

Sustainable Oil Exploitation Versus Renewable Energy Initiatives: A Review of the Case of Uganda

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Abstract

Uganda suffers low electricity supply which translates negatively on the country's socio-economic scorecard. The expectation on the oil and gas sector to revamp the economic situation of a nation upon exploitation of its natural resources is a common phenomenon. Although, oil exploration and future exploitation promise to attract investments and development of technological initiatives, spread across different industrial sectors, as well as, encourage diverse businesses to spring up. Regardless, there are negative consequences. The latest discovery of oil in Kenya, Tanzania and most recently Mozambique creates new attraction and draws global attention toward the continent. This paper evaluates the oil development progress in Uganda to meet the increasing energy demand of the rapid industrialization that flocks the country. We review the oil production and refining processes and argue about the preparedness and likely challenges of the nation to consider her Renewable Energy (RE) potential for power generation. The authors adopt a qualitative research approach, using three unique methods to conduct the assessments. Hence, provide the latest information about ongoing activities on oil and gas exploitation by the Government of Uganda (GoU) from a broader perspective. The study examines and suggests ways to secure the future and energy dispensation of Uganda. GoU will need to review the current structure of its petroleum bill, consider power delegation to include lower organs and forester lucency in the oil exploitation processes. Also, intensify commitment towards the sustenance and development of renewable energy projects.

Keywords

Energy, Government of Uganda, Oil and Gas, Renewable

1. Introduction

No doubt, when good institutions, policies, and strategies exist, oil concentration benefits "growth" will be ensured. However, if the institutions of a nation lack well built regulatory frameworks and the policies governing the resource sector are not suitably organized, will result to a high probability that the country may experience similar natural resource curse as other African Countries: Angola, Nigeria, South Sudan and Chad. With Nigeria standing in the capacity as the giant of oil producers in Africa, discovery in East Africa, according to (Kopiński et al., 2013) has in capacity, up to 20 billion barrels of crude oil to show. South Sudan, Tanzania, Kenya, Mozambique and with Uganda in the limelight, haven commercially discovered oil in 2006 boasting of 6.5-7 billion barrels of oil deposit with a forecast of producing 60,000 barrels per day through an efficient production process before the year 2020 (Polus and Tycholiz, 2016). Whereas abrupt study on refinery citing pertains to capacity, configuration, location, cost, technology, to mention a few. Operationalization of the refinery is pivotal in the entire process of oil production. While the constitution of the land, offers the Ministry of Energy and Mineral Development (MEMD, 2011), the mandate "To work on consultatory grounds with stakeholders, to strategically manage and safeguard rationals that will promote sustainable exploitation and utilization of the countries resources for social and economic development." A futuristic look at oil resources utilization trends shows that oil exploitation gains shall depend mainly on balance between the outcome of the increasing oil price in the face of depletion and reduction in the cost of technologies to aid sustainable production.

The continent - Africa is blessed with abundant RE potential which is poorly harnessed; due to high initial investment cost associated with the project, and in most cases knowledge barrier of the advantages there-in (Ibrahim Oluwale Raji & Peter Onu, 2017; Mas'ud et al., 2015). As the world becomes more conscious about energy security and at the same time, climate mitigation, new policies, and finance mechanism are being designed by different countries to support the development of RE sources. According to the United State Energy Information Agency, as reported by (Mas'ud et al., 2015), fossils have the potential to supply sufficient amount of the energy to the world today and will continue to be a relevant source of power even past the year 2040. Hence, Uganda and the East Africa countries hope to enjoy a great deal, the actualization of oil production in their region. The focus, therefore, is how far, so far. Moving from the upstream of exploration to the mid-stream, assessing production capabilities, infrastructure development, and technological skill-set, to drive the process of exploiting the natural resources, down to the socio-economic benefits to the government and people of Uganda in both the short and long term. More so, what is the preparedness of the Ugandan government, as a new oil-producing nation to meet challenges of licensing deals, infrastructural supports; road networks and associated land fields required for operation and also, the legality involved? The study aims to review strategies that will best serve the interest of the government and the host communities to forestall communal crises through industrial job creation, reduce environmental pollution through joint venture partnership and efforts by key players, and introduce conflicts resolution approach through a consolidated consultations platform.

While the Ugandan government wishes to embrace the private-public partnership business ownership approach to run the oil refining process, they search for investors to take sole responsibilities (design, build, provide 100% finance and operate the refinery). Hence, to assume the risk of crude oil supply, refining, and marketing of products: a merchant type of a refinery. The government of Uganda is currently looking up to Norway, who in several capacities have supported the country to establish the framework for the current electricity act which guides the electricity regulation in the country. Hence, are requesting their Norwegian partners to assist and draw up the legal and institutional framework for the mid-stream process of oil production, processing and transporting (Polus and Tycholiz, 2017). Regardless, it is arguable that Uganda does not have the base to cover skill set and juridical support, legal institutions or framework to mirror the Norwegian triad, and with considerations of the new Petroleum Upstream Bill and Oil Revenue Management Policy in Uganda. The current phase of Ugandan oil exploration requires significant technical, logistical and safety intervention to address challenges with regards to construction and operation of a standard modern-day refinery (Bucelli et al., 2017). There are challenges of top priority, such as decision making; choices of design to meet operability, efficient maintenance over time and skilled professionals needed (Joly, 2012). Others involve resettlement and environmental impact curtailment, plus the scare of declining global fossil price/demand, and the citizens' expectation of their government through the oil market to provide a favorable living condition. This paper takes the following structure. Section 2 discusses in brief, the methodology adopted in the study. Section 3 assesses the Uganda oil exploration and renewable energy activities. Section 4 presents a discussion of the way forward and assessment deductions and conclusions.

2. Methodology

The Conceptual and relational analysis of scientific writing, document or media publication to evaluate its contents and extract data which correlates meaningful relationships between different concepts has been proven sufficient through document review for implicit studies (Bowen, 2009; Creswell, 2012), and to interpret and solve research problems (Fletcher, 2015). In this research, the authors identifying relevant documents that pertain to oil exploitation, interventions, practices, development frameworks and other related activities in Uganda. Followed by a census survey (Key-Informant Interviews), targeting a class of respondents made up of senior government officials in charge of the different oil corporations and their activities, technical partners and local leaders of oil-producing host communities to assess technological developments and the socio-economic impact in the various communities involved, and the country at large. Information's gathered from conferences, oil and gas forums, workshops and focus group discussion (FGD) were a vital instrument for our assessment. We investigate the renewable energy concerns of the nation with an overview of the chance of continuing to the later, old projects and the prospect of the oil and gas sector to support future RE projects, while strategically propelling industrial growth, and climatic mitigation, which is currently a primary global concern.

3. Ugandan Energy Dispensation and Climate Change Impact

3.1 A Brief on Uganda and the Country's Energy Concern

Uganda is one of the East African countries that is landlocked by five countries, i.e., Kenya to the East, Tanzania to the South, Rwanda to the South East, the Democratic Republic of Congo to the west and South Sudan to the north. Uganda is located on latitudes of 4°N and 2°S and longitudes of 29°W and 35°E (Twaha et al., 2016), presented in figure 1(C), with a total land area of 197,100 Km². The population of Uganda is estimated to be 41,487,000 and projected to reach 47 million by the year 2030 (GoU and Unfpa, 2017). The country is enormously blessed, having agricultural food and cash crops potential and abundant renewable energy resources, with a 90% dependence of hydro, for electricity generation as per their current energy mix. Listed as one of the poorest countries in the world, Uganda must strive to utilize their current oil potential optimally, and ensure a balance on the economic and social impacts, as they overcome ill-challenges that threaten its progress (Ogwang et al., 2018). Crude oil discovery in the Albertine Rift, near to Uganda, covering an average area of 22,000Km², puts the country in the spotlight within the East African region. However, the country experiences bordering, insecurity, political and industrial setbacks that have stunted their growth. Presently, The country adopts multiple sources of power generation with an installed capacity of about 1,100Mw comprising mostly of large and small-hydro plants, and with other major hydropower projects still under construction (Totaling 1800Mw installed capacity) (Adeyemi and Asere, 2014; EAC, 2016; Luke, 2015). Uganda will need at least 2000Mw of electricity to power homes and industries by 2025 (Adeyemi and Asere, 2014). Although the country had 650MW of installed capacity for electricity generation, only 21% (16% on the grid) of the Ugandan population, have access to the electricity supply to meet their household energy demand (UMEME, 2016). The GoU has a target of increasing access to the electricity grid for household utilization to reach 40% by 2025, as against the 15% scored in 2013 (EAC, 2016) and the current value of 857.5MW installed capacity (Meyer et al., 2018).

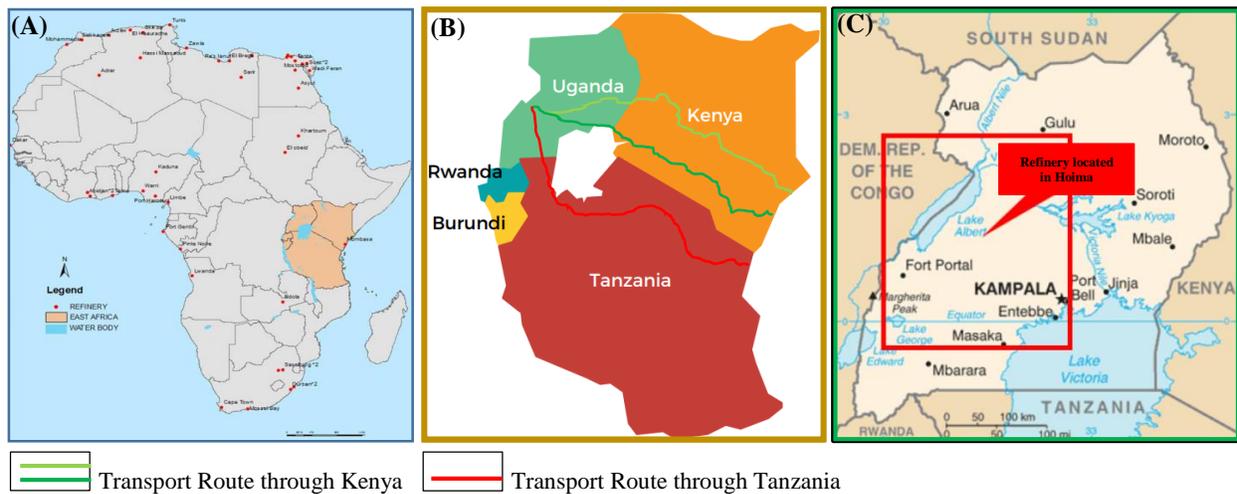


Figure 1: Maps, where; (A) Africa, showing the East African region. (B) The East African region, showing possible transportation route from refinery site to the Indian Ocean. (C) Uganda, Refinery location in Hoima

The GoU by her powers through the Electricity Regulatory Authority holds responsible a concessional designated private company called *Umeme* to distribute power in the country (Tumwesigye et al., 2011). *Umeme* is the single electricity distribution company of Uganda since 2005, and have within the last ten years improved the distribution efficiency and revenue collection by 20% and 18.4% respectively with a doubled effort to reduce energy losses (UMEME, 2016). Extensive work has been carried out by Meyer et al. (2018) on Uganda's independent power projects and other massive international supports, mostly from China. In their research, they cover some factors that help to accelerate private investments in the country's electricity sector, with a full list of the countries investment history on power projects, year and capacity. They conclude their evaluation of the power planning strategy and structure of Uganda electricity sector and Government role in independent power projects procurements. Also, assessing Chinese

inputs and giving more insights into the country's policies for managing demand and supply of energy (Meyer et al., 2018). Twaha et al., (Twaha et al., 2016) also capture policies and challenges facing the adoption of renewable energy sources for distributed generation and why electricity penetration remained below 12% despite the country's abundance of energy sources. Hence (Twaha et al., 2016) has advised on strategy for successful rural electrification. The subsequent sections of this paper draw attention to concerns which have occurred in the energy sector and highlight sensitive matters on oil and gas development in Uganda, renewable energy interventions and finally concluding with the discussion on the way forward.

3.2 Technicalities of Oil Exploration and Production in Uganda

The Focus on Uganda oil, in the Albertine Rift, started in earnest, in the years 2003 and 2004. Although nine potential Exploration Areas (EAs) were discovered, only five received a license for exploration by the Government. The censorious blocks licensed are EAs 1, 2 and 3A (MEMD, 2011), which are found in the Pakwach, Northern Lake Albert, and Lake Semliki Basins in the Southern areas, respectively. Furthermore, a brief historical overview of the events that followed within the years 2010 and 2017 is summarised from Ogwang et al., work (Ogwang et al., 2018) and presented in Table 1. The exploitation of Ugandan crude oil is constrained to three value chain: Upstream, Midstream, and the Downstream. The Upstream entails, licensing deals/contract signing, exploration activities, extraction and collection, and temporary storage of the petroleum. The midstream is the process of refining the oil and production of the various by-product. Logistic decisions, at this level. i.e., after the crude oil finds its way to the Hoima refineries, it shall like-all-others include supply planning, selection of the appropriate transportation modes (since products produced at the refineries shall be sent to the distribution centers), scheduling, and marketing. Hence, transporting the oil via pipelines, trucks, or rail cars to the customers after refining to the downstream where sales, marketing and distribution of the petroleum products to the end users is discharged. As negotiations continue between the Ugandan and Tanzanian government and engineering designs and socio-environmental impact investigation still ongoing on transportation of the crude oil for commercialization purpose, more assessments are being carried-out by both parties independently on the long-term benefits of the projects.

Table 1. Showing critical actions on Oil and Gas Development in Uganda (2006 – 2016). Data obtained from Ref (Ogwang et al., 2018)

Late 19th century, seepage of oil noted in various places in western Uganda
Early 20th century, various exploratory activities
1962 Uganda gains independence from the United Kingdom
1962 to 1998 various oil-related activities, but no substantial outcome
1998 Heritage Oil conducts seismic surveys firmly establishing the presence of oil deposits
2006 Many wells drilled confirming substantial deposits of oil and gas
2010 Government commissions a feasibility study for the construction of a refinery
2013 Government approves construction of a refinery
2013 Chinese company CNOOC is granted a production licence, with production expected in 2017
2013 over 7000 people ordered to vacate land allocated for refinery, compensation paid by Government of Uganda
2014 the Government's National Environment Management Authority approves four companies to construct a waste management facility to process oil drilling waste
2014 The Government signs a Memorandum of Understanding with the three oil companies (Total, Tullow and CNOOC) detailing a roadmap for the commercialization of the country's petroleum resources, specifically agreeing that the country's natural gas will be used for power generation, a refinery will be built, and a crude export pipeline will be built
2014 Over 200 families forcibly evicted by a private company (with police assistance) from land to be used for the waste facility
2014 paved road from Kaiso (on Lake Albert) to Hoima completed
2015 RT-Global Resources is announced winner of the bid to build the crude oil refinery
2015 another waste oil treatment plant is opened near Hoima
2015 announcement of Hoima-Lokichar-Lamu route (through Kenya) for pipeline
2016 oil pipeline route changed to be Hoima to Tanga in Tanzania
2016 RT Global Resources backs out of the refinery, leaving the government without a current developer

The Ugandan oil blend characterization measures between 23 – 33 API (American Petroleum Institute gravity), 0.16% weight proportion of sulfur crude content, and 40% weight proportion of vacuum residue. The oil is waxy with a 40°C

pour point (Luke, 2015). These criteria make the crude more suitable for onsite refining than pipeline transportation. However, current civil works and buildings plan are currently underway in Hoima to locate refineries (MEMD, 2011). The need to transport processed fuels from the refinery to a storage site in Buloba, Wakiso District in Central Uganda, require a 12inch underground pipe that will cover up to 211km. Also, a 24inch pipe to transport the Ugandan Crude under the East African Crude Oil Pipeline (EACOP) understanding, through a distance of 1,445km, and terminates at the Tanga port of Tanzania to access the international market. A second and reliable option is the transporting of the country's oil through the use of a spur down through Nairobi – Kenya from Hoima, and again to terminate at the Indian Ocean (an average distance of 1,300 kilometers) shown in figure 1(B). There will also be a need to devise means and ensure that the transportation pipes are pre-heated, to augment the waxy characteristics of the crude, posing the challenge of high cost of piping. Currently, there are only, but estimates of the costs of building the Ugandan refinery and the share of capital needed from the proposed sole investor, since the withdrawal of the former (Table 1) is still unknown. Other challenges that pertain to the Oil and Gas production in Uganda are: the immense expectation of the community being exploited across the borders and through the countries involved, financial investment decision of partnering nations as to how, when and where the piping logistics will be implemented, rebel activities in the Albertine Rift and of course dwindling global oil price.

The burning of hydrocarbon gases which takes place when oil is pumped from the earth and the waste gases flared during the process raises serious concern about the methods being used. The gas flaring processes has intensified in the past three years, and the impact on the ecosystem within the Hoima District is already tangible. Flaring is a non-environmentally friendly process as it results in noise, and permanent bright light, capable of causing discomfort, even to far away dwellers. The gas flaring process is an incomplete combustion process, thereby leading to oil droplets which contaminate close by water bodies, crops, houses, and disrupt living (NEMA, 2014). These are already being felt and experienced in the Hoima lake region, as wildlife is displaced, and agriculture and horticultural activities put on hold, fishers constrained to relocate and landowners who received unfair compensation watch from a distance. A new discernment about job hiring competence, mid-level contract assignment, and the role of oil producing companies or the level of infrastructural excellence required to sustainably coordinate the oil exploitation activities, have become top issues to unsolve. Several reports of the disproportionate hiring of foreigners and payment of local players wherein they receive poor remunerations is also a pertinent topic. Hence, the need to address the local content law in Uganda.

3.3 Renewable Energy Agitation in Uganda.

A collaborative report managed by the United Nations Industrial Development Organization (UNIDO) and Renewable Energy Policy Network for the 21st Century (REN21) (EAC, 2016), presents the Energy potential and renewable electricity generation capacity of the East Africa region to have risen to 65% for grid-connection in 2015. The value is higher than the total for the southern and Eastern sub-Saharan Africa combined, at 52.1%. Despite this report, and the revised renewables energy target of Uganda; 61% of their total energy consumption by 2017 to come from renewable sources and which they did not achieve. It presents a new perspective for arguments, that attention (funds mobilization and political will) have declined due to the prospective favorable fossil fuel projects. Although, Ugandan's investment in renewable energy increased since 2003, so did the country's population and proportionate to their energy demand. Following the development, small-scale hydro projects and solar home projects have received considerable attention within the past seven years and have become a growing business area and a lucrative approach by industries to save electricity cost. Uganda has since 2015, and till date invested more than USD 135 million on renewable energy initiative, with thousands of biodigesters installed and showing great commitment to installations of solar mini-grid projects. The more significant portion of the said sum is invested in large hydro projects across the country but moving at a much slower pace than anticipated due to political, engineering, and mismanagement setbacks. An estimated 93% of the energy consumed in Uganda is obtained from biomass and mostly used in households for cooking. A donation by the Government of Sweden to Uganda, the tone of USD 4.3 million towards developmental programs which supports clean energy has a far-reaching effect on the poor to promote clean cooking through better cooking technological interventions. The future of renewables holds assurance from the look of things. The country still lacks two key support policies that should transform the renewable energy activities for excellent performance; (1) Production Tax Credit Policy is one which will further encourage investment in the country, and promote hands-on participation and operations by the high percentage of the unemployed workforce, thereby creating new job opportunities. (2) Energy Production Payment is also a vital policy to increase the country's GDP and lead economic prosperity. Stable power/electricity supply can transcend a mediocre economy to a wealthy industrialized nation.

Economic evaluations of oil explorations are risky and cover huge uncertainties related to its costs and with regards to several other censorious variables that include, but are not limited to reservoir features, operational costs, and cost of installing modern infrastructural facilities and systems. Regardless, the exploration and exploitation of oil in Uganda may reduce further, the quest for renewable energy potential which in the long-run is beneficial for climate security. It is worthy of note that there are yet to be, any technologically advanced ‘*carbon-free*’ procedure of oil exploitation known. Nevertheless, regrettably, the adverse implications of exploration and refining on the immediate environments are always put at the lower ebb of discussions by stakeholders and agitators even when the indicators have become evident in the environmental impact assessment for these projects. The question is always whether a government prospecting for oil will focus on climate change security (i.e., climate change effects and threats) and not think of the revenue that will accrue from oil exploitation? Everyone quite knows the answer. Likewise, the Uganda government and stakeholders tend towards the obvious option. Hence, there is the probability; discovering oil countries may resolve to overweigh generation of revenue over climate security despite the recent Paris goals on climate security.

3.4 Climate Change Threats amidst Oil Exploitation

According to a publication by the Investors Group on Climate Change (IIGCC), 60 out of 70% energy-related activities which contribute to global greenhouse gas (GHG) emissions are as a result of gross dependence on fossil fuel production, and related use. Accordingly, (EK, 2016) that by 2100, the number of hot days is expected to grow to 114 days, against the current estimate of average 39 days to 60 days before 2050. This characteristic change is already impacting negatively across Africa, noticing excessive sunshine to high rising floods causing damage to infrastructures, agricultural life stock and disrupting output, including low visibility and carcinogenic effects from GHG emission. Sharing such information is essential to encourage smart adaptation strategies and prompt exploration of different climate resilience practices to survive the adverse effects. Uganda as a country is blessed with sufficient renewable energy potential such as hydropower, biomass, geothermal, solar and peat that could provide 92% of its primary energy demand by 2050 (NEMA, 2014). The benefits accruing from the development of an oil refinery industries are enormous and vital because of the end product from crude oil refineries; LPG, Naphtha, Gasoline, Kerosene, and Diesel and finds vast application for social living. Although oil development so far in Uganda has created opportunities for hundreds of indigenes to study overseas through scholarships funded by contract companies involved in the oil exploit. Policies’ that guide further acceleration of the sector still needs considerable inputs to consolidate. The plan must capture among other things, utilization of the countries crude oil for national development. There is a need for the promotion of a conservative method of oil production, through an outspread distribution of oil by-products and services around the nation to enhance socio-economic activities. Awareness should be transmitted timeously and reactions of the citizens evaluated in a transparent forum for consideration as a way to promote civil, water-down conflict and protect against uncertainties as per future projects. Education and information dissemination of activities being embarked upon by the Government or any independent oil company is a crucial approach to check the uprising violence and subtle dissatisfaction within the residence and local communities where these brawls exist.

Unfortunately, in most of these nations with crises related to crude oil exploration and production, the conflicts, instability, and insecurity at many times arise because of the desire to share in the economic benefits accrued or expected from oil production interest. The security paradigm is expanding the understanding of new approaches that are different from physical threats which may prompt insecurity or crises in different parts of the world (Akiyode et al., 2017). Thereby, the essence of the newer advanced forms of security policy and strategy is to promote and fortify the traditional security that protects against physical aggression, and not disregarding environmental threats, through innovations and technological advances that will adopt a robust reduction of carbon footprint (EAC, 2016) for the East African Region. It is essential to analyze and assess climate security for exploration and exploitation procedures of crude oil such as the case of Uganda to envision its expected implications and further highlights the likely amelioration and mitigation measures that are anticipated to counter adverse consequences both locally and globally. Hence, lead to sustainable development.

4. Discussion and Conclusions

Once again the benefits accruing from the development of an oil refinery industries are enormous, and its exploitation is quintessential because of the end product from crude oil refineries; Liquefied petroleum gas, Kerosene, and Diesel to mention a few, which finds vast usage for social living. Ugandan policies on oil and gas development said among others; “Oil should play a vital role in nation-building,” is a courageous beginning. The focus should be on the expansion of Uganda’s oil reserve base across every part of the nation, and promote, easy-to-adopt strategies in other to conserve its resources. However, it is essential that GoU must choose to become radically convinced of their target to a localized production of oil and meet domestic use or commit more towards the actualization, as international suppliers of crude oil not disregarding that Kenya and Tanzania are also envisioned to explorer oil potential even. The ball has been set rolling, adequate plans are still needed to bridge gaps in contracts and the decisions detrimental. A holistic and comprehensive programme which will address the actualization of realistic development, minimize vulnerability and promote climate change abatement must be part of the country’s plan to meet future sustainable living which will translate to a better lifestyle for her citizenry.

Uganda is ready for RE implementation premise the investment record of the country and supports and collaborations received from international and corporate blocks. The Government must meet the corporate social responsibility and deliver on public expectations which cut across environmental management, health, security and industrial sector development for gainful derivation. As such, the right incentives to attract both private and public sector financial support mechanism is best recommended to bridge existing financing gaps posing challenges to renewable energy revolution in Uganda. Hence, overcoming mediocre standards and weak monitory practices predominant among African countries, implement specific policies that will tackle and ensure quality control and poor management practices toward the utilization of RE technologies to mitigate early park-up of the systems is paramount. In a bid to bolster RE progress and catapult the country to a stable and sustainable energy efficient nation, the GoU must endeavor to upskill local workforce on renewables, stimulate entrepreneurship interest while ensuring available funds for locals who wish to venture in the RE sector. In summary, Oil exploitations have its socio-economic gains. However, the onus is on the GoU to develop the right strategies, policies and regulatory frameworks to change the odds to their advantage.

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