Institute of Petroleum Studies - Kampala

EXAMINING THE LEGAL, ECONOMIC AND TECHNOLOGICAL BARRIERS TO UGANDA'S ENERGY TRANSITION: INSIGHTS FROM THE OIL AND GAS SECTOR

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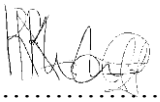
M23M02/004

A DISSERTATION SUBMITTED TO THE FACULTY OF LAW IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF LAWS OIL AND GAS OF INSTITUTE OF PETROLEUM STUDIES- KAMPALA

JULY 2025

DECLARATION

I, Racheal Rwomushana, hereby declare that this is my original work, is not plagiarized and has not been submitted before to any other institution for any award.

Signature  ……..

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APPROVAL

This is to certify that this Research Dissertation titled: "*Examining the Legal, Economic, and Technological Barriers To Uganda's Energy Transition: Insights From The Oil and Gas Sector",* has been done under my supervision and is now ready for submission.

Signature:

Dr. Brian Kalenge

Date: 18/ 07/ 2025

DEDICATION

This Dissertation is dedicated to my husband, Francis Tumwesige Ateenyi, our sons Samuel Mpuuga Tumwesige and Ariho Emmanuel Mugenyi. You motivate me to aim for the sky and to realize my highest potential.

ACKNOWLEDGEMENT

I thank the Lord for granting me the fortitude, grace and providence to embark on and get to this stage of my academic journey.

Great appreciation to my supervisor Dr. Brian Kalenge for unreservedly and patiently sharing his profound wisdom, professional guidance and time during this academic journey.

I wish to also thank and recognize my family especially my Guardian Mrs. Evas Joy Babigumira Rwomushana to whom I owe my literacy and all that I am. My parents Mr and Mrs. Mable Mpiira and siblings for believing in me and praying for me always. My wonderful husband Ateenyi for being supportive and our sons Samuel and Ariho for the patience they exercised when my time with them had to be shared with my academic pursuits. My dear friend Mrs. Doreen Kansiime Turinawe for always encouraging me to aim highest and reach my highest potential.

My sincere gratitude to my Employers, the Ministry of Justice and Constitutional Affairs for giving me an opportunity to practice my trade and for funding my masters academic journey.

Appreciation also goes to the staff of the Institute Petroleum Studies Kampala for creating a conducive enabling environment for me to pursue this academic journey. Special appreciation also goes to all the respondents who freely shared their valuable insights in the course of this research.

And last but not least, my classmates especially Samuel Musoke, Joan Joshua and Kyoshabire Caroline for their constant encouragement for me to keep pushing forward with the rigorous academic journey.

God bless you all.

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LIST OF ACRONYMS

AFOLU Agriculture, Forestry and Other Land Use

BAU Business As Usual

COP Conference of Parties to the UNFCCC

EACOP East African Crude Oil Pipeline

GHG Green House Gas

IOC: International Oil Companies

IPPU Industrial Processes and Product Use

MOFPED Ministry of Finance, Planning and Economic Development

NDC Nationally Determined Contribution

NEMA National Environment Management Authority

UNOC Uganda National Oil Company

PAU Petroleum Authority of Uganda

PFMA Public Finance Management Act

PSAs Production Sharing Agreements

RE Renewable Energy

UAE United Arab Emirates

UNFCCC United Nations Framework Convention on Climate Change

ABSTRACT

Whereas the energy transition has gained global traction, least developed countries such as Uganda are faced with peculiar challenges in getting on board the energy transition train. This research examines the legal, economic, and technological barriers to Uganda's energy transition, with particular specific focus on insights drawn from Uganda's oil and gas industry. Uganda is in a unique position with the discovery of commercial quantities of oil depicting an opportunity to spur economic development, while at the same time, the same discovery presents a precarious situation for the energy transition. The research examines how insufficient legislative frameworks, economic constraints and technological barriers hinder Uganda's energy transition progress. Through use of data from policy makers, industry experts, civil society, local communities and the academia, this research puts into focus Uganda's energy landscape. The findings from the research emphasize the urgent need for legal reforms, focused investment in green technologies to propel Uganda to a sustainable energy transition. Perspectives from the Uganda's oil and gas industry provide a worthy platform for examining its implication on Uganda's energy transition journey.

CHAPTER 1
INTRODUCTION

Introduction

One of the key outcomes from the Conference of Parties to the United Nations Framework Convention on Climate Change (COP 28) that took place in 2023 in Dubai was transitioning away from fossil fuel energy sources, in a just, orderly and equitable manner so as to achieve net zero by 2050[1]

For the African continent that has for so long relied on biomass energy sources and fossil fuels such as coal, oil and gas, and whose contribution to the global climate change crisis is minimal, the above COP 28 outcome is pertinent. This is not to say that heavy reliance on biomass energy sources and fossil fuels has not had its fair share in causing environmental degradation, deterioration of health, energy poverty etc.

This study aims at discussing the barriers that may hamper Uganda from meeting the ambitious decisions such as the one taken at COP 28, along with other drivers, as well as discussing the strategies that may help alleviate the dilemma brought about by the said barriers.

The Study also makes a case that fundamental but careful steps will need to be taken by various stakeholders if Uganda is to along with other Sub Saharan Countries is to meet the ambitious goal under the Paris accord 2015, of attaining carbon neutrality by 2050[2]. It will also analyse how the aforementioned agreement/s directly impact Uganda's policies.

Background to the Study

[1] UN Press Release Climate Press Release. (13 December 2023). COP28 Agreement Signals "Beginning of the End" of the Fossil Fuel Era. Retrieved July 6, 2024 from https://unfccc.int/news/cop28agreementsignalsbeginningoftheendofthefossilfuelera#:

[2] Sustainability For all. A plan for carbon neutrality by 20250. Retrieved July 8 , 2024 from https://www.activesustainability.com/climatechange/aplanforcarbonneutralityby2050/?adin=11734293023#

The energy transition has been defined by the International Renewable Energy Agency to mean the 'pathway toward transformation of the global energy sector from fossil based to zerocarbon'. The global transition toward sustainable energy systems is gaining momentum, attributable to among other factors the need to expediate the globally agreed to goals such as those under the 2015 Paris Agreement and the UN Sustainable Development Goal 7 on affordable clean energy[3].

The energy transition has also become imminent and inevitable because science has established that fossil fuels are limited in supply and are thus depletable, meaning that they cannot be relied upon for sustainable development for the current and future generations.

The discourse relating to the above referenced global goals has not left Uganda out. Just like other continents, Uganda is grappling with the challenge of meeting its development energy needs while at the same time meeting its obligations under various international instruments to achieve net zero by 2050. Accordingly, this study aims at contextualizing the barriers to the energy transition from a Uganda perspective as well as put forward proposals on the appropriate strategies required to overcome the said barriers.

In the subsequent parts of this Study, I will canvass barriers such as economic barriers, at the backdrop that energy is one the fundamental foundations of any nation's economic development. It will also cover legal and regulatory barriers brought about by insufficient and difficult to implement policies and legislation. Another key barrier that will be discussed is

[3] Asami Miketa, Elena Ocenic, Pablo Carvajal (2021). The Renewable Energy Transition in Africa. Country Studies for Côte d'Ivoire, Ghana, South Africa, Morocco and Rwanda

technological inadequacies where Sub Saharan states like Uganda grapple with limited access to advanced clean technologies.

The fact that much as Africa which is mainly comprised of the least developed and the developing countries, such as Uganda and her neighbors is the least responsible for the negative impacts of the green gas house emissions in the atmosphere that have brought about the climate change crisis, it has not been spared from the negative impacts of climate change such as prolonged droughts leading to famine, too much rainfall causing mudslides leading to displacement of scores of people. This makes the implementation of appropriate strategies so as to achieve the energy transition crucial to Uganda. The strategies that will be discussed under this Study include leveraging renewable energy potential, putting in place and implementing the appropriate policy and legal reforms to facilitate the energy transition, capacity building to overcome the technological barriers. The role of regional cooperation too, cannot be over emphasized.

The study will also examine how the energy transition global pressures specifically challenge Uganda's energy policies and practices.

Statement of the Problem

Uganda is at a critical cross road regarding its energy transition journey, considering its now budding oil and gas sector coupled with the growing need to transition to the use of sustainable, renewable energy sources. In spite of Uganda's strides and efforts towards its energy transition journey, it is faced with a number of barriers that include high costs of the renewable energy infrastructure, inadequate policy, legal and institutional frameworks, limited access to advanced technologies etc. As Uganda maneuvers the foregoing challenges, it must be alive to its obligations under various international instruments to reduce

greenhouse gas emissions and mitigate the impacts of climate change. The study identified and critically analysed the barriers standing in the way of Uganda's energy transition and explored feasible strategies for alleviating the said barriers, within the context of evaluating of the implications of the transition on an oil and gas emerging economy like Uganda.

Purpose of the Study

The purpose of this study is to identified and analyzed the barriers to Uganda's energy transition efforts, with particular attention on the renewable energy infrastructure gaps, foreign investment dependencies, inadequate applicable policy, legal and institutional frameworks, limited access to advanced technologies. The study explored and proposes feasible strategies to overcome the aforementioned barriers. Emphasis was placed on demystifying and evaluating the implications of the energy transition on the Uganda's oil and gas sector. By critically analysing the foregoing, this study aims at proposes feasible recommendations that can propel Uganda's trajectory towards use of sustainable and renewable energy sources while at the same time balancing its development needs and international obligations.

Research Objectives

This study was guided by the research objectives set out below:

Examined the conflict between Uganda's oil and gas development and its international commitments to renewable energy.

Critically evaluated the policy and legal frameworks, economic and technological barriers to the energy transition.

Proposed strategies to alleviate the economic, technological, inadequate legal framework challenges faced by Uganda in its transition journey.

Research Questions

The study answers the following questions:

How can Uganda's oil and gas industry be improved to fuel/support the energy transition in Uganda?

What are the major economic, technological and legal barriers inhibiting the energy transition in Uganda?

In what ways can the said barriers be alleviated

Scope of the Study

Geographical scope

The geographical scope is Uganda, a Sub-Saharan oil rich country that is in its nascent stages of exploitation of its oil and gas resources. The study will focus on urban areas such as the capital city Kampala that consume significant energy resources, industrial areas such as the Kampala and Industrial Business Park where the energy demands can contextualize Uganda's energy transition barriers and opportunities. It will also look at the rural communities such as in rural western Uganda where the communities mainly use the age-old traditional biomass energy sources and have limited access to modern renewable energy sources. I will certainly also focus on the Albertine graben region which the current boiling pot of Uganda's oil and gas sector, to assess whether the sector is being sustainably run as well as get perspectives on the influence of the oil and gas sector on the energy transition.

Content Scope

The scope of the study will encompass an overview of the energy transition, its significance to Uganda, the role of Uganda's budding oil and gas industry in the transition, examine existing literature on the energy transition generally especially in developing countries. I will

also look at the various barriers standing in the way of Uganda's energy transition, the tried and tested recommendation of strategies to alleviate the said barriers.

Justification of the Study

The study is justified because of the following reasons:

The study gives insights on climate change mitigation efforts through use of renewable energy. Just like many other countries in Sub–Saharan Africa, much as Uganda has little to do with causing the climate change crisis, it has not been spared from the disastrous effects of the climate change crisis.

The role of energy as a driver to economic development cannot be underestimated. Understanding the barriers and proposing strategies to curb these barriers will add to efforts towards creating a more sustainable energy sector in Uganda.

Uganda has invested a lot in the oil and gas industry thus far. It is very key to explore how this sector can align with sustainable energy practices through responsible integration of the sector into Uganda's energy transition efforts.

The role of the right policy, legal and institutional framework in the energy transition cannot be under estimated. Same with the right technological interventions. The study will identify gaps in these areas and how the said gaps can be closed.

The study also explores and proposes strategies to ensure that the energy transition is not only embraced in the urban areas, but the rural areas as well, so as to achieve equitable energy justice.

The study attempts to contribute to Uganda's efforts to meet her international obligations under various international legal instruments that she is party to.

This study will also attempt to fill the academic and research gaps that exist on the subject of Uganda's energy transition, barriers, opportunities and strategies.

By addressing the above, the study will make valuable and practical recommendations towards Uganda's low carbon energy future.

Significance of the Study

The study is significant in the following ways:

The study will be a source of critical data and insights needed by policy makers in their mandate of developing effective energy transition laws policies that align with both the national and international efforts in Uganda.

By proposing strategies to overcome the barriers to Uganda's energy transition, it is hoped that investment opportunities in the energy sector will be unlocked and this will stimulate economic development through creation of jobs, and reduction of energy poverty.

The role of the transition is climate change mitigation and environmental protection is a great one. The strategies will enable Uganda minimize environmental degradation and also combat the effects of climate change.

The study will contribute towards balancing economic growth with environmental sustainability while at the same time enhancing Uganda's energy security that will arise from focusing on domestic renewable energy sources. The study will contribute to the transformation of Uganda's oil and gas sector from one that negatively impacts the environmental to one that sustainably leverages its economic benefits to support the energy transition needs.

Theoretical Framework

The theoretical framework for the study integrates a number of theories to comprehensively analyze the multipronged factors that influence Uganda's energy transition. The said

framework will guide the study in analyzing the barriers and proposing strategies to overcome the said barriers.

The Energy Transition Theory

The energy transition has been defined by the International Renewable Energy Agency to mean the 'pathway toward transformation of the global energy sector from fossil based to zero carbon'. This theory will give the study a better understanding of the dynamics of moving away from fossil fuel energy sources to renewable energy sources as well as the role of the oil and gas industry in this process.

Sustainable Development Theory

Sustainable Development Commission defined sustainable development as development that meets the needs of the present, without compromising the ability of future generations to meet their own needs[4]. Sustainable development has become a fundamental strategy to guide the world's social and economic transformation[5]. The study will utilize this theory to evaluate how the energy transition can contribute to sustainable development by promoting renewable energy while ensuring long lasting economic and social benefits.

Conceptual Framework

The conceptual framework for the study integrates a number of concepts to comprehensively analyze the multipronged factors that influence Uganda's energy transition. It integrates the following components to render a structured approach to the study.

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[4] Sustainable Development Commission. What is sustainable Development? Retrieved July 20,2024 from https://www.sdcommission.org.uk/pages/whatissustainabledevelopment.html

[5] Shi, L., Han, L., Yang, F., & Gao, L. (2019). The evolution of sustainable development theory: Types, goals, and research prospects. Sustainability, 11(24), 7158.

Barriers to the energy transition- The study evaluates the economic, legal and regulatory and technological barriers to the energy transition in Uganda.

Strategies to resolve the barriers- The strategies proposed cover, economic, legal and regulatory reforms, technological, advancement, social strategies etc.

The role played by the oil and gas industry- The research analyzes the role played by the industry in Uganda's energy economy and the various strategies for integrating sustainable practices within the industry to align it with Uganda's domestic and international energy transition goals.

Successful energy transition- The outcome of a successful energy transition will see Uganda achieving economic growth while at the same time enjoying environmental sustainability and social equity, energy security.

Chapter synopsis

Chapter one of this research entails the general introduction of this study. Chapter two analyses the literature available for review, whereas chapter three will cover the methodology. Chapter four covers the research findings, analysis and discussion of the findings and chapter 5 covers the conclusion and recommendations.

Conclusion

The transition from fossil fuels to renewable energy sources is a sticky issue in Uganda's quest for sustainable economic development. Uganda's reliance on its nascent oil and gas industry puts into perspective the unique complexity that Uganda finds itself in.

This chapter has briefly pointed out the back ground to the study on examining the legal, economic and technological barriers to Uganda's energy transition while drawing insights

from Uganda's oil and gas sector. It has also set out the background to the study, statement of the problem, purpose of the study, research objectives, research questions, hypotheses, scope of the study, justification of the study, significance of the study, theoretical framework and conceptual framework of the study.

By examining the legal, economic and technological barriers, this study aims to provide practicable insights for the relevant stakeholders in Uganda's energy transition trajectory. Addressing the aforementioned barriers requires targeted strategic interventions by all the relevant stake holders. The next chapters will take a deep dive into the foregoing dimensions while giving insights on how Uganda, given its context can best navigate the energy transition in a beneficial and sustainable way.

CHAPTER 2
LITERATURE REVIEW.

Introduction

The energy transition concept has been defined by the International Renewable Energy Agency to mean the 'pathway toward transformation of the global energy sector from fossil based to zero carbon. The concept of the energy transition has been defined by the International Renewable Energy Agency (IRENA) as a pathway toward transforming the global energy sector from a reliance on fossil fuels to a zerocarbon system. This process involves a comprehensive shift to renewable energy sources, improved energy efficiency, and integration of low carbon technologies, which are critical to achieving climate targets like limiting global temperature rise to 1.5°C under the Paris Agreement. The transition aims to ensure energy sustainability, security, and economic growth, while addressing challenges like carbon emissions and reliance on nonrenewable resources.[6]

The zero carbon renewable energy sources include wind, solar, hydroelectric power etc. The transition has become urgent because of the need to mitigate the effects of climate change by reducing greenhouse gas emission in the atmosphere while at the same time ensuring sustainable development. This is all in line with international Agreements such as the United Nations Framework Convention on Climate Change, the Kyoto Protocol, the Paris Agreement, the United Nations Sustainable Development Goals, that Uganda is party to.

This section analyzes existing research related to the topic of study undertaken by various researchers, authors and analysts.

Uganda's Energy Landscape

[6] For more details, See IRENA's publications such as the "Global Energy Transition: A Roadmap to 2050" and the "World Energy Transitions Outlook."

According to Nnamchi et al, while hydropower is the primary source of electricity in Uganda, it still has a lot of untapped potential[7]. The same authors observe that biomass is widely used as an energy source in rural areas in Uganda. According to the Uganda Bureau of Statistics (2020), woody biomas accounts for 78% of energy production. That said, Uganda whose East African Crude Oil Pipeline Project is underway is well on its way to produce its oil resource both for export and also domestic refining. All this happening at a time when the world is experiencing a global push for renewable energy sources puts Uganda at cross roads.

Barriers to the Energy Transition and Strategies to the Energy Transition.

Economic Barriers

Energy is the foundation of economic development[8]. As pointed out by E & Co, oil by gallons is still an essential good to meet the various energy demands by 2040[9]. Transitioning from fossil fuel and biomass sources of energy to renewable sources such as hydro, wind, solar, thermal will require significant financial resources. Scherhoff et al., agrees that whereas renewable energy sources are not expensive to operate, their installation costs are rather high and always require to be paid upfront[10].

Resources are also required to put in place the required infrastructure such as generation plants, transmission lines, distribution lines etc. The shift will inevitably require reconfiguring the existing national grids as well as most of the industrial process etc.

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[7] Mundu, M. M., Nnamchi, S. N., & Muhaise, H. (2000). Sustainable Energy Transitions in Uganda: Influential Determinants of the Renewable Energy Landscape. Europe, 2005(2010), 2015

[8] Miketa et al., (supra note 3)

[9] McKinsey& Company (February 26,2021). Global oil supply and demand outlook to 2040. Retrieved 25th July 2024 from https://www.mckinsey.com/industries/oilandgas/ourinsights/globaloilsupplyanddemandoutlookto2040

[10] Gregor Schwerhoff and Mouhamadou Sy (2020). Where the Sun Shines: Renewable energy sources, especially solar, are ideal for meeting Africa's electrical power needs. International Monetary Fund Volume 57: Issue 001

The 2015 Paris Agreement imposes an obligation on developed countries to take the lead in availing financial assistance (climate finance) to the least developed and developing countries to facilitate their climate change mitigation efforts geared towards reducing emissions[11]. That said, the UN Climate Press Release[12] concerning the recently concluded COP 28 indicates that during the Conference, much as 8 donor governments communicated new financial commitments to least developed countries, the global stock take indicated that these commitments are very much short of the trillions of dollars required by the least developed countries and the developing countries to facilitate their clean energy transitions.

Without the said adequate finances, African countries are forced to lag behind in the energy transition.

When it comes to strategies to combat this barrier, Scherhoff et al., in my view, correctly argues that African Governments can subsidize the renewable energy projects by mobilizing domestic resources to cover the initial capital costs required by such projects.

Nnamchi et al provide an impressive list of recommendations, implementation strategies coupled with the proposed key players to implement the said strategies[13].

While Nnamchi et al and the other authors referred to above provide insights into the high initial costs of renewable energy and go ahead to propose strategies to remedy this particular pitfall, they fail to address the fact that resources are also required for the maintenance of the relevant infrastructure. They also fall short in providing strategies on how some of the infrastructure can be disposed off once they reach the end of their useful life.

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[11] Paris Agreement 2015, Article 9

[12] UN Climate Release (n1)

[13] Mundu, M. M., Nnamchi, S. N., & Muhaise, H (n6)

Legal and regulatory Framework

Despite the overarching global discourse on renewable energy at the global level, Uganda is yet to put in place clear and concise policy and legal frameworks to regulate and facilitate the realization of the energy transition. The Government of Uganda did not until December 2023 have an Energy Transition Plan. The said plan was launched at COP 28 in Dubai last year.

Under the said Plan, one of the proposed actions to achieve the objectives therein is the passing of the Energy Efficiency and Conservation Bill aimed at putting in place the requisite legal framework to regulate energy efficiency in the construction and other sectors.

Nakanwagi Susan indicates that lists the following policies and laws that Uganda has in place concerning access to energy; the National Climate Change Policy (NCCP) of 2015, the Atomic Energy Act, 2008; the Electricity Act, 1999; the Energy Policy of Uganda, 2002; the Renewable Energy Policy, 2007; the National Biomass Energy Demand Strategy, 20012010; and the National Climate Change Policy (NCCP) of 2015; Uganda's 'Vision 2040' and the National Development Plan 2015/16 2019/2020[14].

One limitation of the above research is that she does not critically analyse any of the above policies and legislation to determine to what extent they render guidance to Uganda's energy transition efforts. Some key legislation such as the Climate Change Act, 2021 is also missing in her research.

Another major gap under the legal framework that has not been addressed by Researchers is how states like Uganda should deal with already signed long term oil agreements with international oil companies (IOCs) for the exploration and production of oil and gas among

[14] Nakanwagi Susan (2021). The Fate of Nascent Petroleum Economics in an Accelerating Global Transition.

others. Such Agreements include Production Sharing Agreements, Host Government Agreements, Inter Governmental Agreements. These agreements are typically long term. This means that any attempt to rescind them or depart from them in ana effort to pave way for renewable energy will trigger default clauses therein. Most if not all such Agreements have stabilization clauses meant to maintain the IOCs economic equilibrium at the expense of Host Governments in the event that the host government changing its laws to the detriment of the IOCs. This means that any new legislation meant to operationalize the energy transition agenda may trigger stabilization. This would require the host Government to indemnify the IOCs with huge sums of money. It goes without saying that no African State would want to find itself in such a scenario. Getting funds to indemnify the IOCs is a tall order as it is.

Technological Barriers

The 2015 Paris Agreement recognizes the crucial role of technological development and transfer in the reduction of greenhouse gas emissions[15]. The same Agreement also recognizes the support required of the developed countries to the developing countries in the implementation of the technological development and transfer under the Paris Agreement.

That said, the cost of advanced technologies is very high and require significant investment. The technology required for instance to integrate the energy from renewable energy sources to the existing national grids is complex and may constantly need upgrades.

Nnamchi et al recommends fostering of Research and development by the requisite allocation of funds to R & D initiatives that focus on renewable energy[16]. The authors go a long way in

[15] Paris Agreement 2015, Article 10 (1).

[16] Mundu, M. M., Nnamchi, S. N., & Muhaise, H (n6)

calling for the involvement of universities, private sectors the Uganda Industrial research Institute to get involved in research initiatives.

While the above insights are commendable, the authors failed to address the role of synergies and partnerships with technologically advanced States through knowledge sharing platforms etc. The role of regional cooperation cannot be minimized. Africans when negotiating for technological transfer and support will achieve more when the negotiations are done through negotiating blocs such as the African Union as opposed to negotiate as singular states. Negotiating in blocks lends African states a louder and impressive voice.

Role of the Oil and Gas Sector

With the discovery of commercial quantities of oil in the Albertine Region, it is hoped that the revenues from the same will greatly change Uganda's economic outlook through job creation, technology transfer, infrastructure development, increase in trade etc. The industry is currently witnessing the take off of the EACOP Project which is starting with the construction of a heated pipeline covering a stretch of 1,443 km from Kabaale Uganda to Tanga in Tanzania.

The EACOP Project has however entered its prime at a time when climate change activism as well as the push for renewable energy, globally are at their peak. It is therefore not surprising that the Project has come under global scrutiny and campaigns such as the #STOPEACOP whose major aim is to decampaign the project on allegations that investing in renewable energy is what will economically empower states, while ensuring a cleaner environment. The Campaign further alleges that the Project has a high potential of increasing greenhouse gas emissions, contributing significantly to the global climate crisis.

While Nakanwagi rightfully notes that due to the waxy nature of Uganda's oil, the pipeline will be heated with 80% solar energy to liquify it to ease transportation and to also achieve energy efficiency and reduce carbon emissions and a few other interventions[17], she does not critically anylyse many other steps taken by Uganda to ensure the balance between the oil resource exploitation and sustainable energy practices, that will lend support to the energy transition. She also does not discuss the adequacy of the said interventions.

It fails to mention strategies such as the sample provision in the Model Host Government Agreement which requires setting out detailed environmental standards applicable to the Project in an Appendix to the Host Government Agreement. Further, the national environmental laws were revised to take into account environmental compliance of the oil and gas sector. This has seen the introduction of the National Oil Spill Contingency Preparedness and Response Plans, as well as the enactment of the National Environment (Oil Spill Prevention, Preparedness and Response) Regulations SI NO.145 of 2020.

The requirement to comply with environmental principles prescribed under the National Environment Act and other relevant laws is also espoused under the Petroleum laws.

My study will analyse the efficacy of the foregoing interventions in ensuring that Uganda's sustainably exploits her oil and gas resources.

Conclusion

Much of the existing literature focuses on encouraging renewable energy adoption in Uganda especially solar and hydro solar, but the critical analysis of how this integrates with the nascent oil and gas sector, is limited. The oil sector is often treated in isolation from energy transition discussions.

[17] Nakanwagi Susan (n12)

This research integrates the oil and gas sector in examining Uganda's broader energy transition. It explores the synergies, tensions, and trade-offs between continued investment in fossil fuel infrastructure and the push for the energy transition.

When it comes to the legal and policy framework, Uganda has a plethora of policies and laws related to energy, environment, and climate change. The existing studies do not adequately enforceability of these legal instruments in promoting an energy transition.

This research undertakes an extensive legal and policy analysis, evaluating how existing instruments such as the Petroleum Revenue Investment Reserve Policy 2022 support the energy transition goals. It identifies some contradictions on fossil fuel development incentives versus Uganda's commitments under international instruments such as the Paris Agreement.

The literature review emphasizes the complex nature of Uganda's energy transition, highlighting the interlinkages of economic, legal, technological, social, and environmental factors. By addressing these barriers through targeted and well thought out strategies, Uganda can well be on her way to achieve a sustainable energy transition that strikes a healthy balance between economic growth and environmental sustainability.

CHAPTER 3
METHODOLOGY

Introduction

This Chapter focuses on the methodology that was adopted in the collection, presentation, analysis and interpretation of data to address the research problem. The methodology focused on the research objectives and questions that I set out under Chapter One of this Proposal. It covered the research design, study population, sample size, sampling technique, data collection method, data collection instruments and data analysis.

Research Design

The Study employs a number of techniques to gather views, attitudes and opinions of selected respondents on the research topic. It employs a mixed methods approach of research where both qualitative and quantitative methods were utilized to facilitate a wide analysis of the barriers and strategies to propel Uganda's energy transition.

Interviews with stakeholders in the sector (technical officers from the Ministry of Energy, and Mineral Development (in charge of energy policy and oversight), Ministry of Water and Environment (Climate Change Department- to render guidance on alignment of the energy transition with Uganda's international climate change commitments), Petroleum Authority of Uganda (oil sector regulator – to render), NEMA (Environment regulator- to render insights on environmental sustainability) Uganda National Oil Company (holds Uganda's commercial interests in Oil) Civil Society (to render insights on advocacy and citizen engagement on energy justice), renewable energy private sector players (to render insights on innovation and market participation). The interviews provided qualitative depth in understanding sector specific challenges and potential synergies in sector policy development.

Extensive desk analysis on relevant policy (such as the Energy Policy 2002, the Petroleum Revenue Investment Policy 2022), legal frameworks (such as the Electricity Act, Climate Change Act), plans (National Development Plan III, Energy Transition Plan), research papers, international legal instruments (Paris Agreement, the Rio Conventions), on the research topic to understand the existing frameworks and gaps therein. This helped contextualize stakeholder opinions and availed a detailed analysis on the existing policy, legal and institutional landscape as well as identifying the gaps, contradictions that could stand in the way of the energy transition process. It also contextualized the comparison between what is legally on paper and what is practiced

Conducted surveys using questionnaires distributed to the academia (influence research), business owners (private sector readiness for the transition), households (public awareness and energy access patterns) etc, to gather data on levels of awareness, and attitudes on the energy transition. These enabled a clear understanding on public attitudes, levels of awareness, acceptance of the energy transition and whether the legal and policy interventions were reaching their targeted population.

Picked statistical information from already existing statistical data from Government Documents, sector expert reports and other data bases (such as UBOS Reports) to reports, energy sector analyses, and international databases (such as IRENA, World Bank). This enabled the validation of findings from primary research.

Area of Study

The area of this Study focused on a number of issues related to the energy transition in Uganda with particular focus on the oil and gas industry.

Concerning the geographical scope, the study evaluated the national energy spectrum with a focus on the Albertian Graben area which is the epicenter of oil and gas activities. I also drew a comparison of the energy needs of urban areas such as Kampala City and the rural areas such as Rukungiri. I also undertook a comparative analysis with countries that are on a more advanced energy transition trajectory than Uganda.

Concerning sectoral focus, the study conducted an in depth evaluation of the oil and gas sector in terms of the regulatory framework, economic benefits and the environmental impacts. The study also analysed the current renewable energy space and sources in Uganda such as solar, hydro, wind, biomass etc.

With respect to stakeholders, the study utilized information from the Government Ministries, Departments, and Agencies (MDAs) in charge of the energy, environment and economy portfolios. Information was also be sourced from the private sector companies involved in the oil and gas industry and the renewable energy space. I also engaged civil society organizations working in the climate change, environment and energy space. Other important stakeholders I engaged are researchers in the Academica, in the energy transition space.

The study would be incomplete without the financial institutions both local and international such as the World Bank and the commercial banks operating in Uganda with potential to fund renewal energy projects. Same applies to communities especially those in the oil producing region as well as those in the rural areas.

The study also covered a comparative analysis with other countries that are also on their journey of the energy transition such as the other East African Community members and best practices from other countries that are successfully using renewable energy sources.

Sources of Information

In order to extensively discuss the research topic, I analyzed a lot of information to equip me with the requisite data on various perspectives of the said topic.

The primary sources of information was from interviewing of Government policy makes and technocrats from MDAs such as the Ministry of Energy and Mineral Development, Petroleum Authority of Uganda, Uganda National Oil Company, National Environment Management Authority, Ministry of Water and Environment, Uganda Energy Credit Capitalization Company Ltd and other relevant MDAs. I also interviewed experts on oil and gas, renewable energy, climate change, and environmental management. Other interviews were held with local leaders especially in rural areas and from the Albertine Graben Region. I also interviewed NGOs involved in climate change and renewable energy advocacy.

Another source of primary information is focus group discussions with groups of inhabitants from the Albertine Graben Region, private sector players in the oil and gas and renewable energy sector.

The secondary sources of information used are Government policy documents, strategies, laws on the research topic, as well statistical reports from relevant MDAs on energy uses, consumption, oil and gas forecasted economic impacts, environmental impacts etc. I also combed research publications from the academia on the research topic, theses and dissertations from both graduate and post graduate research on the research topic, research reports published by international organizations such as the UNFCCC, UNDP, UNEP,

International Renewable Energy Agency (IRENA) World Bank, on sustainable energy initiatives etc. I also studied media articles and information both domestic and international media on the research topic. I also drew some insights form case studies undertaken form other countries undergoing their own journey of the energy transition, and other countries from which to borrow best practices.

Another important source that I employed are academic databases such as Google Scholar, OGEL, JSTOR and other related data bases that have a number of published scholarly articles on the energy transition. I leveraged on the above sources to gather information that I analysed to better understand the barriers and the right strategies to overcome the said barriers to the energy transition in Uganda.

Population and Sampling Technique

Study Population

The study population is comprised of a number of stakeholders affected by or involved in Uganda's energy transition. The said stakeholders include:

a) The Ministry of Energy and Mineral Development, National Environment Management Authority, Ministry of Water and Environment, Uganda Energy Credit Capitalization Company Ltd;
b) The oil and Gas and Energy Transition industry professionals
c) Households especially in rural areas and from the Albertine Graben Region.
d) NGO executives involved in climate change and renewable energy advocacy.
e) Academia and Researchers

Sampling Technique

To achieve a comprehensive and representative insight into the barriers and strategies related to Uganda's energy transition, I employed both purposive sampling.

I utilized the purposive sampling technique to pick key informants who have the relevant knowledge and expertise on the study topic to get well informed and credible insights to understand systemic barriers from those best positioned to explain them.

When it comes to the sample size, it was determined by the circumstances during data collection. I however collected data from approximately 5 key Government officials, 5 industry experts, 3 households in the in the rural and Albertine Graben Region, 3 technical persons from civil society, 3 persons from the academia.

The above approach gave credible and comprehensive insights on the energy transition in Uganda.

Variables and Indicators for the Study

The study was guided by the following variables and indicators:

The variable for the economic barriers is inadequate finance for initial capital. The indicators for this variable include, availability of investment finance into renewable energy initiatives, the, the cost establishing renewable energy initiatives viz viz the cost of the non renewable energy initiatives. The variable for the strategy to mitigate the foregoing barrier is availing funding. The indicators here include, the amount of investment in the renewable energy initiatives

The variables for the policy, regulatory and institutional barriers is institutional capacity and policy framework. The indicators include the comprehensiveness of the policies and laws, the enforcement of the said policies and laws, the level of coordination amongst the relevant

stakeholders in the implementation of the said laws and policies. The variable of the strategy to counter policy and regulatory barriers is law and policy development and implementation. The indicators therein include formulation of new policies and reforms to facilitate the energy transition.

Regarding technological barriers, the variable is the access to the appropriate technology. The indicators for this variable is the levels of technical skills required to develop the appropriate renewable energy technologies and access to the said renewable technologies. The variable of the strategy to counter the foregoing barrier is technological adoption and research and development, the indicators include investment in research and development initiatives for the renewable energy spaces, integration of renewable energy into the existing national grid.

When it comes to the environmental barriers, the variable is the environmental impact and the indicator is the environmental degradation from the oil and gas activities and the environmental gains of use of renewable energy sources.

Procedure/Protocols for Data Collection

It is important to have the right data collection protocols in place if reliable, valid and ethically compliant data is to be collected. In undertaking the study on the study topic, I employed the following procedures and protocols.

a) Preparation and planning by setting out the specific objectives of the data collection and ensuring that the said objectives align with the research questions and hypotheses.
b) Development of the appropriate data collection instruments such as structured questionnaires for the surveys, interview guides for the interviews and discussion guides for the focus group discussions.

c) Ensuring prior obtaining of the relevant approvals such as those of the Institute relevant committee, permission from research subjects for sensitive information.
d) Piloting the data collection instruments on a small sample to ensure that the said instruments serve the purpose.

Regarding the data collection process, as already pointed out above, I used the purposive and stratified random sampling technique to select respondents of defined groupings. I conducted surveys both online and offline, set deadlines for data collection and sent reminders to respondents, scheduled interviews with respondents, record (with consent) interviews, took notes form the interviews and focus group discussions.

With regard to data management, I entered all the data collected into a database, reviewed it for errors and organized it according to variables and indicators.

Data Collection Instruments and Equipment

I employed the following data collection instruments and equipment to enable me collect accurate and reliable data;

Use of online and offline surveys and questionnaires using multiple choice questions, interviews to collect qualitative data from key stakeholders (both physical one on one and online interviews**.**

When it came to data collection equipment, I utilized online tools such as google forms, Microsoft forms, offline tools such as printed hard copy questionnaires.

For the interviews, I employed smartphone recorders, purchase zoom licences, cameras, microphones.

Quality/Error Control

Ensuring quality control is very key as it enables the study to be based on reliable and valid results. I employed the following quality/error control measures to minimize errors as much as possible, so as to get credible research findings:

a) Pre testing the instruments by conducting pilot tests of the same to identify any likely weaknesses or errors.

b) Indication clear instructions on the data collection instruments

c) Training research assistants/data collectors on how to use the data collection instruments and equipment

d) Conducting calibration checks on the data collection instruments such as the audio recorders, survey software etc.

e) Supervise data collection exercises

f) Investigate outlier data

g) Obtain informed consent prior to data collection

h) Anonymize data to protect respondent's privacy

Strategy for Data Processing and Analysis

An effective strategy for data processing and analysis is very important in the study coming up with the right insights and conclusions. I analyzed and processed data in the following ways:

a) Identification and remove of duplicate data entries

b) Standardization of data eg using one currency

c) Store the data in a structured way such as use of databases

d) Use of visual representations such as use of graphs, pie charts, tables, to illustrate key finding etc

e) Compare findings with existing literature on the subject

Ethical Considerations

Ethical considerations are very important in ensuring that the study is conducted in accordance with the acceptable legal and moral standards of undertaking research. I ensured the following ethical considerations in undertaking this the study:

a) obtaining informed consent from respondents by first explaining the nature purpose of the study and how the data collected shall be used.

b) Getting written consent prior to engaging respondents

c) Ensuring strict compliance with data protection laws by making sure that I anonymize the respondents

d) Securely store the data prior to its analysis by restricting access from unauthorized persons.

e) Respectfully treat respondents and be alive to the different and unique norms and cultures of the respondents.

f) Use the data collected only for the purpose disclosed to the respondents.

g) Safely dispose of the data that is no longer useful to the study.

Anticipated Methodological Constraints

In undertaking the study, I anticipated the following methodological constraints:

a) Limited access to readily available up to date information from the energy sector in Uganda. I overcame this by collaboration with the relevant stakeholders to avail the said information.

b) Difficulty in getting access to some of the key stakeholders due to busy schedules. I mitigated this contrariant by being flexible with data collection instruments eg use of technology such as the google surveys, zoom etc

c) Language and cultural barriers amongst some of the respondent communities. I overcame this through assembling of a culturally diverse data collection team.

d) Budget constraints in terms of facilitation to converse the various areas in Uganda to collect data. I mitigated this through seeking partnerships with other researchers.

e) Ethical and legal constraints where some of the data required may be confidential and not available to third parties. I undertook to adhere to the highest confidentiality levels and also use of model documents where the actual documents cannot be accessed.

CHAPTER 4
RESEARCH FINDINGS, ANALYSIS AND DISCUSSION

Introduction

The global transition toward sustainable energy systems is gaining momentum, attributable to among other factors the need to expediate the globally agreed to goals such as those under the 2015 Paris Agreement and the UN Sustainable Development Goal 7 on affordable clean energy.

The energy transition has also become imminent and inevitable because science has established that fossil fuels are limited in supply and are thus depletable, meaning that they cannot be relied upon for sustainable development for the current and future generations.

The first part discusses and analyses the research findings on the conflict between Uganda's oil and gas development and its international commitments to renewable energy. The second part discusses and examines the findings on the existing legal and policy, economic and technological barriers on the energy transition.

Uganda's oil and gas development viz viz its international commitments on renewable energy.

Uganda's efforts to commercialize her oil and gas reserves through the operationalization of the EACOP Project and the Refinery Project are viewed as promotion of fossil fuels contrary to the global goal to achieve net zero by 20250 agreed to at COP 28. It is estimated that Uganda's upstream production, EACOP construction phase, pipeline operation, maritime transport, refining and product use will generate 378 million tonnes of carbon

emissions[18].

Uganda's NDC indicates that Uganda's emissions profile presents that Uganda's emissions are projected to increase from 90.1 MtCO2e in 2015 to 148.8 MtCO2e in 2030 and 235.7 MtCO2e by 2050 under the Business As Usual (BAU) Scenario. Uganda plans to implement policies and measures in the AFOLU, energy, waste, transport, and IPPU sectors that will result in a 24.7% reduction of national GHG emissions below the BAU trajectory in 2030, to MtCO2e[19].

While the country has pledged to implement the aforementioned policies and measures to reduce emissions, increase renewable energy's share in its energy mix and reduce greenhouse gas emissions, the country's oil projects that are already set in motion pause a challenge of increasing emissions and hence delaying the transition to clean energy.

The above conflict reflects a delicate contradiction between Uganda's economic pursuits and the long terms sustainability pursuits. The tension between short term economic benefits and long term sustainability goals. An official from the Ministry of Energy and Mineral Development I interviewed emphasized that the Ugandan Government is justified to commercialize its oil and gas reserves since the deposits are crucial for the country's economic development, poverty alleviation, and infrastructure growth. Another official from a civil society organization that is actively involved in climate change activism opposed the commercialization and stated that it comes at the expenses of Uganda's international commitments.

[18] Richard Heede, 'EACOP lifetime emissions from pipeline construction and operations, crude oil shipping, refining and end use' [2022] Climate Accountability Institute 6.

[19] Ministry of Water and Environment," Updated Nationally Determined Contribution.'[2022] iv.

Over Reliance on Fossil Fuels

Uganda's economic development strategy is to a great extent hinged upon its current commercially viable oil and gas deposits in the Albertine Graben region which are estimated to have a capacity of 3.5 billion barrels of oil. This is according to an official I interviewed from Uganda, oil and gas regulator, PAU. Uganda is also anticipating more commercially viable oil and gas deposits from exploration of other areas in Uganda. According to Uganda's Vision 2040, the foregoing presents Uganda with an opportunity to spur economic growth, create employment, foster technological transfer and generate revenues for investments in development of other strategic sectors such as infrastructure and human development[20]. This financial reliance on fossil fuels poses a challenge when it comes to prioritization of renewable energy investment projects. As seen from the foregoing focus of the country's Vision 2040, the oil revenues are to among others be channeled to development of Uganda's infrastructure Projects and other sectors. This has potential to result in the oil curse where over reliance on oil and gas may discourage diversification in other sectors of Uganda's economy.

A civil society official I interviewed from civil society recommended that, to address the over reliance on oil and gas revenues to spur Uganda's social economic development, the Government should effectively implement fiscal policies such as the Petroleum Revenue Investment Policy envisaged under the PFMA.

Environmental and Social Governance Concerns

The development of Uganda's oil and gas sector has sparked concerns over its expected negative impacts on the environment as well as on the social livelihoods on the population in

[20] Uganda Vision 2040

the affected areas. There has been concerns on destruction of natural habitats, potential oil spills, displacement of project affected persons etc. The foregoing are also said to undermine Uganda's efforts to meet its environmental obligations under international Instruments such as the UNFCCC and the Paris Agreement.

Environmental degradation is a threat to Uganda's credibility amongst international stakeholders with regards to Uganda's renewable energy pledges in its Energy Transition Plan. The said international stakeholders and potential financers may view Uganda's efforts as contradictory, hence reducing Uganda's chances at accessing affordance energy transition financing. I interviewed an official from NEMA who emphasized that ample legal frame work has been put in place by the Government to ensure that Uganda's oil commercialization processes do not degrade the environment. She gave an example of the Petroleum (Waste Management) Regulations SI No.3 of 2019, the National Environment (Oil Spill Prevention, Preparedness and Response) Regulations, SI No. 145 of 2020.

Findings on the existing policy & legal, economic and technological barriers on the energy transition

Uganda, like many developing countries, is working toward an energy transition to diversify its energy mix, promote renewable energy, and reduce reliance on biomass and fossil fuels. Despite these efforts, several barriers hinder progress. Below are findings on the existing policy barriers.

Policy Framework

The policy framework relevant to this analysis is the Uganda's Energy policy, which aims to promote sustainable energy development, reduce greenhouse gas emissions, and drive economic growth.

Key Policy Objectives

1. Promote sustainable energy development

2. Reduce greenhouse gas emissions

3. Drive economic growth

Analysis

Uganda's policies on Oil and Gas Management are outdated. For instance, the Oil and Gas Revenue Management Policy provides that investment of the petroleum fund should be made in low risk and well diversified investment portfolios abroad[21]. While Uganda has developed policies to support renewable energy, such as the Renewable Energy Policy (2007) and the recently launched Energy Transition Plan, a lot is still desired. For instance, the overall Policy Goal of the 2007 Renewable Energy Policy is to increase the use of modern energy, from 4% to 61% of the total energy consumption by the year 2017. In a study conducted in 2023, it was established that a high percentage of Uganda's energy consumption is from the traditional firewood and charcoal and that the modern renewables accounted for only 22% in 2020[22]. The fact that the Renewable Energy Policy that was mainly focused on 2017 targets is also very telling.

Despite the overarching global discourse on renewable energy at the global level, Uganda, like most African countries is yet to put in place clear and concise policy and legal frameworks to regulate and facilitate the realization of the energy transition. Case in point is the Government of Uganda that did not until December 2023 have an Energy Transition Plan. The said plan was launched at COP 28 in Dubai last year.

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[21] MOFPED, 'Oil and Gas Revenue Management Policy, 2012', 35.

[22] Sarah Helen Rudenauer, 'The Uganda Energy Sector Renewables' enormous potential is yet to deliver.' Energy Transition the Global Energiewende

Under the said Plan, one of the proposed actions to achieve the objectives therein is the passing of the Energy Efficiency and Conservation Bill aimed at putting in place the requisite legal framework to regulate energy efficiency in the construction and other sectors. This goes a long way to show that much of the requisite legal framework is not yet in place. The situation in Uganda is not any different from the situation in most other African countries.

Policy Recommendations

1. Develop a comprehensive petroleum revenue investment policy: This policy should prioritize investments in renewable energy projects and environmental restoration initiatives.
2. Renegotiate agreements with IOCs: Uganda should explore options for renegotiating agreements with IOCs to promote renewable energy development and reduce greenhouse gas emissions.
3. Explore new financing mechanisms: Uganda should explore new financing mechanisms, such as green bonds, to support its energy transition.
4. Develop a national energy plan: Uganda should develop a national energy plan that outlines its energy vision, goals, and strategies for promoting sustainable energy development.

Conclusion

Uganda's energy transition is crucial for promoting sustainable energy development, reducing greenhouse gas emissions, and driving economic growth. However, several challenges must be addressed, including the lack of a comprehensive petroleum revenue investment policy, long term agreements with IOCs, and limited financing options. By developing a comprehensive petroleum revenue investment policy, renegotiating agreements with IOCs,

exploring new financing mechanisms, and developing a national energy plan, Uganda can overcome these challenges and achieve its energy transition goals.

Legal Barriers

The dissertation identifies several legal barriers to Uganda's energy transition. One of the key barriers is the lack of a comprehensive legal framework for renewable energy development[23]. This is in contrast to other African countries, such as South Africa, which has a dedicated renewable energy law.

Another legal barrier is the dominance of the oil and gas sector in Uganda's energy mix, which is reinforced by the Petroleum (Exploration, Development and Production) Act. This Act prioritizes the development of oil and gas resources over renewable energy development.

Important to note, the PFMA established the Petroleum Fund into which petroleum revenues which accrue to Government should be deposited[24]. Withdrawals from this Fund go to the Consolidated Fund to support the annual budget, to the Petroleum Revenue Investment Reserve, for investments to be undertaken and for funding investments by UNOC[25]. With respect to the portion to be dedicated to investments under the Petroleum Revenue Investment Reserve, the PFMA states that this money shall be invested in accordance with the petroleum revenue investment policy issued by the Minister responsible for finance in accordance with the secretary to the Treasury and on the advice of the Investment Advisory Committee[26]. Respondents from Bank of Uganda and Ministry of Energy and Mineral

[23] Kabasinguzi, 2020, p. 123
[24] PFMA, Cap. 171, s 54.
[25] PFMA, Cap.171, s 56.
[26] PFMA, Cap.171 s 61.

Development confirmed that whereas the Policy was formulated and is in place, its implementation is yet to commence.

It should also be recalled that Uganda, like most oil producing African Countries have long term Agreements with IOCs for the exploration and production of oil and gas among others. Such Agreements include Production Sharing Agreements, Host Government Agreements, Inter Governmental Agreements. These agreements are typically long term. This means that any attempt to rescind them or depart from them in ana effort to pave way for renewable energy will trigger default clauses therein. Most if not all of such Agreements have stabilization clauses meant to maintain the IOCs economic equilibrium at the expense of Host Governments in the event that the host government changing its laws to the detriment of the IOCs. This means that any new legislation meant to operationalize the energy transition agenda may trigger stabilization. This would require the host Government to indemnify the IOCs with huge sums of money. Getting funds to indemnify the IOCs is a tall order as it is.

To overcome these challenges, Uganda must carefully navigate its energy transition, balancing the need to promote renewable energy with the obligations of its existing agreements with IOCs. This may involve renegotiating agreements, exploring new financing mechanisms, and implementing the petroleum revenue investment policy in a sustainable manner.

In this context, officials from the Ministry of Energy and Mineral Development and the Ministry of Water and Environment believe that Uganda's Energy Transition Plan, which aims to achieve universal energy access, reduce greenhouse gas emissions, and promote economic growth, is a crucial step towards a sustainable energy future. The plan recognizes the importance of leveraging Uganda's natural resources, including solar, hydro, and geothermal energy, to drive economic growth and reduce dependence on fossil fuels.

Ultimately, Uganda's energy transition will require careful planning, coordination, and investment. By implementing the Petroleum Revenue Investment Policy and renegotiating agreements with IOCs, Uganda can promote sustainable energy development, reduce greenhouse gas emissions, and drive economic growth.

Economic Barriers

The dissertation also identifies several economic barriers to Uganda's energy transition. One of the key barriers is the high upfront costs of renewal energy technologies, such as solar and wind power. This is a common challenge faced by many African countries, including Kenya, which has implemented a range of incentives to encourage renewable energy development.

Another economic barrier is the lack of access to financing for renewable enernegy projects in Uganda. This is in contrast to other African countries, such as Morocco, which has established a range of financing mechanisms to support RE development.

Energy is the foundation of economic development. As pointed out by McKenzie & Co, oil by gallons is still an essential good to meet the various energy demands by 2040. Transitioning from fossil fuel and biomass sources of energy to renewable sources such as hydro, wind, solar, thermal will require significant financial resources. Scherhoff, agrees that whereas renewable energy sources are not expensive to operate, their installation costs are rather high and always require to be paid upfront.

Resources are also required to put in place the required infrastructure such as generation plants, transmission lines, distribution lines etc. The shift will inevitably require reconfiguring the existing national grids as well as most of the industrial process etc.

The 2015 Paris Agreement imposes an obligation on developed countries to take the lead in availing financial assistance (climate finance) to the least developed and developing countries to facilitate their climate change mitigation efforts geared towards reducing emissions[27]. That said, the UNFCCC Secretariat, concerning the recently concluded COP 28 indicates that during the Conference, much as 8 donor governments communicated new financial commitments to least developed countries, the global stock take indicated that these commitments are very much short of the trillions of dollars required by the least developed countries and the developing countries to facilitate their clean energy transitions[28].

Energy is the foundation of economic development, and the demand for energy is expected to continue growing until 2040 (McKenzie & Co, 2020). However, transitioning from fossil fuel and biomass sources of energy to renewable sources such as hydro, wind, solar, and thermal will require significant financial resources[29]. The installation costs of renewable energy sources are high and require upfront payment, while the operation costs are relatively low.

The shift to renewable energy will also require significant investment in infrastructure, including generation plants, transmission lines, and distribution lines. Moreover, the existing national grids will need to be reconfigured to accommodate the integration of renewable energy sources.

The 2015 Paris Agreement recognizes the importance of climate finance in supporting the transition to renewable energy in developing countries. However, the recent COP 28 conference highlighted the significant gap between the financial commitments made by developed countries and the actual needs of developing countries.

[27] Paris Agreement, Article 9.
[28] UN Climate Press Release (2023)
[29] Scherhoff, 2019.

In Africa, countries such as South Africa and Morocco have made significant progress in transitioning to renewable energy, with the support of climate finance. However, other countries, such as Uganda and Tanzania, still face significant challenges in accessing climate finance and transitioning to renewable energy.

Technological Barriers

The 2015 Paris Agreement recognizes the crucial role of technological development and transfer in the reduction of greenhouse gas emissions.[30]

The 2015 Paris Agreement acknowledges the vital role of technological development and transfer in reducing greenhouse gas emissions. Moreover, the Agreement emphasizes the need for developed countries to support developing countries in implementing technological development and transfer.

However, the high cost of advanced technologies poses a significant barrier to their adoption[31]. The technology required to integrate renewable energy sources into existing national grids is complex and may require frequent upgrades[32].This is particularly challenging for developing countries, which often lack the financial resources and technical expertise to implement and maintain such technologies[33].

In the context of Africa, countries such as South Africa and Morocco have made significant strides in developing and implementing renewable energy technologies[34]. However, other

[30] Paris Agreement, Article 10(1)
[31] IPCC, 2014, p. 25
[32] IRENA, 2019, p. 15.
[33] UNDP, 2019, p. 12
[34] RSA, 2019; Morocco, 2019

countries, such as Uganda and Tanzania, still face significant challenges in adopting and integrating renewable energy technologies into their energy mixes. [35]

Uganda's energy sector is at a critical juncture, with the country seeking to transition from fossil fuels to renewable energy sources. However, this transition is hindered by various legal, economic, and technological barriers. This dissertation provides valuable insights into these barriers, with a focus on the oil and gas sector.

The dissertation also identifies several technological barriers to Uganda's energy transition. One of the key barriers is the lack of infrastructure for RE development, including transmission lines and distribution networks. This is a common challenge faced by many African countries, including Tanzania, which has implemented a range of initiatives to upgrade its energy infrastructure.

Another technological barrier is the lack of technical capacity and expertise in RE development in Uganda. This is in contrast to other African countries, such as Egypt, which has established a range of training programs to build technical capacity in RE development.

Other Inter related Barriers Lack of Clear Energy Transition Roadmap

The lack of a clear energy transition roadmap is a significant barrier to Uganda's energy transition. Unlike countries such as South Africa, which has a clear energy transition plan, Uganda's energy policy is outdated and does not provide a clear roadmap for energy transition. Furthermore, the lack of coordination between government agencies responsible

[35] Uganda, 2019; Tanzania, 2019.

for energy, environment, and finance can hinder the development of a comprehensive energy transition strategy.

High Cost of Energy Storage Technologies

The high cost of energy storage technologies, such as batteries, can make it difficult to integrate intermittent renewable energy sources into the grid. Unlike countries such as Morocco, which has invested heavily in energy storage technologies, Uganda's energy storage capacity is limited. Moreover, the limited access to energy finance, particularly for small scale renewable energy projects, can hinder the development of a robust renewable energy sector.

Dependence on Imported Fossil Fuels

The dependence on imported fossil fuels can make Uganda vulnerable to price volatility and supply disruptions. Unlike countries such as Kenya, which has invested heavily in renewable energy, Uganda's energy mix is still dominated by fossil fuels. Furthermore, the limited technical capacity to develop and maintain renewable energy technologies can hinder the development of a robust renewable energy sector.

Limited Public Awareness and Education

The lack of public awareness about the benefits of renewable energy can hinder the adoption of renewable energy technologies. Unlike countries such as South Africa, which has invested heavily in public awareness campaigns, Uganda's public awareness efforts are limited. Moreover, the limited access to energy education and training can hinder the development of a skilled workforce in the renewable energy sector.

Regional Cooperation and Integration

In terms of regional cooperation, Uganda can learn from the experiences of other African countries, such as Morocco and South Africa, which have invested heavily in regional energy cooperation. The East African Community (EAC) has also established a regional energy policy, which aims to promote regional energy cooperation and integration. Uganda can benefit from participating in regional energy cooperation initiatives, such as the EAC's regional energy policy, to promote the development of a robust renewable energy sector.

Inadequate Grid Infrastructure

Uganda's grid infrastructure is inadequate to support the integration of renewable energy sources into the grid. The country's grid is primarily designed to support fossil fuel based power generation, and it lacks the necessary infrastructure to support the variable output of renewable energy sources.

Limited Access to Finance for Renewable Energy Projects

Access to finance for renewable energy projects in Uganda is limited, particularly for small scale projects. The high upfront costs of renewable energy technologies, combined with the lack of access to finance, can make it difficult for developers to secure funding for their projects.

Inadequate Energy Storage Capacity

Uganda's energy storage capacity is inadequate to support the integration of renewable energy sources into the grid. The country lacks the necessary energy storage infrastructure, such as batteries, to store excess energy generated by renewable energy sources.

Limited Public Private Partnerships in the Renewable Energy Sector

Public private partnerships (PPPs) can play a crucial role in promoting the development of renewable energy projects in Uganda. However, the country lacks a clear framework for PPPs in the renewable energy sector, which can make it difficult to attract private sector investment.

Inadequate Climate Change Mitigation and Adaptation Measures

Uganda is vulnerable to the impacts of climate change, including droughts, floods, and landslides. However, the country lacks adequate climate change mitigation and adaptation measures, which can make it difficult to reduce greenhouse gas emissions and adapt to the impacts of climate change (Ministry of Water and Environment, 2020).

Limited Regional Energy Trade and Cooperation

Regional energy trade and cooperation can play a crucial role in promoting the development of renewable energy projects in Uganda. However, the country lacks a clear framework for regional energy trade and cooperation, which can make it difficult to trade energy with neighboring countries.

Inadequate Energy Efficiency Measures

Energy efficiency measures can play a crucial role in reducing energy consumption and greenhouse gas emissions in Uganda. However, the country lacks adequate energy efficiency measures, which can make it difficult to reduce energy consumption and promote the development of renewable energy projects.

Limited Access to Energy Data and Statistics

Uganda lacks access to reliable energy data and statistics, which can make it difficult to track progress towards energy transition goals. The lack of data and statistics can also make it challenging to identify areas for improvement and to develop effective energy policies.

Inadequate Energy Research and Development

Uganda's energy research and development (R&D) capacity is limited, which can hinder the development of new energy technologies and innovations. The lack of R&D capacity can also make it difficult for Uganda to keep pace with global energy trends and technologies.

Limited Energy Education and Training

Uganda's energy education and training capacity is limited, which can hinder the development of a skilled workforce in the energy sector. The lack of energy education and training capacity can also make it difficult for Uganda to develop the necessary expertise to manage and maintain energy infrastructure.

Inadequate Energy Infrastructure Maintenance

Uganda's energy infrastructure maintenance capacity is limited, which can hinder the reliability and efficiency of the energy system. The lack of maintenance capacity can also lead to power outages and other disruptions to the energy supply.

Limited Access to Energy for Rural Communities

According to the Ministry of Energy, Uganda's rural communities lack access to reliable and affordable energy, which can hinder economic development and poverty reduction. The lack of access to energy can also make it difficult for rural communities to access basic services such as healthcare and education.

Inadequate Energy Sector Governance

According to the Electricity Regulatory Authority, Uganda's energy sector governance is inadequate, which can hinder the effective management and regulation of the energy sector. The lack of effective governance can also lead to corruption and other forms of malfeasance in the energy sector.

Inadequate Energy Sector Transparency and Accountability

Uganda's energy sector lacks transparency and accountability, which can hinder the effective management and regulation of the energy sector. The lack of transparency and accountability can also lead to corruption and other forms of malfeasance in the energy sector.

Limited Access to Clean Energy Technologies

Uganda's access to clean energy technologies is limited, which can hinder the development of a low carbon energy sector. The lack of access to clean energy technologies can also make it difficult for Uganda to reduce its greenhouse gas emissions and mitigate the impacts of climate change.

Inadequate Energy Efficiency Standards

Uganda's energy efficiency standards are inadequate, which can hinder the development of a low carbon energy sector. The lack of energy efficiency standards can also make it difficult for Uganda to reduce its energy consumption and greenhouse gas emissions.

Limited Access to Climate Finance

According to the African Development Bank, Uganda's access to climate finance is limited, which can hinder the development of a low carbon energy sector. The lack of access to climate finance can also make it difficult for Uganda to reduce its greenhouse gas emissions and mitigate the impacts of climate change.

Inadequate Energy Sector Cybersecurity

Uganda's energy sector cybersecurity is inadequate, which can hinder the development of a low carbon energy sector. The lack of energy sector cybersecurity can also make it difficult for Uganda to protect its energy infrastructure from cyber threats.

Limited Access to Energy Storage Technologies

Uganda's access to energy storage technologies is limited, which can hinder the development of a low carbon energy sector. The lack of access to energy storage technologies can also make it difficult for Uganda to integrate intermittent renewable energy sources into the grid.

Inadequate Energy Sector Disaster Risk Reduction and Management

Uganda's energy sector disaster risk reduction and management is inadequate, which can hinder the development of a low carbon energy sector. The lack of energy sector disaster risk

reduction and management can also make it difficult for Uganda to protect its energy infrastructure from natural disasters.

Limited Access to Energy Sector Data and Analytics

Uganda's access to energy sector data and analytics is limited, which can hinder the development of a low carbon energy sector (International Energy Agency, 2020). The lack of access to energy sector data and analytics can also make it difficult for Uganda to track its progress towards energy transition goals.

Conclusion

In conclusion, the findings of this study highlight the need for a comprehensive approach to address the legal, economic, and technological barriers to energy transition in Uganda. This includes the development of a clear energy transition policy, increasing access to finance for renewable energy projects, improving infrastructure, and addressing technological barriers. dissertation provides valuable insights into the legal, economic, and technological barriers to Uganda's energy transition.

CHAPTER FIVE
CONCLUSION AND RECOMMENDATIONS

Introduction

This chapter will propose strategies to counter the apparent conflict between Uganda's oil and gas development agenda viz viz its international obligations and also propose recommendations to alleviate the economic, technological, inadequate legal and policy framework challenges faced by Uganda in its transition journey.

Strategies to counter the apparent conflict between Uganda's oil and gas development agenda viz viz its international obligations.

To reconcile Uganda's economic development priorities of use of oil revenues with its international energy transition commitments, Uganda is should adopt a balanced approach of utilizing a reasonable amount of funds from the oil sector to renewable energy projects and initiatives as well as putting strict environmental safeguards to counter the effects from its oil and gas production and use activities.

Lessons can be drawn from the UAE that has used revenue from its oil reserves to fund massive renewable projects such as the Mohammed bin Rashid Al Maktoum Solar Park which is one of the largest solar parks spread over a total area of 77 km^2 (30 sq mi) in Saih AlDahal. Norway also deposits a significant amount of its oil revenues into the Sovereign Wealth Fund, where sums from this Fund are invested in renewable energy projects.

Recommendations on Legal Barriers

Uganda's efforts in ensuring environmentally sustainable interventions in the oil and gas sector are commendable in the following ways:

Enactment of the Petroleum (Waste Management) Regulations No.3 of 2019 which requires a licensee and a petroleum waste handler to apply measures in the management of petroleum waste to prevent harm to human health and ensure safety of human beings, to prevent pollution, harm to biological diversity and contamination of the wider environment by petroleum waste[36].

Amendment to the National Environment Act to mandate the Office of the Prime Minister to work with NEMA and other relevant agencies to establish a National Oil Spill Contingency Plan which puts in place a framework for planning and responding to oils spills in Uganda and event those crossing from Uganda to other countries[37]. This National Oil Spill Contingency Plan was put in place in 2020.

The enactment of the National Environment (Oil Spill Prevention, Preparedness and Response) Regulations, SI No. 145 of 2020 that requires specified duty bearers to put in place measures to prevent oil spills as outlined in the environmental risk assessment , including by use of best available techniques and best environmental practice; establish a system for tracking the volume or quantities of oil at their facility or used during an activity; and establish operating procedures for the prevention of oil spills[38].

While the above is commendable, it is very vital to point out that the above efforts are alone not adequate enough to guarantee environmental sustainability. For environmental

[36] The Petroleum (Waste Management) Regulations No.3 of 2019, R 4.

[37] National Environment Act, Cap. 181, s 93.

[38] The National Environment (Oil Spill Prevention, Preparedness and Response) Regulations, SI No. 145 of 2020, R 6.

sustainability to be achieved in development of Uganda's oil and gas sector and by extension, promotion of the energy transition, the following is recommended:

a) The political will to implement the foregoing efforts, ought to be intentional, consistence and applicable to all players without discrimination or favoritism.
b) The state agencies responsible for implementation of the legal and regulatory regimes ought to be given sufficient requisite resources to execute their respective legal and policy mandates. These include NEMA, PAU, local authorities in localities where petroleum activities and midstream operations are taking place.
c) The concerned state agencies with related mandates should collaborate and work together towards implementing their respective mandates for the overall success of their endeavors.

Uganda should not just stop at ratifying international legal instruments such as the Paris Agreement, the Kyoto Protocol, the UNFCCC aimed at facilitating the energy transition. The Government should pass the relevant policy and legal frameworks at the national level to customize the energy transition efforts to the needs and circumstances of the populations they lead.

Strategies to overcome the economic barriers

For Africa to overcome the economic barriers to the Energy Transition, a multipronged approach involving the following interventions is required.

According to Carbon Initiative for Development, about 600 million people in rural areas in sub–Saharan Africa do not have access to electricity. It has been correctly proposed that African Governments can subsidize the renewable energy projects by mobilizing domestic resources to cover the initial capital costs required by such projects.

Another approach is increase of momentum to mobilise for the requisite financing. As pointed out above, at COP 28, some countries pledged contributions to the climate finance meant to facilitate the energy transition in the least developed and developing countries. This however does not mean that the said finance is readily available for grabs. It has to be applied for and competed for. It is thus incumbent on the Ugandan Government to prepare bankable project proposals as well as aggressively pursue the set procedures for accessing such financing.

Strategies to overcome the Technological barriers

Uganda needs to create synergies and partnerships with technologically advanced states through knowledge sharing platforms etc. The Government should also allocate substantial budgets towards research, innovation and development to develop technologies that are tailor made for African problems by Africans.

The role of regional cooperation cannot be minimized. Uganda when negotiating for technological transfer and support will achieve more when the negotiations are done through negotiating blocs such as the African Union as opposed to negotiate as singular states. Negotiating in blocks lends African states a louder and impressive voice.

Conclusion

Uganda's energy transition faces significant policy, economic, and technological barriers, but these challenges are not insurmountable. Addressing these barriers through coordinated policy reforms, financial innovation, and technological advancement will be crucial for Uganda to achieve a sustainable and inclusive energy transition.

Navigating the energy transition in Uganda requires a multitude of efforts by all the concerned stakeholders, innovative ideas, and pragmatic leadership at all levels. As indicated above, Uganda needs to carefully leverage on regional cooperation among other strategies, to propel its population towards economies powered by clean energy sources.

The Government of Uganda should develop a comprehensive legal framework for RE development, including a dedicated RE law, increase access to financing for RE projects, including through the establishment of a dedicated RE fund, upgrade its energy infrastructure, including transmission lines and distribution networks, to support RE development and establish training programs to build technical capacity and expertise in RE development.

All in all, and the above notwithstanding, Uganda should be given a chance to exploit its fossil fuels resources in the meantime as it readies itself for the transition. This is partly because Uganda is least responsible for the climate crisis and equally, its efforts towards emissions reductions should be commensurate to such minimal responsibility. This is as compared to the developed states which are the major contributors to the climate crisis that the world is grappling with. This calls for Uganda to strike a delicate balance between exploiting the existing fossil fuel reserves and using some of the revenues from these reserves to harness on the renewable energy transition.

The above notwithstanding, future research should focus on conducting a Larger Scale Study to validate the findings of this study. A comparative study should be conducted to compare the barriers to energy transition in Uganda with other countries in Africa.

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Appendix A: Questionnaire

Energy Transition in Uganda Questionnaire

Introduction:

Thank you for participating in this study on energy transition in Uganda. Your responses will help us understand the barriers to energy transition in Uganda. Please answer the questions honestly, and to the best of your knowledge.

Section 1: Demographic Information

1. What is your age?
2. What is your occupation?
3. What is your level of education?
4. What is your income level?

Section 2: Energy Transition in Uganda

1. What do you think are the main barriers to energy transition in Uganda? (Select all that apply)

Lack of clear energy transition policy

Limited access to finance

Inadequate infrastructure

Technological barriers

Other (please specify)

2. How important do you think energy transition is for Uganda's economic development? (Scale: 15, where 1 is "not important at all" and 5 is "very important")

1

2

3

4

5

3. What do you think is the most effective way to promote energy transition in Uganda? (Select one)

Increasing access to finance for renewable energy projects

Improving infrastructure for renewable energy projects

Providing training and capacity building programs for skilled personnel

Other (please specify)

Section 3: Open Ended Questions

1. What do you think are the main challenges facing Uganda's energy sector?

2. How do you think energy transition can contribute to Uganda's economic development?

3. What do you think is the most important step that the government of Uganda can take to promote energy transition?

Thank you for taking the time to complete this questionnaire. Your responses are greatly appreciated.

Appendix B: Interview Guide

Energy Transition in Uganda Interview Guide

Introduction:

Thank you for participating in this study on energy transition in Uganda. Your insights and experiences will help us understand the barriers to energy transition in Uganda.

Section 1: Background Information

1. Can you tell me a little bit about your background and experience in the energy sector?
2. What is your current role and responsibilities in the energy sector?

Section 2: Energy Transition in Uganda

1. What do you think are the main barriers to energy transition in Uganda?
2. How do you think energy transition can contribute to Uganda's economic development?
3. What do you think is the most effective way to promote energy transition in Uganda?

Section 3: Policy and Regulatory Framework

1. What do you think is the current state of the policy and regulatory framework for energy transition in Uganda?
2. How do you think the policy and regulatory framework can be improved to support energy transition in Uganda?

Section 4: Access to Finance

1. What do you think are the main challenges facing renewable energy developers in accessing finance in Uganda?

2. How do you think access to finance for renewable energy projects can be improved in Uganda?

Section 5: Infrastructure and Technology

1. What do you think are the main challenges facing the development of renewable energy infrastructure in Uganda?

2. How do you think the development of renewable energy infrastructure can be supported in Uganda?

Section 6: Open Ended Questions

1. Is there anything else you would like to share about energy transition in Uganda?

2. Are there any other challenges or opportunities that you think should be considered in promoting energy transition in Uganda?

Thank you for taking the time to participate in this interview. Your insights and experiences are greatly appreciated.

Appendix C: Focus Group Discussion Guide

Energy Transition in Uganda Focus Group Discussion Guide

Introduction:

Thank you for participating in this focus group discussion on energy transition in Uganda. Your perspectives and experiences will help us understand the barriers to energy transition in Uganda.

Section 1: Introduction and Icebreaker

1. Can you please introduce yourself and tell us a little bit about your background and experience in the energy sector?
2. What do you think are the main challenges facing Uganda's energy sector?

Section 2: Energy Transition in Uganda

1. What do you think are the main barriers to energy transition in Uganda?
2. How do you think energy transition can contribute to Uganda's economic development?
3. What do you think is the most effective way to promote energy transition in Uganda?

Section 3: Policy and Regulatory Framework

1. What do you think is the current state of the policy and regulatory framework for energy transition in Uganda?

2. How do you think the policy and regulatory framework can be improved to support energy transition in Uganda?

Section 4: Access to Finance

1. What do you think are the main challenges facing renewable energy developers in accessing finance in Uganda?
2. How do you think access to finance for renewable energy projects can be improved in Uganda?

Section 5: Infrastructure and Technology

1. What do you think are the main challenges facing the development of renewable energy infrastructure in Uganda?
2. How do you think the development of renewable energy infrastructure can be supported in Uganda?

Section 6: Open Ended Questions

1. Is there anything else you would like to share about energy transition in Uganda?
2. Are there any other challenges or opportunities that you think should be considered in promoting energy transition in Uganda?

Conclusion:

Thank you for participating in this focus group discussion. Your perspectives and experiences are greatly appreciated.