigeria/100-percent-renewable-energy-Nigeria.pdf>, accessed 24 April 2020.

⁴⁰Chigasa C. Uzoma and others, 'Renewable Energy Penetration in Nigeria: A Study of the South-East Zone' (2011) 1(5) *Continental J. Environmental Sciences*, 1–5.

⁴¹RL Fagbenle, 'Prospects and problems of solarising transport technology' (1991) 2(1) *Nigerian Journal of Renewable Energy*, 85–88; RL Fagbenle, 'Estimation of Total Radiation in Nigeria Using Meteorological Data' (1990) *Nigerian Journal of Renewable Energy*, 1–10.

⁴²Ibid.

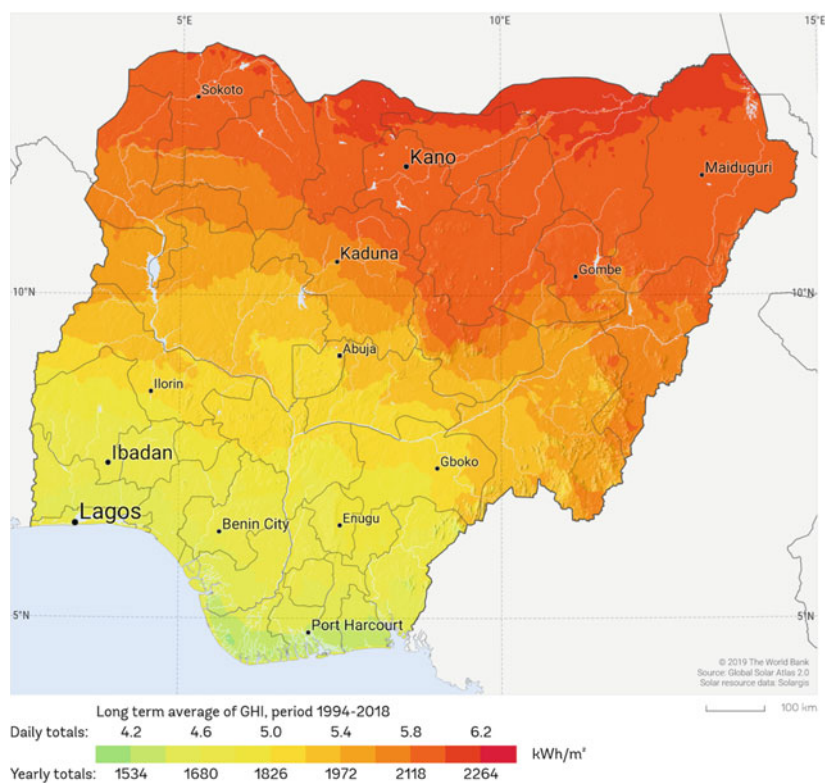


Fig. 7.2 GHI Nigeria (Source SolarGIS)

and recreation.⁴³ One study conducted by Yohanna and Umogbai specifically assessed both solar energy potential and the extent of its application to Nigeria's agricultural sector.⁴⁴ The authors demonstrated extensive, conventional use of solar energy for various agricultural purposes. There is an underlying argument that solar energy is a catalyst for economic development in Nigeria,⁴⁵ and anchor-energy due to its support for

⁴³OI Okoro and TC Madueme, 'Solar Energy: A Necessary Investment in a Developing Economy' (2004) 23(1) Nigerian Journal of Technology, 58–64.

⁴⁴Yohanna and Umogbai (n 32).

⁴⁵Okoro and Madueme (n 39).

tapping other renewables.⁴⁶ A recent study demonstrates that a unit cost of electricity from stand-alone photovoltaic systems is less costly, as opposed to the cost of widely utilized imported diesel generators.⁴⁷

Therefore, economic viability exists for solar energy in Nigeria. This makes for an assumption that an effective harnessing of a substantial amount of disposable solar energy in the country can provide electricity to both urban and rural dwellers. This can be crucial for power decentralization and access localization. There is no doubt that deploying solar technology to support off-grid and on-grid electricity generation would make a significant impact on Nigeria's economy and citizens' well-being. This could be a reality with the government's recent launch of \$75 million in funds to generate electricity for her teeming population.⁴⁸ The government will, nevertheless, need to show a clear political will to scale solar energy technology, and also address challenges to its investments.

7.3.3 Wind Energy

Technology has proven wind to be an economic power-based resource globally, which is relatively ubiquitous. The presence of wind can be naturally felt in every state of Nigeria. This sensation does not, in any sense mean wind viability for power generation in every state. The concern to evaluate wind potential coupled with unjustifiable regular short capacity made wind a great subject of interest, reflecting in efforts from both government and researchers,⁴⁹ but little has been done to commercialize it. On a basic level, some analyses have only focused

⁴⁶Ikponmwosa Oghogho and others, 'Solar Energy Potential and its Development for Sustainable Energy Generation in Nigeria: A Road Map to Achieving this Feat' (2014) 5(2) *International Journal of Engineering and Management Sciences*, 61–67.

⁴⁷Chiemeka Onyeka Okoye, Onur Taylan and Derek K. Baker, 'Solar Energy Potentials in Strategically Located Cities in Nigeria: Review, Resource assessment and PV System Design' (2016) 5(C), *Renewable and Sustainable Energy Reviews*, 550–566.

⁴⁸JP Casey, 'Electrifying Nigeria: Could Solar Power One Million Households?' (Power Technology, 20 January 2020), <https://www.power-technology.com/features/electrifying-nigeria-could-solar-power-one-million-households/>, accessed 14 April 2020.

⁴⁹Oluseyi O. Ajayi, 'Assessment of Utilisation of Wind Energy Resources in Nigeria' (2009) 37 *Energy Policy*, 750–753.

on wind characteristics in some states,⁵⁰ while others assessed wind energy technology potential,⁵¹ challenges to, and solution for effective deployment of such technology.⁵²

The economic viability of wind energy at a core height of 65 metres up from a ground level with a yearly average wind speed of 5.36 m/s was conducted at Umudike, a semi-urban settlement in Ikwuano Local Government Area (LGA) of Abia State, based on a 10 year (1994–2003) wind speed data.⁵³ Fadare, using Weibull distribution function and daily wind speed data from 1995 to 2004, performed a statistical assessment of wind energy potential in Ibadan, Oyo State capital, which shows an average wind speed of 2.943 m/s,⁵⁴ while a study carried out by Adekoya and Adewale to assess wind speed using data from 30 states in Nigeria, reveals that annual average wind speed and power fluidity densities range from 1.5 to 4.1 m/s and 5.7 to 22.5 W/m².⁵⁵ Fagbenle and Karayiannis earlier performed a 10-year data assessment from 1979 to 1988, which considered surface and upper wind, including the maximum gusts.⁵⁶ One study, unlike many others, focused on a review of research developments on onshore and offshore wind energy potentials as well as research for developing, designing, and applying small-scale wind energy turbines for electricity generation in Nigeria, and on the other hand, evaluated the

⁵⁰JO Ojosu and RI Salau, 'A Survey of Wind Energy Potential in Nigeria' (1990) 7(2–3) *Solar & Wind Technology*, 155–167.

⁵¹NA Idris and others, 'Nigeria's Wind Energy Potentials: The Path to Diversified Energy Generation-Mix' (2013) 2(4) *International Journal of Modern Engineering Research*, 2434–2437.

⁵²AA Oyediji and others, 'Wind Energy Technology in Nigeria: Prospect, Challenges and Solution' (2018) 2(2) *Covenant Journal of Engineering Technology*, 52–58.

⁵³AD Asiegbu and GS Iwuoha, 'Studies of Wind Resources in Umudike, South-East Nigeria: An Assessment of Economic Viability' (2007) 2(10) *Journal of Engineering and Applied Sciences*, 1539–1541.

⁵⁴DA Fadare, 'A Statistical Analysis of wind Energy Potential in Ibadan, Nigeria, Based on Weibull Distribution Function' (2008) 9(1) *Pacific Journal of Science and Technology*, 110–119.

⁵⁵LO Adekoya and AA Adewale, 'Wind Energy Potential of Nigeria' (1992) 2(1) *Renewable Energy*, 35–39.

⁵⁶RL Fagbenle and TG Karayiannis, 'On the Wind Energy Resource of Nigeria' (1994) 18(5) *International Journal of Energy Research*, 493–508.

desirability of various geographical sites for onshore and offshore wind energy generation.⁵⁷

The wind potential in Sokoto State alone is as high as 97 MWh yearly.⁵⁸ Besides, harvestable potential wind exists in offshore areas of Lagos, Ondo, Delta, Rivers, Bayelsa, and Akwa Ibom States in a year-round.⁵⁹ Generally, annual wind speed at 10 m up from ground level varies from 2.3 to 2.4 m/s for seaside sites, and 3.0 to 3.9 m/s for semi-arid regions including high land areas with observed poor wind speeds in the southern part of Nigeria, except offshore and littoral regions.⁶⁰ The northern hilly regions are branded with extremely strong wind, whereas fairly exploitable wind energy can be seen in the steep topographies of the middle belt and northern fringes.⁶¹ The wind speed values range from 1.4 to 3.0 m/s in the north and 4.0 to 5.12 m/s in the far northern part, at 10 m height.⁶² The months of April to August account for peak wind energy speed.⁶³

To a quite level of difference, another study indicates that wind speed in the northern and southern regions measures between 4.0–7.5 m/s and 3.0–3.5 m/s, respectively, and of 10 m above from ground level is significant to generate accessible power for a good number of the Nigerian population.⁶⁴ Similarly, states within the sea lying areas have high wind speed sufficient for power generation.⁶⁵ The north is considered one of the most strategic areas for wind technology⁶⁶ because of its promising energy potential of about 8.70 m/s wind speed. Though initial studies

⁵⁷O Adedipe, MS Abolarin and RO Mamman, 'A Review of Onshore and Offshore Wind Energy Potential in Nigeria' (2018) 413 IOP Conference Series Materials Science and Engineering, 1–8.

⁵⁸GENI (n 35).

⁵⁹Oluseyi O. Ajayi, 'The Potential for Wind Energy in Nigeria' (2010) 34(3) Wind Engineering, 303–312.

⁶⁰GENI (n 35).

⁶¹Ibid.

⁶²Ajayi (n 56).

⁶³GENI (n 35).

⁶⁴Ajayi (n 56).

⁶⁵JO Okeniyi, OS Ohunakin and ET Okeniyi, 'Assessments of Wind-Energy Potential in Selected Sites from Three Geopolitical Zones in Nigeria: Implications for Renewable/Sustainable Rural Electrification' (2015) 15 Scientific World Journal, 13.

⁶⁶GENI (n 35).

show that a real utilizable wind energy reserve at 10 m height may vary from 8 MWh to 51 MWh per year in Yola and Jos, respectively, and as high as 97 MWh yearly in Sokoto at 10 m height value increase. To a very relative extent, existing findings show evidence of possible exploitable wind energy in Nigeria. But no single evidence exists to show that wind energy is currently a source of power generation in the country. The first and only efforts to harness wind energy manifested in the 1960s, when a few stand-alone wind energy plants were installed in 5 northern states mainly to power water pumps and a 5 kW wind power conversion machine for power supply at Sayyan Gidan Gada, Sokoto State.⁶⁷

7.3.4 Biomass

The nature of biomass resources makes it a likely enviable RES globally. They are extremely low in carbon emissions and cost-effective, comparing it with other renewable technologies. Biomass can also make a large proportion of energy resources mix. Electricity, liquid biofuels and biogas from a variety of biomass feedstock depend on a wide assemblage of practices taken.⁶⁸ There are a wide variety of biomass resources in Nigeria, making it a highly studied zone for biomass production potential. These resources can be grouped as 'agricultural resources, crop resources, forestry resources, urban wastes and other wastes'.⁶⁹ Urban wastes and other wastes could be industrial and non-industrial wastes as well as a large chunk of wastes from rural areas. The good news, however, is that wastes of any kind remain an important feedstock for clean energy generation. The daily biomass production in Nigeria is around 227,500 tons, which could possibly make up 6.8 million m³ of biogas.⁷⁰ But in a

⁶⁷CE Nnaji, CC Uzoma and JO Chukwu, 'The Role of Renewable Energy Resources in Poverty Alleviation and Sustainable Development in Nigeria' (2010) 3 Continental Journal of Social Sciences, 31–37.

⁶⁸Juliet Ben-Iwo, Vasilije Manovic and Philip Longhurst, 'Biomass Resources and Biofuels Potential for the Production of Transportation Fuels in Nigeria' (2016) 63 Renewable and Sustainable Energy Reviews, 172–192.

⁶⁹Ibid.

⁷⁰GET.invest (n 25).

more general perspective, it contributes roughly 78% to national energy consumption as primary energy.⁷¹

The government's interest in biofuels production from agricultural crops had only become manifest in 2007 when it introduced Bio-Fuel Policy and Incentives.⁷² There exist other research on biomass potential for electricity generation in Nigeria, despite a lack of interest from the government to harness its potential. Based on findings, Nigeria's cultivable agricultural landmass covers about 71 million ha, which is about 77% of the country's total area of 923,770 km²,⁷³ of which 37.3% is arable land,⁷⁴ with over 12.6 million active agriculturists.⁷⁵ There is a massive potential for high energy content crops such as cassava, sugarcane, sorghum and corn in Nigeria, due to a fair availability of water and cultivable arable lands.⁷⁶ These crops are considered the most promising feedstock for biofuel production in the country.⁷⁷ There are also other energy crops such as oil palm, wheat, soya beans, rice, groundnuts, beans grown in the country, including cost-effectively viable feedstock substrates for biogas like water lettuce, water hyacinth, dung, cassava leaves, sewage, etc.⁷⁸

Existing research shows evolving bio-refineries in Nigeria utilize unsustainable first-generation biomass feedstock from food crops, which

⁷¹AA Sokan-Adeaga and GR Ana, 'A Comprehensive Review of Biomass Resources and Biofuel Production in Nigeria: Potential and Prospects' (2015) 30(3) *Rev Environ Health*, 143–162.

⁷²See, the Federal Republic of Nigeria, *Official Gazette of the Nigerian Bio-Fuel Policy and Incentives 2007*, <http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/laws/1517.pdf>, accessed 14 April 2020.

⁷³FAO, 'AQUASTAT Country Profile 2016–Nigeria', www.fao.org/3/i9807en/i9807EN.pdf, accessed 14 April 2020.

⁷⁴Ben-Iwo, Manovic and Longhurst (n 64).

⁷⁵FAO, 'Country Fact Sheet 2016', www.fao.org/nr/water/aquastat/data/cf/readPdf.html?f=NGA-CF_eng.pdf, accessed 14 April 2020.

⁷⁶Nelson Abila, 'Biofuels Adoption in Nigeria: A Preliminary Review of Feedstock and Fuel Production Potentials' (2010) 21 *Management of Environmental Quality an International Journal*, 785–795.

⁷⁷GET. invest (n 25).

⁷⁸John-Felix K. Akinbami and others, 'Biogas Energy Use in Nigeria: Current Status, Future Prospects and Policy Implications' (2001) 5 *Renewable and Sustainable Energy Reviews*, 97–112.

compete with food.⁷⁹ The government needs non-food biomass feedstock to harness renewable energy,⁸⁰ which is crucial for sustainable biofuel. This is also crucial to avoid counter-productive efforts that would adversely impact the agricultural sector, and lead to food insecurity, especially if we factor in the increasing impacts of climate change on agriculture. Crop residues, which could be on-farm burnt or leftover materials or industrial by-products from processed crops,⁸¹ are enormous in Nigeria. Their usefulness can vary in terms of density, moisture content, site and source of origin, a period of harvest, and harvesting technique. But whether field-based primary residues produced in the course of harvest or industrially processed as secondary residues, both have a potential for renewable energy generation.⁸² These resources have simply been underutilized. Local farmers in most cases, convert such residues into locally prepared organic manure in place of artificially produced fertilizer.

Economically, forestry as a source of biomass can substantially contribute to a country's power source. There is revealing evidence from research that about 9.5% of Nigeria's total land is covered by forest.⁸³ The southern part of the country is characterized by tropical rainforest forest, while Sahel savannah exists in the north. The rain forest produces greater woody biomass, unlike savannah forest that mainly produces crop residues.⁸⁴ Throughout Nigeria, the forest is seen, and a larger part of it is under government reserve,⁸⁵ but is not always adequately protected and conserved.⁸⁶ Forest residues remain under-exploited in Nigeria, but most

⁷⁹Ben-Iwo, Manovic and Longhurst (n 64).

⁸⁰Ibid.

⁸¹Ibid.

⁸²Moses Hensley Duku, Sai Gu and Essel Ben Hagan, 'A Comprehensive Review of Biomass Resources and Biofuels Potential in Ghana' (2011) 15 *Renewable and Sustainable Energy Reviews*, 404–415.

⁸³Osakue Jessy Osaghae, 'Potential Biomass-Based Electricity Generation in a Rural Community in Nigeria' (Masters thesis, Luleå University of Technology 2009)

⁸⁴KJ Simonyan and O Fasina, 'Biomass Resources and Bioenergy Potentials in Nigeria' (2013) 8(40) *African Journal of Agricultural*, 4975–4989.

⁸⁵Yekini Suberu Mohammed and others, 'Renewable Energy Resources for Distributed POWER Generation in Nigeria: A Review of the Potential' (2013) 22 *Renewable and Sustainable Energy Reviews*, 257–268.

⁸⁶Ben-Iwo, Manovic and Longhurst (n 64).

local communities instead use much of her biomass resources such as firewood or charcoal for lighting, cooking, heating and meeting related-households needs in unsustainable practices. There is a lack of knowledge among rural people about the health implication of local practices of utilizing forest residues. The government needs to prioritize the forest as a means of economic revenue and clean power generation. This must be supported with clear legal and regulatory frameworks and strong institutions that foster government objectives and enhance forestry knowledge amount the citizens, especially the local people.

Technologically, waste-to-energy (WTE) conversion has become an increasing approach to power generation, especially for countries with a significant amount of wastes. There is a large chunk of wastes or biomass in Nigeria, which can be found in larger expanse in major cities where households consumption and industrial and commercial activities are regularly, increasingly higher. The government's approach of getting rid of such wastes by open burning has been a major state practice instead of utilizing it for biofuel generation. Such practice is pointedly anti-climate and environmentally unsound in terms of pollution or emission of greenhouse gases. The production of biogas from wastes is known to bring immediate benefit.⁸⁷ This benefit can be extensive as biogas is characterized by adaptable technology likely to be scaled at household, industry and community levels.⁸⁸ Thus, tapping Nigeria's enormous wastes by employing modern technology for WTE could bring tremendous social and economic benefits. This will not only contribute significantly to power generation but also offer crucial by-products such as fertilizer for supporting and enhancing agricultural productivity, as well as ensuring effective sanitary practice.

There is no gainsaying as to whether biomass remains an overlooked energy resource in Nigeria. The truth is simple. There is a lack of interest among states and national governments to utilize such resources. For instance, a 5.5 MW biomass gasifier power plant owned by United Nations Industrial Development Organization (UNIDO), and formally

⁸⁷Mofoluwake M. Ishola and others, 'Biofuels in Nigeria: A Critical Strategic Evaluation' (2013) 55 *Renewable Energy*, 554–560.

⁸⁸*Ibid.*

located at UNIDO Mini-industrial cluster in Ekwashi Ngbo in Ebonyi State, which was acquired by Ebonyi State government in 2016,⁸⁹ but has no place of siting much less of being utilized is clearly an illustration of a lack of government's interest in biomass utilization.

7.4 Overcoming Renewable Energy Development Challenges in Nigeria

Though Nigeria has enormous renewables, translating such resources into a meaningful, sustainable economic wealth and power have proved unrealistic. This scenario can be attributed to critical multi-dimensional constraints, in addition to a lack of genuine political will, weak and corrupt institutions, and overly reliance on fossil fuels. The current energy market is monopoly-driven, and as such, remains one greatest barrier to the energy transition process and energy security pathway in Nigeria. There are government policies to support renewable energy deployment, yet none is effective because such policies support mere objectives not regulated under any known legal framework. The electricity generation and supply sectors have not adequately been open to competition, and energy investors have continued to enjoy a significant degree of monopoly over them. The predominant tendency of the Nigerian government in overhauling the power sector has focused on privatization, an entirely different unbundling energy policy concept, which in reality does not create desired competition.

There are different impediments to RES-E development.⁹⁰ Pueyo and others⁹¹ have provided useful insights into barriers to RES-E, especially in developing regions like Nigeria. The authors have grouped such barriers as economic and financial, regulatory and political and technical,

⁸⁹Tamara Posibi, 'Biomass in Nigeria: An Overview' (BioEnergy Consult, 11 March 2020), <https://www.bioenergyconsult.com/biomass-energy-in-nigeria/>, accessed 14 April 2020.

⁹⁰Hugo Lucas, Pablo del Rio and Mohamed Youba Sokona, 'Design and Assessment of Renewable Electricity Auctions in Sub-Saharan Africa' (2017) 48(5–6) IDS Bulletin, 79–100.

⁹¹A Pueyo and others, 'Green Growth Diagnostics for Africa: Literature Review and Scoping Study' (2015) IDS Working Paper 455, <https://opendocs.ids.ac.uk/handle/20.500.12413/6168>, accessed 20 April 2020

which are argued to be more severe in developing countries.⁹² Though unsurprisingly, RES-E development projects in developing countries have inherent challenges, which include:

- a higher capital cost which can be intensified by cost discrepancies in funding,
- perceivable higher risks likely to raise the cost of financing and equity share in a project's funding arrangement,
- lack of suitably domestic equity finance and debt finance maturity, in particular, of private equity, and
- overall, low prices of generated RES-E, which can constrain cost recapture.⁹³

There are other several studies that have identified detailed constraints to RES-E.⁹⁴ Traditionally, power project is always capital-intensive. Therefore, for the government, it is an unbearable financial burden, especially on budgets.⁹⁵ The risks extend to other different types of interlaced constraints involving:

- construction, operation, foreign exchange and country risks,⁹⁶
- off-taker risk,⁹⁷

⁹²Ibid.

⁹³Ibid.

⁹⁴Rainer Quitzow and others, 'The Future of Africa's Energy Supply: Potentials and Development Options for Renewable Energy (2016) IASS, <https://publications.iass-potsdam.2016.008>, accessed 20 April 2020.

⁹⁵Antonio Castellano and others, 'Electric Power and Natural Gas: Brighter Africa: The Growth Potential of the Sub-Saharan Electricity Sector' (2015) McKinsey and Company, https://www.mckinsey.com/-/media/McKinsey/dotcom/client_service/EPNG/PDFs/Brighter_Africa-The_growth_potential_of_the_sub-Saharan_electricity_sector.ashx, accessed 20 April 2020

⁹⁶Quitzow and others (n 90).

⁹⁷Anton Eberhard and others, *Independent Power Projects in Sub-Saharan Africa: Lessons from Five Key Countries* (Washington, DC: World Bank 2016).

- electricity sector structure often controlled by single, state-owned utilities accountable for a sizable share of generation, transmission and distribution,⁹⁸
- weak grids induced technical limitations,⁹⁹ and finally,
- low tariffs and a large volume of required investments.¹⁰⁰

Essentially, any country desirous of deploying a sizable amount of renewables must address these risks through appropriate energy policy and market strategy-based incentives. For Nigeria, appropriate energy policy would need to focus on a redesigned, fully liberalized competitive power market, one that considers competitors in both generation and supply sectors, in addition to remedying critical barriers highlighted above through various incentives. The liberalization process will create an entry point for scaling energy transition regime and overcoming challenges hampering effective renewable energy deployment in Nigeria, and as a process will remove monopoly right and introduce competition and choice of energy providers at competitive prices for energy consumers. The choice of energy itself and the availability of different energy sources is an underlying characteristic of the energy transition. The whole aim of liberalization, however, may not initially focus on price minimization, but at least to encourage new entrants or investors, and or to generate additional funds for investments, since Nigeria does not have existing sufficient capacity to meet demand.

The introduction of competition into the power market is, by implication, an invitation to investors. But investors indeed need an acceptable level of regulatory and political certainty or are otherwise interested in understanding what regulatory and political risks exist in, or characterize a particular energy market. Currently, Nigeria lacks an affirmative legal framework supporting the implementation of government objectives on energy mix. This, coupled with energy-related political instability and rights-based social malady, serves as one of the challenges to renewable

⁹⁸Climatescope, 'The Clean Energy Country Competitiveness Index' (Bloomberg New Energy Finance, 2017), <http://2017.global-climatescope.org/en/download/insights/climatescope-2017-energy-transition.pdf>, accessed 18 April 2020.

⁹⁹Eberhard and others (n 93); Quitzow and others (n 90)

¹⁰⁰Lucas, del Rio and Sokona (n 86)

energy development in the country. For this challenge to be overcome, a well-crafted, robust, stable and transparent legal framework must be put in place to address certain market conditions and risks as well as investments into renewables. The provisions of any legal framework can only become effective if an interaction exists between such framework and strong institutions. There is a need for policy consistencies across a range of institutions manned with the role of energy resources management and regulation, and to make clear government's renewable energy strategy and targets, price outlook and processes for contracts standards. By political and policy implication, lending support to investors by the government is key to effective and viable renewable energy investments. This should be augmented through axiomatic government's Ease of Doing Business (EDB). The World Bank's 2020 EDB report¹⁰¹ shows progress for Nigeria, but a significant gap exists. Therefore, much is needed by the government to improve on its global ranking.

The relative new growth of renewable energy technologies, excluding hydro, is seriously considered a constraint to their deployment. The viability of some renewable technologies is still technically unproven, and as such, attracts risks uncertainty. This means investor's intrinsic risk perception of particular technologies depends on renewable deployment or maturity.¹⁰² Renewable energy technologies deployed at a scale in long term and of different backgrounds, tend to show an acceptable degree of certainty.¹⁰³ To overcome this challenge, it has been suggested that wide deployment of relative renewable technologies be undertaken simultaneously to enable operational testing within different operational environments, and under some conditions of operation so as to provide strong reliability, availability and equipment lifespan information. There are many RES available in different parts of Nigeria, which can be relatively deployed. Accordingly, some renewable technologies such as hydro, solar, biogas, onshore wind, offshore wind and biomass have been argued

¹⁰¹World Bank Group, 'Doing Business 2020: Comparing Business Regulation in 190 Economies', <https://openknowledge.worldbank.org/bitstream/handle/10986/32436/9781464814402.pdf>, accessed 4 May 2020.

¹⁰²Pueyo and others (n 87).

¹⁰³Ibid.

to have low and medium technical risks. Nigeria has a significant amount of some of these renewables and can be effectively deployed.

The identified different barriers to RES-E undertaking can be justified by the choice of different energy mix policies.¹⁰⁴ There are different policy tools identifiable to address such barriers.¹⁰⁵ The most often applied option, in particular, for economic and financial barriers are FITs and feed-in-premiums (FIPs).¹⁰⁶ The mechanism of FITs allows for a complete payment per MWh of generated RES-E by way of guaranteed prices, and as a combination of a procurement requirement by the utilities.¹⁰⁷ FIPs are usually a payment granted on the wholesale market price of electricity per kWh.¹⁰⁸ The former has been used in a number of African countries such as Ghana, South Africa, Kenya,¹⁰⁹ although mixed feelings indicate that it only provided a small fraction of investments in these countries, remarkably, renewable energy auction has emerged as a very increasingly important mechanism to foster electricity generation from renewable sources.¹¹⁰ Most countries are now adopting it as an appealing option to address barriers to RES-E investments, given its success in South Africa and beyond.¹¹¹ Defined as a ‘process in which a good or several goods are offered up for bidding’, the auction offers a procurement mechanism by which an auctioneer buys a ‘good’, in this context, RES-E from bidders offering the best bid such as least support level.¹¹² There is an underlying argument that auction is advantageous over some kinds of administrative set-support mechanisms such as FITs.¹¹³ For example, the auction offers a higher level of transparency for support levels- market prices and limits support to

¹⁰⁴Lucas, del Rio and Sokona (n 86)

¹⁰⁵Pueyo and others (n 87).

¹⁰⁶Lucas, del Rio and Sokona (n 86).

¹⁰⁷Ibid.

¹⁰⁸Ibid.

¹⁰⁹Ibid.

¹¹⁰IRENA, *Renewable Energy Auctions: Cases from Sub-Saharan Africa* (Abu Dhabi: IRENA 2018)

¹¹¹Lucas, del Rio and Sokona (n 86).

¹¹²AURES, ‘About Auctions’, <http://auresproject.eu/about-auctions>, accessed 18 April 2020.

¹¹³Lucas, del Rio and Sokona (n 86).

those granted in the auction.¹¹⁴ Furthermore, it reduces problem associated with information unevenness when remuneration levels are being set and are especially appropriate for the efficiency of allocation, cost control, expansion and technology mix.¹¹⁵

The working condition of auction allows project developers to apply only when a call is made, as opposed to FITs in which application can be made anytime given its long-term open window.¹¹⁶ The efficiency level of the auction makes it the best alternative for the promotion of RES-E,¹¹⁷ a feature that has led to its massive adoption in over 67 countries globally.¹¹⁸ Given its convenience in developing countries, especially with regard to budget constraint,¹¹⁹ auction may prove to be useful in overcoming constraints to RES-E development in Nigeria, in addition to FITs and FIPs. The desirability of the auction, in particular, may, however, depend on specific renewable energy technologies, say photovoltaic due to its attractive features, as opposed biomass, and is likely to appeal to potential investors and decision-makers. But its success may depend on the design elements and supports offered to it by other policies.¹²⁰

The use of tax incentives could be extremely useful in driving renewable energy investments in Nigeria. Thus, certain renewables can receive tax grandfathering, or investors granted tax holiday. The USA has typically used tax incentives to support investments in renewables and boost returns.¹²¹ There is no doubt that tax incentive tool could be attractive for renewable energy projects, especially for the development of off-grid electricity in many remote parts of the country, where different renewables are scattered.

¹¹⁴Ibid.

¹¹⁵Marie-Christin Haufe and Karl-Martin Ehrhart, 'Assessment of Auction Types Suitable for RES-E' (2016) AURES Report D3.1

¹¹⁶Lucas, del Rio and Sokona (n 86).

¹¹⁷Ibid.

¹¹⁸IRENA, *Renewable Energy Auctions: Analysing 2016* (Abu Dhabi: IRENA, 2017).

¹¹⁹S Stratt and others, 'From Growth to Green Investment Diagnostics' (2016) IDS Working Paper 472, <https://www.ids.ac.uk/publications/from-growth-to-green-investment-diagnostics/> accessed 30 April 2020.

¹²⁰Lucas, del Rio and Sokona (n 86).

¹²¹Pueyo and others (n 87).

The resultant effect of unaddressed constraints- economic and financial, regulatory and political and technology would likely result in a lack of interest among investors. The rising of such behavioural disposition is remarkable, as an emerging constraint to renewable deployment.¹²² Therefore, behavioural constraint depends on whether or not other constraints have been addressed by the government. Basically, a good degree of confidence in policy and regulatory framework would suffice to assuage investor's fear.

7.5 Conclusion

Logically, energy resources are the biggest gifts of nature to Nigeria. There are rich CES and RES, with renewables dispersed in every part of the country. The country's renewables have only been relatively, marginally exploited. This is despite a lot of potential market opportunities and supportive government policies for renewable energy deployment. Today, it is clear to note that Nigeria is experiencing a resource curse, short capacity country notwithstanding her abundant energy resources. This scenario can be attributed to a handful of issues inherent in her current energy regime. There is no visible legal framework supporting government policy objectives for the effective renewable regime in Nigeria. As a matter of concern, a lack of effective renewable energy deployment questions her commitment to promoting SDGs and combating global climate change under the Paris Agreement.

The world is moving fast-forward to the energy transition that supports modern energy utilization, at least, for promoting energy security and access. The integration of renewable energy into the national grid system and mainstreaming of small-scale off-grid renewable energy technologies is critical for energy security, green economy and sustainable economic development in Nigeria. This will also offer numerous environmental co-benefits such as improvement in air quality, as well as create decent jobs for the citizens. The use of renewable energy technologies, at best, ensures energy efficiency and reduces greenhouse gas

¹²²Pueyo and others (n 87).

emission. This cannot be realized by mere government policy objectives on renewable development without any robust legal framework supporting such objectives. The role of law and strong institutions are consequently critical to maintain an effective renewable energy regime. Legal framework is an important instrument to address critical issues of investor-state concerns, but especially for investors since the whole aim will be to attract new investments or create access for additional funds for investments in the power sector. The appropriate market strategy, and or policy will focus on incentives-liberalization within the role of a supportive regulatory framework.

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8

Renewable Energy Development in Egypt and Transitioning to a Low-Carbon Economy

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Video interview by the author discussing this book chapter can be accessed at, https://www.youtube.com/watch?v=SSOJ_Qcn_OU&t=2594s. Last accessed on 1st September 2020.

8.1 Introduction

8.1.1 Background

Egypt is the largest non-OPEC oil producer in Africa and the third-largest natural gas producer on the continent.¹ Moreover, Egypt became a net importer of natural gas in 2015 as a result of growing domestic

¹U.S Energy Information Administration Country Analysis Brief: Egypt, available at <https://www.eia.gov/international/analysis/country/EGY>, accessed 18/3/2020.

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demand and declining production levels.² However, the substantial natural gas discoveries, particularly in Egyptian Economic water in the Mediterranean Sea, encouraged the country and the International Oil Companies (IOCs) to fast track the development of such discoveries which made substantial additions to overall supply.³

Investment in the oil and gas sector was affected by the political turmoil and changes of governments after January 25, 2011 revolution. The security status of the projects was a matter of concern; however, Egypt witnessed a stable, friendly investment environment, particularly after the presidential elections held in 2014. Apart from that, The Egyptian Ministry of Petroleum (MOP) adopted an ambitious plan to attract foreign direct investment in the upstream sector and sustaining oil and gas production to meet the domestic market tremendous demand; such plan was promoted by several political, technical and legal pillars that positively impacted E&P activities in the country.

This was promoted by an ambitious initiative launched by the Egyptian MOP in collaboration with the World Bank to modernize the Egyptian Petroleum sector to attract investment in the Egyptian upstream sector through streamlining E&P bid rounds processes and enhancing the commercial terms and conditions of the E&P model agreements adopted by NOCs for petroleum exploration and exploitation.

8.1.2 Changing the Energy Mix to Diversify Energy Resources

According to BP's 2019, statistical Review of World Energy, and the FY 2018/2019's annual report of the Egyptian Natural Gas Holding Company (EGAS), much of the natural gas consumed in Egypt is

²U.S Energy Information Administration Country Analysis Brief: Egypt, available at <https://www.eia.gov/international/analysis/country/EGY>, accessed 18/3/2020.

³The Egyptian Government has fast-tracked the development of the Zohr and Atoll fields and the West Nile Delta (WND) project. These fields made substantial additions to the overall supply. It is worth mentioning that Zohr discovered in August 2015 and labelled as the largest offshore natural gas field in the Mediterranean. In August 2019, production from the field reached more than 2.7 billion cubic feet of gas per day (bcf/d), roughly five months ahead of the development plan, available at <https://www.eni.com/en-IT/operations/egypt-zohr.html>), accessed 19/3/2020.

used to fuel electric power plants while renewable energy share is still minor.⁴ As per the said report, the primary energy consumption in Egypt in 2018 was 94.5 Million tonnes of oil equivalent (Mtoe).⁵ Such value comprises of 36.7 mtoe from Oil, 51.2 mtoe from Natural Gas, 2.8 mtoe from Coal, 3.1 mtoe from Hydroelectricity and 8 mtoe from Renewables. Moreover, the Egyptian electricity sector is the largest gas consumer, where natural gas consumption reached 1359 BSCF (3723.3MMSCFD), representing 62.3% of total local gas consumption.

As can be discerned from the above-mentioned statistics, the Egyptian Energy sector depends principally on fossil fuel as the main source of primary energy in the country. Nevertheless, Egypt enjoys exceptional conditions to produce renewable energies, especially wind and solar. The country is in the Sun Belt where it enjoys up to 9 hours of radiation. Furthermore, it has excellent wind conditions. Moreover, reducing carbon footprint and coping with the environmental standards became a priority considering that Egypt has recently deposited the instrument of ratification of the 2015 Paris Agreement. In this respect, the Egyptian Government has been trying to diversify the energy mix to make the best out of the country's massive potential to produce energy from clean and renewable resources, with around 94% of the current primary energy consumption coming from fossil fuels.⁶

To this end, the country firmly displayed some decisive measures to further patch-up the energy sector paving the way to diversify energy sources to satisfy the local market needs and reduce carbon footprint. This is most likely disclosed under the pillars of the new energy strategy set by the Egyptian Supreme Energy Council including diversifying energy resources and improving energy efficiency in addition to encouraging private sector investment in the Egyptian energy sector. Efforts to diversify the energy sector by increasing the share of renewable energy

⁴EGAS Annual Report for the Fiscal Year 2018/2019, available at <https://www.egas.com.eg/annual-reports/2019>, accessed 19/3/2020.

See as well, BP Statistical Review of World Energy 2019, available at <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-full-report.pdf>, accessed 19/3/2020.

⁵Ibid.

⁶"Renewable Energy Outlook Egypt", IRENA and NREA, 2018, P. 9.

are enshrined in a strategy, known as the Integrated Sustainable Energy Strategy (ISES) to 2035, to ensure the continuous security and stability of the country's energy supply.

Egypt is, therefore, committed to the widespread deployment of renewable energy technologies. To date, the country's total installed capacity of renewables amounts to 3.7 gigawatts (GW), including 2.8 GW of hydropower and around 0.9 GW of solar and wind power. As specified in the ISES to 2035, the Egyptian Government has set renewable energy targets of 20% of the electricity mix by 2022 and 42% by 2035.⁷

In this chapter, we will address the governance of the Egyptian energy sector, and then we shall demonstrate the key Legal measures and policies in place that address the promotion and management of renewable forms of energy and energy efficiency in the country including the various clean energy schemes. Moreover, this chapter will identify the key challenges hindering renewable energy development in the country. Eventually, the last sections are dedicated to focusing on some initiatives and measures adopted by the Egyptian Government that promote the transition to a low-carbon economy in Egypt.

8.2 The Institutional Structure of the Egyptian Energy Sector

The overall governance of the Egyptian energy sector is guided at the strategy and policy level by directions issued by the Supreme Energy Council (SEC) and is managed at the execution level by the Ministry of Petroleum and Mineral Resources (MOP) and the Ministry of Electricity and Renewable Energy (MOERE). The corresponding sections below provide an overview of the responsibilities of these three entities.

⁷The ISES is a promising strategy set by the Egyptian Government envisaging certain levels for diversification in the Energy Mix and Electricity Production. Referred to in the Annual Report of New and Renewable energy Authority, 2018, see also "Renewable Energy Outlook Egypt", IRENA and NREA, 2018, Executive Summary.

8.2.1 The Supreme Energy Council

The Supreme Energy Council was established in 1979 by virtue of the Prime Minister's decree No. 1093 of 1979 and was subject to several subsequent reforms including the reforms made in 2014, 2017 and 2018. The SEC is mandated to review and endorse national energy strategies and policies, monitor the sector's performance and energy pricing policies and approve policies and regulations on energy pricing and incentives for energy sector investments (including the promotion of energy efficiency and renewable energy investment).

8.2.2 The Ministry of Petroleum and Mineral Resources and the Egyptian National Petroleum Companies

The Presidential decree No. 1451 of 1973 generally specifies the main objectives of the ministry of petroleum including among others; the development and the ideal exploitation of petroleum resources in the country. It is also mandated to set the main policies of the Hydrocarbon sector in the light of what has been adopted and guided by the SEC.

Such policies and strategies are conducted through the national petroleum companies including; the Egyptian General Petroleum Corporation (EGPC), the Egyptian Natural Gas Holding Company (EGAS) and Ganoup El Wadi Holding Company (GANOPE). Each of the said companies has its own competence—EGPC and Ganope both manage and regulate upstream oil activities by launching regular upstream Bid rounds for upstream oil exploration and exploitation, while EGAS manages and regulates natural gas exploration and production.

8.2.3 The Ministry of Electricity and Renewable Energy

The first independent Egyptian ministry for electricity was established by virtue of the presidential decree no. 1301 of 1964, then subsequent

decrees were issued regulating the Egyptian electricity sector and illustrates the objectives thereof. The Egyptian Ministry of Electricity and Renewable Energy is entrusted with the overall management of the Egyptian electricity sector through its state-owned company the Egyptian Electricity Holding Company (**EEHC**)—in coordination with the Egyptian Electric Utility and Consumer Protection Regulatory Agency (**EgyptEra**), New and Renewable energy Authority (**NREA**), Hydro Power Plants Executive Authority, Nuclear Power Plant Authority and Atomic Power Plants Authority. The Ministry of Electricity and Renewable Energy also regulates renewable energy activities in the country.

It is worth mentioning that electricity generation, transmission and distribution assets are wholly state-owned and operated under the supervision of the Egyptian Electricity Authority, now known as the **EEHC**.⁸ Moreover, the Egyptian Electricity Transmission Company (**EETC**) is an independent—state-owned—Joint Stock Company exclusively in charge of the electricity transmission activities.

EETC is committed by the Electricity law to allow the third party to access its infrastructure to supply electricity distributors and end consumers with their needs from electricity.

NREA on the other hand, is the state agency in charge of the development of renewable energy. It was incorporated in 1986 by virtue of a private law which was amended in 2014 to cope with the Government's policy to deregulate the energy sector.

The new electricity law no. 87 of 2015, reflects Egypt's approach to the deregulation of the electricity sectors related activities and put an end to the country's monopoly over such activities. Thus, as can be discerned from the foregoing and the string of legislations issued in the last few years in Egypt, the whole approach in the Egyptian Energy sector reflects the country's desire to deregulate the Egyptian energy market and its related activities, putting an end to the country's monopoly over the energy market and adopting several measures to encourage investment in such field.

⁸EEHC currently exists under law no. 164 of 2000 as an Egyptian Joint Stock Company and subject to Commercial Companies law no. 159 of 1981, capital market law no. 95 of 1992 among other correlated laws in force.

8.3 Legal Measures and Policies in Place that Address the Promotion and Management of Renewable Forms of Energy and Energy Efficiency

The Egyptian Government adopted several measures in order to promote the development of renewable energy in the country. This can be discerned from the policies and the regulatory structures that promote renewable energy projects in Egypt.

Egypt's economic development hinges on the energy sector, which represents 13.1% of overall gross domestic product. To meet burgeoning energy demand, the Egyptian Government has pursued an energy diversification strategy to ensure the continuous security and stability of the country's energy supply. This strategy involves stepping up the development of renewable energy and energy efficiency, in part through vigorous rehabilitation and maintenance programs in the power sector. Egypt is, therefore, committed to the widespread deployment of renewable energy technologies.⁹

Apart from that, a string of regulatory reforms came into existence in the last few years aiming at promoting the exploitation of the high potential of renewable energy resources and attracting more investment in that field.

The regulatory framework of renewable energy projects includes a string of measures aiming at the deployment of renewable energy projects and granting various incentives for private investors seeking for pumping investments in such projects. This can be shown apparently in the Egyptian constitution and other parliamentary legislation relating to renewable energy projects in the country. In 2014 a new piece of legislation was issued in Egypt pertaining to the promotion of electricity production from renewable energy Resources (Renewable Energy Law 'the REL'). Such law was issued by virtue of presidential decree no. 203 of 2014 and published in the official gazette on December 21, 2014.

⁹"Renewable Energy Outlook Egypt", IRENA and NREA, 2018, Executive Summary.

REL is the main framework that governs renewable energy projects in Egypt. It sets a definition of renewable energy as all undepletable natural sources of energy that can be used for generating electricity. Apart from that, there are other important legislations that have a tight link to the development of renewable energy projects in the country, including among others; electricity law no. 87 of 2015, and the new investment law no. 72 of 2017. These laws are briefly discussed below:

8.3.1 The Egyptian Constitution

The Regulatory framework pertaining to renewable energy projects in Egypt is aligned with the Government's adopted policies, aiming at the encouragement of renewable energy development. The Egyptian constitution sheds light on the crucial need for the ideal exploitation of renewable resources. It clearly sets the general framework in connection with the exploitation of renewable energy resources. It states that natural resources belong to the people. The state commits to preserving such resources, to their ideal exploitation, to preventing their depletion and to take into consideration the rights of future generations to them.¹⁰ According to the Egyptian Constitution, the state commits to making the best use of renewable energy resources, motivating investment, and encouraging relevant scientific research. The state works on encouraging the manufacture of raw materials and increasing its added value according to economic feasibility.¹¹

8.3.2 Various Schemes to Carry Out Renewable Energy Projects

The REL provides for various schemes for the development of renewable energy projects, so as to enable the Government to reduce Egypt's dependence on fossil fuels, reducing carbon footprint and achieving diversification in the energy mix.

¹⁰Article no. "32" of the Egyptian Constitution issued in 2014.

¹¹Ibid.

The REL envisages the following legal structures for renewable energy projects¹²;

- Projects which are tendered and operated by NREA. The essence of such projects is that NREA, after nominating the successful contractor, concludes an EPC contract for the creation of the electricity production plant which should be totally state-owned.

Then the electricity generated by such projects would be sold to EETC for a price proposed by EgyptEra and approved by the Council of Ministers.

- Projects which are tendered by EETC on a BOO (Build-Own-Operate) basis. The private investor builds, owns and operates the project and concludes with EETC a long-term Power Purchase Agreement (PPA).
- A private investor can create an electricity production plant and sell the generated electricity to EETC based on the feed-in tariff enacted by Prime Minister's Decree 1974/2014 as amended by Decree No. 2532 of 2016. The Decrees specified the electricity price (feed-in tariff) generated by renewable energy projects (Wind and Solar) for a period reaching 20 and 25 years for wind and solar projects, respectively.

Under this scheme, the state is under contractual obligation during the whole period of the PPA to apply the feed-in tariff as specified by any of above-mentioned decrees as the case may be.

According to the REL, a private investor (independent power producer) is entitled to conclude bilateral agreements to sell power generated from renewable energy sources directly to consumers using the national grid against grid access charges payable to EETC and electricity distributor companies.

It is worth mentioning that, EETC or the Electricity Distribution Companies are under a commitment to connecting the plants of the production of electricity from the renewable energy sources to their networks at the expense of the producer.

¹²Article no. "2" of the REL.

As per the Egyptian law, EETC is in charge of supplying the final non-qualified consumers with their power needs by concluding PPAs to off-take the electricity produced/generated by licensed producers of electricity. Moreover, EETC plays a crucial role in carrying out electricity interconnection and electricity exchange projects with other neighbouring countries.¹³

8.3.3 Project's Land

It is worth mentioning that most of the land used for renewable energy projects in Egypt is Government-owned. The land is allocated to the investor on the basis of usufruct (Manfaa) as clearly stated in the article '3' of the REL. Therefore, the Government started to allocate land to NREA, which is designated for renewable energy projects. We believe that this should facilitate the allocation process, as the investor will only be dealing with NREA instead of a multitude of different government entities.

8.3.4 Encouragement of Electricity Production from Renewable Energy Resources for Private Use

According to the Egyptian Law, any private investor who is seeking to carry out any of the electricity market activities (Power Generation–Transmission–Distribution) shall obtain a license from EgyptEra.¹⁴ Moreover, the law requires projects of electricity generation exceeding (500 KW) to incorporate a project company. Nevertheless, the producer of electricity for private use or the projects with a capacity of (500 kW) shall be exempted from incorporating a project company or getting any of the licenses referred to in the REL in accordance with the rules issued

¹³Article no. "31" of the Egyptian Electricity Law no. 87 of 2015.

¹⁴Article no. "13" of Electricity Law no. 87 of 2015.

by EgyptEra. This exemption reflects the Government's desire to generate electricity from renewables (mainly solar) and to reduce the consumption of electricity generated from fossil fuel.

8.3.5 Incentives and Guarantees for Renewable Energy Projects Under the Egyptian New Investment Law

In 2017, Egypt issued a new investment legislation no. 72 of 2017, which cancelled and replaced the Investment Guarantees and Incentives Law no. 8 for 1997. The aim of the new investment law is generally to attract new investments to Egypt through offering further incentives and guarantees for investment in some specific sectors, in addition to removing obstacles and streamlining the procedures of such investment.

As per the Egyptian investment law, Renewable energy projects are among the investment projects enumerated by the law that enjoys investment guarantees and incentives offered by the new investment law.¹⁵ Some of the incentives for renewable energy projects are briefly highlighted below:

- Registration of documents of incorporation of the company, loan agreements and pledge contracts are exempted from stamp duty tax and notary public fees for a period of 5 years from the date of registering the company.
- Exemption from the registration fees of the land of the project.
- Application of a unified flat customs duty rate of 2% on all machines and equipment needed for establishing the renewable energy project.
- Ability to fund the project from abroad with no restrictions and in foreign currencies and transferring profits abroad.¹⁶
- Furthermore, the investment law grants some special investment incentives to projects generating renewable energy or projects depending on it; for instance: deduction of 30% of the net taxable profits for the first seven years of the life of the project, subject to

¹⁵Articles no. "1" and "9" of the Egyptian Investment Law no. 72 of 2017.

¹⁶See articles no. "6" and "10" of the Egyptian Investment Law no. 72 of 2017.

certain conditions such as the incentive value not exceeding 80% of the paid-in capital until the start of the project's operations, as the project company being established within three years from the date of entry into force of the Executive Regulations issued by Prime Ministerial Decree No. 2130 of 2017.¹⁷

Even though the Egyptian investment law encompasses several protective measures for renewable energy projects against nationalization, confiscation or any act of discrimination, it is worth mentioning that private investors in the field of renewable energy enjoy a further layer of protection through Bilateral Investment Treaties (BITs). Egypt is a signatory to approximately 116 BITs; such number makes Egypt one of the top African countries which signed BITs for private investment protection.¹⁸

8.3.6 Educational Programs Focusing on Renewable Energy and Related Technologies

Several universities in Egypt introduced new educational programs focusing on renewable energy and its technologies. Moreover, trainings on renewable energy are often organized by the ministry of electricity and renewable energy. This, for sure, will have a positive impact on the renewable energy market in Egypt as the country will benefit from more experts in renewable energy.

8.3.7 The Government's efforts in promoting Energy Efficiency

EgyptEra is in charge of issuing the rules and procedures for the development and encouragement of energy efficiency. There are several steps taken by the Egyptian Government to promote energy efficiency in the country, as evidenced in the initiatives launched by the Government

¹⁷Article no. "11" of the Egyptian Investment Law no. 72 of 2017.

¹⁸UNCTAD, <https://investmentpolicy.unctad.org/international-investment-agreements/countries/62/egypt>, accessed 6/4/2020.

to increase the citizens and institutions awareness of the importance of reducing the heavy consumption of electricity, fossil fuels and the necessity of energy transition. Moreover, the country is also embracing electric cars and electric trains.

Such initiatives were aligned with the Government's gradual removal of subsidy on petroleum products and electricity aiming at achieving the full removal of subsidy of such products.

Notably, the Egyptian law obliges electricity consumers/entities whose electricity consumption exceeds '500 kW' to nominate a focal person who shall be in charge of the enhancement of energy efficiency in the institution, and in case electricity consumption exceeds 10 megawatts.¹⁹ The above-mentioned designated person shall be in charge of the implementation of several arrangements related to energy efficiency in the entity such as developing the technical and economic feasibility studies of the energy efficiency-related projects and setting proposals for energy efficiency.²⁰ Moreover, the entity whose electricity consumption exceeds 10 megawatts shall cope with the specifications of energy efficiency issued by the Egyptian authority for Specifications and Quality to mitigate inefficient energy consumption.²¹ Apart from this, importers and producers of imported or locally manufactured devices are under obligation to label such devices with 'Energy Efficiency Card' which shall demonstrate the device's level of electricity consumption.²²

8.4 Progress of Renewable Energy Projects in Egypt

This section spotlights some of the successful renewable energy projects in Egypt that prove the country's commitment to transition to a low-carbon economy.

¹⁹Article no. "48" of the Egyptian Electricity Law no. 87 of 2015 and Article no. "64" of its Executive Regulations.

²⁰Ibid.

²¹Article no. "48" of the Egyptian Electricity Law no. 87 of 2015 and Article no. "64" of its Executive Regulations.

²²Article no. "48" of the Egyptian Electricity Law.

8.4.1 Benban Solar Project

The \$4 Billion Benban project is considered one of the largest solar parks in the world, located in Aswan desert and extending over 37 square kilometres, Benban Solar Park is relying principally on the feed-in tariff scheme, and it will generate 1.5 GW, which will be enough to provide renewable energy to more than one million homes (as declared by EBRD).²³ The Benban project is anticipated to generate around 20% of alternative sources by the end of 2020.

8.4.2 Wind Farm in Zaafarana and Gulf of El Zayt

There have been progress in wind projects in the country. Since 2001, the NREA, in cooperation with Germany, Spain, Japan and Denmark, has established a series of large-scale wind farms that totalled 545 MW in 2010/11. These increased to 750 MW in November 2015, under an engineering, procurement and construction (EPC) scheme in both Zaafarana (545 MW) and Gulf of El Zayt (200 MW). This installed capacity corresponded to total wind-generated electricity ranging from 260 GWh in 2001/2002 to 2058 GWh in 2015/2016. Accordingly, total conventional fuel savings as a result of utilizing wind energy for electricity generation increased from 58 Mtoe in 2001/2002 to 432 Mtoe in 2015/2016. Consequently, the avoided CO₂ emissions are estimated at 143,000 tonnes in 2001/2002 and 1.131 million tonnes in 2015/2016.²⁴

²³<https://youtu.be/iH0xDjzCBKg>, accessed 10/5/2020.

²⁴“Renewable Energy Outlook Egypt”, IRENA and NREA, 2018, P. 24.

8.5 Challenges Hindering Renewable Energy Projects in Egypt

There are many drivers that positively affect the development of renewable energy in Egypt and thus changing the current energy mix. Nevertheless, despite the Egyptian authorities' great hopes for the fledgling renewable energy projects in the country, there are various challenges encountered as discussed below:

8.5.1 Creditworthiness of EETC

As per the Egyptian law, EETC is in charge of supplying the final non-qualified consumers with their power needs by concluding PPAs to off-take the electricity produced/generated by licensed producers of electricity. Moreover, EETC plays a crucial role in carrying out electricity interconnection and electricity exchange projects with other neighbouring countries.

One of the main issues to be considered by financial institutions/lenders and licensed private investors (Electricity licensed Producers) who sell electricity to EETC, is the analysis of the creditworthiness of the EETC in the PPAs.

To ensure the best financing conditions of minimizing financial risks and reducing financial cost, it is fundamental that EETC has a good credit quality (credit rating). Since EETC is a stand-alone, Egyptian Joint Stock Company independent from the Egyptian Ministry of Petroleum and other Electricity Companies in Egypt, this implies that EETC's credit rating might not be positive. In this case, it is necessary to provide the proper guarantees, being possibly issued by state institutions, assuring the risk mitigation in case of an unexpected change in EETC's solvency.²⁵

Additionally, to further strengthen the creditability of EETC, there is a need to revisit law no. 14 of 2013 to include EETC among the list of entities (EEHC and its affiliated companies) that are covered by the

²⁵In support of this opinion see: Donia El-Mazghouny—Getting the Deal Through, Renewable Energy, Egypt, 2019, P. 29.

sovereign guarantee of the Egyptian Ministry of Finance, to guarantee EETC while receiving loans or carrying out its financial commitments under any of the contractual arrangements concluded by EETC and any other third party.

8.5.2 Streamlining the Investment Process

A key concern is the crucial need to streamline the investment process in renewable energy-related fields of investments and to promote the idea of a one-stop-shop. Although the Egyptian legislations are comprehensive enough and they offer several incentives to facilitate and streamline investment procedures, they are not sufficient due to lack of implementation. Some difficulties have been experienced by developers and investors in the field of renewable energy in the course of project implementation.²⁶ For instance; the administrative procedures regarding land registration for renewable energy developers are rather complex.

In this respect, there is a need to empower NREA as a 'one-stop-shop' facilitator, instead of being just a developer for renewable energy projects. This will enable it to provide all permits and authorizations required from relevant institutions and administrations relevant to renewables investments, thus easing renewable energy projects development and the implementation process. This may include expediting the selection process of the developers under any of the renewable energy development schemes (EPC, BOO and FIT), issuing renewable energy generation licences, allocating the land for planned renewable energy projects, and handling the contractual process (connection agreements and PPAs) between the developers and EETC.

²⁶"Renewable Energy Outlook Egypt", IRENA and NREA, 2018, P. 78

8.5.3 Small-Scale Renewable Energy Projects Receive Less Attention Than Large Scale Projects

It has been noted that the energy sector in Egypt is confined to large scale investors. This is basically due to the fact that the relevant policies seem to favour large scale commercial production.²⁷ In this respect, smaller-scale projects and the development in the commercial and industrial sectors, which mainly have to deal with distribution companies on the lower voltage networks, do not enjoy the same benefits. There is also a lack of clarity concerning the licensing process for such projects and a lack of support in relation to the permitting of the land required for the establishment of the projects, as well as a lack of detailed information regarding potential opportunities of investment in renewables in general.

8.5.4 Invest in More Research & Development in Renewable Energy Technologies

Renewable energy development is a priority in Egypt's adopted policy. However, the Egyptian renewable energy sector receives less attention to foster research and development. There are just a few ad hoc training workshops organized by NREA, along with a number of on-the-job training sessions in operation and maintenance technologies. These training programs remain limited to engineering and technological aspects though there are several focused on socioeconomic and political issues. This therefore indicates that policymakers view renewable energy projects as a pure technological matter.²⁸

²⁷Marwa Mostafa, Challenges to Energy Transition in Egypt: A study of Wind and Solar Sectors. A thesis presented to the Faculty of Economic and Social Sciences, Postdam Center For Policy and Management, University of Postdam, Germany, 2014, P. 39.

See also, Donia El Mazghony, Getting the Deal Through, Renewable Energy, Egypt, 2019, P. 29.

²⁸Marwa Mostafa, Challenges to Energy Transition in Egypt: A study of Wind and Solar Sectors. A thesis presented to the Faculty of Economic and Social Sciences, Postdam Center For Policy and Management, University of Postdam, Germany, 2014, P. 37.

8.6 Proposed Measures to Encourage Players in the Hydrocarbon Sector to Reduce Their Carbon Footprint/Emissions

Egypt is the 11th largest gas flaring country in the world. There is potential for such flared gas to be processed at oil fields either for on-site electricity production or for the national grid.²⁹ Nevertheless, so far, there is no clear vision with respect to the measures taken or proposed that encourage players in the hydrocarbon sector to reduce their carbon footprint and exploit the on-site flared gas.

Basically, all companies in the hydrocarbon sector are committed to abiding with the environmental legislations in the country including the standards relating to the elimination of the hydrocarbon sector's negative impact on the environment including reducing carbon emissions. Ending flaring is one of the remedies for greenhouse gas emission reductions that Egypt has indicated in its Nationally Determined Contribution (NDC) to the 2015 Paris Climate Agreement.³⁰ In this respect, it is worth mentioning that the European Bank for Reconstruction and Development (EBRD) funded a comprehensive, advanced study shedding light on the economic, technical and legal barriers for the exploitation of flared gas in Egypt, to reduce gas flaring at oil production sites and their carbon footprint.³¹ The main finding of the said study is that, the exploitation of flared gas might be non-feasible for players in the Egyptian Hydrocarbon Sector as flare sites in Egypt are mostly small scale. Only 7 sites (of about 70) have average flaring above 5 million standard cubic feet per day.³² The trend is towards more sites with small gas

²⁹Egypt Targets Gas Flares to Help Meet Increased Energy Demand, published by the World Bank, February 12, 2018, available at <https://www.worldbank.org/en/topic/extractiveindustries/brief/egypt-targets-gas-flares-to-help-meet-increased-energy-demand>, accessed 17/5/2020.

³⁰Egyptian Intended Nationality Determined Contribution, P. 2, available at <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Egypt%20First/Egyptian%20INDC.pdf>, accessed 16/5/2020.

³¹APG Flaring in Egypt: Addressing Regulatory Constraints, Final Options Report, submitted to EBRD by Economic Consulting Associates, April 2017.

³²P. 18 Ibid.

volumes which in many instances are located far from gas infrastructure, so there should be more coordination and cooperation between operators at different concession areas to ideally make the best use of flared gas.³³ Moreover, the absence of a comprehensive framework pertaining to the exploitation of flared gas is a barrier as well.³⁴

8.6.1 Other Regulatory Measures to Reduce Carbon Footprint in Egypt

There are various measures adopted by the Egyptian Government to reduce carbon footprint. Some of these measures relate to the deployment of electric vehicles and producing electricity from waste (garbage).

A. Use of the Electrically Operated Vehicles

The Egyptian Government aims at encouraging the use of electrically operated vehicles for many reasons among which to reduce heavy consumption on fuel and reduce carbon emissions. Nevertheless, persuading the people to buy electrically operated vehicles would require a comprehensive strategy to raise awareness of the new vehicles, market them and address technical concerns. Launching electrically operated vehicles in Egypt would require an awareness campaign, explaining the pros and cons to the public as well as the differences between them and a petrol-driven car.

As far as incentives are important, the presidential decree no. 419 of 2018 was issued deciding the exemption of electrically operated private cars from custom duties, only collecting value-added tax. Tariffs were also reduced for hybrid cars operating on electricity and petrol.

Apart from that, earlier this year the Government declared that it is going to constitute 1000 recharge stations for electrically operated vehicles during the coming 3 years and enabling private sector companies to

³³P. 5 Ibid.

³⁴P. 24 Ibid.

constitute more stations. In addition, the Government's plan is to gradually replace public transportation's traditional vehicles by electrically operated vehicles.³⁵

B. Electricity Production from Waste (Waste-to-Power)

The promotion of electricity production from waste is another step conducted by the Egyptian Government towards the diversification of energy resources in order to minimize electricity sector's dependence on fossil fuel and reducing carbon print. On December 2, 2019 prime minister Decree no. 41 of 2019 was issued, approving the purchasing tariff of electricity generated from waste-to-energy plants.³⁶ As per the decree, the PPA shall be concluded by and between the governorate where the electricity plant is located and the entity owning the plant and shall be effective for a period of 25 years. The land of the project will be allocated by the hosting governorate on a usufruct scheme. The governorate is under obligation to supply the plant with their needs from quantities of waste needed to operate the plant.³⁷

Notably, Egypt's annual wastes amount to 100 m tonnes, including 42 m tonnes from construction and demolition, 30 m tonnes from agricultural processes, 21 m tonnes of solid domestic waste (rubbish), 3 m tonnes from digging and draining, and 2.9 m tonnes from industry, and 0.14 m tonnes of medical waste. Therefore, the exploitation of such quantities of waste to produce electricity is an efficient approach in the meantime and will achieve numerous economic and environmental benefits for the country.

8.7 Conclusion

As discussed in the sections above, it is a fact that the Egyptian energy sector still depends on fossil fuel as the primary source for energy. This is despite the country's numerous policies to deploy renewable

³⁵Press release by the Egyptian minister of public sector enterprises, on January 2020, available at <http://nrea.gov.eg/test/en/home>, accessed 13/4/2020.

³⁶Prime minister Decree no. 41 of 2019.

³⁷Ibid.

energy projects. There is still a high potential for hydrocarbons to satisfy the domestic energy needs in the country. Moreover, the political, economic and regulatory situation in Egypt is convenient for encouraging hydrocarbon players to continue pumping more investments in the Hydrocarbon chain, whether in upstream or downstream sectors. This was promoted by the enormous discoveries achieved in the Mediterranean Sea, which were indeed the spark that unlocked investment opportunities for the exploitation of natural gas resources in the Egyptian Economic Water in the Mediterranean Sea.

Nevertheless, the deployment of renewables is no longer an option, it is crucial to tackle the tremendous local demand for energy and reduce carbon footprint to comply with the environmental standards. Egypt enjoys exceptional conditions for the production of renewable energies, especially wind and solar and the country has adopted numerous legislative and economic reforms to encourage investment in renewable energy projects, by among others introducing considerable incentives and guarantees for renewable energy-related fields of investment. All these are positive signals, to transition to a low-carbon economy in Egypt.

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9

Transitioning to a Low-Carbon Economy and Renewable Energy Developments in Uganda: Challenges and Opportunities for Small-Scale Renewable Energy

Marvin Tumusiime

Video interview by the author discussing this book chapter can be accessed at, <https://www.youtube.com/watch?v=d6kQrs9HugQ&t=138s>. Last accessed on 1st September 2020.

9.1 Introduction

Access to modern energy in Africa is key in addressing the various global challenges including famine and poverty (Nalule 2020). Indeed Goal 7 of the United Nations Sustainable Development Goals emphasizes the need for affordable, reliable, accessible and sustainable energy for whole. Despite these global targets, 93% of Uganda's energy demand is met by tree biomass. Only 1% acquires electricity through hydro and thermal power plants (MEMD Uganda 2015). Overall, approximately 15% of the population has access to electricity, but this figure is different in rural areas where only 5% are connected (MEMD Uganda 2015). Majority of

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Uganda's population reside in rural areas which are far away from the central city and town hubs of Kampala, Entebbe, Mbarara, Jinja, Arua and Gulu.

In Uganda, tree biomass takes up the most extensive form of energy demand, and its regeneration is startlingly being outpaced by population increase expected to balloon to 76 million people by 2040. To achieve a low-carbon economy, there is a strong need to adopt small-scale renewable energy products at the household level; revise methods of biomass production and usage as well as embracing renewable energy. Albeit, biomass is envisioned to be a major contributor to energy demand in Uganda for decades to come, this therefore necessitates more investments in efficient technologies (MEMD Uganda 2015).

As much as public and private sector initiatives have been bolstered to increase the uptake of Improved Cookstoves (ICS), adoption is still low. The most common cooking method in off-grid areas is the three-stone fire method which is wasteful and does not trap heat. The most used charcoal stove is the metallic *sigiri* which GIZ finds to have a cooking efficiency of 15–17% compared to ICS efficiency of 24%. The *old sigiri* cookstoves cause Indoor Air Pollution (IAP), leading to energy poverty on the energy ladder (MEMD Uganda 2015).

Reducing energy poverty is key to the attainment of the SDGs and transitioning to a low-carbon economy. Globally 4 million people die annually due to IAP (WHO 2018). Uganda is no exception because 26% and 17% live in huts and muzigos respectively, which are local tenements. The current rate of the on-grid connection is 100,000 connections per annum which are a far stretch from the 2030 goal of 670,000 connections per annum.

The above notwithstanding, we note that, Uganda is endowed with renewable energy sources in the form of hydro, sustainable biomass and solar. Uganda's SEA4ALL Action Agenda (AA) presents ambitious goals of Uganda's electricity capacity by 2030, estimating the total installed capacity to be 4.17 GW with renewable energy sources contributing 3 GW. 2.81 GW to be connected into the national grid (MEMD Uganda 2015). Uganda's AA appeals to the more significant sustainable development paradigm, i.e. energy access, renewable energy and energy efficiency. Energy efficiency in the AA is to be applied in transportation, buildings and appliances.

Fifty-eight years after colonial independence, it is crucial to examine Uganda's history of economic growth about energy access. While trends in recent years have been upward, it is key to note the stints of political instability, coffee dependence and economic reforms which had affected Uganda's economic growth negatively. Today, agriculture has and continues to dominate the economy with 70% of the population using it as a source of livelihood, whether directly or indirectly. According to 2020 UBOS statistical abstract, manufacturing's contribution to GDP has been constant at only 15% over the last 15 years, and the stagnant growth is constrained by lack of cost-effective electricity which can support in achieving economies of scale needed for productivity increase. It is against this stark background that this chapter looks at how Uganda can explore trends in developing its decentralized energy access for the last mile which is most vulnerable and makes up the most significant demographic of Uganda's population

9.2 Main Constraints to Uganda's Efforts to Transition to a Low-Carbon Economy

9.2.1 Counterfeit Products

The market for household cleantech solutions is becoming saturated (World Bank 2020). As is a commonality trend with many other product lines, cleantech technologies have followed suit as seen by the presence of counterfeits in local markets.

These products are often untested, not of standard and in some cases equal emitters of CO₂ compared to the traditional fuels. Uganda enjoys a market economy and boasts of a bustling entrepreneurial industry. This has its advantages and disadvantages. First, it means it is easy for local people to latch on to a commodity business for which they have no expertise or technical after-sales services. This inadvertently can create an income stream for the parties involved. However, this enables more dissemination of cheaper and less efficient products. In severe cases, the inefficient solar home systems are sold in independent parts which becomes a challenge. Existing institutions mandated to perform this monitoring and enforcement function should be strengthened to do so

in rural areas. To curb the prevalence of counterfeits on the market, certification should step into solve this trust-gap. It is often difficult to differentiate counterfeits from genuine products since the counterfeits producers leverage on the marketing effort of the genuine producers, thereby outcompeting and amassing more revenues.

As a regional testing centre located in Uganda, the CREEC institute, commissioned by the Global Alliance for Clean Cookstoves, is the body that tests and accredits biomass products particularly cookstoves, briquettes and biogas technologies. Using their international state of the art indicators and tests, they perform stress-related tests on technology while calculating their carbon offset to ensure that products release little to no CO₂. For solar, Lighting Global is a worldwide body that accredits good quality genuine solar products regardless of their lumens or wattage. The Uganda National Bureau of standards is stepping into not only accredit other products but also clean energy products using new testing machines (UNBS Uganda 2019). Accredited products create a firmer ground for warranties and guarantees in the unfortunate event of failure or damage of the products. Information dissemination on sensitizing the public on the ways to differentiate real from a fake can go a long way in removing counterfeits out of business. Counterfeits have been recorded as being a significant factor in propagating market distortion of the clean energy product ecosystem (Diecker et al. 2016).

9.2.2 Reliance on Tree Biomass and Oil Economy

Uganda is heavily depending on petroleum for the transport sector, leaving it dependent on swings in the global oil market and supply (Nalule 2020). Notwithstanding the constant delays in final investment decision by oil stakeholders, oil production as of 2020 is postponed and set to begin after 2024. This delayed oil production is reported to affect the economic outlook according to the World Bank (*Daily Monitor* 2020). This is attributed to the heavy reliance on debt for industrial projects, especially given the shaky world crude oil prices. As the future oil economy of Uganda will put the country in a quicker stride towards its goals of achieving middle-income status, it would be key

for other major sectors like industry and coffee to continue without the hopefulness of oil. Current delays can likely produce a less than perfect outcome as the current potential buyers of oil are coming up with innovative ways to transition away from fossil fuels. These innovations put the future value of oil production at odds if production is envisioned to take place post-2024. Already, some European economies like Norway and France have ambitious plans to stop production and sale of fuel-powered cars and shift to hybrid or electric models. The Center for Climate and Energy Solutions reports that mobility transportation today accounts for 62% of petroleum consumption globally and is envisioned to drop to 50% in the next few years. Countries like Estonia are providing free city transportation in their capital, thus eliminating the need for cars (Euronews 2018).

On a more positive and national outlook, there exists an annual financing plan for the 12 districts located in the circuit areas within which petroleum deposits and production is expected to happen. This is being overseen by the Albertine Graben Oil and Gas Districts Association (AGODA) founded in 2015 on the principles of providing a platform for the local governments in the Albertine graben region. Local economies, especially farming communities, have faced eviction from land to make space for oil production. In Buseruka, for example, 30 square kilometres were needed for the construction of an oil refinery (Chimp Reports 2020). It is such displacements that disrupt local economies like small-scale trading, which is essential for livelihoods. AGODA, as a stakeholder, voices opinions of the local communities to ensure a unionized front and enforces issues of common interest (Nyangire et al. 2020). The financing plan that seeks to prioritize its jurisdiction in the key areas of production, natural resources, community, commercial services and others. Key among these interventions is a need to improve social services in the oil-producing areas. This AGODA area, however, is not the only one standing to benefit. Western Uganda is on track to contribute more to Vision 2040 through tourism.

In summary, the population growth rate is slated to continuously increase, and this will remain the single largest determinant of biomass demand. It is this demand from the households that will propagate a shift to increased incomes, hence a subsequent switch to cleaner energy forms like hydroelectricity.

9.3 How Can Uganda Effectively Transition to a Low-Carbon Economy?

9.3.1 Raising Much Needed Awareness

All-round awareness is key in amassing support from major stakeholders in the clean cooking value supply chain. This is particularly crucial for the everyday customer and the ease of access to the mediums through which awareness is being done for the complex clean energy products. The channels employed should allow for the semi-illiterate to ease comprehension, functionality and the benefit of a transition.

Although not fully using clean energy such as solar, in the cooking sector, there have been organizations that have deployed successful campaigns like *fumbalive* (meaning cook and live) and *supa sigiri* (meaning a super cookstove). The campaigns which borrow their language from the local language, Luganda, are perfect in explaining the product and have become an important strategy for influencing urban dwellers. The Uganda Clean Cooking Supply Chain Expansion Project (UCCSCEP) formed the *supa sigiri* campaign that provides a local touch and garners attention and trust from people (World Bank 2020).

The campaign resonates well with people because it contains vernacular and local language that is simple with a call to action. The Private Sector Foundation Uganda (PSFU), Uganda's main agency for promoting economic growth through private sector-led development, is the main implementation agency of UCCSCEP (PSFU Uganda 2019). Supa sigiri launched in 2018 by running massive market activation campaigns in central Uganda. The campaign was the umbrella body of a collection of various improved cookstove brands in Uganda to turn more inventory at scale. Trust was to be gained from people basing on the fact that each brand under Supa sigiri adhered to the required standard with verification done by performance process and customer acceptance trials.

It is no surprise that at its onset, the results from the campaign have been more than positive as evidenced by the distribution of over 500 stoves reaching over 20,000 people on just 162 activations (The World Bank 2016). While this campaign has worked in central Uganda, more

rural areas will need a far more reach by involving more stakeholders and similarly designing market activation campaigns that are localized and communicative of a high level of trust. Supa sigiri has additionally latched on to the tech-savvy urban audience by selling products through Jumia, one of Uganda's largest e-commerce platform (Jumia 2020).

9.3.2 Affordable Products

Small-scale renewable energy products are a proven and feasible alternative for firewood. The type of renewable energy product that aims to increase uptake in the last mile should have certain considerations. Product success ensures market-fit for the last mile with three major considerations; whether the product is affordable, of good quality and after-sales services (Pradhan 2019). By ensuring a good after-sales arrangement, end-users can be confident that there is the ready availability of repair or servicing. Affordability should be key, especially because the income of residents in rural Uganda is very low.

9.3.3 Design of the Product

Beyond that, the weight and mobility of the product should be easy. Looking at the social, economic livelihoods of rural residents, a major source of income is agriculture which necessitates a lot of farm work that subsequently involves physical movement. A solar lamp that is light to carry goes a long way in easing this process, especially for farmers walking back home at night (World Bank 2019). Households in rural Uganda commonly cook food from outdoors and need a light source when cooking at night. It should not be a herculean task to carry a solar lamp around from the outside to the indoors where it is also needed. A heavy or immovable solar lantern would sit in one place, thus defeating the purpose it could have had in providing light outdoors or within other rooms of the household.

Longevity also plays a key role in ascertaining community acceptance of a new product in rural Uganda. It is not feasible for people to continuously purchase good quality but high priced RE technologies. A longer

product life stands a higher chance of being accepted and appreciated by the client base. Sovacool 2009 reports that the average life of a clean-tech product should not be less than three years. Today solar lanterns go beyond this with some extending a 5-year lifetime, and this represents some of the strides that have occurred in Uganda's transition to a low-carbon economy

Product designs should also be cognizant with a social-value adding nature, inadvertently serving more than one purpose (Miller et al. 2018). A useful invention which is becoming mainstream is the solar water pump which has a solar panel to enable the pumping of water for crops, especially during dry spells. Solar Now, a solar company has mastered this by providing solar water pumps at payment terms that are favourable for the customer and going a step ahead to advocate that the farmer lends out the pump for a fee, when not in use. This not only adds an income generation stream for the farmer but also supports the crop livelihoods of other farmers. Value-adding products are a unique advantage for the decentralized supply of clean energy to last-mile populations that cannot sustain extra spending.

9.3.4 Solving the Product Distribution Hurdle

Distribution is one of the underlying bottlenecks for product access, and such logistical challenges should be addressed in order to ensure a transparent and streamlined flow of products from the manufacturers to the end-user. On the upstream end, products that are mostly shipped from eastern countries have a clear and concise flow. The difficulty arises downstream when issuing out products to rural areas. The logistic flow of last-mile distribution is broken, and private sector companies like Godel are stepping into bridge the gap (Digest Africa 2018). This presents an opportunity for new players to come in and fill the gap because SHS distribution branches are mostly located in higher-density areas with little to no service in far-to-reach areas.

The bigger problem here, however, is not the lack of solution; it is the deficiency in the literal access (Schmidt 2019). While some companies have subsidized their prices downwards even with financial support

from development partners, they still cannot distribute to the customers in the last mile because of a shortage of delivery vans: they therefore resort to leveraging on existing methods such as transportation through buses. This type of transport presents its own set of challenges because bus systems mostly lack the capacities and technologies to handle unsupervised large bulk cargo. In this case, products end up getting damaged, lost in transit or worse, stolen.

There is therefore a need to invest in improving payment and distribution processes in order to bring down the transportation costs for the customers (UOM 2018). The unavailability of brick and mortar branches has continuously led to a shortage of product access. Manufacturers simply do not consider far-off areas to be profitable further worsening access to after-sales which is crucial for solar and cookstove companies. This deficiency discourages residents from acquiring products because it becomes unclear as to where product follow-ups can be made. In an urban setting, supermarkets and retail stores that sell cleantech have adopted product bundling. This is a method to entice buyers, especially through bundling complementary energy products (Vianello and Damien 2015). It is a method that has worked for the simplest of bundles like bread and butter. In the same regard, cleantech companies like Living Goods are adopting this bundling methodology for their improved cookstoves with mosquito nets.

To ease distribution hurdles, commission-based selling is a mode that has worked for major solar companies. Solar Sister for instance, launched such a programme and results were positive because the commission agents who were local community women were not only creating income for themselves but also availing products more easily (*The Guardian* 2016).

Another way to solve the distribution hurdle is through training. There is an increasing need to train the young population in innovative ways of making cleantech products. This has worked for the improved cookstove industry which moulds stoves from locally sourced materials as seen by companies like Ugastove Limited and Green BioEnergy Limited. This however, is not the case for solar products that only come from engineering-strong economies like China and India. Uganda's

economy has not yet built its manufacturing capacity for solar equipment, although this is a work in progress as seen by upcoming solar assembling plants (New Vision 2019). Biomass-based products have made a breakthrough in terms of local capacity to manufacture. Case in point is the briquettes which, with the right training in technical expertise, can easily be made manually. Such products are made by the community members using locally sourced materials which are used to make final products for subsistence.

9.3.5 Ensuring Carbon Emission Capability

Carbon emissions per product are integral to consider especially around the efficiency of technology; after all, it is the emission of carbon dioxide into the atmosphere that has brought a dire need for clean energy. Carbon dioxide emitted by Africa is extremely low compared to the rest of the world. However, African populations experience the highest vulnerability on the individual health of people, particularly women (United Nations 2006). While it is very accurate that some cleantech products may not deter carbon emissions completely, their efficiency to a more considerable extent reduces the emission in comparison with the use of fossil fuels which only add to climate damage. In that regard, the carbon efficiency of products should be understood more carefully. An improved cookstove still uses charcoal whose source of material is firewood from a tree. However, what the improved cookstove does is reduce the need for charcoal normally used in a traditional metallic stove because the clay technology in the stove absorbs heat for more extended periods of time. Improved cookstoves are considerable and effective in fuel and cost savings (Bonn International Cooking Energy Forum 2013). Some development agencies like EnDev are supporting other sectors and local people to learn technical skills in becoming stove artisans. It is access to life-changing products that will speed up the transition and progression from over-dependence on what is traditionally the norm of cooking or lighting (Nalule 2020). Urban households, while having affordable access to the grid electricity, still sometimes use cookstoves for cooking certain foods like beans which typically take a long time to get ready.

9.3.6 Affordability by Local Communities

Seasonality impacts heavily on the spending behaviours and patterns of rural customers who largely depend on subsistence farming. A 2016/2017 household survey by UBOS reported 43% of households in the country do depend on subsistence farming, and 25% depends on wage employment. Crop yields increase during rainy seasons, which means more income for farmers, and the opposite is true where incomes will reduce during dry spells. On the one hand, companies that are manufacturing clean energy products are profit-oriented and therefore need to recoup their costs for profitability. On the other hand, the need to become profitable is passed on to the end-user who in most cases has limited ways to afford the product upfront since most available income must be conserved for food, and health (World Bank 2008). Uganda has two annual harvesting seasons, and the typical subsistence dependent family gets money in those two-time windows. During off-peak seasons, there is less inclination to purchase clean energy products. There is therefore, a growing need for SMEs to devise innovative financing mechanisms for their products during low peak seasons in rural Uganda.

9.3.7 End-User Flexible Payment

Civil society and some manufacturing companies have devised ways to address this challenge. Installment basis type of payment has been popular since the early 2000s in the form of pay-go systems. This enables customers to acquire a full solar home system without paying its full price upfront. A customer pays a certain percentage of the system, usually about 20%, and the balance is paid in instalments depending on the income status of the customer. The instalment frequency is sometimes daily for an average of as low as \$0.50 and other times monthly for as low as \$50. This enables more stock turnover for the company but more importantly provides an affordable avenue through which an individual can pay for the cost of a solar home system which would have otherwise put a dent in one's income (USAID 2017). Companies like Dlight have

innovated in the uptake of their stock in the last mile in Uganda, even going a step ahead to reach refugee settlements.

Affordability is affected by counterfeits and substandard cleantech products rampant on the market, and this is seen in both rural and urban settings. These products are cheaper and a replica of the genuine products which leaves unknowing buyers unaware of their quality or standard status leading to unfair competition. This is contrary to the genuine products which are still on the market but expensive (*Daily Monitor* 2018). The government has the policy power to rule out fakes by empowering its standardizing body, the Uganda National Bureau of Standard which has of May 2019 acquired higher grader battery and panel testing equipment (UNBS Uganda 2019).

End-user affordability also comes in the form of subsidies accorded to manufacturers or product companies. This methodology supports governments and development partners that wish to mobilize private finance for climate-compatible development. An example is a price-subsidy model where the agency covers a certain percentage of the cost of the product leaving the other percentage, usually around 40–50% to the consumer. This has happened for improved cookstoves, and while it might create a market distortion for companies that are not a part of the financing programme, it still leads to the high uptake of the products (World Bank 2020). To achieve more mobilized private finance, there needs to be harmonized mindfulness on how to collect more data from the base of the pyramid since developmental metrics often leave out this group. In this regard, the same principle could be applied in other vital fields like health access and agriculture. Disaggregated data reveals deprivations and inequalities that may not be fully reflected in aggregated data.

9.3.8 Avoiding Market Distortion

Market distortion presents its own set of challenges to the local economy (firewood vendors) but especially for those companies that are left out of the private finance. It would, therefore, be of importance for grant-funded subsidy programmes to issue out cleantech to territories

or geographies where the RE technology has never reached (Espa and Rolland 2015). An example of this had happened in refugee settlements at a time when energy intervention programs and products had not yet permeated fully. While this is beneficial at the onset, refugee settlements often become a hotspot for many outreach initiatives that sometimes contribute to market distortions (Rouse 2019). In the arena of biomass, particularly briquettes, companies are coming up with innovative ways to reduce the price. A good case example is seen between development partners and private companies empowering local communities to learn how to produce and sell their own briquettes (UNHCR 2013). The process for making briquettes has a varying level of technical expertise needed, but this can, to a larger extent, be done by hand and is less mechanized. By empowering this level of community-leveraged inventions, people can not only manufacture their cooking fuels but also sell products to their community at large.

On a grander scale, affordability has been one of the largest limiting factors in encouraging more cleantech companies to produce household cleantech. The urban parts of Uganda are primarily served by the national grid, UMEME in all major regions. The West Nile subregion is served by the West Nile Rural Electrification Company (WENRECo), a vertically integrated isolated grid on a Build Own Operate (BOO) basis. The concentration of decentralized energy distribution in urban parts leaves a deficiency in rural areas which are the heaviest users of traditional fuels for lighting and cooking. Innovative financing mechanisms in public–private partnerships have supported businesses and end-users in acquiring improved RE technologies.

9.4 What Are the Transition Needs for Small-Scale Renewable Energy?

9.4.1 Funding

The decline in financing is due to a decline in international public fund flows (Climate Policy Initiative 2019). While the investments into renewable energy are still a worthwhile figure, it is still not enough.

Funding to private NGOs substantially comes from abroad, where some funding restrictions have become a hindrance for project implementation (Global Distributors Collective 2019). The funding's impact expectations are not able to match ground capabilities. Global Distributors Collective, a last mile distributors' collective, in its state of the sector report, laments from their findings that three key challenges exist in decentralized sourcing of funds: minimum investment sizes, collateral requirement and interest rates. Respectively, funders defend this by explaining that transaction costs are too high for small figures, loans become risky without collateral and a need for a high return on last-mile distribution risk (Global Distributors Collective 2019).

Today, funders world over are innovative in the way they provide funding through; Results-Based Financing (RBF) models, incubation, venture capital and debt financing. These diverse methods are a new way to not only mitigate misappropriation but encourage innovations in achieving project goals which sometimes can go awry. The number of energy-focused incubators in Uganda alone is still too low. Incubation and acceleration programmes bridge the gap in connecting various actors along the energy value chain. Commercialization of an innovation or technology is a daunting process since the facilitator like incubators has minimal control power over operations on a day to day basis. The facilitating process, however, works to remove barriers that the innovation may face in its launch stage and in its bid to scale up (Murphy et al. 2000).

Drawing on the above therefore, funding can play a vital role in subsidization of product prices but at the risk of distorting local economy markets which is why clear lines must be put in place. Funding to energy programmes and organizations can also be targeted towards initiatives that empower the creation of more opportunities for other people, thereby increasing the impact of funding.

9.4.2 Empowering More Clean Energy Entrepreneurs

Uganda was in 2015, ranked as the most entrepreneurial country in the world. While entrepreneurship zeal is high, the same does not trickle to low employment rates, thereby impelling many youths to go into business without training (*Daily Monitor* 2018). The bulk of this business is in agriculture because of the need for food both locally and for export. While entrepreneur-support programmes and organizations in Uganda have skyrocketed in the last few years, a handful of these is only targeted towards energy entrepreneurship. There should be an awareness campaign that shows the opportunities in energy entrepreneurship, especially concerning biomass.

9.4.3 Business Prowess

A significant need that is arising to enable energy entrepreneurship is financing and technical know-how. Local sources of financing in Uganda are currently low and those who need it seek it out from donations. Banking institutions in the country have stringent rules and requirements for entrepreneurs regardless of their stage of business. This type of funding is better suited for established businesses, but for a business in the ideation stage, it is challenging to acquire the financial support needed because of the too high-interest rates that go to the upwards of 50% (Global Distributors Collective 2019). With such bottlenecks, energy entrepreneurs seek out funding which can be a competitive process.

More to business prowess, the need for technical capacity. Technical capacity building is paramount in getting an energy enthusiast to become ready for the job market. The Nakawa Technical College in this regard, runs a solar training course for solar technicians in installation and repair (Sun-Connect 2018). Enlight academy is doing similar work but targeting youth in school and technical training institutions. The individuals that graduate from these courses go on to become self-employed and support big solar companies in their day to day operations.

While energy enterprises-support organizations are not many, a few of them like the Renewable Energy Business Incubator Limited (REBI) are promoting biomass technologies through empowering entrepreneurs to take on these responsibilities by providing access to startup capital and training. Associations play a critical role as the information hub to encourage networking and collaboration. The Uganda Solar Energy Association (USEA) for instance, is a membership organization that has a catalogue of various players in the solar energy sector from financiers, private businesses, government and many more. They are an umbrella organization that can propagate entrepreneurship in energy. On a global scale, the GOGLA association plays a similar role, and they have done so in the developing world by providing data needed by entrepreneurs and programmes in energy access.

9.4.4 Gender Equality in Clean Energy Entrepreneurship

Much like many burgeoning sectors, the RE energy sector is dominated by men and has left little room for women. Women-support organizations like Global Women's Network for the Energy Transition (GWNET) are promoting women in energy. In the last mile, it is women who are most vulnerable to the effects of the toxic fumes released by firewood and kerosene and by appealing and involving them more, the ecosystem can grow (Global Women's Network for the Energy Transition 2019).

9.4.5 Civil Society Involvement

Uganda's civil society landscape is influenced by two major groups; the donors who provide the financial backing and the implementing organizations that use the funding to carry out their mandated tasks. This is the same principle in clean energy where donors prefer to work with projects that are scalable and impactful. The implementing partners are usually not profit-making but work on mandated missions to lift

their communities out of poverty. The activities they carry out can be very diverse from technical training to local skilling. They build trust from their community and leverage on this to create programs that self-empower the community into coming up with income-generating streams. However, there should be more mechanisms on how NGOs and funding partners can share risk.

There are increasing associations of civil society groups in clean energy. A good example is the Access Coalition which is an umbrella organization of non-profits that are addressing the energy access challenge. It is such associations that are key in influencing policy formulation and a transition to a low-carbon economy from the ground up.

9.4.6 Research and Stronger Enactment of Existing Policies

Legislation geared towards small-scale enterprise in cleaner energy should be embraced. With respect to biomass, recently, the Biomass Energy Strategy (BEST) birthed the Energy Efficiency and Conservation Bill, and as of April 2020, it is currently tabled for approval by cabinet and parliament. Developed by the MEMD, BEST concretizes Uganda's commitment to tying energy efficiency with social value for poverty eradication.

With respect to research, it is worth noting that collection and use of data is known to influence policies at global levels, in this respect the country should invest in more energy research initiatives.

9.5 Conclusion

Along the way, access to affordable energy cuts across many other SDGs. When looking at achieving a low-carbon economy, SDG 7; access to affordable energy for all is a foundation stone for other livelihood machines. It is the energy that is needed to light up homes

and machines that support production literally. However, Uganda at large is still dependent on fossils to achieve these intended purposes. On a decentralized scale looking at rural contexts, access to energy presents many opportunities for employment, whether it is a full time, formal, informal or self-employment. These opportunities come in the form of commission-based agents, innovation founders, professionals, entrepreneurs and more. Looking at health, a transition to cleantech enables households to steer away from dirty indoor fuels which release toxic fumes that are detrimental to livelihoods. While an energy mix is of paramount importance as a stride to low-carbon economy achievement, rural Uganda stands a good chance of adopting transition to clean energy, and this can be achieved with the right empowerment.

Additionally, Uganda can do well to invest more in research and development by learning with eastern countries like India and Indonesia in their stride to RE technologies. Both geographies and social constructs share many similarities, although eastern countries have advanced more in R&D, many of which are applicable in an African context. This type of collaboration can stimulate already existing south to south technology transfers that have occurred in infrastructure and learning.

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Part III

Extractives in the Energy Transition Era: Key Concepts



10

Local Content Policies in the Energy Transition Era in Africa: A Case Study of the East African Oil and Gas Industry

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Video interview by the author discussing this book chapter can be accessed at, <https://www.youtube.com/watch?v=mAa10UGP-cM&t=726s>. Last accessed on 1st September 2020.

10.1 Introduction

The extractive industry brings about massive revenues and developments for a resource-rich country. Although the world is now transitioning to a low-carbon economy, the continued role of fossil fuels in Africa's economic development cannot be ignored.¹ Energy is key in addressing

¹Nalule, V.R. "Transitioning to a low carbon economy: Is Africa ready to bid farewell to fossil fuels?" In *The Palgrave handbook of managing fossil fuels and energy transitions*. Palgrave Macmillan, Cham, 2020. 261–286.

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the challenges faced on the African continent, including poverty, famine, gender inequality just to mention but a few.² Most importantly, both fossil fuels and renewables are key in achieving the United Nations' Sustainable Energy for All and the associated Sustainable Development Goal (SDG) 7 which advocates for access to modern energy for all.³ The challenge of energy access is anticipated to escalate on the African continent basically due to growing demand for energy fuelled by urbanization, industrialization and population growth. In this respect, these countries will still rely on fossil fuels though they should be mindful of SDG 13 on climate action.⁴ Consequently, the issue of local content in the extractive sector is still relevant in this energy transition era as will be discussed in this chapter. However, it is imperative for African nascent oil and gas economies to note that, the discovery of their resources is during the wake of the clean energy wave and as such the foreign investors will rush into renewable energy, and this might leave stranded resources in Kenya, Uganda and Tanzania. Hence, the local content policies must be adopted not for developing capabilities in the extractive industry but also the renewable energy industry.⁵

Basically, many resource-rich countries have implemented local content policies in the last decade alone, as a means of reaping full advantages of the energy industry lifecycle.⁶ Local content policies are found in various instruments within a legal framework of a resource-rich country. These policies are found in primary and secondary legislation as well as in negotiated instruments.⁷ The policy advocates for the creation of employment opportunities, capacity building

²Nalule, V.R. *Energy poverty and access challenges in sub-Saharan Africa: The role of regionalism*. Springer, 2018.

³United Nations Sustainable Development Goals (SDG), 2015.

⁴Olawuyi, D.S. "Can MENA extractive industries support the global energy transition? Current opportunities and future directions." *The Extractive Industries and Society* (2020).

⁵For a full discussion on local content in the energy transition era, please watch the video featuring the author. Local Content in the East African Oil and Gas Sector in the Energy Transition Era. Link to YouTube video interview by Dr. Victoria Nalule featuring Dr. Rukonge Muhongo, <https://www.youtube.com/watch?v=mAa10UGP-cM&t=395s>.

⁶Marcel, Valérie, et al. "A local content decision tree for emerging producers." Chatham House, The Royal Institute of International Affairs: London, UK (2016).

⁷Tordo, Silvana, et al. *Local content policies in the oil and gas sector*. The World Bank, 2013.

mechanisms, value-addition, educational and training provisions for both the indigenous and local communities.⁸ Most resource-rich countries have currently adopted and implemented legal provisions on local content.

As much as resource-rich countries have implemented local content policies. It should be noted that some countries have adopted favourable and credible local content provisions. Countries such as Norway and the United Kingdom developed successful local content policies in the 1970 s and 1980 s that were based on value creation rather than stringent local content requirements.⁹ It was not only, Norway and the United Kingdom that implemented these policies even other countries such as Trinidad and Tobago, also adopted these policies but through value creation in the industrialization of natural gas, which was previously flared.

Local content policies have traditionally been approached in a stringent way or lenient depending on the policymaker's intention and the nature of the socio-economic and political climate of a given country. After 2006 Brazil oil discoveries, the Country also adopted and implemented stringent local content policies associated with hefty fines for non-compliance.¹⁰ Nigeria was the first country in Sub-Saharan Africa to adopt local content policies.¹¹ Nigeria did not emphasize value creation; neither did the government emphasize capacity building, but the indigenization of the oil and gas industry.

Emerging resource-rich countries such as Kenya, Tanzania, Mozambique and Uganda have the common goal of capturing the broader economic benefits from the extractive industry as well as bolstering industrialization and economic development of the domestic economy for the better welfare of a country's citizens.¹² However, the

⁸Tordo, Silvana. *National oil companies and value creation*. The World Bank, 2011.

⁹Supra n.7 Tordo.

¹⁰Warner, Michael. *Local content in procurement: Creating local jobs and competitive domestic industries in supply chains*. Routledge, 2017.

¹¹Ovadia, Jesse Salah. "Local content and natural resource governance: The cases of Angola and Nigeria." *The Extractive Industries and Society* 1.2 (2014): 137–146.

¹²Nwapi, Chilenye. "A survey of the literature on local content policies in the oil and gas industry in East Africa." SPP Research Paper 9/16 (2016).

ambitious goal is to develop local content policies within an economy of an emergency oil and gas producer.

Literature shows how difficult it is to obtain the probable advantages of implementing such policies.¹³ This is because emerging producers face numerous challenges in materializing the effects of an adequate, credible and exemplary local content policy. Emerging producers are uncertain of their resource base; hence they are not certain of the investment value their reserves pose.¹⁴ Furthermore, they lack both a skilled labour force and limited state administrative capacity. But for emerging producers, local content policies need to be adopted and implemented within the dimensions of the new era and world order.

Emerging producers are creating local content policies in the world that seeks climate change by implementing climate mitigation measures to achieve a just transition. The emerging producers face the difficulty of creating local content policies in a post-COVID-19 era, where supply chains are disrupted, procurement mechanisms are distorted. With the dwindling oil prices that have recorded an unprecedented record of a negative value price per barrel¹⁵; Local content policies are the least desired policy tools that could attract foreign direct investment as well as be a vehicle to further develop an economy.

This chapter is divided into eight parts, the second part of the chapter explains the oil and gas industry as an enclaved industry for domestic suppliers and workforce to integrate due to numerous factors, the third part discusses the policy design and factors that affect local content policy design in any economy be it a developing or developed economy. Furthermore, the chapter discusses the probable advantages and disadvantages of local content policies in oil and gas industries, in the fifth part, the chapter undertakes a case study analysis between Norway and Brazil being exemplary local content models for drawing lessons for emerging oil and gas producers such as Kenya, Tanzania and Uganda.

¹³Ibid.

¹⁴Andrews, Nathan, and Chilenye Nwapi. "Bringing the state back in again? The emerging developmental state in Africa's energy sector." *Energy Research & Social Science* 41 (2018): 48–58.

¹⁵See "East Africa's oil industry: A new story in the making." <https://www.busiweek.com/east-africas-oil-industry-a-new-story-in-the-making/>.

Lastly, the chapter introduces the creation of a regional content policy as a novel means of adopting local content policies for developing local content policies for emerging economies such as Kenya, Tanzania and Uganda.

10.2 Breaking the Enclave in the East African Oil and Gas Industry

Small resource-rich economies such as Tanzania, Kenya and Uganda are largely dependent on the lucrative extractive industry. The foreign direct investment flowing into these small economies dominates these economies with their substantial proportion of goods, services, tools, R&D facilities, personnel and technology as well as service suppliers into the extractive industry.¹⁶ The nature of a multinational investor coming into East Africa with intact linkages does not serve the potential growth and development in other key areas of the economy such as the agricultural, manufacturing and services sector. The nature of the extractive industry inadvertently creates an enclave industry that domestic suppliers cannot integrate to develop their domestic capabilities and compete against the international market participants.¹⁷

It should be noted that countries such as Norway and Brazil have adopted and implemented local content policies to break the enclave nature of the oil and gas industry. Developing countries such as Kenya, Tanzania and Uganda have followed suit. The main aim of implementing these policies is to create downstream value-added products in the domestic industry, to strengthen backward and forward linkages, to drive innovation and develop technological capability in the domestic workforce, to diversify the economy and to secure growth and development of the oil and gas resources.

¹⁶Ibid.

¹⁷Ackah-Baidoo, Abigail. "Enclave development and 'offshore corporate social responsibility': Implications for oil-rich sub-Saharan Africa." *Resources Policy* 37.2 (2012): 152–159.

10.2.1 Understanding Local Content Policies

It should be noted that local content policies are the main driver of development in oil and gas-rich countries if implemented properly. This has been evident in developed and mature oil and gas economies such as Norway, Brazil, Trinidad and Tobago and the United Kingdom. On the other hand, in Sub-Saharan Africa, countries like Angola and Nigeria who have implemented these policies but have not gained similar results as their counterparts of Norway and Brazil. Local content can be understood in three perspectives, namely the economic, social and political perspectives.

Local content policies found their origin from an economic school of thought, classical economists such as Grossman defined local content as ‘a given percentage of domestic value-added or domestic components are embodied in a specified final product’.¹⁸ Furthermore, local content has also been regarded as a policy that increases the costs of production for foreign investors.¹⁹ Thus, the policy involuntarily hinders foreign direct exchange from potential international players due to the increased costs. Secondly, local content is a policy that has a direct impact on the community through the objective of welfare maximization.²⁰ It is a vital component within a resource-rich country’s political economy. It should be noted that local content policies emanate from deliberative political motives of policymakers, to what could be known as ‘government intervention’.²¹ The government intervention takes place through two forces, namely market and public forces as to intervene in the enclaved extractive industry. The policy has been used to solicit political support through clientelism, therefore, maintaining power and destroying democracy by

¹⁸Grossman, Gene M. “The theory of domestic content protection and content preference.” *The Quarterly Journal of Economics* 96.4 (1981): 583–603.

¹⁹Kolstad, Ivar, and Abel Kinyondo. “Alternatives to local content requirements in resource-rich countries.” *Oxford Development Studies* 45.4 (2017): 409–423.

²⁰Nwapi, Chilenye. “Corruption vulnerabilities in local content policies in the extractive sector: An examination of the Nigerian Oil and Gas Industry Content Development Act, 2010.” *Resources Policy* 46 (2015): 92–96.

²¹Tordo, Silvana, et al. *Local content policies in the oil and gas sector*. The World Bank, 2013.

creating autocracy within a country.²² Countries like Nigeria, Equatorial Guinea, Angola, Venezuela, Azerbaijan and Brazil are among the few economies that leaders have used local content policies to retain power. Thirdly, local content policies are used to maximize social welfare in host communities since host communities have public goods such as roads and rudimentary infrastructure, etc.²³ The host communities cannot gain directly from the oil and gas operations without local content policies that set mandatory targets for foreign investors to adhere to.

In this chapter, local content is defined as *‘the administrative, legislative and judicial government intervention into the extractive industry value chain to create provisions for both domestic goods and services as well as the domestic labour force’*.²⁴

Local content is implementable in three ways, the fundamental or conventional type of local content policy is the national content policy. This typology of local content policy avails provisions for the whole country.²⁵ Most resource-rich countries, such as Norway, Brazil, Nigeria, Tanzania, Kenya, Uganda and Mozambique, have adopted and implemented the national content policy. The second typology is the community content policy; this typology brings about provisions for the host communities that surround the extractive industry operations.²⁶ Community content policy is an affirmative action that gives preference to the neighbouring communities in the provisions for goods and services as well as the domestic labour force. Lastly, the regional content policy, this typology of local content policy has not proliferated among resource-rich countries because it raises numerous questions of sovereignty over

²²Ovadia, Jesse Salah. “The making of oil-backed indigenous capitalism in Nigeria.” *New Political Economy* 18.2 (2013): 258–283.

²³Warner, Michael. “Community content: The interface of community investment programs with local content practices in the oil and gas development sector.” Overseas Development Institute (ODI) Briefing Note 9 (2007).

²⁴Authors personal development.

²⁵Nwapi, Chilenye. “A survey of the literature on local content policies in the oil and gas industry in East Africa.” SPP Research Paper 9/16 (2016).

²⁶Warner, Michael. “Community content: The interface of community investment programs with local content practices in the oil and gas development sector.” Overseas Development Institute (ODI) Briefing Note 9 (2007).

natural resources, sharing of benefits and the costs of having a supranational regulatory body over domestic resources.²⁷ But a regional content policy also advocates for pooling of resources and the facilitation of having an independent regulatory body that is not captured by the politics of a particular country. Though regional content policies are yet to be implemented, they may be the answer to questions that arise due to the incremental costs of both national and community content policies, the lack of specialized skills and capital in resource-rich countries. A regional content policy creates channels of pooling resources to attain mutual benefits from the extractive industry.

10.3 Factors Affecting Local Content Design in East Africa

Kenya, Uganda and Tanzania have in the last decade experienced the Gold Rush that South Africa experienced in the twentieth century. This is due to the extractive resources that have been found in these countries. Kenya discovered 700 million barrels of oil in Turkana, Uganda discovered over 4.5 Billion barrels of crude oil in the Albertine region and Tanzania discovered over 47 trillion cubic feet worth of gas in Mtwara, the Southern region of Tanzania. Due to these resources, East Africa adopted local content policies; the policy was adopted based on different rationales. In Kenya, the local content policy emphasizes domestic ownership, while in Uganda the local content policy emphasized domestic supplier integration into the oil and gas industry and in Tanzania, the government emphasized on training the domestic and host community as part of local content development. As much as, these objectives are fundamental to the development of local content policies, different factors affect the design of local content policies depending on the nature of the prevailing circumstances of the economy. These are the following:

²⁷Nwapi, Chilenye. "A survey of the literature on local content policies in the oil and gas industry in East Africa." SPP Research Paper 9/16 (2016).

10.3.1 The Country's Geology and Geography

Resource-rich countries must assess the geography and geology of their extractive resources. The different nature of the topography demands a different type of policy objective as well as expectation. For example, a country like Tanzania where most of the 42 tcf worth of gas is found offshore compared to Uganda and Kenya where their oil resources are found onshore.²⁸ The different governments must ask the multinational oil companies to assess and understand what probable opportunities can be availed from the nature of the resource's geology.²⁹ Rather than implementing policies that eventually become redundant due to the impossibility of fulfilling the objectives.

Governments must obtain information from the foreign investors to provide 'early data' on the skills and goods and services needed. This will enable timeous preparation from the domestic suppliers and workforce. Training and costs differ due to the nature of the geology. IPIECA states that 'geologists and specialist engineers (those trained at the tertiary-education level) are by far outnumbered by skilled and semi-skilled construction tradesmen, metal and mechanical tradesmen, electrical and electronic tradesmen and other experienced heavy industry machine and plant operator'.³⁰ Such costs are associated with the nature of the resources' geology, in frontier countries such as Mozambique, their high risks of exploration. The investors would expect lower local content quotas as compared to reserves found in countries like Nigeria and Angola due to a ready established extractive industry that hinders the costs of production.

²⁸Roder, Kai. "‘Bulldozer politics’, state-making and (neo-)extractive industries in Tanzania's gold mining sector." *The Extractive Industries and Society* 6.2 (2019): 407–412.

²⁹Marcel, Valérie, et al. "A local content decision tree for emerging producers." Chatham House, The Royal Institute of International Affairs: London, UK (2016).

³⁰Ibid.

10.3.2 Structure of the Country's Economy

The nature of the host economy is a pivotal determinant of whether local content policies will thrive within a given resource-rich country. It should be noted that countries that do not solely depend on the extractive industry to develop and maximize social welfare for its citizens tend to gain more from the policy, than countries that are petro-states or solely dependent on the extractive sector for economic survival.³¹ This is because of the local content policy to be efficient in any economy, the economy must have the absorptive capacity to absorb the massive inflow of the foreign direct investment otherwise the lack of such an absorptive capacity can lead to the Dutch disease.³²

Economies such as Brazil and Norway that had thriving industries (shipping and fishing industry) pre-discovery of the oil and gas resources have developed exemplary local content policies, mainly attributed to the fact that the economies have skills and capabilities to leverage on to the oil and gas industry within their domestic economies. This made these economies ready to facilitate the interaction between the oil and gas industry and other industries such as the shipping industry that developed linkages in the whole economy. Economies such as Kenya, Uganda and Tanzania do not have the absorptive capacity to individually contain the extractive foreign direct investment. Hence the economy cannot leverage on its capacity to facilitate domestic integration into the oil and gas industry.

10.3.3 The Labour Market of the Country

The labour market of an economy determines what level local content targets should be set at. The government must readily avail of a workforce that can integrate the extractive industry and be internationally

³¹Larsen, Erling Røed. "Escaping the resource curse and the Dutch disease? When and why Norway caught up with and forged ahead of its neighbours." *American Journal of Economics and Sociology* 65.3 (2006): 605–640.

³²Ramírez-Cendrero, Juan M., and Eszter Wirth. "Is the Norwegian model exportable to combat Dutch disease?" *Resources Policy* 48 (2016): 85–96.

competitive.³³ The extractive industry requires specific skills such as welders, fabricators, electricians that have sophisticated skills for the extractive industry. If a country has high literacy levels as well as competencies for the extractive sector or even skills that can be leveraged by the extractive industry.³⁴ Local content policies can call for a high target of national participation in the extractive industry value chain.

If the labour market of an economy has low literacy levels and a lack of a skilled workforce. The foreign investor will definitely rely on the foreign workforce to meet the demands of the extractive industry operations.³⁵ The foreign company will set a budget for training the domestic workforce, but this will be based out of the goodwill of the company as the government cannot set the budget for training the domestic workforce for the company.³⁶ Hence this enhances CSR rather than local content policy targets. In this case, the government will set minimal local content targets. Training provisions, in this case, should be placed by both the government and the multinational companies, as the government needs to place the right educational policies and fund technical schools and universities to offer the needed skills so as to build a domestic workforce that can integrate the extractive industry value chain. The East African economy has largely been driven by the agricultural, tourism, services and manufacturing sectors.³⁷ The oil and gas sector is a nascent industry in the region; the skills and capabilities are not readily available within the domestic population. Hence local content policies must be designed accordingly to facilitate the optimal exploitation of the resources while developing domestic capability.

³³Ngoasong, Michael Zisuh. "How international oil and gas companies respond to local content policies in petroleum-producing developing countries: A narrative inquiry." *Energy Policy* 73 (2014): 471–479.

³⁴Marcel, Valérie, et al. "A local content decision tree for emerging producers." Chatham House, The Royal Institute of International Affairs: London, UK (2016).

³⁵Ozigbo, Nathaniel C. "Technological capacity building in Nigeria's oil and gas industry." Proceeding of the 19th annual International information Management Association, San Diego, CA (2008).

³⁶Ramdoo, Isabelle. "Unpacking local content requirements in the extractive sector: What implications for the global trade and investment frameworks." International Centre for Trade and Sustainable Development (ICTSD).

³⁷Na, Hyeseon. "Is intraregional trade an opportunity for industrial upgrading in East Africa?" *Oxford Development Studies* 47.3 (2019): 304–318.

10.3.4 International Trade Agreements

Local content design is largely affected by international agreements that a country ratifies since these agreements affect the structure and design of other policies such as industrial, procurement and fiscal policies that change the manner in which local content policies can adopt and be implemented within a resource-rich country. International agreements have also been key in discouraging the use of local content policies in resource-rich countries. International instruments such as the World Trade Organization (WTO), where the members to the WTO have ratified certain international agreements such as the agreement on Trade-Related Investment Measures (TRIMs), the General Agreement on Tariff and Trade (GATT) and the Agreement on Subsidies and Countervailing Measures (ASCM); all these international agreements place emphasis on the 'national treatment' principle.³⁸ This principle holds every member country to treat one another as they would their own nationals.³⁹ But for the least developing countries, international agreements have created some limited exceptions in the application of this principle.

Local content pioneer countries such as Norway and the United Kingdom dropped these policies after joining the European Union due to the national treatment principle.⁴⁰ Kenya, Tanzania and Uganda have all ratified the WTO; the ASCM makes an exception for least developed countries with a GNP per capita of less than US\$ 1000 to implement subsidies that do not have 'adverse effects' on international trade.⁴¹ Local content's main mechanisms are having a deliberate preference on the domestic supplier and labour force. With countries like Kenya having a

³⁸Ramdo, Isabelle. "Unpacking local content requirements in the extractive sector: What implications for the global trade and investment frameworks." International Centre for Trade and Sustainable Development (ICTSD).

³⁹Ibid.

⁴⁰Norway—Local content lessons learned. Willy H Olsen <http://www.biece.org/wpcms/wp-content/uploads/Olsen-Norway-local-content-strategy2.pdf>.

⁴¹Ramdo, Isabelle. "Local content policies in mineral-rich countries." An Overview. Discussion Paper 193, 2016.

USD 1320 GNI per capita in 2020, this largely affects the development of local content policies in Kenya.⁴²

10.3.5 The Volatility of Oil and Gas Prices

Oil and gas prices are known for their volatility in the international market. When the oil and gas industry experienced increased oil and gas prices in the international market as in the decade of 2005–2015, the pressure to intensify local content policies in the oil and gas-rich countries escalated due to the massive profits the multinational oil companies were making. But currently, the effects of the Corona Virus (COVID-19) pandemic have led to weathering oil and gas prices in the international market reaching less than \$1 per barrel due to the effects of the wide lockdown measures to combat COVID-19 across the globe.⁴³ It is clear that after the wave of the COVID-19, multinational companies will not be in a favourable position to invest leave alone to meet their local content mandatory targets. The design of local content policies must take into account such uncertainties and be flexible in its application so as to meet the objectives of the policymaker.

10.4 The Advantages and Disadvantages of Local Content Policies

Local content is both disadvantageous and advantageous in its application. The policy's efficiency and functionality are dependent on the nature of the factors that affect the local content design. In countries with unfavourable political economies and poor social welfare, poor infrastructure as well as lack of capital to integrate the extractive industry⁴⁴:

⁴²East Africa Economic Outlook 2019. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/2019AEO/REO_2019_-_East_Africa_.pdf.

⁴³Albulescu, Claudiu. "Coronavirus and oil price crash." Available at SSRN 3553452 (2020).

⁴⁴Subai, Pereowei. *Local content oil and gas law in Africa: Lessons from Nigeria and beyond*. Routledge, 2019.

Local content policies do not thrive in such economies. The following are the advantages and disadvantages of local content policies.

10.4.1 The Advantages of Local Content Policies

Local content policies create regional clusters and pool resources: Clusters encourage the transfer of technology which results in high rates of innovation by creating competent channels to public goods and other market determinants that would have been expensive to acquire. Norway established indigenous supplier clusters that were involved in the oil and gas industry.⁴⁵ These established clusters in Norway employed approximately 114,000 people in the indigenous market and sales worth \$32 billion in the indigenous economy.⁴⁶ Local content policies through cluster creation can reduce the expenditure margins on R&D and improve productivity.

a. Economic Diversification

Local content policies facilitate the diversification of the economy. This is possible through public-based and market-based inputs, that create development channels for other industries other than the oil and gas industry. For example, in Trinidad and Tobago the government through their local content policy chose to create incentives for inward investments and joint ventures between indigenous and foreign market participants.⁴⁷ This facilitated the capital-linkage from the oil and gas industry to other industries with limited domestic competitiveness. Equally, through their 2010 Economic Transformation Plan,

⁴⁵Knop, Lilla, and Marzena Kramarz. "Attractiveness of the region in connection with inter-modal transport development." In *Sustainable logistics and production in industry 4.0*. Springer, Cham, 2020. 197–217.

⁴⁶Ibid.

⁴⁷Boopsingh, Trevor M., and Gregory McGuire, eds. *From oil to gas and beyond: A review of the Trinidad and Tobago model and analysis of future challenges*. University Press of America, 2014.

Malaysia adopted local content policies in the same design, facilitating economic diversification.⁴⁸

b. Provision for Social Welfare Maximization

The oil and gas industry calls for a sophisticated and highly skilled labour force. Resource-rich countries like Nigeria, Angola, Tanzania and Uganda do not have the required skills. Local content policies create mechanisms for indigenous employment. In Brazil, local content policies involved the national oil company Petrobras in skills development. Petrobras created a human resource programme through the Agência Nacional do Petróleo in 1999.⁴⁹ The programme encouraged training courses that met the demands of the oil and gas industry. Local content policies give international oil companies a social license to operate since they maximize social services within the host communities.

c. Rent-Seeking

The oil and gas industry creates a large part of a country's GDP in resource-rich countries. These policies bring the expectation for indigenous inclusion. Hence the labour force of resource-rich countries seeks the big proceeds from the industry. Rent-seeking wastes competition for a given economic opportunity and, in this case, the opportunity is the oil and gas industry.

d. Redundancy

Hufbauer, Schott and Cimino state that 'the effect of local content policies on trade is to discourage foreign imports and to stifle competition between domestic and foreign firms. The impact on trade of local content policies depends on the percentage of local content required and

⁴⁸Rahim, Khalid Abdul, and Audrey Liwan. "Oil and gas trends and implications in Malaysia." *Energy Policy* 50 (2012): 262–271.

⁴⁹Mendonça, Roberto Wagner, and Luiz Guilherme de Oliveira. "Local content policy in the Brazilian oil and gas sectoral system of innovation." *Latin American Business Review* 14.3–4 (2013): 271–287.

the efficiency of existing firms. In an economy with inefficient firms, a high degree of required local content thwarts competition'.⁵⁰ Local content policy avails a deliberate preference to the domestic suppliers, as some oil and gas-rich countries would emphasize on the domestic suppliers meeting international standards in terms of price, quality and delivery. Most developing countries treat the local content policy as an affirmative action that automatically integrates the domestic supplier into the oil and gas value chain.

10.5 The Norwegian and Nigerian Case Study: Lessons to Be Drawn for Emerging Resource-Rich Countries

The chapter has so far explained local content policies and how these policies are applicable within a resource-rich economy. For the purposes of developing a proper analysis of the abstract explanation of local content policies, it is important to make a case study on two (2) countries. Two reasons lead the research to make these two case studies. Firstly, three (3) of the selected countries are emerging oil and gas producers, while the other two (2) are mature oil and gas economies. This will facilitate understanding of what drives the adoption of local content policies at different stages of the extractive industry value chain. The countries selected are Norway, Brazil, Kenya, Tanzania and Uganda. Norway, Brazil are mature economies that have implemented local content policies since the 1970 s.⁵¹ While Kenya, Uganda and Tanzania are nascent or emerging oil and gas producers.⁵² It is clear that lessons fare to be drawn from mature local content regimes and economies to the nascent economies so as to reap the full benefits of implementing such policies.

⁵⁰Hufbauer, Gary Clyde, Jeffrey J. Schott, and Cathleen Cimino-Isaacs. *Local content requirements: A global problem*. Vol. 102. Columbia University Press, 2013.

⁵¹Brekke, Josefine Smith. "Machine learning effects on the Norwegian oil and gas industry." Diss. 2020.

⁵²Steinhauer, Ineke, et al. "Advisory review of the environmental and social impact assessment for the East Africa Crude Oil Pipeline (EACOP)/Uganda" (2019).

10.5.1 Brazilian and Norwegian Oil and Gas Industry: The Local Content Setting in Mature Oil and Gas Producers

The local content policy in Brazil and Norway both have four main policy objectives, to increase domestic participation on a competitive basis, to develop the national technological advancement, to improve the domestic industry capabilities, as well as to create employment channels for the domestic workforce.⁵³ It should be noted that both Brazil and Norway are among the wealthiest economies in the world with a large domestic market, favourable business climate, efficient financial markets as well as a high level of domestic driven innovation and technological adoption mechanisms. Both Norway and Brazil found offshore oil and gas resources; Brazil is endowed with 13.1 billion barrels of proven reserves and 16 trillion cubic feet of proven natural gas reserves.⁵⁴ Norway is endowed with 8.6 billion barrels of proven reserves and 66 trillion cubic feet of proven gas reserves.⁵⁵ These resources brought about huge investments in Norway and Brazil; the extractive foreign investment led to the development of the petroleum industry in both Norway and Brazil.

Both Norway and Brazil developed giant national oil companies, Norway created Statoil (currently known as Equinor) while Brazil created Petrobras. These two national oil companies held a monopoly over the domestic oil and gas value chain.⁵⁶ Both countries build domestic capabilities using knowledge transfer mechanisms, training programs and development of R&D. The national oil companies both control most of the oil and gas production in Norway and Brazil, including other multinational oil and gas companies.⁵⁷

⁵³Acheampong, Theophilus, Marcia Ashong, and Victoria Crystal Svanikier. "An assessment of local-content policies in oil and gas producing countries." *The Journal of World Energy Law & Business* 9.4 (2016): 282–302.

⁵⁴Ibid.

⁵⁵Ibid.

⁵⁶Noreng, Øystein. "Brazil and Norway–Offshore petroleum experiences and lessons." *The Journal of Energy and Development* 35.1/2 (2009): 79–99.

⁵⁷Ibid.

The licensing system in Brazil established local content targets created by the APN. The multinational oil companies were to meet the scores on the basis of technical, financial and local content targets throughout the exploration to the production phase of the oil and gas value chain.⁵⁸ The Norwegian licensing procedure did not follow strict requirements on local content targets. The policymakers specified that Norwegian-based firms should be chosen whenever the firms were competitive in price, quality and delivery.

The Brazilian and Norwegian oil and gas governance had incentives and penalties. In Brazil, the fiscal policy had exemptions on the oil and gas-related goods that are manufactured in Brazil, the raw materials used in manufacturing domestic goods and services were exempted from a social security system, import tax and tax on industrial products and social integration plan.⁵⁹ The Merchant Marine Fund was established by the Brazilian government to finance the 17 new shipyards and the expansion of the existing shipyards. It should be noted that Norway also leveraged on the shipping industry that the Country possessed in local content development. Furthermore, Norway created the 'Goods and Service' Office that was the Watchdog on the quality, price and delivery of the goods and services that were manufactured in Norway.⁶⁰ Norway also developed a gradual fiscal regime according to the development of domestic capabilities. The political will of the policymakers in Norway and sentiment of local content development was known to the multinational oil and gas companies.

The Brazilian and Norwegian oil and gas industry had a systematic institutional set-up. In Brazil, the Conselho Nacional de Política Energética created guidelines for local content policies in harmony with the Ministry of Mines and Energy.⁶¹ The Regulatory activities fall under the

⁵⁸Ngoasong, Michael Zisuh. "How international oil and gas companies respond to local content policies in petroleum-producing developing countries: A narrative enquiry." *Energy Policy* 73 (2014): 471–479.

⁵⁹Tordo, Silvana, et al. *Local content policies in the oil and gas sector*. The World Bank, 2013.

⁶⁰Ibid.

⁶¹Gonzales Rodriguez, Marco Antonio. "Success below the surface: Explaining success in the management of petroleum resources in Norway and Brazil." MS thesis. Norwegian University of Life Sciences, Ås, 2013.

responsibilities of Agência Nacional do Petróleo, which sets the minimum local content requirements. The PROMINP includes the Minister of Mining and Energy, the Minister of Development, Industry, and Trade Ministry, President and Services Director of Petrobras, the President of BNDES, the President of ONIP and the President of the Brazilian Petroleum Institute.⁶² In Norway, the Ministry of Petroleum and Energy was responsible for policymaking and awarding licences that met the Norwegian requirements.⁶³ The Norwegian Petroleum Directorate dealt with the technical control and regulatory advisory functions. Lastly, Statoil was the state-owned monopoly that was and still is instrumental in maintaining the government interests on behalf of the government.

10.6 Analysis of the Norwegian and Brazilian Local Content Regimes

The Norwegian and Brazilian local content regimes are the exemplary and poster boys for oil and gas governance as well as local content implementation and adoption. The analysis of these regimes will be undertaken under four significant issues. These are the institutional set-up, the nature of the local content policy and the rationale of implementing the policy.

10.6.1 The Institutional Set-up

Local content development relies heavily on the presence of good independent institutions, just like any other policy. Since local content policies are susceptible to corruption, the presence of independent institutions provides checks and balances that lead to effectiveness of the policy. Structurally, Brazil and Norway divided labour between different institutions. The business and regulatory interest of the government

⁶²Ibid.

⁶³Tordo, Silvana, et al. *Local content policies in the oil and gas sector*. The World Bank, 2013.

were separated within the same oil and gas governing framework.⁶⁴ The division of labour was to achieve domestic capabilities to facilitate the domestic industry to function at an internationally competitive level. Statoil and Petrobras emphasized on commercial activities while other government agencies regulated the oil and gas industry.⁶⁵

10.6.2 The Nature of the Local Content Policy

Local content can be approached in one of two ways, the policy's regulatory model can be either based on principle or rule-based associated with stringent requirements. The nature of the local content policy is through government intervention into the oil and gas value chain. Such intervention must be either through a rule-based approach or a strict, stringent approach within the oil and gas economy. The Norwegian model of local content adopted a principle-based approach that did not institute strict quantitative local content targets that were associated with hefty fines for non-compliance.⁶⁶ Instead of creating laws and rules that were strict on the foreign investors, the Norwegian model implemented the 'ten commandments' that were the framework that governed the oil and gas sector as well as local content policies in Norway.

Meanwhile, Brazil adopted a strict regulatory approach that did not appreciate the limitations facing the oil and gas industry. The Brazilian local content model allowed space for creative compliance, due to the stringent local content plans that were to be made in the local content booklet.⁶⁷ The restrictive Brazilian rules led to a legitimacy crisis as the industry could not meet the objectives of the policymakers. This led to

⁶⁴Mendonça, Roberto Wagner, and Luiz Guilherme de Oliveira. "Local content policy in the Brazilian oil and gas sectoral system of innovation." *Latin American Business Review* 14.3–4 (2013): 271–287.

⁶⁵Mendes, Pietro A.S., et al. "Reforming Brazil's offshore oil and gas safety regulatory framework: Lessons from Norway, the United Kingdom and the United States." *Energy Policy* 74 (2014): 443–453.

⁶⁶Ibid.

⁶⁷Noreng, Øystein. "Brazil and Norway–Offshore Petroleum Experiences and Lessons." *The Journal of Energy and Development* 35.1/2 (2009): 79–99.

corruption scandals such as the car-wash scandal in Brazil that were motivated by oil and gas operators circumventing the industry's requirements through corruption.⁶⁸

10.6.3 The Rationale and Objective of the Local Content Policy

The rationale behind adopting and implementing local content policies is a fundamental principle to the effectiveness and efficient implementation of the policy. Brazil and Norway understood that for local content policies to propel their economies to success, they needed to focus on the capacity development and gradual domestic integration into the oil and gas industry without heavily affecting the market forces. Hence, they emphasized R&D development, transfer of knowledge, technological transfer and achieving more from the multinational oil companies than just compliance of the local content targets.⁶⁹ For instance, Norway did not define what local content was but developed mechanisms that could channel domestic value creation and facilitate local participation.⁷⁰

10.7 Lessons for Emerging Oil and Gas Producers Such as Kenya, Tanzania and Uganda

Kenya, Uganda and Tanzania have recently been the new kids on the oil and gas block. These emerging oil and gas producers do not possess the technology, capital, capacity and supporting industries to develop from the maximum output of the industry.⁷¹ In terms of gas resources,

⁶⁸De Figueiredo, Fernanda Odilla. "Inside the car wash: The narrative of a corruption scandal in Brazil" (2016).

⁶⁹Dos Santos Silvestre, Bruno, and Paulo Roberto Tavares Dalcol. "Geographical proximity and innovation: Evidence from the Campos Basin oil & gas industrial agglomeration—Brazil." *Technovation* 29.8 (2009): 546–561.

⁷⁰Tordo, Silvana, et al. *Local content policies in the oil and gas sector*. The World Bank, 2013.

⁷¹Anderson, Wineaster. "Local suppliers in Tanzania: Ready for the petroleum sector?" *The African Review* 43.2 (2017): 51–82.

the countries do not have the domestic demand to contain the gas supply for their domestic consumption. But the following are the lessons that Kenya, Uganda and Tanzania can take into consideration from the Norwegian and Brazilian experience.

- a. The nascent oil and gas economies must have clear guidelines to the roles and responsibilities of different stakeholders. The economies must have a favourable business climate to bolster further investment that is backed by good transparent political decisions.
- b. The nascent oil and gas economies must not only place emphasis on the rents that are accrued from the multinational oil companies but also the development of competent domestic-based firms that leverage on the domestic capabilities to integrate the oil and gas value chain.
- c. The nascent oil and gas economies must also create a synergy between the domestic and international supply firms so as to develop competence in terms of price, quality and delivery within the domestic industry.
- d. The nascent oil and gas economies must understand that the oil and gas industry is characterized by highly sophisticated technology. Hence, they must invest in technology development and capabilities, through educational programmes in tertiary institutions. Furthermore, through shadowing schemes between foreign and local experts.
- e. The fact that Kenya, Uganda and Tanzania are nascent oil and gas economies, the local content policy is 'protective' in nature. The policy creates a deliberate preference for domestic firms in terms of goods and services. These economies must take note that the oil and gas industry is an industry intertwined with global value chains. The industry's main customers and investors are not found in the domestic market. Having strong protective measures, through local content policies, will inadvertently delay further investment in the sector. Secondly, multinational oil companies are not found in transferring technology to domestic firms the governments must devise means that develop these capabilities faster and not being dependent on the foreign investors.
- f. The nascent oil and gas economies must take note that the discovery of their resources is during the wake of the clean energy wave. With

the pandemic outbreak of the Coronavirus, that has brought about massive fatalities to human life, but the lockdown provision has exhibited what a cleaner world could be. The foreign investors will rush into renewable energy, and this might leave stranded resources in Kenya, Uganda and Tanzania. Hence, the local content policies must be adopted not for developing capabilities in the extractive industry but also the renewable energy industry.

In essence, Kenya, Tanzania and Uganda must understand that local content policies are not only developed through protective mechanisms that develop infant domestic industries. But rather through the dynamic and peculiar development industrial and technological development that involves the clustering, synergy and cooperation of different actors within the East African region. This cooperation mainly facilitated the domestic knowledge base, leading international competence through regional mechanisms, so as to enhance the competitiveness of the domestic firms relative to the foreign firms.

10.8 Creating a Regional Content Policy for the Oil and Gas Industry in East Africa

East Africa must approach local content policy as a regional issue that can facilitate domestic industry integration without negatively affecting the market forces by attempting to be stringent. East African countries are members of the East African Community (EAC), they have also ratified the African Continental Free Trade Area (Acfta), the Common Market Eastern and Southern Africa Community (COMESA) and the Southern Africa Democratic Cooperation (SADC).⁷² Through the tools of these vast regional agreements such as the Business Council of the EAC, the Educational policies in SADC and the synergy towards the

⁷²Langston, Charles A., Andrew A. Nyblade, and Thomas J. Owens. "Regional wave propagation in Tanzania, East Africa." *Journal of Geophysical Research: Solid Earth* 107.B1 (2002): ESE-1.

African Union Mining Vision that facilitates regional value chains in between African countries, and the Common Market Protocol that facilitates the free movement of the domestic workforce within the East African region, a regional content policy can be created for the efficient and effective domestic integration into the nascent oil and gas industry.

A regional content policy in East Africa would facilitate the creation of regional linkages that could pool talent in the region, making the countries operate on larger economies of scale. This can be through a regional procurement scheme that would standardize goods and services at an internationally competitive price, quality and delivery.⁷³ The regional content policy will also address institutional failure, countries like Kenya, Tanzania and Uganda that are 'party states' have a tendency of regulatory capture due to lack of transparency and heavy infiltration of corruption in governmental institutions.⁷⁴ The move of regulating local content policies from a national to a regional scale creates an accountability sentiment due to the increased numbers of stakeholders.

The thought of developing a regional content policy in East Africa must sound absurd and ambitious, since the cooperation of Kenya, Tanzania and Uganda has ever collapsed in the 1970 s. The collapse of the first East African Community was mainly due to different ideologies that were the underpinning framework of governance at the time, Kenya and Uganda were capitalistic countries while Tanzania was a socialist country this led to clashes within the interests of the region.⁷⁵ Furthermore, Kenya was accused of having the lion's share of the EAC by Tanzania and Uganda; such accusations led to the break-up of the first EAC.⁷⁶ But currently, the new EAC has more members not only Tanzania, Kenya and Uganda but also South Sudan, Rwanda and Burundi. Furthermore, East Africa has currently developed infrastructure on a regional scale such as the East African Crude Oil Pipeline and the

⁷³Los, Bart, Marcel P. Timmer, and Gaaitzen J. de Vries. "How global are global value chains? A new approach to measure international fragmentation." *Journal of Regional Science* 55.1 (2015): 66–92.

⁷⁴Lodge, Tom. "Corruption in African Politics." *Oxford Research Encyclopedia of Politics* (2019).

⁷⁵Cooksey, Brian. "Tanzania and the East African Community: A comparative political economy." Discussion Paper 186, European Centre for Development Policy Management, Maastricht (2016).

⁷⁶Ibid.

Lamu Port and Lamu-Southern Sudan-Ethiopia Transport Corridor such projects are vital for the region's growth.

Thus a regional content policy should identify the stakeholders, create a platform for stakeholder engagement, adopt, synchronize and harmonize local content policies into the region, compare and contrast the regional content policy from international best practice as well as developing a regional content unit that evaluates and monitors regional content development in the East African region. A regional content policy is the best local content policy option for Kenya, Tanzania and Uganda; the policy is more principle-based and non-protectionist against foreign investors.

10.9 Conclusion

The Norwegian and Brazilian domestic economy have similar features in that they can absorb the foreign direct investment from the oil and gas industry and efficiently leverage their competitive advantages for the development of the whole economy. Due to the high demand of governmental control especially when oil and gas prices in the international market both Norway and Brazil created national oil companies that had the monopoly share of the market, both countries introduced local content policies as a means of governmental control and intervention into the oil and gas sector, both countries advocated for provisions for the training of domestic workforce as well as technology transfer from foreign investors to domestic suppliers. However, the policy design was dependent on the individual Country's ability to enforce and monitor the policy as well as the peculiar conditions prevailing in the domestic economy, and this has been a pivotal aspect in local content success in both Norway and Brazil.

It should be noted that leading local content countries such as Nigeria and Angola who have been the pioneers in the oil and gas industry in Sub-Saharan Africa (SSA) have truly failed to implement credible policies such as those of Norway and Brazil regardless of the fact that all these

countries are mature oil and gas producers. The main reason for local content policy failure in SSA is the 'transferist' aspect, whereby policies are transferred from mature developed economies and implemented in a 'copy-paste' manner in developing countries such as Kenya, Tanzania and Uganda without taking into consideration the prevailing circumstances staging these policies for immediate failure from their inception in the oil and gas industry. For example, the Norwegian or Brazilian local content model is neither technically nor politically adaptable in Tanzania, Kenya and Uganda since the countries do not face similar problems. Norway and Brazil had a strong shipping industry prior to the discovery of the oil and gas resources, the skills and capabilities from the shipping industry could be leveraged on the oil and gas industry unlike Kenya, Tanzania and Uganda where the driving industry has been agriculture, and the skills from this sector are not transferable to the sophisticated capital-intensive oil and gas sector. Though Kenya, Tanzania and Uganda must adopt the policy design from Norway and Brazil, they must not adopt the policy in 'one-size fits all' approach but the countries must synchronize and harmonize the policy to the prevailing domestic circumstances.

Since Kenya, Tanzania and Uganda do not have the absorptive capacity to integrate the oil and gas industry, the countries should adopt a regional content policy, which will create stronger regional value chains. The regional value chain will solve the current bottlenecks such as access to finance, development of particular technologies as well as create a conducive climate in the region to attract further investment in the sector as well as maintain intra- and inter-regional trade within the members of the EAC that will further develop downstream and upstream linkages. Hence countries such as Kenya, Tanzania and Uganda must consider using regional integration initiatives as a means of developing their domestic economies, promoting industrialization as well as gaining a competitive advantage against the multinational oil and gas companies.

Most importantly, as emphasized in this chapter, with respect to energy transitions and local content, the nascent oil and gas economies must take note that the discovery of their resources is during the wake of the clean energy wave. With the pandemic outbreak of the Coronavirus, that has brought about massive fatalities to human life, but the lockdown provision has exhibited what a cleaner world could be. The

foreign investors will rush into renewable energy, and this might leave stranded resources in Kenya, Uganda and Tanzania. Hence, the local content policies must be adopted not for developing capabilities in the extractive industry but also in the renewable energy industry.

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11

Social Licence to Operate in the Energy Transition Era: Case Study of the East African Oil and Gas Sector

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Video interview by the author discussing this book chapter can be accessed at, <https://www.youtube.com/watch?v=yuig1CtyxxE&t=637s>. Last accessed on 1st September 2020.

11.1 Introduction to Social Licence to Operate

The Social Licence to Operate (SLO), has been defined as existing when a project has ongoing approval within the local community and other

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stakeholders.¹ Although mostly common in the extractive industry, SLO is relevant in other energy sectors including renewables. Following the adoption of the 2015 Paris Agreement, many countries across the globe are embracing clean energy sources such as renewables as a way of not only tackling energy access challenges but also climate change.² Nevertheless, with the anticipated industrialization and urbanization in Africa, the oil and gas sector still has a crucial role to play on the African continent and as such concepts such as SLO ought to be given much attention in this energy transition era.³ Additionally, the principles concerning SLO in the oil and gas sector are also relevant to clean energy such as renewables. In this respect therefore a discussion on SLO in the oil and gas sector is relevant to clean energy sources such as solar and wind.

Basically, SLO is defined as an intangible, informal and non-permanent right wielded by the community of relevant stakeholders.⁴ This right may be granted, withdrawn or subject to change as new information about the project is acquired. It is usually granted on a project-specific basis, meaning that a company may have a social licence for one operation but not for another. The SLO must, therefore, be earned and then maintained. Earning an SLO often involves building social capital over time in a process that is also known as ‘community building’, ‘capacity building’ and ‘institutional strengthening’.

Generally, it may be considered as a two-tier right. At the lower level of acceptance, the consent granted is sufficient to allow a project to

¹“The Social Licence to Operate”. 2019. Sociallicense.Com. <https://sociallicense.com/definition.html>.

Robert G Boutilier and Ian Thomson, ‘The Social License to Operate’ (Sociallicense.com, 2018). <https://sociallicense.com/definition.html>, accessed May 27, 2020.

²Nalule, V.R., 2018. Energy Poverty and Access Challenges in Sub-Saharan Africa: The Role of Regionalism. Springer.

³Nalule, V.R., 2020. Transitioning to a Low Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels? In *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions* (pp. 261–286). Palgrave Macmillan, Cham.

⁴Boutilier, Robert G., and Ian Thomson. 2019. Modelling and Measuring the Social Licence to Operate: Fruits of a Dialogue Between Theory and Practice. <https://sociallicense.com/publications/Modelling%20and%20Measuring%20the%20SLO.pdf>.

Robert G. Boutilier and Ian Thomson, ‘Modelling and Measuring the Social License to Operate: Fruits OF a Dialogue Between Theory and Practice’ (Sociallicense.com). <https://sociallicense.com/publications/Modelling%20and%20Measuring%20the%20SLO.pdf>, accessed May 27, 2020.

proceed and enjoy a quiet relationship with its neighbours, while at the higher level of approval, the consent is more enduring and facilitates more benefits accruing for all stakeholders. The ‘community of relevant stakeholders’, includes the participation of groups or organizations that might not be part of a geographic community that are either affected by the operation or that can affect the operation.⁵ In practice: the absence of legitimacy leads to rejection of a project, while the presence of legitimacy and credibility leads to acceptance of a project. At a high level of credibility, the presence of trust is the basis for approval. The most significant level of SLO, co-ownership, can only occur when a high level of trust is present.⁶

In East Africa, like many developing countries, there has been a shift from purely economic-driven development, and SLO has become a significant factor for governments, communities and oil and gas companies. There are significant examples of oil and gas operations that have been setback in East Africa because of inadequate consideration of SLO issues. For instance, in Kenya, Tullow Oil, a UK-based oil company, faced SLO issues in 2018 after the official launch of the Early Oil Pilot Scheme by the Government of Kenya which led to the stalling of oil trucking operations for almost two months.⁷

In Uganda, the five major oil projects in play—Tilenga; Kingfisher; the East African Crude Oil Pipeline; the Kabaale Industrial Park; and the Hoima–Kampala Petroleum Products Pipeline—require significant infrastructure development.⁸ This, in turn, demands the considerable acquisition of land from the communities which surround project sites.

⁵“The Social Licence To Operate”. 2019. Sociallicense.Com. <https://sociallicense.com/definition.html>.

Robert G Boutilier and Ian Thomson, ‘The Social License to Operate’ (Sociallicense.com, 2018). <https://sociallicense.com/definition.html>, accessed May 27, 2020.

⁶Boutilier, Robert G., 2014. “Frequently Asked Questions About the Social Licence to Operate”. *Impact Assessment and Project Appraisal* 32 (4): 263–272. <https://doi.org/10.1080/14615517.2014.941141>.

⁷Senelwa, Kennedy. 2018. “Kenya Oil Trucking to Resume on August 22”. *The East African*, 2018. <https://www.theeastafrican.co.ke/business/Kenya-oil-trucking-to-resume-on-August-22/2560-4710984-ewju0t/index.html>, accessed May 23, 2020.

⁸Ogwang T, and Vanclay F, ‘Social Impacts of Land Acquisition for Oil and Gas Development in Uganda’ (Ideas.repec.org, 2019). <https://ideas.repec.org/a/gam/jlands/v8y2019i7p109-d246589.html>, accessed May 21, 2020.

It is expected that they will require the acquisition of approximately 115,000 hectares of land which will displace nearly 15,000 people.⁹ The potential and actual social impact of these projects on the local communities include increased levels of poverty; conversion of agricultural land to industrial purposes thereby increasing food insecurity; the disintegration of social and cultural cohesion; increased social inequalities between men and women in terms of access to the economic benefits of land sale (which is the compensation following land acquisition) and inflation in the cost of goods.¹⁰ The influx of economic immigrants into communities is viewed by the local people as a threat to their survival due to increased competition for limited job opportunities. Further, since most land is communally owned, there are significant social tensions within communities about how land may be kept for viable agricultural production, which is the primary source of livelihood for rural communities.¹¹

In Tanzania, following the discovery of a natural gas field off the coast at Mtwara, escalating community unrest and violent riots by Mtwara residents in response to the proposed gas pipeline between Mtwara and Dar es Salaam led to the unfortunate loss of life.¹² Case studies relating to SLO in East Africa will be discussed in Sect. 11.2 of this Paper and the various reasons for community pushback highlighted further.

Consequently, the changing societal expectations have influenced the way oil and gas sector operations are conducted globally. As has been alluded to, communities are increasingly demanding more involvement in decision-making around such operations; they have expectations of receiving a greater share of the benefits from these operations and require assurances that the international oil and gas companies and other industry participants involved are appropriately regulated. There

⁹Ibid.

¹⁰Ogwang T, and Vanclay F, 'Social Impacts of Land Acquisition for Oil and Gas Development in Uganda' (Ideas.repec.org, 2019). <https://ideas.repec.org/a/gam/jlands/v8y2019i7p109-d246589.html>, accessed May 21, 2020.

¹¹Ibid.

¹²'Tanzania Mtwara Gas Riots: 'Pregnant Woman Killed' (BBC News, 2013) <https://www.bbc.com/news/world-africa-22652809>, accessed May 18, 2020.

has been an evolution from the voluntary application of different categories of industry standards to the application of legally binding SLO requirements which are stakeholder-led and mandated by statute.

In response to the trend, East African governments have attempted to provide for issues concerning SLO in their sector legislation. For instance, in all the East Africa environmental legislation, environmental impact assessment (EIA) studies are required to include aspects of social impact assessment and are also required to include public participation by affected stakeholders. In Kenya, the new Petroleum Act 2019 requires oil and gas licensees to include comprehensive community development plans in their project development plans.¹³ The Petroleum Act, 2015 of Tanzania introduced guidelines that require companies to obtain an SLO to operate.¹⁴ These and other legislative interventions will be discussed in Sect. 11.3 of this Paper.

The main challenge with the laws on SLO in East Africa is that generally, the legislation is fairly recent, and regulations are still being formulated. Further, there is insufficient enforcement caused by insufficient financial resources and governance issues. As such, companies in the private sector are increasingly implementing corporate social responsibility (CSR) programmes geared towards achieving SLO. There is also increasing pressure on companies and Government from non-governmental organizations (NGOs), international organizations and private sector member organizations. For instance, in 2007, the World Bank Group published its Environmental, Health and Safety Guidelines (WB-EHS Guidelines) for reference on technical issues during project appraisal. The WB-EHS Guidelines apply to all World Bank-funded projects and are technical reference documents with general and industry-specific examples of Good International Industry Practice. The WB-EHS Guidelines have a detailed section on community health and

¹³'The Petroleum Act, 2019' (Kplc.co.ke, 2019). https://kplc.co.ke/img/full/WiUDxtboLpSw_Petroleum%20Act%202019.pdf, accessed 18 May 2020.

¹⁴'The Petroleum Act, 2015' (Teiti.or.tz, 2015). <http://www.teiti.or.tz/wpcontent/uploads/2014/03/The-Petroleum-Act-2015.pdf>, accessed 18 May 2020.

safety.¹⁵ In addition, in 2012, the International Finance Corporation (IFC) published eight (8) performance standards (the IFC Performance Standards), applicable to all projects funded by the IFC.¹⁶ Four (4) of the IFC Performance Standards deal directly with community SLO issues and include standards for community health, safety and security; and safety, land resettlement, indigenous peoples and cultural heritage. Other interventions have been benchmarked against leading international standards, including the United Nations Sustainable Development Goals (SDGs), the Rio Declaration and the Global Reporting Initiative. These will be discussed further in Sect. 11.4 of this Paper.

To conclude, as a concept, the social licence to operate is concerned with having the activities undertaken by a company accepted by the stakeholders, both the host community and those affected by the project. This is particularly relevant in the oil and gas sector due to the potential impact of projects on the life of the communities as well as on the environment. Neither obtaining formal licences nor meeting regulatory requirements is enough to facilitate the smooth running of operations by investor companies. Indeed, hostile pushback by the communities has been experienced even where companies have complied with the legal and regulatory formalities.

The aim of this paper is to provide a detailed study of SLO in the oil and gas sectors in 3 East African countries: Kenya, Tanzania and Uganda, with a view to determining whether SLO issues are adequately addressed in the oil and gas sectors in East Africa, and what if any further steps need to be taken. Section 11.1 has introduced the concept of SLO. Section 11.2 of this paper analyses the economic status of the 3 East African countries, and the current state of each country's oil and gas sector. The section will also analyse oil and gas projects in the three countries that have been affected by SLO. Section 11.3 reviews the laws and regulations governing oil and gas in East Africa, and their provisions

¹⁵"World Bank's EHS Guidelines". 2007. Ifc.Org. https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines, accessed January 6, 2020.

¹⁶"IFC Performance Standards". 2019. Ifc.Org. https://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Sustainability-At-IFC/Policies-Standards/Performance-Standards, accessed January 6, 2020.

relating to SLO. The section also discusses the administrative institutions that are responsible for oil and gas regulation in the countries and their role in fostering SLO. Section 11.4 analyses the private sector and international organizations efforts to achieve SLO, especially in situations where laws are lacking or wanting. Section 11.5 of this Paper offers a conclusion on whether SLO issues are adequately addressed in the oil and gas sectors in East Africa, and whether any further steps need to be taken.

11.2 The State of Oil and Gas and SLO in East Africa

In this section, we provide an economic background of oil and gas in the 3 East Africa countries of Kenya, Tanzania and Uganda. The section also analyses examples of oil and gas projects that have been affected by SLO in East Africa and demonstrate that failing to secure SLO can have a significant impact on a company including widespread public criticism, social conflict and costly damage to company reputation.

11.2.1 SLO Issues in Oil and Gas in Kenya

Kenya is the largest economy in the East Africa Community (EAC) in terms of gross domestic product (GDP), and the country has positioned itself as a major economic power in Sub-Saharan Africa.¹⁷ In 2012, the first commercially viable oil discovery was made. An estimate of over 4 billion barrels of crude oil reserves and 750 million barrels of recovery oil have been encountered in the Lokichar sub-basin by Tullow Plc and its partners.¹⁸

¹⁷In April 2018 the IMF estimated that the Kenyan economy would expand by 5.5% in 2018 and 6% in 2019, compared to 4.8% in 2017—Oxford Business Group. 2018. “The Report: Kenya 2018”. <https://oxfordbusinessgroup.com/kenya-2018>, accessed May 27, 2020.

¹⁸“Upstream—National Oil Corporation of Kenya”. 2019. Nationaloil.Co.Ke. <https://nationaloil.co.ke/upstream/>.

‘Upstream—National Oil Corporation of Kenya’ (Nationaloil.co.ke). <https://nationaloil.co.ke/upstream/>, accessed May 27, 2020.

Though commercial production has not commenced, Kenya launched its Early Oil Pilot Scheme (EOPS) in June 2018 in a bid to test demand in the international market. The Scheme entails the road transportation of stored crude oil drawn from the testing oil wells at a production rate of 2,000 barrels of oil per day over two years and then transported by truck over 1,000 kilometres from Northern Kenya south to the Coastal port of Lamu. However, within three weeks of the euphoric flagging-off of EOPS in June 2018, community members blocked trucks from transporting oil from the Ngamia 8 site in Lokichar.¹⁹ They held violent protests over several issues including job opportunities, the award of tenders, insecurity and the community's share of proceeds from the oil. This led to the suspension of operations, evacuation of critical staff by the Operator (Tullow Oil) for an almost 7-week period and substantial financial losses for the Government, estimated at approximately USD 40 million. The impasse between the community and the investor was eventually resolved, in part due to timely intervention by the Government and the gazettelement on August 7, 2018, of the Turkana Grievances Management and Inter-Ministerial (Escalation and Support) Committee, whose mandate is to facilitate engagement with the local community with a view to providing collaborative solutions to any emerging issues associated with EOPS.²⁰

11.2.2 SLO Issues in the Natural Gas Sector in Tanzania

Tanzania is a natural gas producer. Though Tanzania is not an oil producer, it aims to boost investment in cross-border pipeline transport for Uganda's oil, Uganda being a landlocked oil producer. In May 2017,

¹⁹Senelwa, Kennedy. 2018. "Kenya Oil Trucking to Resume on August 22". The East African, 2018. <https://www.theeastafrican.co.ke/business/Kenya-oil-trucking-to-resume-on-August-22/2560-4710984-ewju0t/index.html>, accessed May 27, 2020.

²⁰Senelwa, Kennedy. 2018. "Kenya Oil Trucking to Resume on August 22". The East African, 2018. <https://www.theeastafrican.co.ke/business/Kenya-oil-trucking-to-resume-on-August-22/2560-4710984-ewju0t/index.html>, accessed May 27, 2020.

Tanzania and Uganda signed an intergovernmental agreement (IGA) for the construction of the East African Crude Oil Pipeline (EACOP).²¹

EACOP will transport crude oil from Uganda's oil fields to the Tanga port in Tanzania. The Project partners comprise of the Tanzania Petroleum Development Corporation (TPDC), the Uganda National Oil Corporation (UNOC), France's Total, China's CNOOC and the UK's Tullow Oil. The proposed Uganda–Tanzania pipeline will be 1,443 km long and will cost about USD 3.55 Billion. It will have the capacity of carrying 200,000 barrels per day.²²

However, the project has suffered delays, including most recently, a suspension due to a stalled sale of Tullow's stake to Total and CNOOC. The delay in the stake sale has been caused by a tax dispute with the Government of Uganda.²³

In natural gas, operations occur in the areas of Mtwara and Lindi. A total of 67 wells for both exploration and development were drilled between 1952 and 2013. Five (5) oil and gas companies are undertaking onshore and offshore natural gas exploration activities in Tanzania. These are Ophir Energy, BG Group (BP), Equinox, Exxon Mobil and Aminex. Natural gas annual production increased from 5.2 billion cubic feet (BCF) in 2006 to 35.1 BCF in 2013. Most of the natural gas is used domestically for electricity generation.²⁴ Natural gas is a cleaner form of energy than petroleum or coal. Further, in 2015, it was estimated that

²¹“Tanzania And Uganda IGA”. 2017. Eacop.Com. <http://eacop.com/publication/view/uganda-and-tanzania-sign-inter-governmental-agreement-for-crude-oil-pipeline/>, accessed May 27, 2020.

‘Joint Press Statement—Uganda And Tanzania Sign Inter-Governmental Agreement For Crude Oil Pipeline’ (eacop.com, 2017). <http://eacop.com/publication/view/uganda-and-tanzania-sign-inter-governmental-agreement-for-crude-oil-pipeline/>, accessed May 27, 2020.

²²“EACOP Overview”. 2017. Eacop.Com. <http://eacop.com/unlocking-east-africas-potential/>. ‘Unlocking East Africa’s Potential—EACOP’ (Eacop.com). <http://eacop.com/unlocking-east-africas-potential/> accessed May 27, 2020.

²³Reuters. 2019. “Ugandan Oil Pipeline Plan Suspended Due to Collapse of Tullow-Total Deal”, 2019. <https://www.reuters.com/article/us-total-tullow/ugandan-oil-pipeline-plan-suspended-due-to-collapse-of-tullow-total-deal-idUSKCN1VP1WW>, accessed May 27, 2020.

²⁴“Gas—Tanzaniainvest”. 2019. Tanzaniainvest. <https://www.tanzaniainvest.com/gas>, accessed January 6, 2020.

Tanzania saved about USD 6.5 Billion after moving from heavy fuel oil (HFO) and diesel to natural gas to generate electricity.²⁵

As of March 2016, the discovered reserves of natural gas in Tanzania amounted to 57.25 trillion standard cubic feet (TCF).²⁶ There is a current proposal for a two-train liquefied natural gas (LNG) export facility in Lindi, Tanzania, involving a consortium of Norway's Equinox, Royal Dutch Shell, ExxonMobil, UK-based Ophir Energy and Singapore's Pavilion Energy. However, as of November 2019, the parties were still yet to sign an agreement with the Tanzanian Government, with the Government citing that it wished to negotiate a favourable commercial deal that would not be costly or loss-making for the country. Tanzania has no commercial oil discoveries and is a net importer of petroleum products. It is estimated by the US Energy Information Administration (US EIA) that Tanzania consumes about 35,000 barrels of oil per day of refined oil products.²⁷

Currently, natural gas from Mtwara and Lindi is transported from Mtwara through Somanga to the Ubungu electricity generation plant in Dar es Salaam through a gas pipe with a capacity of 8.1 cubic metres per year which is owned and managed by Gas Supply Company (GASCO) Ltd. Prior to the construction of the pipeline in late 2013, there were mass violent protests by community stakeholders challenging the entry of this project resulting in damage of approximately USD 650,000²⁸

²⁵ESI Africa. 2018. "Tanzania: Use of Natural Gas Can Boost Economic Growth", 2018. <https://www.esi-africa.com/industry-sectors/business-and-markets/tanzania-use-of-natural-gas-can-boost-economic-growth/>, accessed May 27, 2020.

²⁶Ng'wanakilala, Fumbuka. 2017. "Tanzanian President Splits Energy and Mining in Ministry Shake-Up". Reuters, 2017. <https://af.reuters.com/article/topNews/idAFKBN1CC0BF-OZATP>, accessed May 27, 2020.

²⁷"Tanzania—EIA Analysis". 2016. Eia.Gov. <https://www.eia.gov/beta/international/analysis.php?iso=TZA>.

"Tanzania—International—Analysis—US Energy Information Administration (EIA)" (Eia.gov, 2016).. <https://www.eia.gov/beta/international/analysis.php?iso=TZA> accessed May 27, 2020.

²⁸<https://www1.oanda.com/currency/converter/>.

and the loss of life.²⁹ The substance of the discontent by the community stakeholders was that there was a history of unfair and exploitative resource extraction in the region. Specifically, the residents of the region were protesting the fact that they would not benefit from a government budget proposal in the financial year 2013/2014 to construct the pipeline. Residents, therefore, wanted a more significant share of the benefits from gas development.³⁰ The stakeholder perspective was that the Mtwara gas project was introduced in a 'top-down' manner which initially ignored the land tenure of the community as well as the authority and function of the local leadership.³¹ There were concerns about the lack of transparency on the various social and economic impacts of the project on the lives of the locals citing the lack of effective pathways for communication between the Government, private stakeholders and the project-affected communities. In light of previous gas activity in the region, the people felt that there had been a severe case of historical neglect by the national Government over time and were also disgruntled by the fact that they had seen very little gas project-related employment opportunities, women's income-generating activities and social service infrastructure.³²

The riots subsequently forced Tanzania's parliament to postpone debate on the budget proposals in order to consider the community views.³³ In the end, political leaders, company representatives and other stakeholders in the project had to make deliberate efforts to adhere to

²⁹R. Kamat V and others, 'Natural Gas Extraction and Community Development in Tanzania: Documenting The Gaps Between Rhetoric And Reality' (Cirdi.ca). https://cirdi.ca/wp-content/uploads/2019/07/Natural_gas_extraction_and_development_Tanzania.pdf, accessed May 18, 2020.

³⁰Ibid.

³¹Because of the lack of consultative forum, the District Council was more of a recipient of instructions from TPDC and the Ministry of Energy and Minerals than a partner in local development.

³²R. Kamat V and others, 'Natural Gas Extraction and Community Development in Tanzania: Documenting The Gaps Between Rhetoric And Reality' (Cirdi.ca). https://cirdi.ca/wp-content/uploads/2019/07/Natural_gas_extraction_and_development_Tanzania.pdf, accessed May 18, 2020.

³³Ng'wanakilala, Fumbuka. 2013. "Tanzanian Gas Pipeline Plan Sparks Riot-Government Officials". Reuters, 2013. <https://uk.reuters.com/article/tanzania-riots/tanzanian-gas-pipeline-plan-sparks-riot-government-officials-idUKL6N0E33YE20130522>, accessed May 27, 2020.

the principles of social and distributive justice, which led to legislative reforms. The legislative reforms are discussed in Chapter 3.

11.2.3 SLO Issues in Oil and Gas in Uganda

Commercial discovery of oil in Uganda was made in 2006 with about 6.5 billion barrels of oil reserves and 1.4 billion barrels estimated to be economically recoverable.³⁴ The major players in the oil and gas market are France's Total E&P Uganda, the UK's Tullow Uganda Operations Pty Limited and China's China National Offshore Oil Corporation (CNOOC).³⁵ Uganda is landlocked, and for the export of oil, Uganda entered into an IGA with Tanzania on May 19, 2017, for the construction of the 1,443 km EACOP crude oil pipeline from Hoima in Ugandan to the port of Tanga in Tanzania.³⁶

In terms of SLO, there have been conflicts between the Tullow Oil/TOTAL joint venture (investors) and the local community around the Lake Albert Rift Basin. Broadly, these issues have involved land grabbing, population displacement, lack of/inadequate compensation, violations of human rights, pollution and threat to wildlife. Since the commencement of petroleum operations in the region, there have been various incidences of community unrest demonstrated through: blockades; lawsuits and other forms of judicial activism; objections to the Environmental Impact Assessment; street protests and refusal of compensation.³⁷ Further, local residents were pushing for compensation for the problems caused by the waste dumping in the local game park and in inhabited areas. There has also been conflict between oil extraction

³⁴The bulk of the discovery is located mostly in Albertine Graben, in Uganda's western border with the Democratic Republic of the Congo.

³⁵'Uganda—Oil and Gas | Export.Gov' (Export.gov, 2019). <https://www.export.gov/article?id=Uganda-Oil-and-Gas>, accessed May 27, 2020.

³⁶This is discussed in detail in the Tanzania section above.

³⁷EJAtlas. 2015. "Oil Exploitation Conflict in Buliisa District, Uganda | EJAtlas". Environmental Justice Atlas. <https://ejatlas.org/conflict/land-acquisition-conflict-and-waste-dumping-in-buliisa-district>.

'Oil Exploitation Conflict in Buliisa District, Uganda | Ejabat' (Environmental Justice Atlas, 2015). <https://ejatlas.org/conflict/land-acquisition-conflict-and-waste-dumping-in-buliisa-district>, accessed January 6, 2020.

and wildlife due to the fact that the Albertine region houses ten of Uganda's twenty-two national parks and protected game reserves, such as Murchison Falls National Park.³⁸ This community resistance has significantly contributed to the fact that Uganda has not yet commenced crude production more than ten years after discovery.

It is noteworthy that as at the time of this publication, Tullow had exited the Uganda project by selling the entirety of its stake to TOTAL for USD 575 million, as it strives to raise USD 1 billion in 2020 in order to reduce its USD 2.8 billion of debt.³⁹

11.3 East African Oil and Gas Laws in Relation to SLO

In a continuing effort to encourage SLO so as to foster projects for economic development, the East African governments have formulated new laws and institutional directives which specifically provide for aspects of SLO, such as prior and informed consent, mandatory legislated corporate social responsibility (CSR), community development agreements and programmes, local content requirements, among others. This section provides a background of the laws relevant to aspects SLO in the three (3) East African countries and the institutional directives that have been formulated to enforce corporate and Government responsibility to enforce SLO.

11.3.1 Kenya's Oil and Gas Laws and SLO

The recognition of community and stakeholder rights in the oil and gas sector was introduced in the 2010 Constitution of Kenya.⁴⁰ Articles 10

³⁸Ibid.

³⁹Nasralla S, 'Tullow Exits Uganda Project, Sells Stake to Total For \$575 Million' (reuters.com, 2020). <https://www.reuters.com/article/us-tullow-m-a-total/tullow-exits-uganda-project-sells-stake-to-total-for-575-million-idUSKCN2250KD> accessed May 18, 2020.

⁴⁰"Kenya Law: The Constitution of Kenya". 2019. Kenyalaw.Org. <http://kenyalaw.org/kl/index.php?id=398>, accessed May 27, 2020.

and 12 of the Constitution provide for a general right to public participation and access to information. Under Article 62 (3), minerals and mineral oils form part of sections of Public Land that is vested in the National Government for the People of Kenya, and the Public Land is administered by the National land Commission. Under Article 71, agreement relating to natural resources, which include minerals and mineral oils, require Parliamentary ratification.

The Kenyan Petroleum Act, 2019 relates to upstream oil and gas operations (exploration and extraction) and was enacted in March 2019, repealing the old 1984 Petroleum (Exploration and Development) Act Cap 308.⁴¹ As relates to SLO, Section 25 provides that the community is to be permitted adequate opportunity to participate in the process of reviewing and awarding permits. Section 125 provides that the community shall have the right to: be educated and sensitized on petroleum operations in their county or sub-county; be informed prior to the carrying out of any upstream petroleum operations; inquire and interrogate planned petroleum activities that affect their ecosystem; and participate in the planning of corporate social responsibility projects by the contractor in consultation with the national and county governments. Under Section 126, the Cabinet Secretary for Petroleum is required to make regulations in relation to the above. Regulations are under development. Under Section 58, petroleum revenues are to be shared as follows: 75% to the National Government; 20% to the County Government and 5% to the Community.

The Kenyan Energy Act, 2019 relates to downstream petroleum operations (distribution). The Energy Act 2019 was also enacted in March 2019 and replaced the Energy Act 2006. Section 9 of the Energy Act 2019 establishes the Energy and Petroleum Regulatory Authority (EPRA), which replaced the Energy Regulatory Commission under the old Energy Act. The Kenyan EPRA is also charged with the regulation of upstream petroleum operations under Section 3 of the Petroleum Act 2019.⁴²

⁴¹“EPRA Statute Downloads”. 2019. Kenya EPRA. <https://www.epra.go.ke/downloads/>.

‘Downloads—Energy and Petroleum Regulatory Authority’ (Energy and Petroleum Regulatory Authority). <https://www.epra.go.ke/downloads/>, accessed May 27.

⁴²*Ibid.*

The petroleum legislation in Kenya explicitly references the regulatory requirements set out by the Environmental Management and Coordination Act (EMCA) 1999 and the Regulations thereunder. The EMCA requires public participation in conducting EIAs for projects. Further, under the Kenya Climate Change Act of 2016 (Section 20) NEMA is required to integrate climate change risk and vulnerability assessment in all forms of EIA.⁴³

The Kenya Public Participation Bill 2018, which is not yet enacted into law, is also critical in ensuring the acquisition of SLO. It refers to the democratic process of having an open, accountable and structured dialogue where citizens or people or a segment of a community can interact, exchange views and influence decision-making. It should however be noted that the Public Participation Bill has been in draft since 2015.⁴⁴ Kenya also has a draft Local Content Bill 2018, which affects SLO by requiring local content participation in all development sectors, including the oil and gas industry.⁴⁵ Further, in addition to picketing, communities which have not provided SLO and have complaints and/or concerns about projects have used legal redress to express their grievances.

11.3.2 Tanzania's Oil and Gas Laws and SLO

In Tanzania, the Petroleum Act 2015, the Tanzania Extractive Industry (Transparency and Accountability) Act 2015 and the Oil and Gas Revenues Management Act 2015 are the overarching legislation. The

⁴³“Kenya Climate Change Act”. 2016. Environment.Go.Ke. http://www.environment.go.ke/wp-content/uploads/2018/08/The_Kenya_Climate_Change_Act_2016.pdf.

⁴⁴“The Climate Change Act, 2016” (Environment.go.ke, 2016). http://www.environment.go.ke/wp-content/uploads/2018/08/The_Kenya_Climate_Change_Act_2016.pdf, accessed May 27, 2020.

⁴⁴Mariru, Patrick. 2015. “What About Public Participation? Where Are We?”. International Institute for Legislative Affairs. <https://ilakenya.org/what-about-public-participation-where-are-we/>.

Patrick Mariru, ‘What About Public Participation? Where Are We?’ (International Institute for Legislative Affairs). <https://ilakenya.org/what-about-public-participation-where-are-we/>, accessed May 27, 2020.

⁴⁵“Kenya Local Content Bill”. 2018. Parliament.Go.Ke. <http://www.parliament.go.ke/sites/default/files/2018-11/Local%20content%20Bill.pdf>, accessed May 27, 2020.

Acts update and consolidate existing legislation for the oil and gas sector and repealed two Acts: the Petroleum (Exploration and Production) Act 1980, covering upstream petroleum operations; and the Petroleum Act 2008, covering mid and downstream petroleum supply operations.

The Tanzania National Energy Policy 2015 notes that public expectations have increased after the discovery of deep-sea natural gas, yet there is a long-time lag between petroleum discovery and conversion of such discovery into monetary terms. The National Energy Policy recommends that there should be sensitization to critical stakeholders, NGOs, community groups, activists, media and the general public. There is also recognized a need for oil and gas companies to play an active role in the communities surrounding petroleum operations through CSR programmes.⁴⁶

Other Tanzanian legislation that foster SLO efforts in Tanzania's petroleum sector include the Environmental Management Act 2004 and the Regulations thereunder. Section 7 of the Environmental Management Act 2004 espouses the principle of public participation in environmental planning and other matters. Section 17 requires there to be public participation in the making of environmental policies and Sects. 89 and 90 require public participation in EIA studies including notifications of the EIA process in public media, and the holding of public hearings.⁴⁷

The government entities relevant to the Tanzania oil and gas sector include the Petroleum Upstream Regulatory Authority,⁴⁸ which was created in 2015 to manage upstream affairs, and the Energy and Water Utilities Regulatory Authority,⁴⁹ the midstream and downstream regulator. The state's national oil company, Tanzania Petroleum Development

⁴⁶"Tanzania Ministry of Energy". 2019. Nishati.Go.Tz. <https://www.nishati.go.tz/en/>.

'Ministry of Energy—The Republic of Tanzania' (Nishati.go.tz). <https://www.nishati.go.tz/en/>, accessed May 27, 2020.

⁴⁷"Tanzania Environmental Management Act". 2004. Tzdpgr.Or.Tz. http://www.tzdpgr.or.tz/fileadmin/_migrated/content_uploads/Environmental_Management_Act_04.pdf, accessed May 27, 2020.

⁴⁸"Tanzania PURA". 2019. Pura.Go.Tz. <http://pura.go.tz/pura-home>.

'PURA Home | Petroleum Upstream Regulatory Authority' (Pura.go.tz). <http://pura.go.tz/pura-home>, accessed May 27, 2020.

⁴⁹"Tanzania EWURA". 2019. Ewura.Go.Tz. <https://www.ewura.go.tz/>.

'Energy and Water Utilities Regulatory Authority—Energy and Water Utilities Regulatory Authority' (Ewura.go.tz). <https://www.ewura.go.tz>, accessed May 27, 2020.

Corporation (TPDC), is responsible for upstream and downstream activities, including operating the country's growing network of domestic pipelines and gas-processing plants. TPDC is the sole gas aggregator in the country under the Petroleum Act of 2015.

11.3.3 Uganda's Oil and Gas Laws and SLO

Prevailing legislation in the oil and gas sector in Uganda which have a bearing on SLO include among others:

- a. The Constitution of Uganda of 1995 as amended in 2015. Article XIV provides that all developmental efforts are directed at ensuring the maximum social and cultural well-being of the people. Further, Article XXVII of the Constitution provides that the state shall promote and implement energy policies that will ensure that people's basic needs and those of environmental preservation are met.⁵⁰
- b. the Petroleum (Exploration, Development and Production) Act, 2013 (the Uganda Upstream Law 2013), the Petroleum (Refining, Conversion, Transmission and Midstream Storage) Act No.4, 2013 (the Uganda Midstream Law) and the Petroleum Supply Act, 2003 (the Uganda Downstream Law).⁵¹ The emphasis in terms of the obligations under these Acts is on the use of raw materials, the creation of a skilled local Ugandan workforce and the sourcing of goods and services locally.
- c. The Uganda National Environment Act 2019 provides for public participation in the EIA process.⁵²

⁵⁰"Uganda Constitution". 2015. Statehouse.Go.Ug. http://statehouse.go.ug/sites/default/files/attachments/Constitution_1995.pdf, accessed May 27, 2020.

⁵¹"Uganda Petroleum Acts". 2019. Petroleum.Go.Ug. <https://petroleum.go.ug/index.php/policy-and-legislation/petroleum-acts>.

'Petroleum Acts' (Petroleum.go.ug). <https://petroleum.go.ug/index.php/policy-and-legislation/petroleum-acts>, accessed May 27, 2020.

⁵²"Uganda National Environment Act". 2019. Nema.Go.Ug. <https://www.nema.go.ug/projects/national-environment-act-2019>.

'The National Environment Act, 2019' (nema.go.ug, 2019). <https://www.nema.go.ug/projects/national-environment-act-2019>, accessed 27 May 2020.

Uganda's oil and gas policies are formulated and directed by the Ministry of Energy and Mineral Development, under the Directorate of Petroleum.⁵³ The sector regulator is the Petroleum Authority of Uganda.⁵⁴ The Government's participation in the sector is through the Uganda National Oil Company (UNOC).⁵⁵ Other relevant sector regulators for petroleum include the Uganda National Environment Management Authority (for ESIA's and environmental regulation),⁵⁶ and the Uganda Revenue Authority, for taxation.⁵⁷

11.3.4 Local Content as a Tool to Acquire SLO in Africa

As was highlighted in Chapter 1, the main challenge with respect to the SLO legislation in East Africa is that it is fairly recent, and the relevant regulations are still being drafted. However, SLO is easily granted where there is local participation. In this respect, the general concept of local content is crucial in achieving SLO. This section refers to some African countries which have legislated on local content.

- a. In Angola, the principal law that governs petroleum activities is the Petroleum Activity Law (PAL) 2004 (Law 10/04).⁵⁸ Although the PAL neither refers to local content specifically nor constitutes a

⁵³"Uganda Directorate of Petroleum". 2019. Petroleum.Go.Ug. <http://www.petroleum.go.ug/>. 'Directorate of Petroleum—Ministry of Energy and Mineral Development' (Petroleum.go.ug). <http://www.petroleum.go.ug>, accessed May 27, 2020.

⁵⁴"Petroleum Authority of Uganda". 2019. Pau.Go.Ug. <https://pau.go.ug/>. 'Petroleum Authority Uganda'. <https://pau.go.ug>, accessed May 27, 2020.

⁵⁵"Uganda UNOC". 2019. Unoc.Co.Ug. <https://www.unoc.co.ug/>. 'Ministry of Energy and Mineral Development—Uganda' (energy and minerals.go.ug). <https://www.unoc.co.ug/laws-policies/>, accessed May 27, 2020.

⁵⁶"Uganda NEMA". 2019. Nema.Go.Ug. <https://www.nema.go.ug/>. 'The National Environment Act, 2019 | National Environment Management Authority' (Nema.go.ug). <https://www.nema.go.ug/projects/national-environment-act-2019>, accessed May 27, 2020.

⁵⁷"Uganda Revenue Authority". 2019. Ura.Go.Ug. <https://www.ura.go.ug/>. 'Uganda Revenue Authority' (Ura.go.ug). <https://www.ura.go.ug>, accessed May 27, 2020.

⁵⁸"Petroleum Activities Law No. 10/04 of November 12 2004' (Extwprlegs1.fao.org, 2004). <http://extwprlegs1.fao.org/docs/pdf/ang81903E.pdf>, accessed May 21, 2020.

comprehensive local content framework, it provides guidance on local employment and the procurement of goods and services. In terms of employment, Article 86 of the PAL requires investors both local and foreign to employ only Angolan citizens in all categories and functions, except where no Angolan citizens exist in the national market with the required qualifications and experience.⁵⁹ With respect to the procurement of goods and services (materials, equipment, and machinery), Article 27 of PAL requires that national production of the same or approximately the same quality and which is available for sale and delivery in due time, at prices which are no more than 10% higher than the imported items including transportation and insurance costs and customs charges due, should be procured.⁶⁰

- b. In the Democratic Republic of Congo (DRC), the Hydrocarbons Code of 2016 contains specific provisions for local content development under Articles 7 and Articles 139—147.⁶¹ These sections contain detailed provisions for local content requirements on all activities along the hydrocarbons value chain. Specifically, these provisions address the utilization of local human and material resources, training and local capacity development, technology transfer, utilization of local goods and services and the creation of additional and measurable value added to the local economy. The new code takes into consideration the aspirations of Congo to use local content as a development tool and thereby promote employment, skills development/training, technology transfer as well as national industry participation.⁶²
- c. Ghana enacted the Petroleum (Local Content and Local Participation) Regulations 2013, (L.I 2204), based on the Local Content Policy of 2011, to promote the maximization of value-addition and

⁵⁹Ibid.

⁶⁰Berryl C, 'Chapter 12—Role of Angolan Local Content Requirements: A Means for Benefit Sharing or an End in Itself? Art and Science of Benefit Sharing: Local Content Requirements in Angola's Petroleum Sector' (Hal.archives-ouvertes.fr, 2018). <https://hal.archives-ouvertes.fr/hal-01792311/document>, accessed May 21, 2020.

⁶¹'Hydrocarbons Code Law No. 28 of 2016' (Congomhc.com, 2016). <https://www.congomhc.com/downloads>, accessed May 22, 2020.

⁶²Oyewole (Consultant) D, 'Overview of Local Content Regulatory Frameworks in Selected Eccas Countries' (Unctad.org, 2018). https://unctad.org/en/PublicationsLibrary/ditcominf2018d4_en.pdf, accessed May 22, 2020.

- job creation through the use of local expertise, goods and services business, financing in the petroleum industry value chain and their retention in Ghana.⁶³
- d. Nigeria enacted the Nigerian Oil and Gas Industry Content Development Act in 2010.⁶⁴ This Act establishes a comprehensive local content regime that enshrines legal measures which promote the patronage of Nigerian products and services by operators in the Nigerian oil and gas industry. The Act was a culmination of the efforts which commenced under the 1969 Petroleum and Drilling Act, The Gas Master Plan and the previous version of the Local Content Act, 2003.⁶⁵

11.4 Corporate and Government Initiatives to Seek SLO in East Africa

The principles of sustainable development demand that a balance must be achieved between the freedom that oil and gas industry players have in maximizing the use of these resources towards prosperity while also managing the responsibilities that come with growth. Some of these responsibilities accrue to the communities that host or are otherwise impacted by these operations.⁶⁶ This led to the development of the concept of ‘corporate social responsibility’ (CSR), upon which the acquisition of SLO is built. Though there is no universal definition of CSR, it is generally held that it involves going beyond the basic business responsibility to maximize profits for the sake of shareholders to meeting the

⁶³Petroleum (Local Content and Local Participation) Regulations, 2013’ (Reportingoilandgas.org, 2013). <http://www.reportingoilandgas.org/wp-content/uploads/PETROLEUM-LOCAL-CONTENT-AND-LOCAL-PARTICIPATION-REGULATIONS2013.pdf>, accessed May 21, 2020.

⁶⁴Nigerian Oil and Gas Industry Content Development Act 2010 Act No. 2’ (Ncdmb.gov.ng, 2010), <https://www.ncdmb.gov.ng/images/GUIDELINES/NCAct.pdf>, accessed May 21, 2020.

⁶⁵Enyoghasim M, Adichie I, and Olulu R, ‘The Local Content Law in Nigeria: Strategies for Greater Impact on The Economy’ (iiste.org, 2017). <https://www.iiste.org/Journals/index.php/JRDM/article/viewFile/38101/39179>, accessed May 21, 2020.

⁶⁶Emas R, ‘The Concept of Sustainable Development: Definition and Defining Principles’ (Sustainabledevelopment.un.org, 2015). https://sustainabledevelopment.un.org/content/documents/5839GSDR%202015_SD_concept_definiton_rev.pdf, accessed May 22, 2020.

needs of other interest groups impacted by the operations of a company, i.e. stakeholders. Thus, merging profitability and social responsibility.⁶⁷

CSR emphasizes the activities of the organizations established within society and how those activities should effectively contribute towards social, economic and environmental well-being and progress that would then pave the way for positive transformation in those societies. This becomes a key component towards the delivery of projects because success is no longer measured purely in financial terms.⁶⁸ The development of CSR into a strategic issue for companies, in turn, led to the development of organizational ethics.⁶⁹ The competitive edge among companies took a different direction; with greater emphasis on the socially responsible behaviour of companies and the sponsorship of the communities in which they are hosted and ultimately expand. This means that how companies are perceived to behave is as important as how they behave, and the faith that stakeholders have in the company conduct is essential to company prosperity.⁷⁰ Notably, the reputational damage to companies that can come from failing to consider CSR may eventually impact its profitability and longevity.

This section will discuss the international initiatives to foster SLO in oil and gas industries, including treaties, voluntary international declarations and oil and gas member association initiatives that influence the same. The section will also highlight various CSR projects that private companies have established in East African countries to acquire and maintain SLO in the oil and gas sectors.

⁶⁷Frynas J, 'Corporate Social Responsibility in the Oil and Gas Sector' (researchgate.net, 2009). https://www.researchgate.net/publication/247577729_Corporate_social_responsibility_in_the_oil_and_gas_sector, accessed May 22, 2020.

⁶⁸Gayatri G, 'Corporate Social Responsibility in Oil and Gas Industry—Insights—Energy Dais' (Insights—Energy Dais, 2018) <https://insights.energydais.com/corporate-social-responsibility-in-oil-and-gas-industry/>, accessed May 22, 2020.

⁶⁹The principles and values used by an organisation to govern its actions and decisions—'Human Rights and Ethics in the Oil and Gas Industry' (ipieca.org, 2020). <https://www.ipieca.org/resources/good-practice/human-rights-and-ethics-in-the-oil-and-gas-industry/>, accessed May 22, 2020.

⁷⁰Frynas J, 'Corporate Social Responsibility in the Oil and Gas Sector' (researchgate.net, 2009). https://www.researchgate.net/publication/247577729_Corporate_social_responsibility_in_the_oil_and_gas_sector, accessed May 22, 2020.

11.4.1 International Treaties and Initiatives on SLO

As discussed, neither obtaining formal licences nor meeting regulatory requirements is enough to facilitate the smooth running of operations by investor companies. SLO is an important component, and as demonstrated in Sect. 11.2, hostile pushback by the communities has been experienced even where companies have complied with the legal and regulatory formalities.

Various international conventions and voluntary international obligations by states and companies have supplemented national laws in providing for SLO related matters. Some examples are discussed below.

- a. The United Nations Global Compact which was launched in 2000 by the UN.⁷¹ It is non-binding and encourages businesses worldwide to adopt sustainable and socially responsible policies. The Global Compact has ten (10) Principles in the areas of human rights; labour; the environment and anti-corruption. Among others, companies are required to support and respect the protection of human rights and make sure that they are not complicit in human rights abuses; eliminate all forms of forced labour, compulsory labour and child labour; eliminate discrimination in employment; support a precautionary approach to environmental challenges and promote greater environmental responsibility and work against corruption in all its forms.
- b. The Equator Principles, adopted in 2010.⁷² The Equator is a risk management framework, adopted by 101 financial institutions in 38 countries for determining, assessing and managing environmental and

⁷¹Kingo, Lise. 2019. "The UN Global Compact: Finding Solutions to Global Challenges". Un.Org. <https://www.un.org/en/un-chronicle/un-global-compact-finding-solutions-global-challenges>.

Kingo L, 2019 'The UN Global Compact: Finding Solutions to Global Challenges | United Nations' (Un.org). <https://www.un.org/en/un-chronicle/un-global-compact-finding-solutions-global-challenges>, accessed May 27, 2020.

⁷²"The Equator Principles". 2010. The Equator Principles. <https://equator-principles.com/about/>.

'The Equator Principles' (equator-principles.com, 2019). <https://equator-principles.com/about/>, accessed May 27, 2020.

social risk in projects being considered financing. The Equator Principles provide a minimum standard for due diligence and monitoring to support responsible risk decision-making by project financiers.

- c. In 2007, the World Bank Group published its Environmental, Health and Safety Guidelines (WB-EHS Guidelines) for reference on technical issues during project appraisal. The WB-EHS Guidelines apply to all World Bank-funded projects and are technical reference documents with general and industry-specific examples of Good International Industry Practice. The WB-EHS Guidelines have a detailed section on community health and safety ('World Bank's EHS Guidelines' 2007).
- d. In addition to the WB-EHS Guidelines, in 2012, the International Finance Corporation (IFC) published eight (8) performance standards (the IFC Performance Standards), applicable to all projects funded by the IFC.⁷³ Four (4) of the IFC Performance Standards deal directly with community SLO issues and include standards for community health, safety and security; and safety, land resettlement, indigenous peoples and cultural heritage.
- e. Principle 10 of the Rio Declaration on Environment and Development, 1992 provides that Environmental issues are best handled with participation of all concerned citizens. Each individual should have appropriate access to information concerning the environment that is held by public authorities. They should have the opportunity to participate in decision-making processes, and States should facilitate and encourage public awareness and participation by making information widely available.⁷⁴

⁷³"IFC Performance Standards". 2012. Ifc.Org. https://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Sustainability-At-IFC/Policies-Standards/Performance-Standards.

'Performance Standards' (Ifc.org). https://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Sustainability-At-IFC/Policies-Standards/Performance-Standards, accessed May 27, 2020.

⁷⁴"Rio Declaration on Environment and Development". 1992. Cbd.Int. <https://www.cbd.int/doc/ref/rio-declaration.shtml>.

'Rio Declaration on Environment and Development' (Cbd.int, 2006). <https://www.cbd.int/doc/ref/rio-declaration.shtml>, accessed May 27, 2020.

11.4.2 Seeking SLO by Private Companies in East Africa

This section discusses some of the initiatives undertaken by private companies in East Africa as CSR, in order to gain and maintain SLO in their projects. It is important to note that the below list is non-exhaustive and not intended to promote the actions of particular companies. The list is provided purely as examples of corporate CSR initiatives. Some company efforts have been successful, and some have not.

- a. Tullow Oil, Kenya and Uganda—In a 2017 human rights policy statement, Tullow Oil commits to engage with the community in order to obtain broad community support and the informed agreement of communities affected by projects prior to their commencement, during the operational phase and upon project expiry.⁷⁵ According to a 2017 study by Oxfam, in August 2015, Tullow Oil initiated four community consultation processes with each process involving multiple meetings to discuss the company's request for land for a new well pads in Etete, Erut, Ngamia and Amosing oil fields. This was for purposes of drilling appraisal wells intended to help Tullow better understand the size of oil discoveries.⁷⁶ Concerning Tullow Oil, as discussed in Sect. 11.2, community protests to EOPS in 2018 have demonstrated that while SLO may have been acquired initially, it has been difficult to maintain.
- b. Shell, Tanzania—In Mtwara natural gas exploration area, Shell Tanzania set aside up to USD 280,000 to support three areas of

⁷⁵Tullow Oil. 2017. "Human Rights Policy Statement". Tullowoil.Com. https://www.tullowoil.com/Media/docs/default-source/1_About_us/policies/tullow-oil_human-rights-policy-2017.pdf?sfvrsn=14.

'Tullow Oil PLC Policy Statement—Human Rights' (Tullowoil.com, 2017). https://www.tullowoil.com/Media/docs/default-source/1_About_us/policies/tullow-oil_human-rights-policy-2017.pdf?sfvrsn=14, accessed May 27, 2020.

⁷⁶Oxfam. 2017. "Testing Community Consent: Tullow Oil Project In Kenya". Www-Cdn.Oxfam.Org. https://www-cdn.oxfam.org/s3fs-public/file_attachments/bp-testing-community-consent-tullow-oil-kenya-081117-en.pdf.

'Testing Community Consent—Tullow Oil Project Kenya' (Www-cdn.oxfam.org, 2017). https://www-cdn.oxfam.org/s3fs-public/file_attachments/bp-testing-community-consent-tullow-oil-kenya-081117-en.pdf, accessed May 27, 2020.

health care namely, pre-hospital care and the ambulance service; emergency rooms for resuscitation care and capacity building to manage common medical emergencies, trauma and snakebite management.⁷⁷

- c. Total E&P Uganda, CNOOC Uganda Limited and Tullow Uganda—In June 2015 the consortium unveiled the revamped dedicated oil and gas section at the Uganda Museum. The project was aimed at educating and increasing awareness of the oil and gas industry to various stakeholders and the general public.⁷⁸ Additionally, Total E&P Uganda has offered local and international scholarships through its Oil and Gas Scholarship Programme.⁷⁹

11.5 Conclusion

Although the world is now transitioning to a low-carbon economy, the principles concerning SLO in the oil and gas sector are relevant to clean energy such as renewables. This paper therefore aimed to provide a detailed study of SLO in the oil and gas sectors in 3 East African countries: Kenya, Tanzania and Uganda, with a view to determining whether SLO issues are adequately addressed in the oil and gas sectors in East Africa, and if any further steps need to be taken. This work has demonstrated that adequate consideration of SLO is at least as essential

⁷⁷Shell Tanzania. 2019. “Working Together to Improve Local Health Care Facilities”. Shell.Co.Tz. <https://www.shell.co.tz/sustainability/working-together-to-improve-local-health-care-facilities.html>.

Tanzania S, ‘Working Together to Improve Local Health Care Facilities’ (Shell.co.tz). <https://www.shell.co.tz/sustainability/working-together-to-improve-local-health-care-facilities.html>, accessed May 27, 2020.

⁷⁸Total Uganda. 2016. “Total Partners to Revamp the Oil and Gas Section of The Uganda Museum to Improve Information Access”. Total Uganda. <https://ug.total.com/total-partners-revamp-oil-and-gas-section-uganda-museum-improve-information-access>.

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⁷⁹Total Uganda. 2019. “Total Scholarships to Counter the Challenge of Finding Enough Skilled Talent in A New Oil Sector”. Total Uganda. <https://ug.total.com/total-uganda/better-energy-projects-uganda/total-scholarships-counter-challenge-finding-enough-skilled-talent-new-oil-sector>.

‘Total Scholarships to Counter the Challenge of Finding Enough Skilled Talent in A New Oil Sector’ (Total Uganda). <https://ug.total.com/total-uganda/better-energy-projects-uganda/total-scholarships-counter-challenge-finding-enough-skilled-talent-new-oil-sector>, accessed May 27, 2020.

to project success as is meeting the legal and regulatory requirements. The inadequate consideration of SLO issues can have significant negative project impacts in terms of cost and time overruns. In order to prevent these unwanted outcomes, and/or better manage them when they arise, the community of stakeholders needs to come together and collaborate in terms of finding a way forward. Effectively managing the information concerning and understanding of the projects by the stakeholders is vital. Notably, effective public participation and timely access to information by members of the community is integral in fostering SLO.

Going forward, certain adjustments may be considered in addition to the collaborative efforts of the community of stakeholders in fostering and in continuously maintaining SLO. National and regional governments may also consider statutory intervention so as to create mandatory legally binding obligations. This is in order to firmly cement the established industry standards which are practised through the CSR initiatives which the companies already adopt and to keep industry players accountable to those standards. However, this needs to be addressed with a measure of urgency noting that matters concerning SLO are fluid and continue to adapt as projects develop and simultaneously, laws and regulations are only as good as their enforcement. This means that governments need to dedicate adequate man-power, finances, as well as create the institutional integrity that is necessary for building and maintaining credible SLO within the promising oil and gas sector in East Africa.

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12

Gender Justice in the Energy Transition Era: Exploring Gender and Technology in the Extractives Sector

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Video interview by the author discussing this book chapter can be accessed at, <https://www.youtube.com/watch?v=pcIIxucbDOg&t=851s>. Last accessed on 1st September 2020.

12.1 Introduction

Although the energy industry is predominantly thought to refer to the electrical power sector (i.e. sources of electricity, electricity generation, distribution, etc.), it is an all-encompassing term that comprises different other industries, including the extractives sectors, being the mining and minerals sectors. Oil and gas resources, for example, are components of

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energy, and account for the majority of global energy consumption.¹ Similarly, minerals play a significant role in the energy industry, for example, cobalt is increasingly becoming essential, as it is used in the manufacturing of electric vehicles, and other vital elements of the global efforts to transition to cleaner sources of energy.² The focus of this chapter is on gender and technology issues specifically in the oil and gas, and mining industries, as elements of the energy industry, in line with the global developments in energy transitions.

It is becoming increasingly evident that the world is continuously transitioning as a result of different factors, including the growing influence of technology in different areas, especially the advent of the so-called Fourth Industrial Revolution (referred to henceforth as “the 4IR”). The 4IR refers to a phenomenon that is characterized by technological innovations as well as the growing utilization of new technologies, which include among other things: Artificial Intelligence (“AI”), cloud computing, blockchain technologies, Virtual Reality (VR), robotics, 3D printing, among others.³ These innovations have ushered in an era of digital transformation and globalization in the twenty-first century that has revolutionized the global economy, including the energy and extractives sector. The influence of the 4IR on the energy and extractives sector is the focus of this chapter, particularly the position of women amid the 4IR.

The growing influence of the 4IR has been acknowledged around the world. For example, in 2019 last year, the 4IR was the focus of the World Economic Forum (WEF) annual meeting in Davos, Switzerland.⁴ The theme for the meeting was: ‘Globalisation 4.0: Shaping a Global

¹OECD, ‘Energy’ (2011) OECD Green Growth Studies, 17, <https://www.oecd.org/greengrowth/greening-energy/49157219.pdf>, accessed March 16, 2020.

²A new World Bank report reveals that over 3 billion tons of metals and minerals will be needed to utilize geothermal, solar and wind power (i.e. alternative and cleaner sources of energy), in order to replace carbon-intensive technologies. For further discussion, see, The World Bank, ‘Mineral Production to Soar as Demand for Clean Energy Increases’ (2020), <https://www.worldbank.org/en/news/press-release/2020/05/11/mineral-production-to-soar-as-demand-for-clean-energy-increases>, accessed March 16, 2020.

³David Peetz, *Digitalisation and the Jobs of the Future* (ANU Press 2019), 93.

⁴World Economic Forum, ‘Globalisation 4.0 Shaping a New Global Architecture in the Age of the Fourth Industrial Revolution’ (2019) World Economic Forum White Paper, http://www3.weforum.org/docs/WEF_Globalization_4.0_Call_for_Engagemen.pdf accessed April 14, 2020.

Architecture in the Age of the Fourth Industrial Revolution'. Global economies take into account the fact that the 4IR is changing how we live, work and relate to one other.⁵ Since the meeting, 4IR and especially Artificial Intelligence (AI) have remained prominent and have sparked multidisciplinary research and scholarship, as will be shown below.⁶ This prominence emphasizes the relevance of the discourse today.

The global market is adapting to new trends and faster turnaround times.⁷ Mining companies are embracing data, analytics and connectivity in order to compete favourably. It has often been alleged that 'Data is the new gold', and digitization, as well as automation, are redefining the accelerated pace of change. Digital technologies could be leveraged to achieve socio-economic growth and development generally for developing countries, and specifically for women.⁸ Innovation has become an imperative today, but the question is where the adoption of technology leaves women, particularly in the extractives sector, which is infamous for having a gender diversity problem. Additionally, technology is also key in ensuring that African countries transition to a low-carbon economy. The United Nations Sustainable Development Goal 5 focuses on gender equality while SDG 7 advocates for energy access. Ensuring gender equality has been highlighted by scholars as being crucial in tackling the energy access challenges on the African continent.⁹ The continued role of the extractive industries including oil, gas and mining on the African continent clearly indicates that some countries might not be ready to fully transition to a low-carbon economy, especially considering the fact that oil and gas is capable of tackling the energy access challenges; while critical minerals such as cobalt are key in the energy transition.¹⁰

⁵Ibid.

⁶Ibid.

⁷See Peetz (n 3).

⁸McKinsey & Company, 'The Future of Women at Work: Transitions in the Age of Automation', <https://www.mckinsey.com/featured-insights/gender-equality/the-future-of-women-at-work-transitions-in-the-age-of-automation>, accessed April 14, 2020.

⁹Nalule, V.R., 2018. *Energy Poverty and Access Challenges in Sub-Saharan Africa: The Role of Regionalism*. Springer.

¹⁰Nalule, V.R., 2020. Transitioning to a Low Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels?. In *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions* (pp. 261-286). Palgrave Macmillan, Cham.

Women are historically excluded from contributing effectively to the economies in different sectors. The International Labour Convention (ILO) of 1935 prohibited the employment of women in underground mining.¹¹ Although many countries that were initially signatories to this Convention have since denounced it, it depicts the attitudes that existed at the time, relating to the participation of women in mining. Some of these attitudes may have been transmitted to societies today. It is common cause that there is a disproportionate number of women, as compared to men, as active participants in the global economy, for example in the extractives sector.¹² Women are presently at further risk of being left behind in the global digital revolution.

Additionally, women were barred from entering the mining industry, particularly in the upstream sector.¹³ This exclusion was as a result of *inter alia*, legislative restrictions, gender restrictions and superstition, stemming from traditional cultural practices that designated gender roles that have created the perception of women's maternal function, particularly in traditional African societies that culturally relegate women's roles to domestic household duties.

The disparity is attributed to the lack of requisite skills to engage properly with these new technologies, which would hamper any attempts to become active contributors in the 4IR era. The growth of technology is an opportunity to overcome these inequalities, as it provides avenues to upskill women, to address the displacement curve, thereby evening the gender disparity. The segregation of men and women into differentiated sectors of the economy contributes to lower innovation levels in professions that lack gender diversity.¹⁴

¹¹C045—Underground Work (Women) Convention No. 45, 1935.

¹²Adam Smith International, 'Women in Mining: Can a Mining Law Unlock the Potential of Women?' (2017) Adam Smith International, 13, https://issuu.com/adamsmithinternational/docs/asi__iwim_2017, accessed April 10, 2020.

¹³Halo Media, 'The Barriers That Barred Women from the Mining Industry' (Mining Review Africa, 2019), <https://www.miningreview.com/gold/the-barriers-women-faced-in-the-mining-industry-in-south-africa/>, accessed April 13, 2020.

¹⁴World Economic Forum, 'Global Gender Gap Report 2020' (2020) World Economic Forum Inside Report, 42, http://www3.weforum.org/docs/WEF_GGGR_2020.pdf, accessed March 29, 2020.

This chapter therefore seeks to address the influence of the 4IR on the extractives sector, especially the position of women amid the 4IR in this energy transition era. The chapter explains why it is crucial to include women in global economies. It then focuses on the position of women historically and presently in both the mining and oil and gas sectors globally, to show that there is a disproportionate number of women as compared to men in these sectors, hence the need to address such gender disparity. Emphasis is drawn towards AI technologies as a critical form of technology that has the widest influence and application in these sectors of the economy, and how its continued use could have an adverse effect if efforts to upskill women in using such technologies, are not made. The chapter concludes with a brief synopsis of the proposed solutions to the aforementioned gender disparity problem in the mining and oil and gas sectors of the global economy.

12.2 Why It Is Imperative to Include Women in the Global Economy

The reasons for the disparity, as compared to men, are numerous, and mostly relate to the circumstances where the technology field has often been perceived as appropriate for men, thus explaining why it is male dominated. To address this myth, the digital revolution ought to prioritize training and upskilling women in digital competencies, for example, in the oil, gas and mining sectors.

For women, the oil, gas and mining sectors can provide for better livelihoods by creating jobs, access to financing, business ownership and the reduction of poverty within communities. In the last decade, there has been a myriad of research revealing the participation of women in the extractives sector. Such research prioritizes their economic empowerment to become critical economic drivers especially for developing countries with mineral resource wealth, through access to finance; access, use and control of land; licenses and permits to mine; skills development, education and training, etc.

Investing in gender equality, for companies improves workforce performance and enhances better Company- to- community relations.¹⁵ It also provides access to financing and secures supply chains along the extractives value chain, among other benefits that will be explained in this chapter.¹⁶

The demand for new kinds of skills in AI, digitalization and machine learning is eliminating many jobs involving low and middle-skill routine functions and tasks through automation. The BBC notes that an estimated 200 million people will lose their jobs as a result of the present Covid-19 pandemic, and the financial burden often falls on the most vulnerable categories of people in society, mostly women.¹⁷ Digitalization and such pandemics have adversely affected the availability of jobs for people.

It is vital to understand the shift and impacts of modern-day trends as we advance the narrative of gender equality in the extractives sector. Our ability to mitigate the impact on the workforce and the most vulnerable, i.e. women is the conundrum facing most industries and countries. This predicament warrants more attention as well as a speedy resolution.

In the African context, women account for more than half of the total population; therefore, it is imperative to consider women in the implementation of policies. In 2019, African countries undertook to establish the African Continental Free Trade Area (AfCFTA) Agreement.¹⁸ This Agreement, once implemented, is set to establish Africa as the largest free trade area in the world, by creating a single market for goods and services,

¹⁵PwC Norway, 'Investing in Gender Equality' (2019) PwC Norway Report, 7, https://www.google.com/url?sa=t&rcrt=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwiv6YmFtrjpAhWYURUIHZoKC2wQFjAAegQIARAB&url=https%3A%2F%2Fwww.storebrand.no%2Fasset-management%2Fpublikasjoner%2F_%2Fattachment%2Fdownload%2F4ac78ed2-b927-4612-a2fe-80cbebbf610b%3A595ed2730809c0622af216b95c1f0959af438888%2FInvesting_in_Gender_Equality_20190628.pdf&cusg=AOvVaw3Z9eqdO7JJvzajr_nxpD44, accessed April 28, 2020.

¹⁶*Ibid.*

¹⁷BBC, 'Coronavirus: Four Out of Five People's Jobs Hit by Pandemic' (2020), <https://www.bbc.com/news/business-52199888>, accessed April 10, 2020.

¹⁸Kennedy Chege, 'OPINION: Challenges to Promoting Intra-African Trade in the Petroleum Industry in the Wake of the AfCFTA Agreement: Africa's Insufficient Petroleum Refining Capacity' (2019), <http://www.mlia.uct.ac.za/news/opinion-challenges-promoting-intra-african-trade-petroleum-industry-wake-afcfta-agreement>, accessed November 28, 2019.

and ensuring more interconnectedness between African countries, thus limiting their dependence on other countries outside the continent.

The intention of the Agreement is: to increase intra-African trade by expediting the establishment of regional value chains, to reduce over-reliance on other countries outside the continent, and to allow African states to retain the value that they create, within the continent.¹⁹ The Agreement would have positive benefits, particularly for the extractives industries within the continent.

Women are a crucial cog in the wheel to ensure the proper implementation of the AfCFTA Agreement, i.e. the Agreement will not be successful without the participation of women. The role of women in driving general consumption patterns cannot be overstated. According to statistics, women reinvest 90% of their income back into their households, while men reinvest only 30–40%.²⁰ Therefore, women have a critical part in promoting the requisite demand that would support the exchange of goods and services among countries throughout the AfCFTA Agreement.

The agricultural sector, for example, is historically the key driver of the majority of economies in Africa. Women contribute significantly to this sector through labour. Such contribution emphasizes the assertion that the Agreement would be unsuccessful without the equal participation of women. Other industries like the extractives ought to take the necessary steps to include women in order to ensure the success of the AfCFTA Agreement. With this realization that women are essential to in promoting economic activities between countries, it is expected that this Agreement would act as an incentive for governments to promulgate targeted policies and legislation that is female-focused, to boost productivity for the continent, to enable it to be an equal participant in the global economy.

¹⁹Chege (n 16).

²⁰IFC, 'Assessing Private Sector Contributions to Job Creation and Poverty Reduction: Findings on Gender' (2013) IFC Jobs Study, <https://www.ifc.org/wps/wcm/connect/2125f97c-da65-4fb0-aba7-1d554bfe55bb/full-study-gender.pdf?MOD=AJPERES&CVID=jRvG5JC>, accessed April 14, 2020.

Increased diversity has been associated with greater creativity and organizational performance and improved problem-solving mechanisms.²¹ Hence further emphasizing the need to promote gender equality in the workplace.

The above are some of the reasons why it is crucial to involve women in the global economy in all sectors, including the extractives. These are in no way an exhaustive list of justifications for the equal participation of women. Several others will be discussed further in this chapter, specifically in the context of the extractives industries.

12.3 The Need for Automation in the Extractives Industries

At the time of writing, the Covid-19 pandemic has claimed the lives of more than 300,000 people around the world, yet it has not peaked in many countries. Hence the numbers are expected to rise exponentially.²² The pandemic has revealed the urgent need for automation in the different sectors of the economy, including in the oil and gas, and mining sectors. Many countries are fighting the prospect of economic collapse as a result of the pandemic.

In South Africa, president Ramphosa on March 27, 2020, announced a national lockdown, as an attempt to curtail the spread of the Coronavirus.²³ The lockdown commenced for an initial duration of a month. Midway through that period, the Minerals Council, union heads and other stakeholders in the extractives sector impressed upon the government to allow operations in the sector to continue in order to prevent

²¹Marie-Anne Birken and Gian Piero Cigna, 'Gender Diversity on Boards: A Cause for Multilateral Organisations' (2018) *AIIB Yearbook of International Law* 2018, 29.

²²Worldometer, 'COVID-19 Coronavirus Pandemic Latest Update' (May 16, 2020), https://www.worldometers.info/coronavirus/?utm_campaign=homeAdvegas1?%22%20%5C%20%22countries, accessed May 16, 2020.

²³Nelson Mandela University, 'UPDATE 11: Lockdown Update—27 March 2020' (March 27, 2020), <https://www.mandela.ac.za/News-and-Events/Coronavirus-Information/COVID-19-Memos/UPDATE-11-Lockdown-Update-%E2%80%9327-March-2020>, accessed March 27, 2020.

permanent and potentially irreversible damage, having already made record losses amounting to billions.²⁴

The various stakeholders emphasized to the Department of Mineral Resources and Energy (DMRE) how important it was for operations to continue. The economic damage of the lockdown to the country is profound. The Minerals Council estimates a drastic decline in mining production for the year.²⁵ This decline excludes the costs incurred to place operations under ‘care and maintenance’ during the lockdown,²⁶ as well as the amounts spent on wages over the lockdown period. Mining companies such as Impala Platinum,²⁷ have hitherto lamented the fact that they will be unable to continue to pay workers in the event that the lockdown period is extended.

The circumstances explained above are not unique to South Africa. A massive plunge in global oil prices has hampered all economies in the world, including the major economies like the USA and in Europe. The oil and gas industry is projected to experience up to 20% reduction in labour and workforce over to 2021.²⁸

The pandemic highlights that we need automation/mechanization in the extractives industries around the world. It shows the importance of digital readiness to allow businesses to continue as much as possible despite the challenging circumstances. Mines ought to be operational even in circumstances of a lockdown, where workers are unable to physically go into a mine. The pandemic has made this realization more apparent. Thus, there is an urgent need to accelerate efforts to promote automation in the energy industry, including the mining and oil and gas

²⁴BusinessDay: BL Premium, ‘Mines Must Return to Work on April 17 or Face Permanent Damage’ (April 6, 2020), <https://www.businesslive.co.za/bd/companies/mining/2020-04-06-mines-must-return-to-work-on-april-17-or-face-permanent-damage/>, accessed April 6, 2020.

²⁵Ibid.

²⁶A mine is considered to be under ‘care and maintenance’ when production has ceased for various technical, environmental, financial or labour-related reasons. The mine does not necessarily declare the intent to close indefinitely.

²⁷Impala Platinum Holdings Limited (Implats), is a South African holding company that owns several companies that operate mines producing platinum and other platinum group metals, as well as nickel, copper and cobalt.

²⁸See Matthew Farmer, ‘How Will the Offshore Industry Recover After Covid-19?’ (March 27, 2020), <https://www.offshore-technology.com/features/coronavirus-covid-19-offshore-cost-opec/>, accessed April 14, 2020.

sectors, through for example adopting AI and other measures to ensure the smooth running of operations without necessitating human agency. Many have referred to the current circumstances as the ‘new normal’.

12.4 Sector Outlook: The Position of Women in the Extractives Sector

Building the necessary infrastructure to support a digitalized world will be essential for any business to remain competitive even after the pandemic, as they realign and adjust to embracing measures to cut costs in a move to automate operations. According to a recent survey by The Hoxby Collective, a virtual firm in the United Kingdom (UK), more than two-thirds of business owners opine that remote working is ‘the future’ for their organizations.²⁹ It was found that workers were more productive and positive while working at home, as opposed to when confined to their workplaces.³⁰ A post-COVID world is bound to see many remote working practices, as organizations shift their businesses remotely, pursuant to the lockdown/remote working measures that governments are instituting across the world.

This section will analyse the position of women in the mining and oil and gas sectors, amid the gradual adoption of technology into these industries.

a. The Mining Sector

Despite mounting pressure on the mining sector to maximize diversity, women still make up less than 20% of the workforce in the industry, and the percentage is less in executive positions.³¹ There are numerous reasons for the meagre inclusion of women in mining including legislative and gender restrictions; superstitions deeming women as not quite ready for the top roles; minimal formal training for women on specialized

²⁹CharlieHR, ‘Why 95% of Jobs Will Eventually Be Remote Working’ (2020) the workspace by Charlie, <https://www.charliehr.com/blog/the-advantages-of-remote-working/>, accessed May 10, 2020.

³⁰Ibid.

³¹Adam Smith International (n 10).

technical skills required by the sector; lack of fair employment and career advancement policies, coupled with limited career progression opportunities, owing to the large number of men that occupy senior positions in the industry. Safety and security concerns could also be inhibitors for women participating in mining.

South Africa, for example, has made great strides in recent years to address gender disparity. In 2002, the South African Mining Charter was promulgated to ensure that mining companies included 10% of women in their total workforce by 2009.³² Subsequent Mining Charters and other policies have ensured the sustainable participation of women in the economy, e.g. requiring greater representation of women in boards and senior management positions in companies, as ‘Previously Disadvantaged South Africans’.³³

Today in South Africa, there are many mining companies that have close to 20% female participation in the workforce, whereas there are other countries that still do not permit women to be involved in mining, especially in underground operations. South Africa is now regarded as a global leader in terms of employing women in the mining and minerals sectors.

The extractives industry generally classifies the mining sector into two broad categories; Large Scale Mining (‘LSM’) and Artisanal and Small-scale Mining (ASM). On the one hand, LSM refers to capital-intensive operations that are carried out by large mining conglomerates who apply heavy-duty and advanced technological know-how to mine.³⁴ On the other hand, ASM refers primarily to informal miners and those who operate for subsistence as well as those who mine commercially on a small scale.

³²Broad-Based Socio-Economic Empowerment Charter for the South African Mining Industry 2002 (‘Mining Charter I’).

³³See Amendment of The Broad-Based Socio-Economic Empowerment Charter for the South African Mining and Minerals Industry 2010 (‘Mining Charter II’), and Broad-Based Socio-Economic Empowerment Charter for the Mining and Minerals Industry 2018 (‘Mining Charter III’).

³⁴Francis Kariuki, Geoffrey Kerecha and James O. Kirwa, *Handling Extractives Related Grievances in Kenya. A Judicial Guide for Officers* (Strathmore University, Extractives Industry Centre 2019), 3.

Women tend to gravitate towards the provision of goods and services, as opposed to seeking to work on mine sites.³⁵ The challenge in bridging the gap is how to attract female skills to the mining sector, and retaining them.

ASM attracts a fair number of women. By 2017, 40.5 Million people were directly involved in artisanal and small-scale mining around the world, with 150 million solely dependent on mining activities.³⁶ Women account for 30% of the workforce, and in some regions such as South East Asia women make up to 50%.³⁷ Though the numbers are significant, the contribution by women relates to subservient and supporting roles such as panning, washing, transporting material and cleaning. Their participation in the high income earning mine activities such as owing license, drilling and extraction of minerals, value addition/beneficiation, trading, etc., is insignificant.³⁸ Efforts must be made by all stakeholders in both the public and private sectors to incentivize women to become more involved in the mining industry. Several initiatives have been put forward as will be discussed in this chapter.

b. The Oil and Gas Sector

Similarly, the oil and gas sector has historically been male-dominated, and there is now surmounting pressure on companies to attract and retain highly skilled women to the workforce. According to recent research by McKinsey, the sector struggles to recruit, retain and promote women.³⁹ This struggle could be because of the various reasons outlined above, including outdated perceptions that women either cannot or do

³⁵Andreas Kotsadm and Anja Karolina Tolonen, 'African Mining, Gender and Local Employment' (2015) Policy Research Working Paper; No. WPS 725, <http://documents.worldbank.org/curated/en/199161468187785282/pdf/WPS7251.pdf>, accessed May 14, 2020.

³⁶Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF), 'Global Trends in Artisanal and Small-Scale Mining (ASM): A Review of Key Numbers and Issues', <https://www.iisd.org/sites/default/files/publications/igf-asm-global-trends.pdf>, accessed March 24, 2020.

³⁷Ibid.

³⁸Ibid.

³⁹Kassia Yanosek, Sana Ahmad, and Dionne Abramson, 'How Women Can Help Fill the Oil and Gas Industry's Talent Gap' McKinsey & Company, <https://www.mckinsey.com/industries/oil-and-gas/our-insights/how-women-can-help-fill-the-oil-and-gas-industrys-talent-gap>, accessed February 19, 2020.

not want to handle physical labour such as working in mines or on pipelines. Such myths and hurdles must be dispensed with, as they are experienced across the board globally.

In developed oil and gas civilizations like the USA, women represent a paltry 38% of the workforce, but only 22% of the wage earners work in the oil and gas sector.⁴⁰ Diversity decreases in senior positions whereby at entry-level, women account for 17% of senior management positions. Female chief executives make up only 1% of industry leadership.⁴¹

Change is inevitable as the sector addresses the workforce deficiencies and acknowledges that the world is changing, as has been expressed above, with the advent of the 4IR. Also, as the world focuses on the transition from fossil fuels to cleaner sources of energy, i.e. decarbonizing, this would be facilitated by using wind, solar and other modern technologies. Companies that will succeed in upskilling will be those that appreciate the advantages of having a diverse workforce. This realization would see more women recruited into the industry.

The untapped female talent is rampant as it cuts across all regions and types of establishments. Women in international oil and gas companies account for 26% of the workforce while in national oil companies, the number is 13%. In both oilfield services and equipment companies, the number of women is up to 16%.⁴²

As experienced in the mining sector, women are most visible in the business support functions at a corporate level such as in legal, human resource and finance services. Even where women are employed in technical roles, they are likely to hold office jobs than purely technical and field jobs.⁴³ Their representation on all job groups decreases over time, as a result of the low numbers during recruitment at entry levels.

⁴⁰Ibid.

⁴¹Katharina Rick and others, 'Untapped Reserves: Promoting Gender Balance in Oil and Gas', <https://www.bcg.com>, 2020 accessed April 13, 2020.

⁴²See Yanosek, Ahmad, and Abramson (n 37).

⁴³Ibid.

12.5 Artificial Intelligence and the Future of Extractives

AI, machine learning, the use of robots in mining, etc., are changing the extractives industry landscape around the world.⁴⁴ AI especially has seen more uptake by entities in the extractives sectors, as compared to other forms of technology, and this is the reason for its emphasis in this chapter.

The most critical components in the extractives are efficiency, effectiveness and environmental and human safety concerns. Extraction and production of resources from the ground involves different processes, to the point that the products reach the final consumer in the downstream stage of the cycle. Minute improvements in the execution speed, the efficiency of operations, safety and reduced turnaround times, separate a profitable venture from an unsuccessful one in the extractives.

AI has widely been adopted by mining companies in recent times to improve the efficiency of operations in mines as well as to reduce costs, in a capital-intensive industry by its very nature. Mining companies are only beginning to appreciate the potential of AI in mining, and it is expected that AI will become more commonplace, as we move towards fully adopting the 4IR into many of our economic activities in various sectors of our economies.

AI is instrumental in the making of decisions, by analysing algorithms, especially when discovering deposits in the prospecting phase of the mining cycle. AI automates decisions that were previously made by human beings, which were influenced by inherent biases and were prone to costly mistakes. Additionally, AI assists in extracting minerals from hard-to-reach areas, and in harsh weather conditions. Therefore, minerals are extracted from previously inaccessible areas, without endangering the lives of workers and with little to no human error.

Many companies are beginning to adopt technology in their operations. For example, Canada's GoldSpot Discoveries Corporation utilizes AI and other new technologies like machine learning, to improve mineral

⁴⁴Gerlind Wisskirchen and others, 'Artificial Intelligence and Robotics and Their Impact on the Workplace' (IBA Global Employment Institute 2017).

exploration by reducing capital risk and increasing efficiencies to enhance success rates in resource exploration and investment.⁴⁵ This constitutes one of the companies that are renowned for revolutionizing the mining industry. It uses AI to extract almost 90% of gold with the help of detailed geological, topographical and mineralogical data.⁴⁶

Another major company incorporating new technologies is Rio Tinto, an Anglo-Australian multinational and the world's second-largest metals and mining corporation.⁴⁷ It recently started using autonomous vehicles/trains and haul trucks that run without a driver for hundreds of kilometres. Such innovation comes in handy for transportation of minerals, especially in harsh weather conditions. There are many more examples of companies that recognize the future of mining in their operations to solve problems that human beings cannot solve, thus explaining the inevitability of the adoption of 4IR into the extractives industries.

This automation age, women will encounter new barriers shrouded on the existing long-established ones. Women will be required to progress, shift or upskill between occupations by the year 2030, reducing the wage gap considerably.

12.6 Proposed Solutions to the Challenge of Gender Inclusivity in the Extractives Sectors

Collaborative and innovative parameters will be needed to allow women to transition into the mechanical space. This metamorphosis will not be cheap. Approximately 150 million jobs will be added to existing occupations and majority towards emerging economies in developing countries.⁴⁸ We would have to be adaptable, reinvent ourselves and unlearn traditional ways of doing things, to prepare adequately for the changes in the global market.

⁴⁵ Goldspot Discoveries, <https://goldspot.ca/>, accessed May 13, 2020.

⁴⁶ Ibid.

⁴⁷ Rio Tinto, <https://www.riotinto.com/about/innovation>, accessed May 13, 2020.

⁴⁸ Mc Kinsey & Company (n 8).

Governments, the education sectors, industry stakeholders, development partners and Non-Governmental Organizations ('NGOs') will be required to spearhead the transition for women in the extractives sector, as will be shown below. For instance, adopting AI into modern mines will not be easy, as it requires much planning, research and assessment, and establishing well-defined infrastructures and platforms, clear communication practices and effective change management.⁴⁹ These elements require policies to be set up to provide guidelines/a framework for adoption of these and other technologies.

The concerted effort by the public, private and social sectors in the extractives sector will have to heed the clarion call of automation in the following ways:

a. Governments Role

Automation-driven changes in the labour market will attract new entrants into the workforce. The seasoned barriers override new challenges to develop highly skilled technological savvy workers that can adapt to the changing times.

The Kenyan government, through the Ministry of Energy, for example, has taken steps to institute a gender policy that aims to promote gender awareness, to change negative stereotypes and to inculcate an engendered work culture in the energy, and related sectors.⁵⁰ This policy is the first of its kind in Africa on a national level, though there exists similar policies on a regional level from the AU, the New Partnership for Africa's Development (NEPAD) and the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE).⁵¹

Other African countries ought to borrow a leaf from Kenya in this regard and promulgate such policies to further the goals of ensuring equal opportunities for all persons irrespective of gender. Such a policy establishes a framework for both the public and private sectors to prioritize gender issues in the policies and other programmes in the energy sector.

⁴⁹The Draft Digital Transformation Strategy for Africa (2020–2030).

⁵⁰Kenyan Ministry of Energy Gender Policy in Energy 2019.

⁵¹Ibid.

i. Women Will Need to Be Reskilled

We must take cognizance of the social, cultural and traditional norms that inform the different ways in which men and women work. Women are deemed too risk-averse and lack the conviction to take up opportunities.

Governments in developing and frontier oil and gas economies should consider these social, cultural differences when creating regulations. Initiatives through the education sector should advocate for skill-based courses that will increase the uptake of women in technical careers. These initiatives may be conducted through partnerships with schools, colleges, vocational centre and universities.⁵² In frontier economies such as Kenya and Uganda that have recently discovered oil reserves, governments should ensure that the transfer of skills and knowledge should incorporate elements of AI.

ii. Subsidies

Although most efforts to address the gender disparity between men and women have focused on the supply side, there have been several demand-side efforts to create incentives for women and girls to enrol in Science, Technology, Engineering and Mathematics (“STEM”) education programmes.⁵³ Such efforts are intended to enable and provide women with the requisite skills in the highest-growth roles of the future, especially those that apply STEM skills.

The provision of subsidies for technical courses and programmes in STEM would allow women to reskill. Such initiatives can be spearhead by governments to aid in skills development in developing countries.⁵⁴ Countries such as Singapore have developed a national movement called ‘Skills Future’.⁵⁵ This initiative provides a platform whereby people access training to develop skills and technical expertise at any stage in

⁵²Colleges and Institutes Canada, ‘Kenya Education for Employment Program (KEFEP)’, <https://www.collegesinstitutes.ca/what-we-do/international/education-for-employment/kenya/>, accessed May 5, 2020.

⁵³UNESCO, ‘Girls’ and Women’s Education in Science, Technology, Engineering and Mathematics (STEM)’, <https://en.unesco.org/stemed>, accessed May 13, 2020.

⁵⁴Ibid.

⁵⁵Skillsfuture, <https://www.skillsfuture.sg/AboutSkillsFuture>, accessed April 14, 2020.

their careers of business as the economy braces the transition to 4IR.⁵⁶ Skills Future actively engages women in the technical space at entry-level, mid-career and even women looking to return to the workforce, in a bid to create an inclusive workforce.⁵⁷

The private sector can also play a vital role by creating Company policies that aid the absorption and retention of women. Safaricom, a telecommunications company in Kenya, boasts up to 51% of the workforce being women.⁵⁸ Its pioneer 'Bring your child to work policy' has demonstrated commitment to the female personnel in the Company.⁵⁹ Such initiatives reduce the risks of new mothers leaving the workforce, hence can act as catalysts for women to actively pursue careers and eventually ascending to executive and leadership positions.

As emerging economies anticipate the future of automation, such in-country incentives both by government and industry stakeholders, allow the public to access the skills and knowledge that will equip them for the revolution.

iii. Advocate for Women in Science Technology Engineering and Mathematics (STEM)

The evolving labour market and the increasing number of opportunities will require an emphasis on STEM-related expertise. STEM incorporates and allows for the application of math and science to create technological solutions to solve real-time global problems by using and engineering design approach.⁶⁰ Women are underrepresented in this area.⁶¹

Governments can play a pivotal role in the education system by initiating the interest in STEM subjects at an early age to allow for girls to access equal professional opportunities. Equipping the teachers with

⁵⁶Skillsfuture (n 55).

⁵⁷Ibid.

⁵⁸IFC, 'Tackling Childcare: The Business Case for Employer-Supported Childcare' www.ifc.org accessed May 13, 2020.

⁵⁹Ibid.

⁶⁰Rebecca Davis, 'Women in STEM and Human Information Behavior: Implications For LIS Educators' (2014) Vol. 55 No. 3 *Journal of Education for Library and Information Science* 225, 258.

⁶¹Michael A. Fletcher, 'Women Continue to Be Underrepresented in STEM Industries' (2015) Vol. 14 No. 1 *Women of Color Magazine* 22–23.

proper tools and equipment and providing a proper learning environment from the onset that is critical to the socialization and engagement of young girls.⁶²

Policy regulations, coupled with financial incentives and partnerships with the private sector, can play a significant role in increasing the participation of women in STEM-related courses and careers.⁶³ Governments can also incentives companies and as a result, offer internships, training and mentorships to bridge the gender disparity in employment.

b. Private Sector

The private sector is imperative to supplement efforts taken by governments to promote gender inclusivity in the workplace. These efforts could be in the form of, among others, investments in measures to reskill women through ensuring their access to training facilities.

i. Digital Learning Platforms

Access to learning tools and technology permits people to develop cognitive and effective skills. The learner is in a position to identify the exact resource and apply the information to solve a specific problem and even get feedback through evaluation.

A digital learning platform with sector-specific programmes, training manuals and information can enable women to enhance their skill levels, particularly in emerging economies.⁶⁴ Engagements on digital platforms sharpen critical thinking skills and allow the student to be analytical as opposed to the traditional memorizing of a textbook.

The role of the private sector is to facilitate access to information from any corner of the world, breaking geographical and financial barriers that sometimes hinder learning.⁶⁵ Industry stakeholders can contribute to the body of learning by partnering with companies to invest in digital learning platforms. Online courses should be made accessible to personnel in order for them to reskill.

⁶²UNESCO (n 51).

⁶³Colleges and Institutes (n 50).

⁶⁴Sui Cheung Kong and Others, 'E-Learning in School Education in the Coming 10 Years for Developing 21st Century Skills: Critical Research Issues and Policy Implications' (2014) Vol. 17 No. 1 *Journal of Educational Technology & Society* 70, 72.

⁶⁵See Cheung Kong and Others (n 62) 75.

ii. Skills and Technological Transfer

International oil and gas and mining companies should be at the forefront of spearheading the need to address the skills gaps that could ensue due to automation, as such efforts would aid in fulfilling their local content requirements.

Companies can prepare curriculums that are sector focused and infuse them into STEM-based courses. Upon completing, the students can be attached to the companies for the experience. Such tailor-made training courses will encourage the uptake of women, who in turn will acquire the skills and knowledge, and levels the playing field to access the highly competitive technology-based jobs. Investing in training and reskilling programmes for women in technical and vocational training will allow for professional and business development and reignite return to work.

iii. Investing in Internet and Mobile Infrastructure

Unlimited, reliable and low-cost internet connectivity is the backbone to technological advancements.⁶⁶ The internet has created an explosion of new possibilities through free and open content, creating a global learning environment.

For people in developing countries, the cellphone is the main getaway to the internet. This has enabled the growth of complex mobile ecosystems of services and applications which has improved access to educational platforms.⁶⁷

Private sector participation in internet infrastructure will provide women with easy access to a myriad of skills and knowledge that will spur innovation and increase productivity.⁶⁸ The availability of technology will allow society to address digital inclusion issues and create a skilled woman.

⁶⁶Laura DeNardis, 'Introduction: The Shifting Geopolitics of Internet Access' in *The Shifting Geopolitics of Internet Access: From Broadband and Net Neutrality to Zero-Rating* (Centre for International Governance Innovation 2017), 1–4.

⁶⁷De Nardis (n 66).

⁶⁸Ibid.

c. Non-Governmental Organizations

NGO's play a significant role in agitating for change in the decision-making process locally and globally. New policy initiatives, rules and regulations are shaped as a result of extensive lobbying and campaigns on behalf of collective interest to influence a way of life.

Key stakeholders and lobby groups advocate for the reformulation of policy. As the world adjusts to technology as a way of life, work will evolve, and thus NGOs contribute to the identification of information that will empower, educate and inform key policymakers to initiate a new cycle of decision-making.

NGOs agitating for digital inclusion can create awareness on the barriers that impede women from participating equally in the world of work. Tailoring measures such as legislation and policy documents that will address this disparity and will allow women to take up opportunities in this automation era.

The increasing influence of NGOs can be witnessed through drafting. They can provide expert knowledge and evidence on the value proposition on women seizing opportunities in the technological space, they can propose solutions, and they can consult key stakeholder dialogues for input towards creating targeted policy documents.

Draft legislation should be open to input and public participation by different stakeholders, including NGOs. The consultations will allow for varied opinions and views before laws are enacted to allow for transparency and accountability.

One of the key roles of NGOs is the implementation of policy measures that will ensure women access digital platforms to reskill, ascend the career ladder and access the internet to phase into the automation world. Monitoring and evaluation, which is core to implementation, will show progress and whether we adhere to the measures and increase the representation of women in the technology-intensive fields.

12.7 Conclusion

The importance of diversity in the oil and gas and mining industries cannot be overstated. Companies that promote inclusivity/diversity have

been proven to outperform others, and tend to be more creative, innovative and productive. The adoption of 'new' technologies in the extractives could accelerate a paradigm shift and a change in working cultures that are already emerging.

Transformative leadership is much needed, not only in the extractives but in every facet of livelihoods. A transformative leader has the following attributes: is supportive, flexible, empathetic, caring or nurturing; traits that are more prevalent in women, hence emphasizing the need to bring women on board in these industries. More balanced teams make the best decisions, and women could be instrumental in bringing different leadership skills and behaviour, that is required in the industry. This diversity not only relevant in the workforce but also imperative in the extractives industries that are reliant on new ways of working to boost productivity levels efficiency.

With the advent of the 4IR, the enactment of policies like the AfCFTA, as well as the Covid-19 pandemic, countries are being forced to adapt to challenging circumstances and to devise innovative solutions to ensure inclusive, sustainable and equal development today and for future generations.

The chapter has explored the position of women in both the mining and oil and gas sectors, as subsets of the energy industry, and it is evident that there is a disproportionate number of women, as opposed to men in these sectors, particularly in a senior management position. This situation warrants the measures that have been suggested for different role players like the government/public sector, the private sector and NGOs.

Possible solutions to address the gender disparity challenges include ensure female participation at all levels of the oil and gas processes by introducing incentives to encourage more females to join the industry. Companies also need to reconsider how they retain and promote personnel to senior positions. Promotions ought to be based solely on merit, including at senior management positions. Top talent needs to be attracted, regardless of gender. Companies need to be more aggressive in promoting women in senior management positions, which are male-dominated. Only then would younger women be empowered and motivated to pursue long-term careers in the oil and gas industry. Companies could adopt performance indicators that consider inputs that

could help in the advancement of women. These potential solutions apply for both the mining and oil and gas sectors of the economy, and the other sectors in the energy industry.

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13

A Critical Intertemporal Analysis of Uganda's Fiscal Regime in the Energy Transition Era: Are Uganda's Upstream Projects Still Viable?

Ayebare Rukundo Tom

13.1 Introduction

The oil and gas sector still has a significant role to play in African countries in this energy transition era. Fossil fuels are not only crucial in tackling the energy access challenges in Africa but they are also key in the economic development of these resource-rich countries (Nalule 2018). While countries in the different parts of the globe are moving towards a low-carbon economy, Uganda is focused on developing its oil and gas sector. Nevertheless, the country has various renewable energy projects but this chapter will focus on the upstream projects.

The sharp increase in the oil price from \$34.75 per barrel in March 2003 to \$156.62 per barrel in 2008 led to several expropriations of assets owned by International Oil Companies (IOCs) and the introduction of windfall taxes (Rühl 2008; Stroebel and Van Benthem 2013). These occurred at varying levels in Algeria, Bolivia, China, Russia and

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Venezuela all occurring in 2006. Similarly, the Oil price collapse in August 2014 from USD 100.80 per barrel to USD 29.44 per barrel in January 2016 emphasized the exposure of many countries to oil price volatility (Bharat Petroleum 2017; Stroebel and Van Benthem 2013). Furthermore, the weaker oil price led to the deferral of Final Investment Decisions (FIDs) for about USD 380 Billion worth of new Upstream and incremental investment projects (WoodMac 2017). Countries on the verge of production, therefore need to develop broader-based strategies to ensure that fiscal terms are efficient under low and high oil prices.

In August 2016, the Government of Uganda (GoU) granted eight petroleum production licenses to a joint venture (JV) split equally three ways between Total E&P Uganda (TEPU) a subsidiary of Total SA, Tullow Oil plc and China National Offshore Oil Corporation (CNOOC). This was in addition to the 2013 Production license granted to CNOOC. The JV partners are estimated to spend 18 Billion dollars on Upstream infrastructure and wells before first oil, and \$4 Billion on the World's most prolonged heat traced crude export pipeline measuring 1443 km traversing from Hoima to Tanga port. The joint venture is currently mandated to take their Final Investment Decisions (FID) within 18 months and commence production by 2020. Furthermore, the country's first open competitive licensing round for petroleum exploration covering six blocks was launched in 2015 and is yet to be concluded (DoP 2017). In light of the recent oil price collapse, the project viability of the greenfield development under the current fiscal costs is questioned.

With the Uganda project on the brink of production and licensing of subsequent projects, this chapter presents a critical intertemporal analysis of Uganda's fiscal regime from the Government perspective and its impact on the planned Oil projects. Specific emphasis is applied to the full cost structure of the projects with the analysis seeking to determine the possible reaction of the investors utilizing the range of the fiscal terms applied within the country from 2004 to 2012. The study further highlights the fiscal incentives availed to date and their impact on the project viability in the new oil price environment. The study employs both a qualitative and quantitative analytical approach to

critically assess the fiscal elements prevalent in light of the investment incentives provided. The chapter seeks to answer the following questions from the Government perspective;

- What has been the nature of Uganda's Fiscal regime over time?
- What are the project characteristics and cost structure of the current projects within the country?
- What is the break-even prices of the Uganda Projects, and how do the fiscal regimes impact them?
- What would be the investor response to the current fiscal regimes and how can Uganda amend its fiscal regime in order to optimize its project portfolio?

The chapter presents a theoretical fiscal regime with progressive features to reduce the fiscal burden on marginal fields and provide more responsiveness of the Government revenue to project profitability regardless of the level of production. This is particularly applicable to fields similar to Jobi-East and Mpyo which were downgraded from the initial estimated recoverable reserves of 200 MMbbl to 11 MMbbl and 89 MMbbl to 12 MMbbl, respectively (Ward and Malov 2016).

Section 13.2 presents a review of the recent economic literature and studies relating to fiscal regime design and evaluation. A background on Uganda explicitly addressing the need to foster investment is additionally presented in this section. The detailed methodology utilized within the study is highlighted in Sect. 13.3. The qualitative and quantitative analysis of the Uganda Fiscal regime and the possible impact on the current projects presented in Sects. 13.4 and 13.5 concludes.

13.2 Literature Review

13.2.1 What Is the Nature of the Fiscal Costs Imposed by Regimes?

Natural resources such as petroleum generate economic rent because the marginal revenue accrued from the resource exceeds the marginal cost

of extracting it. Therefore, it is theoretically possible to impose a fiscal cost with a purpose of taxing the entire economic rent generated without distortion to the investment activity. Identification of the source and level of rent in practice may be difficult; thus the fiscal regimes are designed to suit the preference of the resource owners (Gaudet and Lasserre 2015).

Fiscal instruments that progressively increase the fiscal cost due with the increase in the economic rent generated have been cited to be the ideal fiscal instruments (Garnaut and Clunies Ross 1983; Boadway and Keen 2010). However, they have been noted to be distortionary in the presence of uncertainty because they discourage investment in risky projects over safer ones. Furthermore the difficulty of their administration and the high amount of information required for the determination of the level of rent questions the practicability of their application (Garnaut and Clunies Ross 1983; Boadway and Keen 2010).

In practice, numerous fiscal systems that insensitive to all the critical project metrics; such as project costs, production volumes and resources prices; linked to the generation of economic rent are utilized (Boadway and Keen 2010). Therefore under these systems, the fiscal cost imposed remains relatively constant and on average increases at lower levels of project profitability. The majority of these arrangements were designed for periods of relatively long and stable resource prices (Stroebel and Van Benthem 2013).

13.2.2 What Is the Impact of Different Levels of Fiscal Costs?

Petroleum resources are site-specific and homogenous, implying that the various fields, even within the same geological location, will possess different costs of extraction. Fields with lower marginal and development costs will typically yield higher profits (Garnaut and Clunies 1975, 1983; Nakhle 2008). The profits generated from the production of the resources is, however, subject to the fiscal regime established between the parties as it imposes a cost on the projects. The level and nature of this cost could yield unintended consequences on current and future projects.

Fiscal incentives may be utilized by Governments to attract irreversible frontloaded investment within the sector. Upon investment, the subsequent long-term production period requires an optimal level of commitment to ensure the projected levels of return envisaged at the time of investment are obtained. However, the economic significance of petroleum projects may create political pressure to increase the financial costs imposed during periods of high resource prices (Nakhle 2008). These short-term tax benefits to the State could create long-term dynamic deadweight losses leading to underinvestment in the basin.

Cognizance and anticipation of the State's opportunistic behaviour could incentivize the resource developer to operate strategically by under-investing, tactically overstating costs (gold plating) and eroding the tax base through transfer pricing (Lund 2009; Engel and Fischer 2010). Therefore a detailed understanding of the evolution, nature and impact of the fiscal regime on the projects within a petroleum province or internationally is of paramount significance.

Daniel et al. (2016) present a qualitative and quantitative assessment of fiscal arrangements prevalent in some of the Joint Development Zones (JDZs) around the World. Quantitative simulations from the Government perspective are utilized to rank the performance according to the Average Effective Tax Rate (AETR) of the prevalent JDZ fiscal regimes around the World. The Malaysia Thailand JDZ regime is ranked first, and the Australia Timor-Leste regime ranked last according to all the criteria under evaluation and in all scenarios. A detailed example of the interim arrangements made between Australia and Timor-Leste was highlighted to establish whether JDZ fiscal arrangements significantly differ from those under exclusive jurisdictions. The study further highlighted the critical challenges in the designing of JDZs, lessons learnt from previous experiences and policy recommendations for practical implementation in the future.

Similarly, Mintz (2016) analyses the impact of company tax and resource royalties on the incentive to invest in cross-border projects and the revenues accrued by Governments. The study analyses the marginal effective and royalty tax rates (METRRs) generated by fiscal systems of Australia, Brazil, Canada, Norway, United Kingdom and the USA on exploration, development and extraction using the DCF analysis

under different scenarios. The study finds that rent-based royalties cited in Brazil and the USA significantly often impose relatively higher tax thresholds on marginal investments. These are compounded by other cross-border challenges such as transfer pricing and conduit financing to mention a few. The study concludes that rent-based versions of royalties optimally provided a minimum revenue or output-based royalty is utilized to ensure governments obtain a requisite level of revenue.

Mintz and Chen (2012) survey the tax and royalty systems existent within six countries namely Australia, Brazil, Canada (five provinces), Norway, United Kingdom and four US states in search for the optimal fiscal regime. The study analyses the impact of both taxes and royalties of the fiscal regimes on the investment decision. The study postulates that the more efficient tax should be rent based. The study further ranks the METRRs of the fiscal regimes on the different levels of the project and provides recommendations for a rent-based royalty and other rent-based taxes.

Cottarelli (2012) provides an analytical framework to follow when providing country-specific advice to developing countries to improve their natural resources taxation. The study finds that current fiscal regimes prevalent in the petroleum industry around the World generate an Average Government take (AETR) ranging from 65 to 85% however they do not inhibit all avenues of base erosion. The study concludes that the combination of royalty, a rent tax and standard corporate income tax could improve fiscal performance of many developing countries.

The model utilized in the quantitative review in this chapter follows the DCF method utilizing the production profiles and technical costs estimated for the Kingfisher, Kaiso Tonya and Buliisa fields in Uganda. Osmundsen et al. (2017) cite that IOCs utilize adjusted project metrics with minimum thresholds to determine decisions to sanction projects. Therefore the net cash flow generated was discounted to present value to account for timing and risk, thus providing an estimate of the Present Net Value (NPV). The Net project cashflows were utilized to calculate the project pre-tax IRR, AETR, METR, Break-even prices and other relevant metrics. This approach assessed the impact of the various fiscal regimes prevalent in Uganda on the investment decision in cognizance of scarce and mobile capital while holding other project and jurisdictional

characteristics constant. A theoretical regime for the future projects with a progressive-based profit oil sharing mechanism based on the R-factor was presented in line with recommendations from Cotarelli (2012), Mintz and Chen (2012), and Mintz (2016).

The methodology utilized faced difficulties in choosing a reasonable discount rate to account for risk subjected to the various components of the project at different stages and prediction of the highly volatile future resource prices. Hurdle rates of 9 and 12.5% were utilized as per Daniel et al. (2010, 2016) and Osmundsen et al. (2017). The oil price uncertainty was handled by use of a base price and a monte carlo simulations of the key project metrics to changes in the oil price (Daniel et al. 2010, 2016).

The study faced limitations with regard to obtaining proper estimates and schedules of the exploration costs incurred to date. The analysis, therefore, did not evaluate the impact of the exploration costs on the key project metrics as the study assumes they were sunk costs. Furthermore, the fields were grouped as per the development proposals laid out in Ward and Malov (2016) and subjected to the same fiscal regimes to determine the required project metrics. However, in practice, it is anticipated that while the production facilities of the different fields will be physically integrated, the fields in different license areas will be fiscally separate.

13.2.3 Background on Uganda

Uganda has been cited as one of the fastest-growing economies in the World in the past decade (Polus and Tycholiz 2016). In 2016, Uganda's Gross Domestic Product was approximately \$25.53 billion (World Bank 2017) with an average annual growth rate of 4.5% over the past five years to 2016 generating tax revenue of 14.6% of GDP (CIA 2017). The country's economy is constituted of 24.5% agriculture, 21% industry and 54.4% services with the country largely dependent on agriculture for both revenue and employment (World Bank 2017).

The country is currently pursuing an extensive infrastructure development campaign with the existing infrastructure financing deficit estimated at 0.4 Billion per annum and rising (World Bank 2017). The country further hopes to attain upper-middle-income status by 2040. This target requires significant resources with the current sources unable to match the demands. The agricultural sector is mostly subsistence-based, and the services sector offers minimal linkages. The anticipated revenues from Oil and Gas extraction are, therefore, a key resource to actualizing Government programmes (NPA 2013). Resource governance and development are equally paramount as resource possession alone does not guarantee successful development in line with Government and Investor objectives.

13.2.3.1 Hydrocarbon Development in Uganda

Petroleum resources were first documented by the colonial government geologist EJ Wayland in the publication *Petroleum in Uganda* (1925) which detailed 52 oil and gas seeps, 10 of which were confirmed on the Ugandan side of the Albertine Graben. This led to the drilling of the first shallow stratigraphic well; Waki-B1; in 1938 by the Anglo European Investment Company and the subsequent drilling of 22 shallow stratigraphic wells in Kibiro and Kibuku for geological correlation. Attempts to further the resource development were hampered by the Second World War and later the colonial zoning of East Africa as an agricultural region. Following independence in 1967, a period of political upheaval befell Uganda and thus hampered the investment in petroleum exploration (Twebaze 2013).

As political stability was re-established in the late 1980s, the Government was able to acquire geological data commencing with 9578 line kilometres of aeromagnetic data in 1983 and gravity data over Lake Albert in 1992. The establishment of a Petroleum Exploration Project in 1985 facilitated the promotion of exploration, acquisition of geological and geophysical data and the enactment of the Petroleum (Exploration and Production) Act 1985 (Twebaze 2013).

1991 marked a major reference point in the history and development of Uganda's oil and gas industry for two reasons. Firstly, the Petroleum Unit within the Geological Surveys and Mines Department (GSMD) was transformed into the Petroleum Exploration and Production Department (PEPD) mandated to supervise and manage the country's upstream petroleum activities (Twebaze 2013). Secondly, Fina Exploration Uganda was granted a license to explore the entire Albertine Graben. However, the license was not renewed in 1993 due to unfulfilled work programmes. A subsequent uptick in exploration interest within the country facilitated the gazetting of 11 Exploration areas within the Graben subsequently licensed out to Independent Oil companies (Patey 2017).

On January 6, 2006, the first commercial discovery of petroleum was declared when Mputa-1 well encountered hydrocarbons in both targeted zones. The zones were subsequently confirmed as hydrocarbon bearing by wireline logging (Twebaze 2013). While the geological potential of the country had been proven, there was a need for a robust regulatory and legal regime to support the development and production phases (Patey 2017).

A moratorium on further licensing was imposed in 2007 to facilitate the enactment of a robust regulatory and fiscal framework. The National Oil and Gas Policy (NOGP) of 2008 and two new legislations; the Petroleum (Exploration, Development and Production) Act and the Petroleum (Refining, Conversion, Transmission and Midstream Storage) Act both of 2013; were enacted to form the foundation of this regime. The Upstream regulations enacted in 2016 provide further cover in the upstream areas of General, Health and Safety, Metering and National Content.

The first licensing round in the country's history covering six blocks; namely Ngassa (410 Km²), Taitai and Karuka (565 Km²), Ngaji (895 Km²), Mvule (344 Km²) with Turaco (425 Km²) and Kanywantaba (344 Km²); was announced in February 2015 following the lifting of the moratorium. The licensing round was intended to facilitate increased investment and develop the country's project portfolio in a bid to enhance competition and promote cost efficiency in line with the NOGP (DoP 2017). With a recorded rate of the success rate of exploration wells

exceeding 85%, the Graben is highly prospective (Polus and Tycholiz 2016). However, challenges relating to the commercialization of the onshore waxy petroleum remain significant. In light of this, the GOU has over time offered a number of fiscal incentives to reduce the costs imposed on the nascent developments.

13.2.3.2 Fiscal Incentives

VALUE-ADDED TAX (VAT)

Section 4 of the Value-Added Tax (Amendment) Act of 2015 exempted imported materials, equipment and services utilized in the development phase of the petroleum sector. The VAT imposed would have increased the upfront financial requirements without generating an associated revenue stream for the IOCs. The delayed recoverability of the expected refunds would have further hampered the project value by imposing a cost akin to an implicit export tax (Boadway and Keen 2010).

13.3 Methodology—Evaluation of Economics of Fiscal Terms and Alternative Regime

The economic terms for the current and future petroleum operations in Uganda were evaluated within the licensed areas based on the proposed development plans envisioned within the country. A robust economic model reflected the fiscal terms for the EA1 2004, EA3A 2004 and EA1A 2012 to highlight the evolution and nature of the fiscal costs imposed. A theoretical fiscal package was utilized to facilitate comparative analysis and demonstrate the potential benefits of enhancement.

13.3.1 Geology and Operating Assumptions

13.3.1.1 Kingfisher and Kaiso—Tonya Developments

The Kingfisher development lies within EA3A block south of Lake Albert. It possesses approximately 196 million barrels of recoverable oil

within one field. A total of 27 production wells and 13 injectors will be drilled from 5 well pads onshore targeting the reservoir offshore. The development further consists of a large CPF, a liquid petroleum gas (LPG) truck loading arm, water abstraction from Lake Albert and an export pipeline to Hoima. The unique cost features of the development arise from the complexity of horizontal drilling onshore targeting offshore resources and the operational costs for the heated pipeline to Hoima. The KF production profile is anticipated to ramp-up for two years to a plateau of 40,000 barrels per day for six years before commencing a decline in 2028 (Ward and Marlov 2016).

The Kaiso-Tonya development is located within EA2 block, southeast of Lake Albert. The development consists of three fields, namely; Mputa, Nzizi and Waraga; with approximately 39 MMbbl of oil recoverable. A total of 28 production wells with 19 injectors will be drilled from 6 well pads before subsequent heating and export of the crude through a heat traced pipeline to the Kingfisher CPF thus eliminating the need for a CPF. KT is designed to tie back to the Kingfisher CPF, and therefore its start of production is pushed back by eight years to coincide with the start of the KF decline in 2028 (Ward and Marlov 2016).

13.3.1.2 Buliisa Development

The Buliisa development is comprised of 11 fields located in EA2 North and EA1 blocks with approximately 819 million barrels of recoverable oil. The development comprises of 307 production wells, 153 injection wells and 40 monitoring wells channelling the production to a large focal CPF. Due to the dispersed nature of the project footprint, the CAPEX is spread eight years into the production phase. The Buliisa project is anticipated to ramp-up for two years to a plateau of about 180,000 barrels per day for three years subsequently commencing decline in 2026. The decline of Buliisa is slower due to the prolonged drilling schedule from the 11 fields included in the development of the project production period (Ward and Marlov 2016).

Table 13.1 Model assumptions

	Kingfisher and Kaiso Tonya development		Buliisa development	
Recoverable reserves	235	MM BBL	819	MM BBL
Project costs	\$ MM	\$ / BBL	\$ MM	\$ / BBL
Development costs	2042.00	8.70	6598.00	8.06
Operating costs	2160.00	9.20	6929.00	8.50
Decommissioning costs	243.86	1.04	487.71	0.60

The project assumptions relating to the developments are summarized in Table 13.1. The analysis was focused on the development decision considering exploration costs as sunk.

13.3.2 Oil Prices

The base oil price was assumed at US \$60 per barrel; real 2015 dollars; to evaluate the highlighted fiscal regimes. Monte Carlo simulations were run to account for oil price variability.

13.3.3 Hurdle Rate

The hurdle rate has to cater for time value and other non-price risks such as political risk related to the political environment prevalent in the location of the oil reserves. Base rates of 9 and 12.5% were utilized with the corresponding break-even prices and Marginal Effective Tax rates presented.

13.3.4 Theoretical R-Factor Regime

R-Factor was expressed as the ratio of cumulative contractor net revenues from the start of the project to total investment. It is also known as payback ratio and was given by the formula below;

$$\text{R Factor} = \frac{\sum_{i=1}^{t-1} (\text{Revenues} - \text{OPEX} - \text{Replacement CAPEX} - \text{Royalty})}{\sum_{i=1}^{t-1} (\text{Exploration} + \text{Development CAPEX})}$$

An interpolating sliding scale with a minimum threshold of 50% below an R-factor of 1, a maximum threshold of 75% for an R-factor over three and an interpolating threshold between 50 and 75% for an R-factor between 1 and 3. The interpolation formula is given by;

$$\text{Gov.Share} = \text{Min Gov.Share} + \text{Max} \left[0, (\text{Max Gov.Share} - \text{Min Gov.Share}) \times (\text{Rfactor} - 1 / \text{Rfactor max.band} - 1) \right]$$

13.4 Results and Analysis

13.4.1 Evaluation of Uganda's Fiscal Terms

The fiscal terms evaluated are summarized in Table 13.2. They highlight the evolution of the fiscal terms over time from 2004 to 2012 with the inclusion of a theoretical regime with a profit-sharing mechanism based on the R-factor and an interpolating sliding scale.

13.4.1.1 Royalty Analysis

All the prevalent regimes provide for sliding scale royalties based on Daily Rate of Production (DROP).

A maximum threshold of 7500 bopd was applicable to the cumulative production with ring-fencing at contract area level. However, this threshold was easily attained by the Buliisa and KF-KT developments currently planned. This likened the sliding scale royalty to a single percentage ad valorem royalty. Two aspects were deduced from these results.

Firstly the current regimes were designed to suit fields with low production thresholds, and subsequent regimes could benefit from either increasing the production thresholds and royalty percentages while maintaining ring-fencing at contract area level or maintaining of the current DROP and reducing the ring-fence applicable to the field level.

Secondly, the sliding scale could be advantageous in the later stages of production as it would impose a reduced fiscal burden on a declining

Table 13.2 Fiscal terms under review

	EA1 PSA 2004	EA3A PSA 2004	EA1A PSA 2012	Theoretical terms (R-factor)
1 State participation	15%	15%	15%	15%
2 Cost recovery	60%	60%	60%	60%
3 Royalty	<i>k bopd</i> <2.5 2.5–5.0 5.0–7.5 >7.5	<i>Contractor k bopd</i> <2.5 2.5–5.0 5.0–7.5 >7.5	<i>Contractor k bopd</i> <2.5 2.5–5.0 5.0–7.5 >7.5	<i>Contractor k bopd</i> <2.5 2.5–5.0 5.0–7.5 7.5
3 Additional royalty (Cumulative production)	N/A	N/A	<i>mmbbl</i> <50 50–100	<i>Contractor</i> N/A 2.50% 5.00%
6 Profit oil split	<i>k bopd</i> <5 5.0–10.0	<i>Contractor k bopd</i> <5 5.0–10.0	<i>Contractor k bopd</i> <5 5.0–10.0	<i>Contractor R-factor</i> R-factor <1 1<R-factor<3
				<i>Contractor</i> 50 Interpolation between 50–75

	EA1 PSA 2004		EA3A PSA 2004		EA1A PSA 2012		Theoretical terms (R-factor)	
	10.0– 20.0	47.50%	10.0– 20.0	46.50%	10.0– 20.0	47.50%	R-factor>3	25
	20.0– 30.0	42.50%	20.0– 30.0	41.50%	20.0– 30.0	42.50%		
	30.0– 40.0	37.50%	30.0– 40.0	36.50%	30.0– 40.0	37.50%		
	>40.0	32.50%	>40.0	31.50%	>40.0	32.50%		
7 Taxation	30%		30%		30%		30%	
rate-CIT	6		6		6		6	
depreciation								

field. This benefit would only apply if there were only one declining field within the ring-fence, further providing an incentive for reduction of the ring-fence to the field level.

The low threshold rates highlight the geological uncertainty that surrounded the initial developments, and newly available data could enhance the design of future regimes. The theoretical regime was proposed to reduce the fiscal burden on marginal projects and fields and provide more responsiveness to the Government revenue to project profitability regardless of the level of production.

13.4.2 Quantitative Analysis of Uganda's Fiscal Regime

13.4.2.1 Minimum Effective Royalty (MER)

The royalty imposed interacts with the cost recovery limit to form an added layer of royalty, and the minimum effective royalty imposed by the different fiscal regimes are summarized in Fig. 13.1. This provides an indication of the minimum share of gross revenues a government

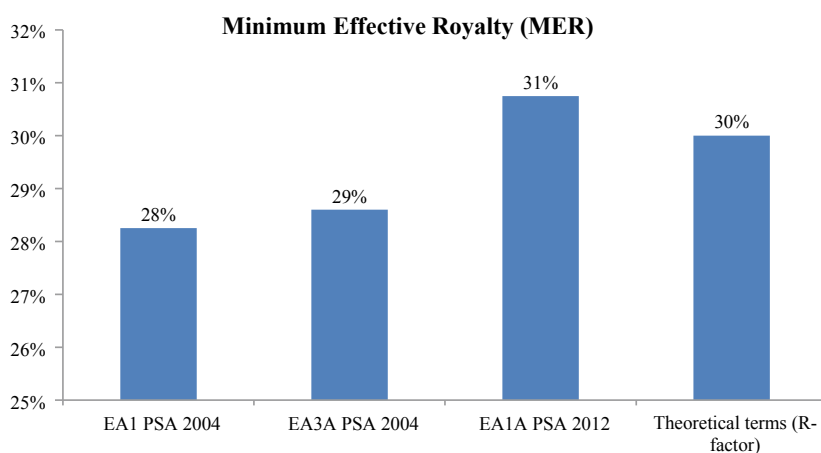


Fig. 13.1 Minimum effective royalty implied by the fiscal terms

will receive in any given accounting period for a field and the level of frontloading of the fiscal terms.

The similar structure of the PSAs yielded relatively similar levels of front-loading for the existing regimes. The 2012 EA1A PSA possesses a higher MER due to the additional royalty imposed based on cumulative production. The theoretical regime possesses the second-highest MER due to the fact that it possesses a higher initial profit-sharing threshold of 50% compared to 45 and 46% of the EA1 2004 and EA3A 2004 respectively.

13.4.2.2 Amount of Government Revenues

With a price assumption of US \$60 FOB Mombasa, real dollar 2016, the Buliisa project yielded a pre-tax IRR of 29.6% because of the high production volumes and the lower development and operating costs per barrel. Under similar assumptions, the KF-KT project yielded a pre-tax IRR of 26.5% and is less profitable than Buliisa. Both projects possess considerable revenue-raising ability for the GoU subject to the oil price realized. Table 13.3 summarizes the main economic results from the analysis of the two projects across all the regimes evaluated.

Under the Buliisa project, the EA1A 2012 PSA generated the highest government take of US \$14.1 Billion discounted at 10%. This was due to the interaction of the fiscal terms and the additional layer of royalty based on cumulative production prevalent in the EA1A PSA. All the existing PSAs were cited for outperforming the theoretical R-factor terms from the Government perspective with the EA3A 2004 PSA raising US \$13.7 Billion, the EA1 2004 PSA raising US \$13.6 Billion and the theoretical terms raising US \$13.1 Billion. The limited difference in performance was explained by a similar general structure of the terms and the reducing level of the effective royalty rates in the order of the fiscal term performance. This implies that the negotiation of the fiscal terms improved over time, probably as more information on the geological attributes and capacity developed.

Considering KF-KT development, the results were reversed. The theoretical R-factor regime raised the highest Government revenue of US

Table 13.3 Main economic results

	EA1 2004		EA3A 2004		EA1A 2012		PSA R-factor	
	Buliisa	KT & KF	Buliisa	KT & KF	Buliisa	KT & KF	Buliisa	KT & KF
Project pre-tax real IRR	29.6%	26.5%	29.6%	26.5%	29.6%	26.5%	29.6%	26.5%
Post tax real IRR to contractor	11.9%	12.9%	11.7%	12.7%	10.7%	12.1%	13.2%	12.1%
Project pre-tax NPV at 10% (\$mm)	14,382.5	3397.7	14,382.5	3,97.7	14,382.5	3397.7	14,382.5	3397.7
Contractor NPV at 10% (\$mm)	754.8	355.7	666.9	333.4	254.8	250.3	1243.1	239.8
Government revenue NPV at 10%	13,627.7	3042.0	13,715.6	3,064.3	14,127.7	3147.4	13,139.3	3157.9
Government take (AETR) at 10%	94.8%	89.5%	95.4%	90.2%	98.2%	92.6%	91.4%	92.9%

\$3.16 Billion at a 10% discount. This is followed by the EA1A 2012 PSA generating US \$3.15 Billion, the EA3A generating the US \$3.06 Billion, and lastly EA1 generating US \$3.04 Billion. The lower production levels explain these results from the KF-KT development compared to Buliisa development. Furthermore, the theoretical regime is able to generate more revenue resulting from the recovery of costs and improvement of the project profitability regardless of the production levels.

13.4.2.3 Timing of Government Revenue

The profile of revenue generated from the four regimes across both projects generally follows the production profile. The revenue profiles are summarized in Fig. 13.2.

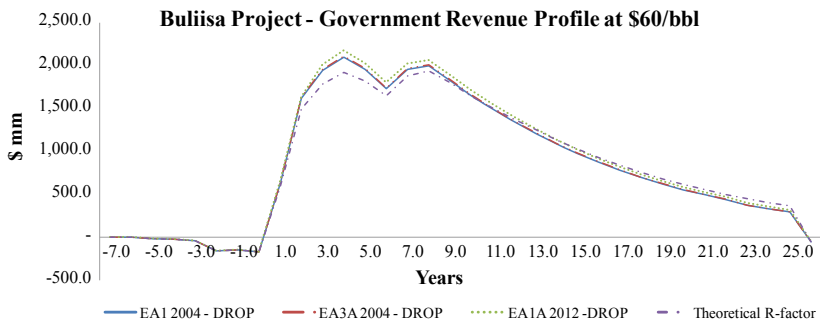


Fig. 13.2 Buliisa development revenue profiles under the different fiscal regimes

From Fig. 13.2, the existing PSAs based on the DROP generate more revenue to the Government earlier in the field production life corresponding to the increase in the production levels from the project. The performance is based on the level of MER with the EA1A raising the most revenue from the ramp-up to plateau before being overtaken by the theoretical R-factor regime in decline. The EA1 2004 and EA3A 2004 were observed to follow a similar revenue path with slight differences in the revenue profile stemming from the slight differences in the profit-sharing split percentages. The theoretical R-factor was cited for raising lower revenues at the start of production due to the delayed shifting of the profit threshold until the payback transition was obtained. In the decline phase, the theoretical regime was observed to outperform the existing regimes due to the attainment of higher thresholds after the attainment of payback. The high production rates, even during the decline, enabled the DROP PSAs to outperform the theoretical R-factor regime overall.

From Fig. 13.3, a similar pattern of performance was observed. The DROP PSAs raised more revenue from ramp-up to plateau. However, due to the lower production levels of the KT-KF development, the difference in revenue generated between the DROP PSAs and the theoretical R-factor regime was marginal. The theoretical regime outperforms the DROP regimes in the decline phase as the payback has been obtained in

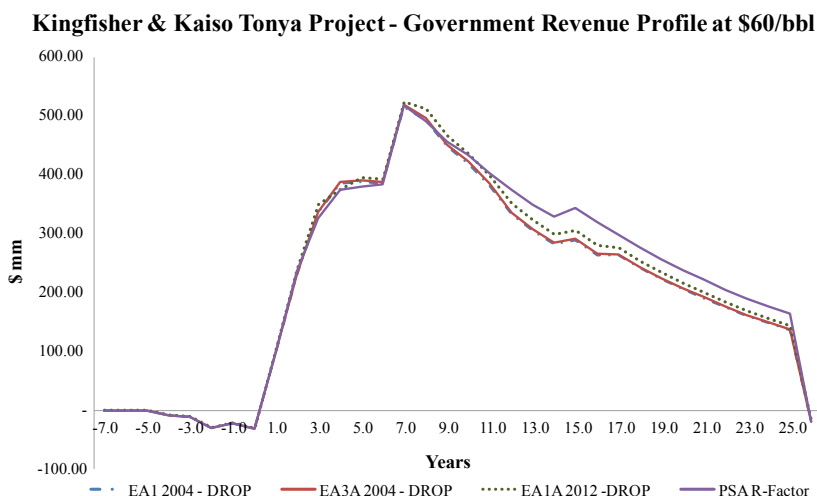


Fig. 13.3 Kingfisher and Kaiso Tonya development revenue profiles under the different fiscal regimes

the R-factor formula and the lower DROP profit split rates are applicable to the lower production levels.

13.4.2.4 Stability of Government Revenue

Figure 13.4 highlights the Average Effective Tax Rate (AETR) raised by the different fiscal regimes at varying prices on the Buliisa Project. The AETR refers to the ratio of the Government revenue receipts to the pre-tax net cash flow (Devereux and Griffith 2003). It is synonymous with the term Government Take and is given by the formula;

$$\text{AETR} = \frac{\text{NPV (Gov Revenue)}}{\text{NPV (Revenue - Exploration - Dev \& Replacement Capex - Opex - Decomm)}}$$

The DROP PSAs generate more revenue for the Government under the study price assumptions, as prices increase the revenue generated by the theoretical R-Factor regime increases while those generated by the DROP level off. At US \$90 per bbl, the 2012 EA1A PSA generates a similar AETR to the theoretical R-factor regime. At prices above US

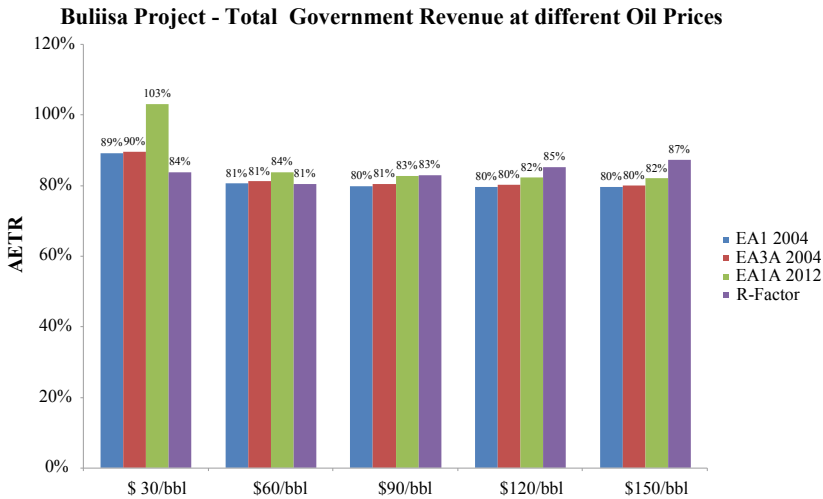


Fig. 13.4 AETR generated by the different fiscal regimes at varying oil prices from the Buliisa project

\$120 per bbl, the theoretical R-factor regime generates higher revenue for the Government than the DROP PSA regimes. At US \$30 a barrel, the DROP PSAs were cited for imposing a higher AETR on the Buliisa project. The 2012 EA1A PSA was cited for imposing the highest AETR of 103%, the 2004 EA3A imposes an AETR of 90% and the EA1 PSA imposes an AETR of 89% on the Buliisa project.

Figure 13.5 presents the AETR generated by the different fiscal regimes from the Kingfisher development at varying Oil prices. At US \$30 per bbl, the fiscal regimes were cited to generate AETRs ranging from 93 to 103% with the EA1A 2012 PSA generating the highest AETR of 103%. From the US \$60 per barrel, the theoretical regime was cited to generate a higher AETR from the KF-KT development than the DROP PSAs rising from 80% at \$60 per barrel to 87% at \$150 per dollars. The DROP PSAs generated AETRs ranging from 77 to 74% at US \$60 per barrel developing to 75 to 72% at US \$150 per barrel.

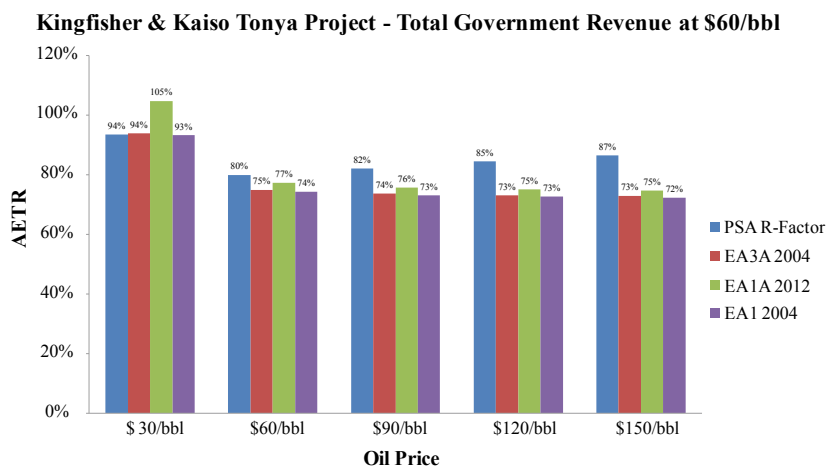


Fig. 13.5 AETR generated by the different fiscal regimes at varying oil prices from the KF-KT development

13.4.2.5 Neutrality

Figure 13.6 indicates the AETR generated by each regime at zero and 10% discount. In undiscounted terms, the four regimes under evaluation

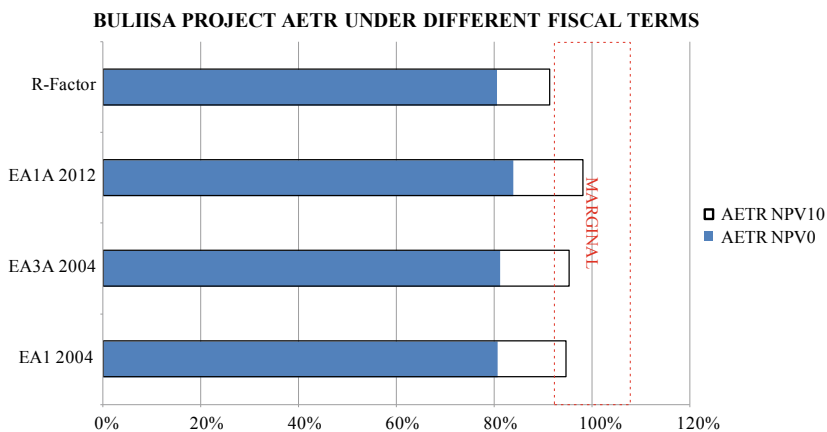


Fig. 13.6 AETR0 and AETR10 for the Buliisa development

generate similar AETRs from the Buliisa Development between 81 and 84%. Utilizing a discount rate of 10%, the 2012 EA1A PSAs generates an AETR of 98% and the 2004 EA1 and EA3A PSAs yield AETRs of 95%. This is due to the fact that the 10% discount rate is close to the Post Tax contractor IRRs of 10.66% under the 2012 EA1A PSA, 11.86% under the EA1 2004 PSA and 11.66% under the EA3A 2004 PSA. The theoretical R-factor regime generates an AETR of 91% for the Buliisa development at a 10% discount rate.

The AETR of the four regimes from the KT-KF development undiscounted and at 10% discount are summarized in Fig. 13.7. The undiscounted AETRs for the four regimes are similar, ranging from 75 to 80%. At a 10% discount rate, the theoretical R-factor regime and the 2012 EA1A PSA have the highest AETR of 93%. This is due to the Post Tax contractor IRR of 12.12% for the R-factor regime and 12.09% for the EA1A PSA regime. The EA1 2004 and EA3A 2004 PSAs possess an AETR of 90% from the KT-KF development at a 10% discount rate.

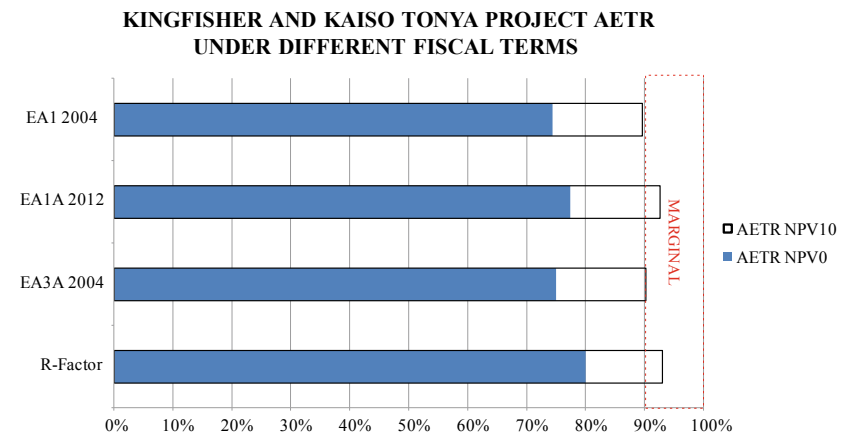


Fig. 13.7 AETR0 and AETR10 for the KF-KT development

13.4.2.6 Progressivity

The progressivity of the four regimes under evaluation was measured by estimating the AETR over a range of different pre-tax IRR and the corresponding pre-tax IRRs for the developments. The theoretical R-factor regime was observed to be more progressive than the DROP PSAs. This is due to the utilization of the R-factor that increases the Government take as the project costs are recovered, and the profitability increases. The results for Buliisa and KF-KT developments are summarized in Figs. 13.8 and 13.9.

From Fig. 13.8, the theoretical R-factor regime is cited to generate lower Government share of the Total benefits at project pre-tax IRR below 30% corresponding to an oil price of US \$60 per bbl. The Government share of total benefits subsequently increases as the oil price and project profitability increases, and at higher oil prices, the R-factor regime outperforms the DROP PSAs.

Figure 13.9 indicates that the theoretical R-factor regime captures a larger share of the Government revenue at all levels of project profitability above 18% Project Pre-Tax IRR for the KF-KT development. The DROP was cited to generate lower Government share of Total benefits for projects with lower production volumes.

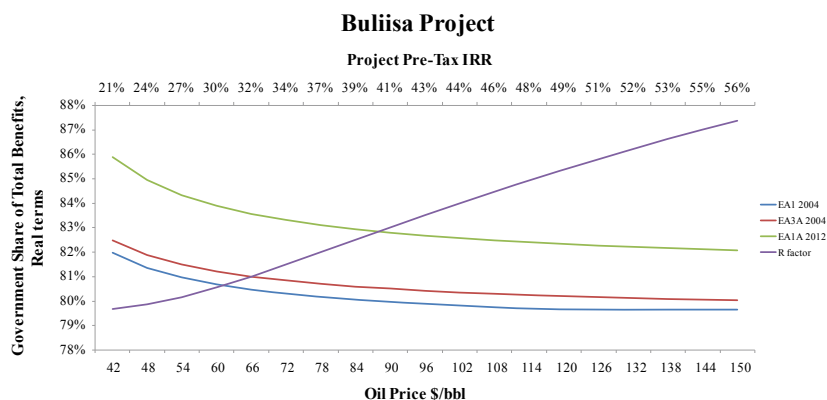


Fig. 13.8 AETR for Buliisa development over varying project pre-tax IRR and corresponding oil prices

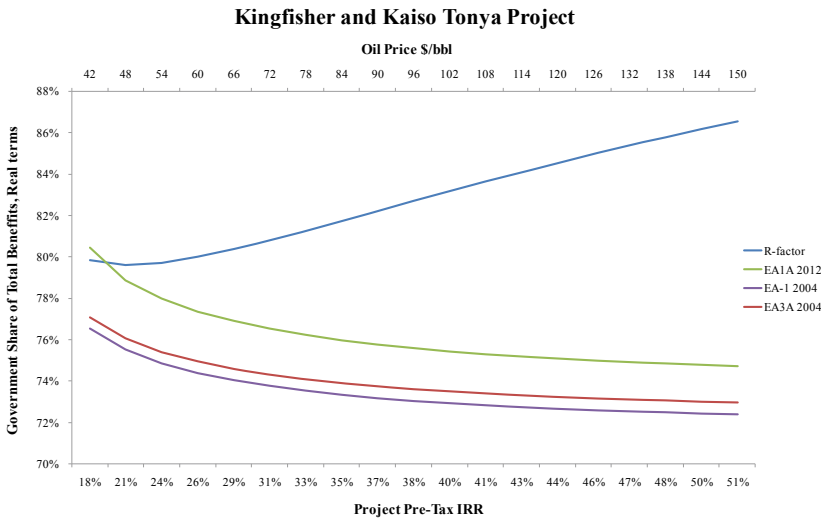


Fig. 13.9 AETR for KF-KT development over varying project pre-tax IRR and corresponding oil prices

The METRs and corresponding break-even prices (BEPs) imposed at 9 and 12.5% on the two developments by the four regimes under evaluation are summarized in Figs. 13.10 and 13.11. The METR is defined as the level of the fiscal burden imposed by the tax regime on a project at the periphery of feasibility. It highlights the extent to which the fiscal regime may impact the investment decision relating to the project. It is given by the formula;

$$\text{METR} = \frac{\text{Pre Tax IRR} - \text{Post Tax IRR}}{\text{Pre Tax IRR}}$$

The price required to attain a minimum required return on the capital employed in a project is known as the break-even price. Under the Buliisa development, the DROP PSAs impose a higher fiscal burden on the projects than the R-Factor regime. This is reflected in the higher BEPs at 9% of US \$52.38, US \$48.47 and US \$47.92 for the EA1A 2012, EA3A 2004 and EA1 2004 PSAs; while the R-factor regime generated a BEP of US \$44.11. At 12.5%, the Buliisa development yields BEPs of

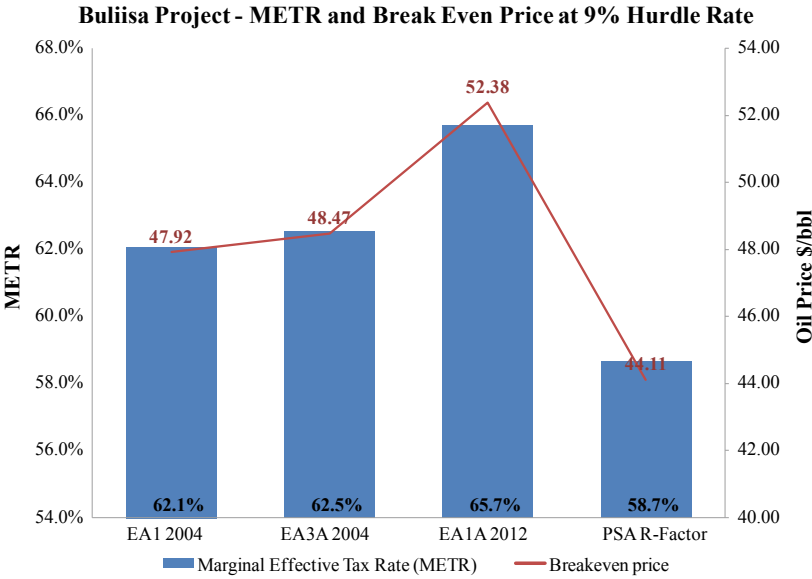


Fig. 13.10 Buliisa project METRs and BEPs at 9% hurdle rate

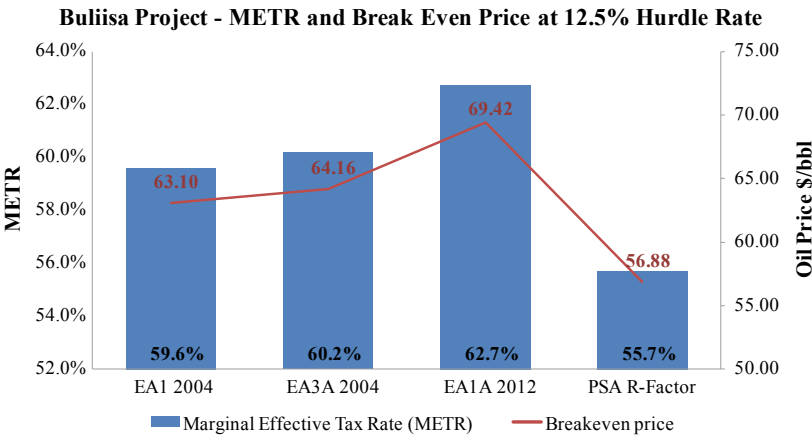


Fig. 13.11 Buliisa project METRS and BEPs at 12.5% hurdle rate

US \$69.42, US \$64.16 and US \$63.10 for the EA1A 2012, EA3A 2004 and EA1 2004 PSAs; while the R-factor regime generated a BEP of US \$44.11. These results were observed due to the activation of higher profit oil split percentages in the DROP PSAs ranging from 60 to 65% due to the high field productivity. The R-factor regime was cited for building up the profitability of the project slower as the initial revenues were utilized to recover project costs.

The results are overturned for Kingfisher development, as highlighted in Figs. 13.12 and 13.13. The R-factor regime and the 2012 EA1A PSA were cited to generate the highest METR of 58.37 and 57.30% with corresponding BEPs of US \$48.87 and US \$47.78, respectively, at 9 and 12.5%. These results are due to the lower production volumes anticipated from Kingfisher; therefore activating lower profit oil splits under the DROP PSAs ranging from 45 to 54% in the initial 12 years of production. This is lower than the initial minimum profit split of 50% prevalent under the R-factor regime. Furthermore, as the production continues, and the initial costs are recovered, the R-factor regime can outperform the DROP PSA regimes.

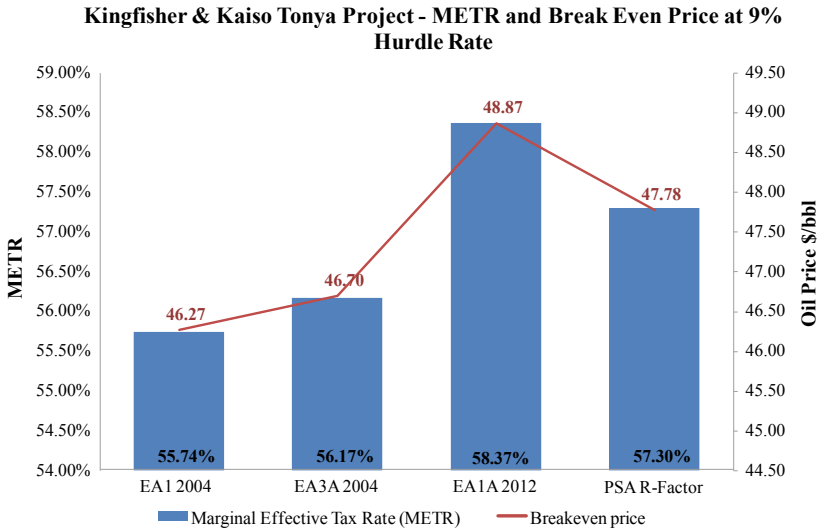


Fig. 13.12 KF-KT project METRS and BEPs at 9% hurdle rate

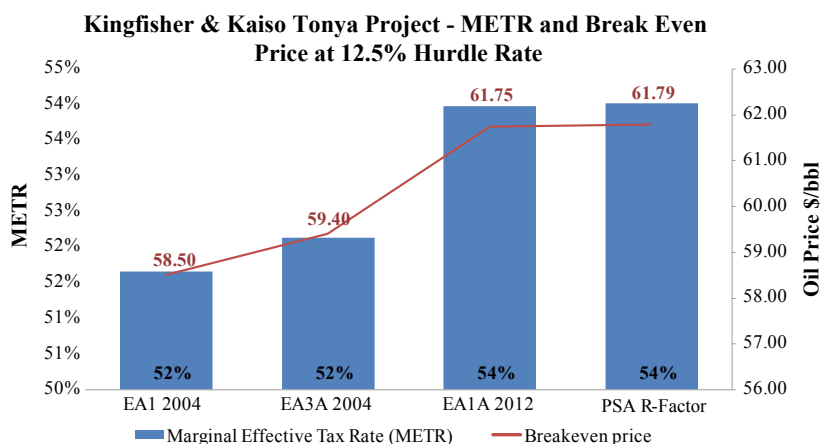


Fig. 13.13 KF-KT project METRS and BEPs at 12.5% hurdle rate

13.5 Conclusion

While the global focus is on clean energy advancements, the continued role of fossil fuels in developing countries necessitates a review of the fiscal regimes. As discussed in this chapter, the sharp increase in the oil price from \$34.75 per barrel in March 2003 to \$156.62 per barrel in 2008 led to a number of expropriations of assets owned by IOCs and the introduction of windfall taxes. These occurred at varying levels in Algeria, Bolivia, China, Russia and Venezuela all occurring in 2006. Similarly, the Oil price collapse in August 2014 from USD 100.80 per barrel to USD 29.44 per barrel in January 2016 emphasized the exposure of many countries to oil price volatility. Furthermore, the weaker oil price led to the deferral of Final Investment Decisions (FIDs) for about \$380 Billion worth of new Upstream and incremental investment projects. Countries on the verge of production, therefore need to develop broader-based strategies to ensure that fiscal terms are efficient under low and high oil prices.

In Uganda, all the prevalent regimes provide for sliding scale royalties based on DROP with a maximum threshold of 7500 bopd applicable to the cumulative production with ring-fencing at contract area level. This was observed to be a low threshold for the contract area ring-fencing.

Therefore, subsequent regimes could benefit from either increasing the production thresholds and royalty percentages while maintaining ring-fencing at contract area level or maintaining of the current DROP and reducing the ring-fence applicable to the field level. Furthermore, the sliding scale could be advantageous in the later stages of production as it would impose a reduced fiscal burden on a declining field providing additional incentive for reduction of the ring-fence to the field level.

Uganda's Fiscal regimes have increased in the level of regression over time. This, on the one hand, provides stable and secure Government revenues; however, on the other hand, it limits the Government to take on the project upside due to high resource prices or reduced project costs. The theoretical regime was sighted to be progressive with regard to the Buliisa and KF-KT projects. However, in line with the theory, it imposed a higher fiscal burden on the KF-KT project to its lower profitability.

The Buliisa and KF-KT projects were found to be averagely viable at a 9% discount rate and marginal at a 12.5% discount rate. The fiscal regimes in place were further cited for providing significant incentives to the IOCs to significantly improve project profitability, therefore increasing their upside take. The Government, therefore, should reduce the non-price risks within the country and carefully monitor the resource development.

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14

Energy Transitions and Environmental Protection: Environmental Impact of the Oil and Gas Production Activities in South Sudan

Peter Reat Gatkuoth

14.1 Introduction

The main aim of the 2015 Paris Agreement is to tackle climate change. In this respect, different countries across the globe have established strategies and policies aimed at transitioning to a low-carbon economy. The main feature of these energy transition policies is that they emphasize the need for countries to deploy renewable energy and energy efficiency technologies.¹ Albeit, fossil fuels still have a major role to play in not only ensuring the economic development of African countries but also

¹Nalule, Victoria R. *Energy Poverty and Access Challenges in Sub-Saharan Africa: The Role of Regionalism*, Springer, 2018.

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tackling energy access challenges.² Whereas this chapter will not dwell in the efforts aimed at transitioning to a low-carbon economy, it nevertheless highlights the negative impacts of fossil fuels in South Sudan and sets out recommendations for the country to transition to a low-carbon economy.

South Sudan became an independent State in July 2011 after decades of a protracted civil war and the signing of a Comprehensive Peace Agreement (CPA) in 2005. The Agreement ushered in a new era of hope to the people of South Sudan. The independence came with an inherited barrage of the oil and gas industry coupled with the associated environmental impacts. Oil and gas resources also referred to as the black gold, are a significant factor in the governance and economics of the Republic of South Sudan. Ownership and utilization of these resources are highly contested by the political minds in the country.³

While oil and gas are significant sources of revenue for South Sudan, the management of the sector is a crucial factor that determines the future earnings of the country. Oil and gas exploration and production have, however, caused adverse impacts on the environment. This has affected societies, economies, livelihoods and Ecology. The environment has been wasted and destroyed due to damage from oil and gas production activities in the splendid Upper Nile Region of South Sudan.

A major problem with oil and gas activities in South Sudan is that the existence of a weak regulatory framework to control or mitigate environmental damage. Institutions charged with the responsibility of enforcing the law are not strong enough to supervise and implement environmental laws in the country. Additionally, the laws do not adequately impose an obligation on private oil companies to protect the environment.

Due to civil strife and destabilized governance in the country, the environment has become prone to wanton destruction and flagrant degradation in the great Upper Nile Region. Generally, oil companies tend to flout national and international environmental standards in

²Nalule, V. R., Transitioning to a Low Carbon Economy: Is Africa Ready to Bid Farewell to Fossil Fuels? In *The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions* (pp. 261–286), Palgrave Macmillan, Cham, 2020.

³Nyaba, Peter Adwok, South Sudan: The Crisis of Infancy. Centre for Advanced Studies of African Society (CASAS), 2014.

developing countries, especially in Africa and this is no different from what is happening in South Sudan.⁴ Consequently, the impact of oil and gas activities on the environment has led to massive displacement, inadequate compensations, deaths, loss of ancestral lands due to evasive operations of oil and gas by Exploration Companies (OEC) in the Upper Nile Region.⁵

This chapter, therefore, analyses the impact of the oil and gas exploration and production in the Upper Nile region of South Sudan on the country's environment. The chapter discusses the legislative and institutional steps taken by the South Sudanese Government to control environmental degradation. In this respect, therefore, the main questions to be addressed in this chapter include:

1. What is the impact of the oil and gas exploration and production in the Upper Nile region of South Sudan on the country's environment?
2. What legislative and institutional steps have been taken by the South Sudanese Government to control environmental degradation?

The chapter consists of four sections. Section 14.1 is the introduction; the negative impacts of the oil and gas activities on the environment are discussed in Sect. 14.2; Section 14.3 looks at the legal and institutional framework, while Sect. 14.4 gives the concluding remarks.

14.2 Environmental Impacts of Oil and Gas in South Sudan

Oil and gas resources though important for economic development and are essential in achieving the United Nations Sustainable Goal 7 on Energy Access they are also associated with various negative impacts on the environment. Environmental degradation is critical because the ability of the environment to support and sustain life depends on the proper natural balance of its parameters such as the water, air, soil,

⁴Ibid.

⁵Nyaba, Peter A., *South Sudan: The State We Aspire To*, Cape Town, Casas, 2011.

flora and fauna, temperature, oxygen for the sustenance of life on the life-supporting planet. Oil exploration and production involve various chemical and seismic wave generation is a major source of environmental degradation, particularly through liquid discharges and oil spills as well as gas flaring.

Petroleum renders the soil infertile, burns vegetation and kills useful soil microorganisms, thereby hampering agricultural productivity.⁶ Accordingly, before mineral/fossil fuel resources are harnessed, they pass through the stages of exploration, mining and processing. Different types of environmental damages and hazards inevitably accompany these three stages of mineral development. Oil spills (either in crude or refined form), natural gas flaring and deforestation which are highly associated with oil extraction are common phenomena in the oil communities and have caused severe environmental degradation in the oil-producing enclaves. This is because they contaminate the environment, cause water and land pollution with grave consequences on both human and natural environment due to the toxic nature of the chemical discharged as it is in the case of the Niger Delta in Nigeria.⁷

Taking stock of the above, we note that petroleum resources besides negatively impacting on the environment, they have also been characterized with political unrest hence being a curse to some developing countries. Nevertheless, developed countries such as Norway have highly benefited from the sector, but this is no guarantee that developing countries will experience the same blessing. By the end of the 1960s, Norway was the poorest country in Scandinavia, this however changed by the end of 1990 when the country, after discovering oil, became the wealthiest in the region.⁸

Moving forward, we note that the presence of oil infrastructure per se is known to lead to a wide range of environmental impacts. Oil spilled

⁶Monitor, Fiscal, and Regional Economic Outlook. "How Oil, Gas, and Mining Projects Can Contribute to Development," *Finance & Development* (2000).

⁷Cave E.O and McDonald J. D., *Birds of Sudan* (1958).

⁸McKenzie, L. M.; Guo, R.; Witter, R. Z.; Savitz, D. A.; Newman, L. S.; and Adgate, J. L., *Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado*, Colorado: National Institute of Health Sciences (NIHS), 2014.

on terrestrial environments will undergo volatilization and biodegradation.⁹ On soil, a significant fraction will infiltrate into the subsurface, the remaining oil fraction with heavy molecules has attracted significant concern due to carcinogenic potentials and the ability to bioaccumulate. Additionally, the pipelines are causing major problems from leaking leading to massive oil spills along the transportation line to the sea terminal at port Sudan.¹⁰ Thus, the effect of the oil spills on ecosystems is detrimental to both humans and wildlife. This section briefly discusses the environmental impacts associated with fossil fuels and these are outlined below:

● Effect on Underground Water

A serious threat posed by oil-related pollution is the impact on both surface and underground waters. When oil spills occur or when there is an effluent discharge, it seeps into the ground and becomes mixed in the underground water system. This, in turn, pollutes the streams and wells, which are mostly relied on by the local communities—hence resulting in water-borne diseases.¹¹

In South Sudan, the issue of pollution has affected the traditional relationship of the people with water in the oil-bearing enclaves. Contrary to the general perception that water is a source of life, the polluted wells have not only caused misery to the local people but also disease and death.

Operational discharges from the oil industry have created public concern because they represent a substantial continuous input of contaminants to the environment from many widely dispersed point sources. A large volume of produced water is generated at the Melut basin

⁹Kuch, Simon Garang; and Bavumiragira, Jean Pierre, “Impacts of Crude Oil Exploration and Production on Environment and Its Implications on Human Health: South Sudan Review.”

¹⁰Ibid.

¹¹MOE. The National Environment Protection and Sustainable Development Policy, 2014–2024 Por. Juba: Ministry of Environment (MOE), Republic of South Sudan. Retrieved 13 March 2019.

oil fields daily which pose a threat to the life since apparently there is no effective treatment at the site.¹²

Another thing that was discovered in South Sudan is that, oil is always pumped together with water. There are big volumes of produced water stagnant in ponds with apparently inadequate treatment such as skimming which is less effective. The discharge of produced water causes serious environmental risks to both the human and the natural environment.

● Effect on the Air Quality

Just like in Nigeria, gas flaring is common in South Sudan. Basically, gas flaring is the process of separating and burning of the gas produced during oil resources extraction from the ground. In countries like the Republic of South Sudan that lacks the technological advancement to tap the product gas, gas is instead flared hence polluting the air and general environment. Gas flaring without temperature or emissions control pollutes the air and releases unacceptably high levels of carbon dioxide into the atmosphere. For example, in the Niger Delta, an independent study has revealed that 75% of gas is being flared and contributes to air pollution, the situation is similar in South Sudan though at a lower percentage.

● Effect on the Surface Water Quality

Oil production has a significant impact on the landscape and the local environment. Contamination of soil and water is a major common consequence of oil production, particularly in areas with non-existence or insufficient environmental regulation.¹³ Groundwater is particularly susceptible to high contamination from the produced water and

¹²Patey, Luke. "A Belated Boom: Uganda, Kenya, South Sudan, and Prospects and Risks for Oil in East Africa" (2017).

¹³el Moghraby, A. I., The Jonglei Canal—A Needed Development or Potential Ecodisaster? *Environmental Conservation*, 9(2), 141–148, 1982.

other uncontrolled chemicals during oil drilling. These effluents contain contamination of both oil fractions and heavy metals.¹⁴

Oil spills are a major concern, according to the Ecuadorian government; the trans- Ecuadorian pipeline has spilled about 17 million gallons of oil since it began operating in 1972. This has not only impacted on the environment directly but raises the potential as well for both surface water and underground water.¹⁵ In a country like South Sudan, the potential for accidental leakage and intentional leakage from skirmishes has not yet been assessed, but it should be noted however that most of the South Sudanese people and their livestock in the area and beyond, are depending on the untreated water of the river Nile for their domestic needs.¹⁶

● Effect on the Upper Nile Biodiversity

Just like in other oil-rich countries such as Nigeria, the negative impact of fossil fuels in South Sudan are characterized by loss of biodiversity and destruction of habitats. The oil pollution in Paloich has not only left many farmlands infertile, but it has also driven away wildlife. Additionally, it has resulted in the destruction of ecosystems and the savannah grassland. Basically, oil spills impair the process of photosynthesis which is key in enhancing plant diversity thus leading to biodiversity loss.¹⁷

The toxic crude also affects underground herbs and shrubs, while microbial organisms that form essential groups in the food web are also destroyed, this phenomenon is evident in the unchecked oil pollution as it is in the case of the Paloich area as the dark blend crude oil is acidic in nature.¹⁸ Besides this, deforestation is rampant and yet there are weak awareness and sensitivity on environmental issues among the public and the policymakers.

¹⁴Ibid.

¹⁵Ibid.

¹⁶Ibid.

¹⁷Mohammed, Y. A; Nimer, N. B.; and el Moghraby A. I., Policy Profiles Africa Biodiversity Series-Sudan, UNEP/ACI (1996).

¹⁸Harrison, M. N.; and Jackson, J. K., Ecological Classification of Vegetation Of Sudan. Bulletin No. 2. 1–45 Forest Dept. Khartoum (1958).

- **Impact on Human Health**

Healthwise, pollution from fossil fuels is characterized by numerous health problems including congenital disabilities, female infertility, eye and skin problems just to mention but a few.¹⁹ In South Sudan, data reveals that people leaving in Melut and Koch have experienced some of these health issues due to pollutants from oil. These health issues are not only unique to South Sudan, but other jurisdictions including the USA, where the State of Colorado has also highlighted the negative impacts of oil pollution on the health of communities including congenital heart defects and neural tube defects in infants.²⁰

- **Food Security**

Given the superior revenues earned from the oil industry, less support is given to agricultural-based production; coupled with the political insecurity; this has continued to put stress on farming. Already, food production has been disrupted with the displacement of farmers due to the conflict, hence leading to the destruction of scarce farm capital, and the interruption of transportation networks for food distribution.²¹ With access to markets impeded, households are unable to acquire food and other basic goods. Even when the insecurity subsides, returning communities have found their land occupied by oil products.

¹⁹Oliver and Boyd, UK. Hammerton, D., Hydrobiological Research in Sudan. Sudan Phil. Soc. 12th Annual Symposium. Khartoum 1964.

²⁰Chaudhuri, An Industrial Development Framework for South Sudan. Juba. Retrieved from <http://gurtong.net/ECM/Editorial/tabid/124/ctl/ArticleView/mid/519/articleId/4311/An-Industrial-Development-Framework-for-South-Sudan.aspx> (2010).

²¹Callaghan, T. V; Bacon, P. J.; Lindley, D. K.; and el Moghraby, A. I., The Energy Crises in Sudan: Alternative Supplies of Biomass, *Biomass*, 8, 217–232, 1985.

14.3 Legal Framework Regulating the Oil and Gas Impacts on the Environment

14.3.1 South Sudanese Legal and Institutional Framework

Since the attainment of independence in July 2011, the Government of the Republic of South Sudan has adopted a new Republican Constitution, and several policies and legislation. These are aimed at ensuring sustainable development in the country, and they are briefly discussed below:

- **The Transitional Constitution of 2011**

Environmental protection is one of the key features of the Transitional Constitution of the Republic of South Sudan of 2011. The right to a clean and healthy environment is enshrined in Article 41 (1), and it is an obligation of all citizens to protect the environment. Furthermore, Article 166 (6) expects local governments to involve communities in decision-making in the promotion of a safe and healthy environment.

- **Environment Policy of South Sudan, 2010**

The main goal of the policy is to protect and conserve the environment to meet the needs of the present and future generation. The policy provides a wide range of guidance in response to emerging environmental management challenges to enable decision-makers and resource users to make development choices that are economically efficient, socially equitable and environmentally friendly to ensure the realization of sustainable development. The policy also acknowledges the need to not only involve the public in environmental management; but also integrate environmental considerations into the development policies, plans and programmes at the community, government and private sector levels.

● The Environment Protection Bill, 2014 Cap 7

Environment Bill 2014 addresses the issue of air pollution in various sections. Section 20(6) talks explicitly about reducing carbon emissions into the air, water and soil, and promotes the use of high-performance, low-noise, low-fuel consuming electric generators. Further, in Section 80, it stipulates that the emissions from electric generators will need to follow strict air quality emissions standards that will be developed. Section 75 directs the relevant Ministry to address the issue of air pollution by developing air quality standards and to ensure their implementation and enforcement as required.²² Section 81 on ambient air standards clearly states that no enterprise or individual is allowed to pollute the air, and any emissions must adhere to the air standards.²³

Other relevant legislations include the Land Act of 2009, which not only promotes a land management system but also aims to preserve the environment and ecology in South Sudan. Besides providing for fair compensation for land lost, the Act also recognizes customary land tenure systems, and it grants protection to the pastoralists.²⁴

14.3.1.1 History of the Legal Framework in South Sudan and Other Relevant Legislations

Historically, South Sudanese legal framework can be traced as far back as the 1890s, when the British established the legal system of the Anglo-Egyptian Sudan. While there is a rich history to be explored with respect to the legal regime in South Sudan, this section will focus on the environmental and petroleum laws. Nevertheless, it is worth noting that the country relied mostly on the Sudanese laws until recently when it enacted its own laws. In this respect therefore, a brief about the relevant laws in Sudan will be discussed in as far as they have an impact on the South Sudanese legal framework.

²²Section 75 Environmental Protect Bill, 2007.

²³Section 81 Environmental Protect Bill, 2007.

²⁴Section 15 Land Act of 2009.

Basically, Sudan is considered as one of the first African countries that have formulated legislation about environmental and natural resources. For instance, the Forestry Act was established in 1901. Over 150 sectorial laws have been instituted to regulate different sectors, such as health, water supply, land use, fisheries, wildlife and other sectors of the environment and natural resources. The Environmental Health Act 1975 is one of such environmental legislation that precedes the discovery of oil in Sudan on a commercial scale.

The Act does not mention the environmental impact of the oil and gas industry, specifically, but generally, prohibits the discharge, dumping or disposal of any substance into rivers, lakes, affairs (water wells) or other water sources in a manner harmful to human or animal health. This Act does not state where these substances are to be discharged or otherwise disposed of.²⁵

The Petroleum Resources Act 1998 is one of the main legislations that regulate the development and management of petroleum resources in the country. While the Act was drafted and passed for Sudan Republic, the nation of South Sudan carries on its usage as a result of the stabilization clause that required the utilization of oil resources to remain unchanged. The Act deals mainly with issues relating to the country's ownership of the oil resources and rules imposed on oil companies to carry on exploration and production. The issues regarding the consequences of those operations on the environment were not given much attention in the Petroleum Resources Act 1998. For instance, Section 13(4) of this Act in general terms requires oil companies to protect the environment and to take the necessary measures to prevent pollution.²⁶

The most detailed legislation on the preservation of the environment in the oil and gas industry is supplied by the Regulations for Protection of the Environment in the Petroleum Industry (Amendment) 2005. These regulations were passed by the Ministry of Energy and Mining in 2002 and amended in 2005. In 2008, these regulations were also revised and up until now (the fieldwork period) there is still a committee working on updating these regulations.

²⁵EIA, Block 5B, 2008.

²⁶Section 13(4) Petroleum Resources Act 1998.

The Regulations for the Protection of the Environment in the Petroleum Industry (Amendment) 2005 should be adopted and implemented by all oil companies working in Sudan; whether in upstream or downstream operations. The implementation of such regulations should be under the direct supervision and follow-up of the General Directorate of Environment and Safety (GDES), which is a governmental regulatory body under Sudan's Ministry of Petroleum. The Ministry of Petroleum is in charge on behalf of the government in signing the oil agreements between the oil companies and the government.

In the early 1980s, the Sudan government signed Exploration and Production Sharing Agreement (EPSA) with many companies that include China National Petroleum Company (40%), PETRONAS (30%) and SudaPet (5%). Those EPSA legal documents highlighted the regulations governing exploration and production in Sudan. When South Sudan separated from Sudan, the government of the Republic of Sudan left all oil facilities to the new government of South Sudan, and all the oil and gas companies operating in Sudan moved to Juba, the capital of the Republic of South Sudan.

The new country continues extracting oil and gas, using the same companies that signed the EPSA with the Sudan government. The government of South Sudan has also continued to use the old policies and regulations governing the oil and gas in Sudan to date. In September 2012, the government of South Sudan established the South Sudan Petroleum Act, which requires the formulation of strategies, plans and programmes for the development and management of the petroleum sector. The main purpose of the Act is to manage the petroleum sector in an ethical, efficient, transparent and accountable manner, based on environmentally, socially and economically sustainable principles.²⁷

The enactment of the Act raised hopes for environmental protection. As such, the Act puts an obligation on the Ministry of petroleum to initiate and coordinate a strategic environmental assessment (SEA) before opening an area for petroleum activities according to Section 15 of the Act.

²⁷Section 2 of the South Sudan Petroleum Act, 2012.

Section 15 of the Act states that: the Council of Ministers may, in consultation with the Ministry, open an area for petroleum activities after a strategic environmental assessment (SEA) is carried out and a determination made by the Council of Ministers to open the area under Section 59 of the Act.²⁸ The Act defines SEA as a formalized, systematic and comprehensive process of evaluating a policy, plan and programme and its alternatives, including the preparation of a written report on the findings of that evaluation.

The above notwithstanding, we note that the environmental provisions in the Act have not been effectively implemented as expected. Some of these provisions include having a detailed decommissioning plan, undertaking proper Environmental Impact Assessments (EIAs). As a result, the government does not have a baseline for evaluating the rate of pollution in the oil-rich areas of South Sudan. Oil and gas exploration and production have caused adverse impacts on the environment since the beginning of the exploration in the 1980s. The government of Sudan and South Sudan, respectively, did not effectively manage the activities of the oil and gas as indicated in the laws because the country was in the war.

Sudan government had the sole monopoly of the oil and gas industry, extracting most of it from southern fields but did very little to care for the environment. Worst of all, since South Sudan gained independence, nothing much has changed. The environment has been wasted and destroyed due to damage from oil and gas production activities. The livelihoods of the people in the great Upper Nile Region of South Sudan have been exposed to environmental damage and risks.

On the other hand, the continued armed conflict in South Sudan has worsened the environmental conditions as some oilfields have been abandoned without cleaning of leakage and spills.

²⁸Section 59 of the South Sudan Petroleum Act, 2012.

14.3.2 International Instruments Relevant to South Sudanese Environmental Protection

Environmental problems have been neglected for a long time. After the United Nations Conference on the Human Environment (UNCHD) which held in Stockholm in 1972, environmental concerns were known globally. Later on, in 1987, World Commission on Environment and Development (WCED) proposed the idea of sustainable development which entails meeting the needs of the present without compromising the ability of future generations to meet their own needs.²⁹

South Sudanese environmental laws are in line with various international instruments. However, most of the treaties South Sudan is a party to, are inherited from its earlier mother nation Sudan; therefore, in reviewing them, the research will mention the signatory being Sudan. Sudan has recognized the importance of natural resources management since the beginning of the twentieth century and first passed legislation relating to forests and wildlife in 1902.

Sudan participated in the Stockholm Conference (1972) on Environment and Human Development and established the first committee dealing with the environment in the National Council for Research in 1977. Sudan also signed and ratified the International Convention on Biological Diversity (CBD) and received funding for the preparation of the National Biodiversity Strategy and Action Plan (NBSAP). The country further signed and ratified the United Nations Convention to Combat Desertification (UNCCD) and prepared a National Action Plan to Combat Desertification. Sudan also ratified the Kyoto Protocol as well as the Cartagena Protocol on Biosafety and the Stockholm Convention on Persistent Organic Pollutants.

Another instrument that is worth highlighting is the Agenda 21.³⁰ Sudan, being a party to the Earth Summit in 1992 and the follow-up on the implementation of Agenda 21 in Johannesburg in 2002 and Rio in 2012, agreed to follow a road map to implement activities that

²⁹Brundtland Commission Report, 1987.

³⁰Agenda 21 is a non-binding action plan of the United Nations with regard to sustainable development. It is a product of the Earth Summit held in Rio de Janeiro, Brazil, in 1992.

enhance equitable resource use promoting human welfare. At the Rio + 20 Conference in 2012, countries, including Sudan, agreed to promote the Green Economy in the context of sustainable development. The document presented by Sudan at Rio + 20 reflected its commitment to incorporate the principles of the Green Economy into its Five-Year Plans.

Being party to these conventions, Sudan has set national priorities regarding them and implemented programmes for capacity building on Persistent Organic Pollutants (POPs) and National Adaptation Programmes of Action (NAPA) to address priority activities on climate variability and climate change, within the context of economic development priorities.

Sudan's willingness to embrace the principles of global thinking through the adoption of international agreements is to be applauded. However, the limited capacity, resources and weak coordination mechanisms have undermined implementation, with few projects that resulted from these conventions reaching the local or state level. An important exception is the UNDP/HCENR-led NAPA process, whose implementation is donor-funded and driven with good civil society and grassroots involvement in some states (for example, South Darfur). Several initiatives were made, but the main point remains that a tremendous effort is needed to translate international initiatives to action on the ground.

Most of the projects, such as Agenda 21 and the Nile Basin Initiative, have implemented small projects and capacity building activities at the state level through community-based organizations (CBOs). The Agenda 21 project succeeded in involving a broad cross-section of Sudanese societies in defining their local agendas and priorities and to implement small-scale projects through funding from international agreements. The project played an important, catalytic role in promoting community-level environmental protection.³¹

Through the Agenda 21 Project, an attempt was made to decentralize environmental actions, through building capacities at state levels and preparing action plans. The project, through mobilizing state-level authorities and technical staff and local leaders, managed to prepare

³¹Lindner, Chip. "Agenda 21." In *The Way Forward*, pp. 3–14. Routledge, 2019.

an Environmental Action Plan for North Darfur. The plan was not implemented for several reasons, including financial constraints.

Nevertheless, following the issuance of the National Comprehensive Strategy (NCS) and adoption of Agenda 21, the Government of Sudan, often in collaboration with the U.N., has launched several initiatives, notably; the National Biodiversity Strategy and Action Plan, 2001; the Agenda 21 Project; the National Action Plan to Combat Desertification, 1998; Enabling Project to Mitigate Climate Change; Towards a National Environmental Action Plan (produced by the HCENR, Friedrich Ebert Institute, and SECS); the National Water Policy, draft 1999 which to this day is still being used in South Sudan.

There are other relevant international instruments that are instrumental in the protection of the environment including the United Nations Framework Convention on Climate Change (UNFCCC), 1994; The U.N. Framework Convention on Climate Change of 1992; the Kyoto Protocol; Vienna Convention for the Protection of the Ozone Layer (1985); International Convention on Biological Diversity (CBD) just to mention but a few.

14.3.3 Further Thoughts on Environmental Protection in South Sudan

Effective institutions are key in ensuring environmental protection in South Sudan. This section therefore gives further thoughts on the legal and institutional framework in South Sudan with respect to managing the negative impacts associated with hydrocarbons.

Institutionally, the petroleum sector regulator in South Sudan is the Ministry of Petroleum. The Ministry is guided by the Petroleum Act, 2012, and the Mining Act, 2012, as well as the Mineral Title Regulations 2015 and other bills that are currently being drafted to implement its mandate. The Ministry is assisted in its duties by three institutions: The National Petroleum and Gas Commission, the National Petroleum and Gas Corporation and the Petroleum Exploration and Production Authority. The National Petroleum and Gas Commission is the policy-making body for the petroleum sector. It is also in charge of petroleum

resources management and coordinates all petroleum stakeholders at the national and state level.

The Petroleum Act of 2012 stipulates the legal framework for the petroleum sector and provides some crucial requirements to ensure transparency in the management of oil revenues. In particular, the Act provides for public disclosure and publication of information about contracts, oil production data, revenues and ownership of contractors or companies. The Petroleum Act provides a factual basis for building sound oil company–community relations, notably its Articles 52, 59, 82, 94 and 100. Unfortunately, these articles have yet to be fully implemented.

What is more, the country has enacted the Petroleum Revenue Management Act 2012, in part to establish an Oil Revenue Stabilization Account and a Future Generation Account. The stabilization account is intended to protect the country from volatility, mainly when revenues go down, and the future generation account provides reserves for when the oil deposits are depleted. This approach of saving for the future has enabled other resource-rich countries, particularly Botswana, to reduce resource curse (availability of extractive resources).

With respect to the environment, the Petroleum Act has features built in to ensure environmental protection.³² These include the requirement for Environmental and Social Impact Assessments (ESIA).³³ An Environmental Management Plan is required in Section 60 to guide the implementation of the Environmental and Social Impact Assessment. Section 61 highlights the responsibility for pollution control. Health and safety considerations are paramount as stated in this Act and are also highlighted in the Labour Bill 2012, which specifies the guidelines for industrial safety in Chapter 11, Articles 73–96.

The Environment Protection and Management Bill, 2012 also has provisions for Environmental Impact Assessments and Environmental Audits for projects in mining, all aimed at reducing environmental degradation and ensuring pollution control. The National Environment Policy 2012 also aims to control pollution and ensure the protection of the environment and water bodies that may arise from mining activities. For

³²Sections 50–62, the Petroleum Act.

³³Section 15 and 59, the Petroleum Act.

instance, it requires that riverbanks be protected from mining activities through the construction of embankments and to avoid sand harvesting too close to the banks and in vegetated areas. It also requires the restoration of landscapes after the conclusion of the various mineral extraction activities.

Finally, the Act encourages waste minimization, restoration of degraded ecosystems and the need to keep up with the best practice that encourages the efficiency and competitiveness of the mining industry. Chapter 15 states the provisions for pollution control and the restoration of land after mine closure.

14.4 Conclusion

While South Sudan still utilizes some of its Parent country's laws and regulations like the Petroleum Resources Act 1998, the Environmental Health Act 1975, the Land Act of 2009, the country has made recognizable steps in establishing its own comprehensive constitution by enacting such laws as the Environment Policy of South Sudan (2010), the South Sudan Petroleum Act (2012) the Mining Act (2012) and The Environment Protection and Management Bill (2012)

The impact of oil and gas exploration activities in the Upper Nile Region is very alarming. Oil exploration and production have had severe implications for the environment: oil spill and gas flaring have contaminated, degraded and destroyed the forests, and water bodies of the Melut Basin, thereby causing severe destruction of its biodiversity over the years. The harmful effects of oil exploration and exploitation on the environment are many as discussed in this chapter. Although the South Sudanese government has established various policies and strategies to protect the environment, implementation is still lacking. There is therefore a strong need to establish a robust mechanism for environmental impact assessment, and such assessment must be supported and expanded to include other rural areas. Additionally, the country should consider investing more in renewable energy and energy efficiency technologies so that it embraces the global move to transition to a low-carbon economy.

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15

Steadfast for East Africa: Powering Energy Dreams Through Regional Cooperation

Japhet Miano Kariuki

15.1 Introduction

East African countries are making progress with respect to tackling energy access challenges, including lack of electricity. Although there are several initiatives at the national level, the common energy challenges faced in the region, such as unreliable electricity and reliance on traditional biomass have necessitated regional cooperation in addressing these challenges. Moreover, the global efforts to transition to a low-carbon economy have made many commentators question the future of fossil fuels in Africa, albeit it is recognized that both fossil fuels and renewable energy are essential for the continent's economic development (Nalule, 2020). Goal 7 of the United Nations Sustainable Development Goals emphasizes access to modern, efficient and sustainable energy for all. Under the auspices of the East African Community (EAC), regional

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initiatives including among others the establishment of the East African Power Pool (EAPP) have been embraced in tackling the common energy challenges in the region. However, although there are several advantages associated with regional cooperation, there are various barriers including lack of energy infrastructure, weak legal and institutional frameworks at both the national and regional levels; lack of finances to invest in regional energy projects just to mention but a few (Nalule 2018).

Basically, the EAC is a regional intergovernmental organization of six countries including Uganda, Kenya, Tanzania, Rwanda, Burundi and recently South Sudan. The EAC was established under Article 2 of the EAC Treaty with the main objective of widening and deepening cooperation among partner states. The EAC regional integration is a progressive process through four major pillars, including Customs Union, Common Market, Monetary Union and the Political Federation (EAC Treaty 1999). This chapter will highlight some of the regional initiatives at EAC, although the focus will be on Kenya for some specific energy projects.

Even though most EAC countries are struggling with the issue of electrification, there has been a high level of electrification in Kenya. Estimates show that by 2018, 75% of the population had access—making the country to have the fastest increases in electrification rates within Sub-Saharan Africa since 2013 (IEA, 2019). By 2030, Kenya will be a middle-income country, with a considerable high living standard, and it is projected to be the leading economy in Africa. This was just recently released through independent studies undertaken by the World Bank and CNN International (World Bank 2016; CNN 2018). According to October 31, 2018, CNN led survey/poll; the respondents answered the following questions;

- Which nation in Africa has the best workforce and innovation?
- Who will lead Africa in the next 20 years?

Rankings:

Nigeria—43%

Kenya—41%

South Africa—9%

Ethiopia—7%

The above therefore reveals that Kenya's economy is growing at a high-speed rate. This implies that the country and the East African region at large will require more energy for industrialization and economic growth. Hence, how can this rising tide lift all the boats? There are ambitious targets to meet the energy demand in Kenya. For instance, according to the National Electrification Strategy, Kenya has set a target of achieving universal electricity services to all households and businesses by 2022 at the acceptable quality of service levels. To meet this target, the country has not only invested in various energy infrastructure, but it has also set a target to produce 100,000 barrels of oil per day from 2022 and develop 2275 MW of geothermal capacity by 2030. Despite the energy transition debates, the country has hopes of utilizing its oil and gas resources. These hopes are shared by other countries in the region including Uganda, which is endowed with 6.5 billion barrels, about 2.2 billion of which is recoverable; and South Sudan which has the third-largest oil reserves in Sub-Saharan Africa (SSA).

This chapter, therefore, looks at the regional electrification efforts in East Africa. The chapter has three sections, this being the introduction. Section 15.2 highlights the key issues with respect to energy investments; Sect. 15.3 analyses the Integrated feed-in-tariff structure for the East African Community; Sect. 15.4 gives the concluding remarks.

15.2 Energy Investments in East Africa: Issues of Concern

Energy projects are very expensive ventures requiring enormous capital, and as such energy investors are often concerned about protecting their investments, hence they look out for countries with a favourable legal and regulatory frameworks (Cameron, 2017). The main issues of concerns for the investors, therefore, include fair laws with provisions that protect both local and foreign investments; favourable fiscal

regimes and political stability. For the host governments, they are mostly concerned with attracting energy investments and ensuring that the country benefits from the energy projects through revenues and empowerment of the local people. In recent years, we have seen an emphasis on concepts such as local content and social license to operate. All these have an impact on energy investments in Africa; however, this section will focus on Chinese investments on the continent with the example of Guanxi below.

- **Guanxi—China, Inc.**

In the business of investing in Greenfield, risky projects/investments, the common rule of thumb is that out of 10 start-ups/projects, only three or four fails. Another three or four return the original investment, and one or two produce substantial returns. The People's Republic of China is saliently taking this approach as it finances numerous projects around the 54 countries in Africa. How this unravels in Africa is not ever straightforward to the untrained eye, but with some patience, one can get an understanding of how the communist state operates as a venture capitalist and angel investor.

To begin with, when we take the case of Kenya, the High Grand Falls Dam was conceived in 2009 as part of an ambitious effort to build 1000 water reservoirs across the country and boost irrigation-based farming. The project is also projected to cover 165 square kilometres, and the dam will hold 5.6 billion cubic metres of water in the process adding 700 MW to the national power grid. The host government tried to get the project off the ground via grant funding applications from multilateral development banks, which were not successful. It is only in late 2013 that real work commenced with the feasibility study, hydrological and other pre-construction studies. This was made possible by the involvement of China State Construction Engineering Corporation (CSCEC).

This is a very costly project at US\$1,642,300,000 with the hydro-electric component costing investment and recurrent costs, including engineering services but excluding compensation costs final resettlement action plan {RAP} and physical and price contingencies at US\$117,000,000 (USD 26,000/ha) and US\$3,100,000/year (USD

684 ha/year), and US\$137,600,000 including physical and price contingencies and extension services. The water supply for domestic and industrial purposes component is an additional \$7,560,000 (Fig. 15.1).

The mechanisms of the projects are that the Chinese government will hand a Chinese state-owned corporation, local government authority and local corporation a project after a bilateral government Memorandum of understanding has been signed. The role of the Chinese state-owned corporation, local government authority and/or local corporation is to prepare the project to be investor-ready and bankable. The understanding is when this Chinese state-owned corporation, local government authority and/or local corporation undertakes to finance the initial work which would include but is not limited to a feasibility study, hydrological and pre-construction studies; the Chinese government will facilitate the project finance from its national coffers (mostly through the EXIM Bank).

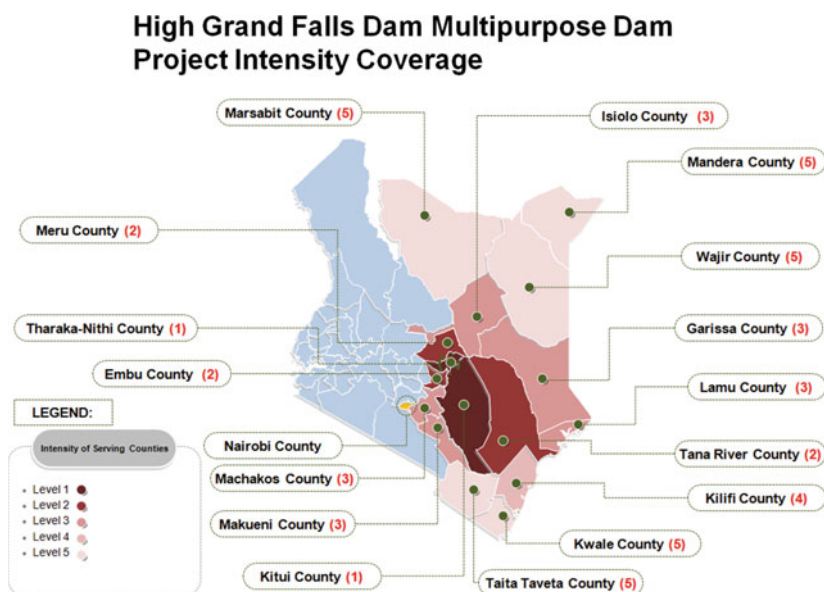


Fig. 15.1 Expected county intensity coverage by the High Grand Falls multipurpose dam project (HGF)

Once the project achieves financial close, the 'angel investor' gets a return in the form of a government contract to partially or wholly undertake the engineering, procurement and construction (EPC) portion of the project. A sovereign guarantee is preferred to ensure the investor (Chinese government) gets its guaranteed return. In the Kenyan case, the operation and maintenance (O&M) costs will be paid entirely by the Government of Kenya for the first six years, followed by a gradual transfer to the farmers until year 11 when the principal and interest payments should be almost completed. This model has been replicated in numerous infrastructure projects in South Sudan, Zimbabwe, Democratic Republic of Congo and other African states. However, when this doesn't play out as expected, then just as in any business, a restructuring scenario is undertaken to ensure project success. This increases the risk profile and cost of the project.

The Kenyan government signed a commercial EPC contract with CSCEC, which was to be executed via a commercial loan facility to be negotiated between China and Kenya however because Kenya is currently over-borrowed (Debt to GDP ratio) and as such can't proceed with the initial plan of commercial loan financing for this project, hence its conversion into a Public-Private Partnership Project, with the Chinese state-owned corporation, local government authority and/or local corporation having a call option on the EPC component of the project with the new private entity to be awarded.

In addition, we see the host country has an unparalleled advantage of taking funds from the angel investors (Chinese state-owned corporation, local government authority and/or local corporation) in that there are no monthly payments, such as the interests required by bank loans and credit cards. They pay angels the share of their profits that equates with their investment, and that is only after the project begins construction and starts to generate activity.

In conclusion, this rare and symbiotic relationship has contributed to the changing climate of project execution in Africa. The government of Kenya through the Kenya Electricity Generating Company and the Chinese government through the firm Shandong Kerui Oilfield Service Group are taking the drill/exploration risk of geothermal plants in Sub-Saharan Africa. The State utility firm Ethiopian Electric Power

(EEP) recently signed an agreement with this consortium for the Aluto–Langano 70 MW geothermal power project. Historically, this type of work is given to multilateral development banks like Japan International Cooperation Agency (JICA), The African Development Bank (AfDB) and World Bank, but with the growth of the China Belt and Road Initiative, this is now becoming the ‘New Normal’. Ethiopia currently produces only 7.3 MW of geothermal energy. In addition, there are talks for a similar venture in Djibouti for a geothermal project.

15.3 Integrated Feed-in Tariff Structure for the East African Community: Lessons from Thailand

Renewable energy sources have undergone tremendous technical improvements over the last two decades and can now satisfy the baseload requirement for energy security. Importantly, when we control the following typical system losses contributors to solar energy projects (drivers of yield), then we can safely plot our area for execution for large scale utility-sized energy projects in the concerned geography.

- Temperature > 10%
- Shading < 5%
- Inverters < 5%
- Irradiance < 4%
- Soiling < 3%
- Reflection < 3%
- AC System < 1%
- Mismatch < 0.01%
- Wiring < 0.05%

The most obvious of these in relation to feed-in tariffs (FITs) is the issue of whether or not there is a substantial national grid, without which the system cannot be directly applied in the same way as for developed countries using rural grid connection, as a dividing line helps demonstrate

some profound differences in circumstances between developing countries. We note that in much of Sub-Saharan Africa only between 2 and 5% of the rural population are connected to the grid, while in Thailand which is our benchmark study it is at 98% (Martinot et al. 2002).

When we study the Thailand story, we learn of the first ASEAN (Association of Southeast Asian Nations) Member State to institute the equivalent of a feed-in tariff (FIT), and subsequently, more solar power capacity has been installed in Thailand than in any other of the 10 ASEAN members. That's a diverse group that, along with Thailand, ranges from Cambodia, Laos and Myanmar, Indonesia and the Philippines to Brunei, Vietnam, Malaysia and Singapore. A solar power milestone was reached in Thailand in 2017 as cumulative installed capacity surpassed the 3-gigawatt (GW) mark (EPPO 2016). Table 15.1 highlights the energy situation in Thailand.

As illustrated in Table 15.1, the Thailand energy market is supplied by the following sources/fuel types; Hydropower, fuel oil, lignite, natural gas, geothermal, diesel (Salosis 2020). Table 15.1 shows Thailand's successful energy generation system, which could be replicated in East Africa. To illustrate the potential and opportunities for this, I shall compare the energy industry of two East African nations; Kenya and Rwanda. These are illustrated in Table 15.2.

As illustrated in Table 15.2, there are impressive efforts to develop the energy sector in both Kenya and Rwanda. However, in both countries, we notice that renewable energies are under-utilized. One would be side-tracked and blinded by the good news coverage on a clean Kigali, ease of doing business rankings and the recent Kigali Arena launch. However, energy yardstick really matters in economic development. Currently, the total installed generation capacity in Rwanda is 218 MW from more than 40 plants, mainly hydro; in contrast, the Kenyan installed capacity is 12X (2856 MW dependable capacity).

In a bid to catch up with energy demand, Rwanda seeks to increase around 400 MW on the existing national grid by 2024. Even then, most of these pipeline projects are Independent Power Producers (highly unlikely to be locally funded), with the Rwandan Government playing a facilitation role. Nyabarongo Hydro II will increase grid generation capacity to an estimated 513.5 MW. Other several power plant

Table 15.1 Thailand energy statistics

2015

Resource	Accumulated Renewable Energy Capacity selling to the Grid					
	Small Power Producers (SPPs)		Very Small Power Producers (VSPPs)		Total	
	No of Projects	Installed Capacity (MW)	No of Projects	Installed Capacity (MW)	No of Projects	Installed Capacity (MW)
Bioogas	-	-	133.00	277.80	133	277.80
Biomass	-	286.50	130.00	1,521.10	139	1,807.60
Hydro	-	-	7.00	2.00	7	2.00
MSW	2	80.00	20.00	51.70	22	131.70
Solar	5	413.70	305.00	1,042.30	301	1,456.00
Wind	2	207.00	180.00	19.70	9	226.70
Total	18	987.20	593.00	2,914.60	611	3,901.80

2019

Resource	Accumulated Renewable Energy Capacity selling to the Grid					
	Small Power Producers (SPPs)		Very Small Power Producers (VSPPs)		Total	
	No of Projects	Installed Capacity (MW)	No of Projects	Installed Capacity (MW)	No of Projects	Installed Capacity (MW)
Bioogas	-	-	175	321.90	175	321.90
Biomass	-	-	167	1,044.50	175	1,261.20
Hydro	-	-	4	0.90	4	0.90
MSW	3	163.00	30	121.20	33	284.20
Solar	7	436.00	554	2,275.40	561	2,711.40
Wind	3	270.00	7	27.90	10	297.90
Total	21	-	937	3,791.80	958	4,877.50

Target for Power Generation from Renewable Energy by 2037

Resource	Supported by Government Policy		Under New AEDP	
	Installed Capacity (MW)		Installed Capacity (MW)	
Waste Energy	-	400.00	-	-
Biomass	-	120.00	-	3,376.00
Solar	-	-	10,000.00	-
Bioogas	-	-	546.00	-
Floating Solar & Hydro	-	-	2,725.00	-
Wind	-	-	1,485.00	-
Industrial Waste	-	-	44.00	-
Total	-	520.00	-	18,132.00

Table: Thailand Energy Sources Statistics

Source: Japhet Kariuki's Database

Table 15.2 Kenya and Rwanda—target countries—energy-supply outlook

Kenyan energy industry outlook (Demand and Supply)

SNO.	CATEGORY	CAPACITY INSTALLED (MW)	Percentage (%)
1	Hydro	820.7	35.13%
2	Geothermal	627	26.84%
3	Co-generation (Biomass)	28	1.20%
4	Wind	25.2	1.05%
5	Thermal (Fossil)	816.2	34.94%
6	Off-grid	19	0.81%
Total		2,336.10	100.00%

*PPE—Lake Turkana Wind Project

SNO.	CATEGORY	CAPACITY INSTALLED (MW)	Percentage (%)
1	Hydro	820.7	29.30%
2	Geothermal	792	28.27%
3	Co-generation (Biomass)	28	1.00%
4	Wind	375.2	11.67%
5	Thermal (Fossil)	816.2	29.14%
6	Off-grid	19	0.65%
Total		2,801.10	100.00%

*POST—Lake Turkana Wind Project and Olkaria V Geothermal Power Station

SNO.	CATEGORY	2020 CAPACITY INSTALLED (MW)	Percentage (%)
1	Hydro	820.7	28.73%
2	Geothermal	792	27.73%
3	Co-generation (Biomass)	28	0.96%
4	Wind	325.2	11.39%
5	Thermal (Fossil)	816.2	28.55%
6	Off-grid	19	0.67%
7	Solar	55	1.93%
Total		2,856.10	100.00%

Table: Kenyan Energy Sources Statistics

*POST—Geirra Solar Power Station

Source: Japhet Kariuki's Database

Rwandan energy industry outlook (Demand and Supply)

SNO.	CATEGORY	2017 CAPACITY INSTALLED (MW)	Percentage (%)
1	Hydro	100.34	46.61%
2	Geothermal	0	0.00%
3	Biomass (Rice Husk)	0.07	0.03%
4	Solar	12.08	5.61%
5	Thermal	57.8	26.65%
6	Peat Deposits	15	6.97%
7	Berthane	30	13.93%
Total		216.29	100.00%

SNO.	CATEGORY	POTENTIAL CAPACITY (MW)	Percentage (%)
1	Hydro	313	19.40%
2	Geothermal	520	32.24%
3	Biomass (Rice Husk)	0	0.00%
4	Solar	0	0.00%
5	Thermal	0	0.00%
6	Peat Deposits	300	18.60%
7	Berthane	460	29.76%
Total		1,613.00	100.00%

Table: Rwandan Energy Sources Statistics

Source: Japhet Kariuki's Database

projects in the Rwandese pipeline include; Rusizi Hydro Power III where 147 MW will be shared between DRC, Burundi and Rwanda with the latter taking a share of 49 MW. The Rusumo's 80 MW will be shared between Burundi, Tanzania and Rwanda with the latter taking a share of 27 MW. Hakan Peat to Power Project will give Rwanda 80 MW while other 50 MW will come from Symbion Methane Gas Project. Moreover, another 40 MW is expected to be generated from other Micro or Mini-Hydro projects which are at different development stages.

Rwanda is mostly countryside, there is no grid, and generators that run on gasoline or diesel are becoming more expensive by the day to operate (Disch and Bronckaers 2012). One may ask, how are the people of Rwanda going to maintain vaccines, provide clean water, run fans or operate a clinic to improve health care over the long run, or simply adapt to climate change, without reliable energy—clean or dirty, cheap or expensive?

We can conclude that in a bid to address this matter, the nations have started to adopt the FIT structure. However, they are limited by the availability of large resources for utility-scale based plants that can provide baseload. The wind resources in Rwanda and Burundi can play a major role in meeting the energy demand in these countries. However, equally impressive is that the neighbouring countries are well endowed, complimenting the lacking nations. A 2015 study undertaken by the World Bank's Energy Sector Management Assistance Program (ESMAP) found that according to initial renewable energy mapping studies, Tanzania had solar resources equivalent to Spain's, and potential for wind power exceeding that of California. Developing all these resources would lead to a supply glut and stranded resources, as the economy doesn't have the active demand to absorb power generation north of 4 GW at the current economic development.

East African countries should, therefore, consider looking into an East African Premium Tariff design for large scale utility projects that will have a more than 50% export component of their total generation. This model would replicate the export processing zones, which offer locators tax incentives and monetary incentives to produce goods in the host country. However, most if not all these goods don't actually get to be consumed in the host market but are export-oriented. This model of export processing zones has been very efficient in attracting

foreign direct investment, technology transfer, enhancing employment and competitiveness in the host country.

This proposed premium tariff is already in use in Spain, Slovenia, The Netherlands, Denmark and the Czech Republic (Mendonca 2007). Unlike the fixed tariff design where producers receive a certain level of remuneration per kWh of electricity generated, the premium tariff is independent of the electricity market price. It represents a modification of the commonly used fixed tariff towards a market-based support instrument. With the premium option, we get higher compatibility of a liberalized electricity market, which is the reason Thailand thrived and continues to thrive with large renewable energy installations. It involves a better and more efficient assignment of grid costs with an emphasis on alternative routings and supplementary services. There is a high risk for the developer since the total level of remuneration is not determined in advance, and there is no purchase obligation as is with a fixed tariff.

However, the upside is big and more market-driven as it assigns the supply to real demand. This premium tariff thus has to be greater than that of the fixed tariff option in order to compensate for the higher risk for the developer. To avoid the corresponding higher electricity price, which will be passed through to the customer, the Danish model can be adopted. The Danish model has a premium varying with the electricity market price or a top limit for the overall remuneration paid in the case of the premium option. If the prices are expected to fall, then a bottom limit could also be incorporated. Premiums also enhance efficiency, as is the case in France for Biogas or geothermal plants which provide an incentive for the plant operators to use the most advanced and efficient technologies.

Such a tariff structure should reduce the subsidies between different customer categories, reflect the economic costs of the electricity and adjust the electricity tariffs through a flexible and automatic mechanism. As such it would be composed of the base tariff and a fuel adjustment charge. The base tariff is a bulk supply tariff, comprising the wholesale tariff that the developer will charge and the fixed retail tariff that the local utility or distributor will charge power consumers during each regulatory period. There are many factors that will be used to calculate the base tariff, which includes fuel prices, power generation expenses; electricity

demand forecasts power generation expenses which are inclusive of the distribution and transmission costs. Most importantly, they also consider developer, distributor and utility capital expenditures and include their return on invested capital.

The additional premium on the tariff should be the incentive to entice a developer to develop a large-scale utility project within a neighbouring country to the one that shall contract and consume the majority off-take to supplement its local production deficit. The additional component of the premium should be borne by the final consumer state, through the host state where the developer is undertaking the project. A regional entity should be set-up to manage the flow of revenue from the final consumer state, through the host state to the developer in a transparent and efficient way. This entity should act an impartial custodian of the agreement and clearinghouse of the transaction.

The Government of Rwanda issued a Renewable Energy Feed-in Tariff (REFIT) on February 9, 2012, for small and mini-hydropower. The REFIT guarantees access to the grid for renewable energy generators and obliges the national utility Energy Water and Sanitation Authority (EWSA) to purchase the renewable energy generated (IPAD 2015). The REFITs are calculated based on a cost-plus return basis to ensure sufficient incentives for private investors. They apply only to hydropower plants ranging in size from 50 kW to 10 MW and are valid for a period of 3 years after which they will be subject to review by the Rwanda Utilities Regulatory Authority (RURA). There has been a long discussion and wait for REFITs for other renewable energy technologies, such as solar, wind and geothermal. This means that if the regulator decides to implement a premium tariff, then there will be no conflict with existing REFITs. There is, however, the potential for solar power in East Africa, and this could contribute greatly in tackling the energy access challenges in the region (Hansen et al. 2015). Figures 15.2 and 15.3 illustrate the solar potential in both Kenya and Rwanda.

As illustrated in Figs. 15.2 and 15.3, there is potential for solar energy to tackle the energy access challenges in both Rwanda and Kenya. However, more investments are needed especially to ensure that the people in rural areas to access to affordable solar energy services.

East African nations. For this to happen seamlessly across the border, it would be prudent to invest more in the already established East African Power Pool. This shall integrate the national power systems into a unified regional electricity market with the ultimate goal of providing in the medium and long term, regular and reliable energy at a competitive cost to the citizenry of the East African Community. Increased investments in the power generation and transmission infrastructures would lead to the need for a coordinated power exchange among the EAC member states. Over the next five years, countries in the East African Power Pool (EAPP) would start to buy and sell electricity depending on their generation capacity and their demand needs. The idea is that by creating a large unified power market instead of 6 small markets, East Africa would attract even more investment in the power industry to build cleaner and more efficient power plants.

The East Africa Community—formerly the East African High Commission—is a unique common market which is aiming for federation in the near future. Many may not be aware that the European Union—formerly the European Economic Community—more than half a century ago during its inception borrowed heavily from this unique idea envisioned by our founding fathers. It then goes without saying that just as the Asian century is currently celebrating the success of the foundation laid by the ‘Asian Tigers’, Africa’s moment post-2040 will celebrate the ‘African Lions’. To achieve this dream, African lions have to deal with their energy poverty problem through innovation, strong leadership and in an integrated manner. In conclusion, I borrow from the flying geese paradigm (FGP) that postulates that African nations will catch up with the West as a part of a regional hierarchy where the production of commoditized goods would continuously move from the more advanced countries to the less advanced ones.

Through the ‘flying geese’ model, one economy, like the first goose in a V-shaped formation (Kenya), can lead other economies (East and Central Africa) towards industrialization, passing older technologies down to the followers as its own incomes rise, and it moves into newer technologies. With this success we can emulate it across the continent via our common market structures; Common Market for Eastern and Southern Africa (COMESA), Economic Community of Central Africa States (ECCAS),

Economic Community of West Africa States (ECOWAS), Southern African Development Community (SADC) and West African Economic Market Union (WAEMU) and successfully power our dreams.

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Part IV

Epilogue



16

Extractives and Beyond: Managing the Energy Transition in Africa

Victoria R. Nalule

The global move to tackle climate change as envisaged in the 2015 Paris Agreement has necessitated debates and actions geared towards transitioning to a low carbon economy. Although there is no agreed international definition of the term energy transition, it has basically been defined to mean a shift from fossil fuels to renewables. But does this mean that the transition to a low carbon economy will close off the future for African producers of fossil fuels? Most commentators think not, but they do believe the market will change. Indeed, we should all be concerned about climate change. Still, we need to ask ourselves if the steps being taken to transition at an international level will have more adverse negative impacts on developing countries. This book contributes to the global debate on energy transition with a focus on the initiatives taking place on the African continent in reducing energy-related CO₂ emissions.

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The contributions to this book highlight several challenges and opportunities facing attempts to manage the decline of fossil fuels in Africa. The book doesn't provide all the answers but rather, referring to different jurisdictions in Africa; the book gives an analysis of different approaches and methodologies in transitioning to a low carbon economy in Africa. As the chapters in this book show, different African countries are at different levels of this transition, although there are some common concerns shared by these countries.

The book highlights the challenges and frustration of the transition because African countries still need fossil fuels to not only provide access to modern energy to over 600 million people without access but also for their economic development (Chapters 1 and 3). The heavy reliance on traditional energy, especially charcoal and lack of finances for small renewable energy enterprises are also the main barrier to energy transition in Africa (Chapters 6, 9, 14, and 15). Given the importance of the legal and regulatory framework in the development of the energy sector, contributors to the book express their frustrations concerning the conflict of electricity laws that present a barrier to energy transition (Chapter 5). There is however some optimism to transition to a low carbon economy and as such different African countries have deployed renewable energy and energy efficiency technologies both at the national and regional levels (Chapters 2, 7, and 8). Alternative cleaner energy such as nuclear is also seen as an option in tackling energy access challenges and responding to climate change (Chapter 4). However, the continued role of fossil fuels in Africa can not be ignored. As such, thematic cross-cutting issues including upstream fiscal regimes (Chapter 13); local content in the oil and gas sector (Chapter 10); Social license to operate in extractives (Chapter 11); and gender justice and technology in extractives (Chapter 12) are discussed through the lens of the energy transition debate on the African continent.

Whereas there are various advantages associated with transitioning to a low carbon economy, the strategies and international responses towards this transition will in no doubt negatively affect the economies of African countries. One of the obvious negative impacts is a decline in investments in fossil fuels which in recent months has been exacerbated by the COVID-19 crisis. It is true that many developing countries still need

fossil fuels to address the anticipated boom in urbanization; population growth; industrialization and also to tackle energy access challenges. However, although it would be expected that these reasons would justify softer transition measures or let's call it 'energy progression', the world as it stands is ready to embrace clean energy and this, in essence, has led to a decline in investments in fossil fuels. African countries, therefore, need to respond to this transition by setting up unique policies and strategies that align with their energy and developmental goals. The book shows how African countries are responding to energy transitions, and it offers recommendations to African policymakers. In summary, we should be reminded of these facts when discussing energy transitions on the African continent:

- 600M people in Africa lack access to modern energy.
- 2 billion people are likely to live in urban centres by 2040 (one-third of this from Africa).
- Population growth estimated to increase by around 1.7 billion to reach 9.2 billion people in 2040 (Africa at the centre of this).
- African countries are not climate change deniers: there are already initiatives to transition to a low-carbon economy in Africa.
- African countries contribute less to carbon emissions.

While we are thinking about the future of the African Energy sector, we must ask ourselves if it is better to have more people die from indoor air pollution due to lack of access to modern energy? Is it better to have more people die from preventable diseases because our healthcare services are not equipped with modern energy? Or is it better to let more Africans stay impoverished because most of them are below the poverty line and their countries are still economically struggling and yet they are being told they cannot utilize fossil fuels for their economic development? Or should we embrace energy progression and have a softer transition whereby finances are still made available for clean technology to exploit fossil fuels on the African continent? These questions should guide the international debate on energy transitions. The time is now for African countries to address their energy and economic challenges in this global

energy transition era. However, support from the international community, energy companies and other relevant stakeholders is required to ensure that the global move to transition to a low carbon economy does not in any way leave many people impoverished and lacking access to modern energy such as electricity.

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