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Navigating the Energy Transition in Africa The Fate of Nascent Petroleum Economies in an Accelerating Global Transition

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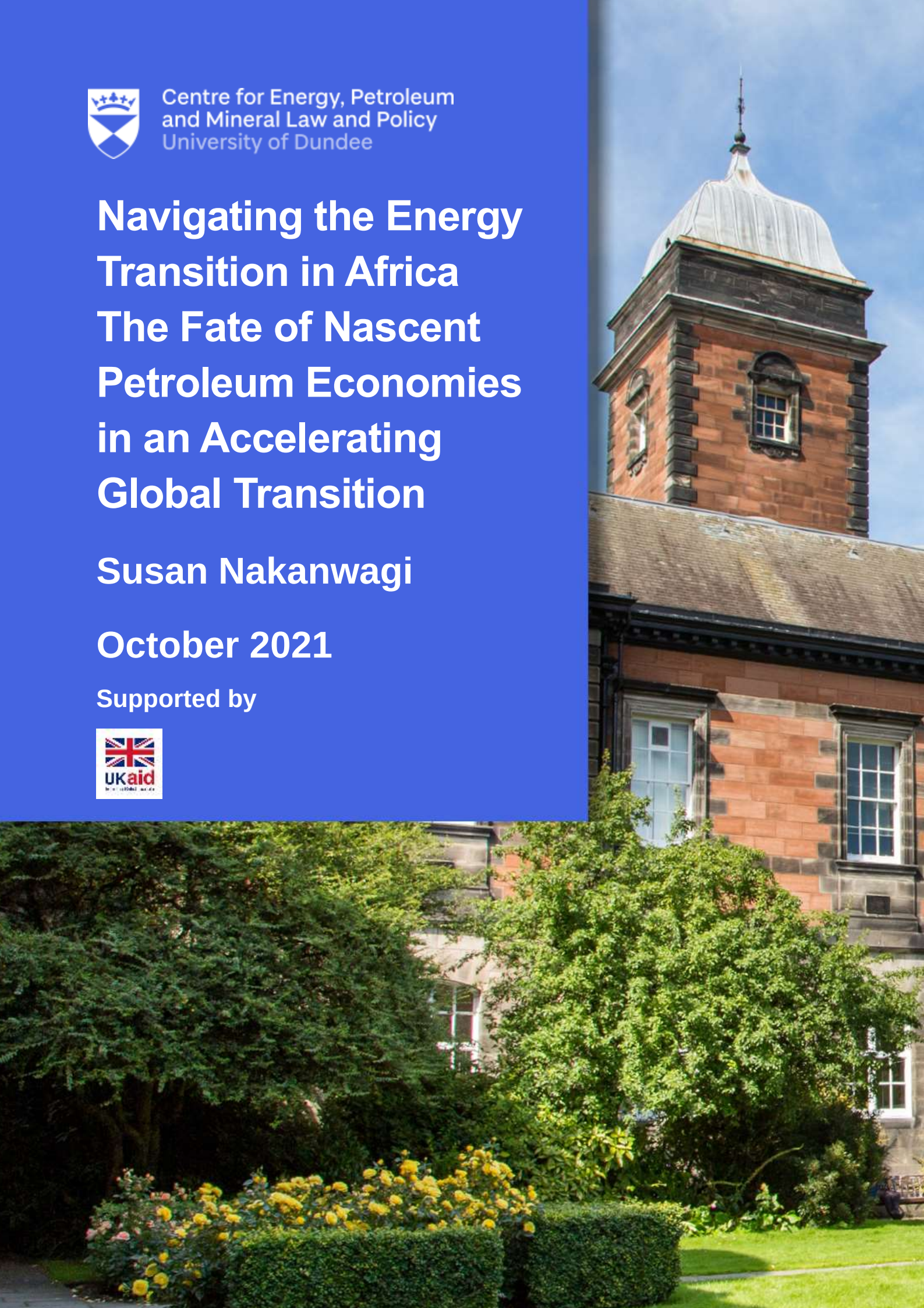

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Abstract

Oil and gas producing countries are under pressure to join the current energy transition process driven by the global climate change legal regime to mitigate the causes and effects of climate change. As the energy landscape transforms at a breakneck pace, it is clear that this transition will have far-reaching implications for emerging oil and gas producing nations. These changes create uncertainty about how the petroleum sector will evolve. For countries that have recently discovered natural resources, the difficulties in navigating the energy transition come as a surprise and seem without precedent. This paper undertakes an analysis of four African states, Kenya, Mozambique, Tanzania, and Uganda, each of which falls into that category, even if there are nevertheless some differences among them. The aim is to examine their prospects for petroleum wealth development, in relation to their wider energy needs, and their approach to transition policy. This article also examines the concept of environmental sustainability vis-à-vis the utility function of resources, in order to better understand these countries' energy transition and development needs. The critical question is whether emerging oil and gas producing countries can position themselves in the energy transition era so that they can ensure long-term sustainability while also generating revenue from their resources (growth). Through a dissection of global events and trends, the research shows the need for the countries to embrace the energy transition even as they strive to get value from and develop their petroleum resources. It makes a case for balancing the sustainability concerns and the utility potential of petroleum resources. Finally, it sheds light on the new players' challenges and provides insight into the policy options available for balancing the transition and socio-economic needs of the countries. More comprehensive recommendations include decarbonising oil and gas activities, intermediate development of natural gas energy, systematic investment in renewables, and, most importantly, pursuing their individual transition paths considering their unique growth needs and resources.

Keywords: Energy Transition, Nascent Oil and Gas Producers, Sustainability, Utility

1. Introduction

Oil and gas producing countries are under pressure to join the current energy transition driven by the United Nations Framework Convention on Climate Change (UNFCCC) and the 2015 Paris Agreement to mitigate the causes and effects of climate change. Further, after the global oil and gas crisis triggered by the COVID-19 pandemic,[1] there is a marked increase in pressure to decarbonise energy production activities by moving to cleaner fuel sources.[2] As we strive to safeguard the Earth by diminishing our carbon footprint, it is crucial to remember that our globe currently relies on fossil fuels (coal, oil, and gas) for 84% of its energy demands.[3] Researchers have found that the transition to a low carbon economy must be more inclusive and equitable, considering the development needs of emerging economies, particularly those with nascent oil and gas production such as Kenya, Mozambique, Tanzania, and Uganda.[4] These countries have vast untapped fossil fuel reserves that they want to exploit to grow their economies. They are keen to benefit from their oil and gas wealth for social and economic transformation, both for domestic energy consumption and revenue. Moreover, the 2015 Paris Agreement establishes measures and conditions requiring all member states to mitigate climate change through emission reductions.[5] Further, Goal 7 of the 2030 Agenda for Sustainable Development calls for concerted efforts to ensure access to modern, cleaner forms of energy, while Goal 13 calls for action to combat climate change.[6]

Although Africa is endowed with renewable energy sources like hydro, biomass, wind and solar – challenges still exist in providing universal access to reliable, modern, affordable, and sustainable energy.[7] However, given the recent discoveries and developments in the oil and gas sector, for instance, in Uganda, Kenya, and Senegal, there is a danger of a significant increase in the countries' carbon footprint undermining the global climate change mitigation efforts. The same countries are keen on utilising the natural resources for economic and social transformation as they strive to lift their populations out of poverty – in line with Goal 1 of the Sustainable Development Goals (SDGs). The resultant predicament of these countries lies in how to utilise the petroleum wealth in a way that is both environmentally friendly way and matches up to their commitments and aspirations with respect to the energy transition. In parallel, and outside Africa, there is pressure on

[1] IEA 2020. Global Energy Review 2020. International Energy Agency, Paris [online] available at: <https://www.iea.org/reports/global-energy-review-2020> /> [Accessed 12 September 2021]
[2] Nakanwagi S and Rukundo A.T. 2020. COVID-19 Pandemic Deranging Energy Transition in Uganda: Challenges and Prospects. *Global Energy Law and Sustainability*, 1.2 (2020): 211–216
[3] BP 2021. Statistical Review of World Energy 2021 | 70th edition, [online] available at: <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-full-report.pdf> [Accessed 11 September 2021]
[4] Delina, L.L., 2018. *Accelerating Sustainable Energy Transition (s) in Developing Countries: The challenges of climate change and sustainable development*. Routledge.
[5] Paris Agreement, 2015, United Nations <https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf> [Accessed 12 September 2021]
[6] See 'Transforming our world: the 2030 Agenda for Sustainable Development, 2015' [online] available at: <http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E> /> [Accessed 12 September 2021]
[7] IEA 2019. Africa Energy Outlook 2019, IEA, Paris <https://www.iea.org/reports/africa-energy-outlook-2019> /> [Accessed 11 September 2021]

multinational companies (MNCs) to divest from the fossil fuel industry, with leading countries and international corporations encouraged to favour green technologies, such as, for example, Tesla, Google, and Apple Inc.[8] Banking institutions are also taking steps to rebalance commitments away from financing fossil fuel projects and technologies. The oil and gas companies face a backlash from activist shareholders and populations, becoming in some cases the targets of climate litigation. For instance, in the Netherlands recently the Hague District Court ordered Royal Dutch Shell (RDS) to reduce RDS's CO_2 emissions of by 45% (net) by 2030 and compared to 2019 levels.[9]

In such a context of dramatic change, this paper explores the question of sustainability *vis-à-vis* utility as it is faced by the emerging oil and gas producers in Africa, focussing on four prominent examples of this phenomenon: Kenya, Mozambique, Tanzania, and Uganda. It examines in each case the state's transition policy and the regulatory approaches undertaken (or proposed) with respect to the energy transition and mitigation of potential emissions from the petroleum sector. Lastly, the paper seeks to provide recommendations to African governments on why and how they can adapt their current policies to make a powerful contribution to the energy transition but taking into account their unique circumstances.

[8] The UK government announced a significant prohibition on foreign funding of fossil fuel projects and to cut carbon emissions, a new 'North Sea Transition Deal' will see governments and business invest up to £16bn in renewables, hydrogen, and carbon capture and storage by 2030. The G7 also agreed to stop international funding for coal and phase out support for all fossil fuels, to meet globally agreed climate change. See Elizabeth Piper and Markus Wacket, 2021. 'In climate push, G7 agrees to stop international funding for coal.' Reuters, 21 May 2021 [online] available at: <https://www.reuters.com/business/energy/g7-countries-agree-stop-funding-coal-fired-power-2021-05-21/> [Accessed 12 September 2021]

[9] The court based its decision against RDSon the Dutch Civil Code, specifically a key section containing what is known as the conventional duty of care in Civil Law, which is a general need to avoid causing people reasonably foreseeable harm. The court decided that RDS has a duty to respect human rights and is legally compelled to reduce emissions by its own measures, citing both hard and soft international law sources and scientific data. (See link for English translation [online] available at: <http://deeplink.rechtspraak.nl/uitspraak?id=ECLI:NL:RBDHA:2021:5339> /> [Accessed 10 September 2021]

2. Energy Transition in Context

In 2016, the United Nations ratified the Paris Agreement, committing the world to limit global warming to 1.5 to 2.0°C over pre-industrial levels. There is now a worldwide campaign for states to shift from dependence upon fossil-based fuels to cleaner forms of energy like nuclear energy and renewable energy for their economic growth: such is the 'Energy Transition' to foster progress in mitigating climate change and adapting to its adverse effects. The term "energy transition" refers to a paradigm shift in the energy system from one model to another, often intricate and encompassing more than simply switching from one fuel source to another.[10] It entails making modifications to three interdependent dimensions: the energy systems (for example, infrastructure, technology, and supply chains); stakeholder behaviour (for example, through new strategies and investment patterns); and socio-technical regimes (for example, through legal and regulatory adjustments and also social beliefs).[11] This shift means that all sectors of the global economy will need to reduce emissions to attain a 1.5°C route drastically. Low-carbon technology will need to expand swiftly for this to happen. Renewable energy, infrastructure electrification, bioenergy, hydrogen, carbon capture, utilisation, and storage (CCUS), negative emissions technologies like nature-based solutions and direct air capture, and carbon trading are potential growth markets.

Even before COVID-19, there was a growing demand for transitioning the energy system away from hydrocarbon-based fuels to low-carbon alternatives. According to a recent International Renewable Energy Agency (IRENA) analysis, the COVID pandemic has "heightened investors' interest in sustainable and resilient assets, particularly renewables".[12]

One of the significant ways climate change can be mitigated is by reducing the amounts of carbon emitted; thus, clean energy presents a viable solution.[13] This is because greenhouse gas emissions (GHG) and local air quality pollution are well-known to occur from traditional fossil fuels and wood-based fuels in many developing countries with limited access to modern fuel means.[14] Approximately 78% of the total global greenhouse gas emissions between 1970 and 2010 resulted from CO_2 emissions from fossil fuel combustion and industrial processes, with the trend continuing for the proceeding years.[15] Studies show that clean energy posits advantages on energy systems, the environment and the general

[10] Fattouh, B., Poudineh, R. and West, R., 2018. The Rise of Renewables and Energy Transition: what adaptation strategy for oil companies and oil-exporting countries?

[11] Sovacool, B.K. and Geels, F.W., 2016. Further reflections on the temporality of energy transitions: A response to critics. *Energy Research & Social Science*, *22*, pp.232-237

[12] IRENA, 2020. The post-COVID recovery: An agenda for resilience, development and equality. International Renewable Energy Agency, Abu Dhabi ISBN 978-92-9260-245-1

[13] See Mark Maslin, 2013. *Climate: A Very Short Introduction*,' Oxford University Press

[14] In fact, about half of the world's population and 80% of Africans rely on wood-based fuels for their energy needs. *See* World Bank. 2011. *'Wood-Based Biomass Energy Development for Sub-Saharan Africa: Issues and Approaches,' at p.8*, Energy Sector Management Assistance Program (ESMAP); World Bank, Washington, DC. © World Bank <https://openknowledge.worldbank.org/handle/10986/26149> [Accessed 14 September 2021]

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

economy; however, it affects the demand for and supply of conventional energy.[16] This directly contributes to reducing energy consumption due to energy efficiency programmes and increased energy from clean sources rather than conventional sources.[17] Indirectly, clean energy leads to environmental and human health benefits by reducing pollutants released into the atmosphere. It also has several economic benefits like employment, economic growth, and development, reducing energy costs and waste.[18]

[16] United Nations Protection Agency, '*Assessing Multiple Benefits of Clean Energy: A Resource for States*,' 2011, UNPA, State and Local Climate and Energy Programme, pp.3-8
[17] United Nations Protection Agency, '*Assessing Multiple Benefits of Clean Energy: A Resource for States*,' 2011, UNPA, State and Local Climate and Energy Programme, pp.3-8
[18] Ibid

3. Methodology

This study's overall methodology is based on a case study analysis to facilitate emerging oil and gas producing countries formulate energy transition strategies and policies in line with the global and local demands. Case studies, according to Yin, can be used to explain, describe, or explore events or phenomena in their everyday contexts.[19] These can assist in comprehending and explaining causal connections and pathways resulting from a new policy initiative or service development, for example. Energy transition phenomena occur in everyday life, and the case study methodology isolates them within a given context: in this case, East African nascent oil and gas producing countries. This entails an analysis of four East African Sub-Saharan African countries through the lens of a case study: Mozambique and Tanzania are developing their natural gas sectors, with proven reserves of 100 trillion cubic feet (Tcf) and 57 Tcf, respectively; Kenya and Uganda discovered 4bn barrels and 6.5bn barrels of crude oil, respectively. Mozambique and Tanzania are increasing their capacity to generate natural gas, while Uganda and Kenya are rushing to produce their 'first oil.' Kenya, Tanzania, and Uganda are members of the East African Community. At the same time, Mozambique is a member of the Great Lakes Region, with the Indian Ocean serving as their sole gateway to European and Asian markets. As a result, they are all affected uniformly and simultaneously by the Global North's accelerated energy transition. The research employs a qualitative methodology to understand better how emerging oil and gas producers embrace the energy transition, taking into account the utility of the resources compared to global demands for ecological sustainability, which necessitate the transition. The paper transcends doctrinal research by incorporating socio-legal and economic interdisciplinary aspects resulting from the units of analysis. Finally, the study collects data using search engines, books, and articles, while focusing on environmental, social, economic, and legal and regulatory issues.

[19] Yin, R.K., 2009. *Case study research: Design and methods* (Vol. 5). Sage

4. Case Studies

4.1 Mozambique, Tanzania: Natural Gas

Natural gas generates cost-effective, flexible electricity that improves supply security and acts as a balancing force for variable energy sources integration. Natural gas is considered 'environmentally preferable'[20] and is well-placed as a 'transitional fuel.'[21] Additionally, a 2020 study by KFW, GIZ and IRENA showed that, unlike coal, natural gas is less constrained by funding restrictions such as international donors, export credit agencies, and finance organisations.[22] The gas-rich states of Africa, such as Mozambique, Nigeria, Tanzania, and Tunisia, benefit from this situation since investing in natural gas enables the continued use of fossil fuels in electricity systems. However, there is a risk that investments in gas may hinder the ultimate adoption of renewable energy.[23]

(a) Mozambique

Mozambique has approximately100 Tcf of proved natural gas reserves, with the most recent significant discoveries in the Cabo Delgado province.[24] The major players in its liquefied natural gas (LNG) industry being Total, Exxon Mobil, Chevron and B.P., Japan's Mitsui, Malaysia's Petronas, and China's CNPC. The gas projects are estimated to be worth $60bn[25] in total output value. In 2018 alone, Mozambique produced 212 billion cubic feet (Bcf) of natural gas. It exported 148 Bcf, with South Africa receiving 81% of its natural gas exports through the 535-mile Sasol Petroleum International Gas Pipeline.[26]

The Mozambique LNG project consists of developing the Golfinho-Atum gas field in the deep-water Rovuma Basin's offshore Area 1 Block. Further, the construction of an onshore LNG facility with capacity of 12.88 million tonnes per annum (Mtpa) on Mozambique's Cabo Delgado coast will be Mozambique's first onshore LNG facility.[27] In 2019, a consortium of export credit agencies and 20 commercial banks received a $15.8bn final investment decision (FID) to finance the Rovuma LNG project.[28] The US Export-Import Bank (EXIM) was the group's primary lender, providing a $4.7bn credit for the project. The FID was

[20] The term 'environmentally preferable' refers to products or services that have a lower or negligible impact on human health and the environment when compared to comparable products or services. See UNCTAD, 1995. Environmental Preferable Products (EPPs) as a Trade Opportunity for Developing Countries, Report by UNCTAD Secretariat, UNCTAD/COM/70, Geneva.

[21] Safari, A., Das, N., Langhelle, O., Roy, J. and Assadi, M., 2019. Natural gas: A transition fuel for sustainable energy system transformation? *Energy Science & Engineering*, *7*(4), pp.1075-1094; Pfoser, S., Schauer, O. and Costa, Y., 2018. Acceptance of LNG as an alternative fuel: Determinants and policy implications. *Energy Policy*, *120*, pp.259-267

[22] KFW, GIZ, IRENA. 2020. The Renewable Energy Transition in Africa Powering Access, Resilience and Prosperity.' On behalf of the Federal Ministry of Economic Cooperation and Development (BMZ), p.26

[23] Ibid

[24] Eia.gov. 2020. *International -Mozambique. U.S. Energy Information Administration (EIA)*. [online] Available at: <https://www.eia.gov/international/analysis/country/MOZ> [Accessed 12 September 2021]

[25] All $ figure quoted are United States Dollars

[26] Ibid.

[27] Total-led Mozambique LNG Project. 2021. *About the Mozambique Liquefied Natural Gas Project*. [online] Available at: <https://mzlng.totalenergies.co.mz/en/about-mozambique-liquefied-natural-gas-project> [Accessed 12 September 2021]

[28] Eia.gov. 2020. *International -Mozambique. U.S. Energy Information Administration (EIA)*. [online] Available at: <https://www.eia.gov/international/analysis/country/MOZ> [Accessed 12 September 2021]

scheduled to be implemented in 2020 but was delayed until 2021 due to the COVID-19 impacts on oil prices[29]. Further, the developments suffered a blow due to military insurgency in the Delgado area. For instance, the international oil company (IOC) Total S.E. suspended its $20 bn liquefied natural gas project in Mozambique indefinitely due to increased violence in March of 2021.[30]

Mozambique, however, largely relies on renewable power for its domestic energy needs. Hydropower accounts for 77% of the country's total installed capacity, while thermal power from natural gas, diesel, and other renewables accounts for the remaining 643 megawatts (MW).[31] Nonetheless, only 31% of Mozambique's population has access to electricity, with the largest segment of the population relying on traditional biomass and waste for household heating and cooking. Mozambique has promoted solar photovoltaic solutions in rural areas.[32]

In terms of policy, the 1998 National Energy Policy's primary objectives were to ensure a secure energy supply, expand domestic energy options, and promote environmental sustainability through renewable energy technologies, including hydro, wind, biomass and solar.[33] The country's National Electrification Strategy of 2018 aims for universal access to electricity.[34] However, there is no regulation concerning the decarbonisation of the gas industry, save for an environmental impact assessment from the Ministry of Land, Environment, and Rural Development required to develop the natural gas reserves.[35]

(b) Tanzania

Off the coast of Tanzania, major gas finds have been discovered, and the country is emerging as a potentially significant gas producer in East Africa. Tanzania has estimated natural gas reserves of 57Tcf and an annual production capacity of 110Bcf and at least 49.5Tcf offshore in the Indian Ocean.[36]

Large global oil corporations like Equinor have been granted licences to explore natural gas and oil in Tanzania's offshore and onshore areas. The country is currently scaling up natural gas investments with a projected $30bn Tanzania LNG project, which has been in development since 2013. The project entails the construction of an LNG plant in Lindi,

[29] Ibid
[30] Beaupuy, F., Burkhardt, P. and Nhamire, B., 2021. *Total suspends $20BN LNG project in Mozambique indefinitely*. [online] Available at: <https://bioreports.net/total-suspends-20bn-lng-project-in-mozambique-indefinitely/> [Accessed 12 September 2021]
[31] IEA. 2021. *Mozambique - Countries & Regions - IEA*. [online] Available at: <https://www.iea.org/countries/mozambique> [Accessed 12 September 2021]
[32] IEA. 2021. *Mozambique - Countries & Regions - IEA*. [online] Available at: <https://www.iea.org/countries/mozambique> [Accessed 12 September 2021]
[33] Waty T. 2018. Mozambique: Energy Policy. In: Tiess G., Majumder T., Cameron P. (eds) *Encyclopedia of Mineral and Energy Policy*. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-40871-7_163-1
[34] Government of Mozambique 2018. National Electrification Strategy.
[35] Global Group., 2021. *Oil & Gas Regulation 2021 | Mozambique | ICLG*. [online] International Comparative Legal Guides International Business Reports. Available at: <https://iclg.com/practice-areas/oil-and-gas-laws-and-regulations/mozambique> [Accessed 12 September 2021]
[36] TanzaniaInvest. 2021. *Gas and LNG in Tazania - TanzaniaInvest*. [online] Available at: <https://www.tanzaniainvest.com/gas> [Accessed 12 September 2021]

Tanzania. It will provide considerable long-term advantages to Tanzania in government revenues, gas for energy production, jobs, and economic development.[37]

According to the World Bank's Tracking SDG 7 Energy Progress Report, approximately 21.87 million (m) people in Tanzania have access to electricity, while the remaining 36.14m people have no access.[38] Of these, only 19% of the rural population have access to electricity. Tanzania derives most of its electricity from oil (40% of installed capacity), while gas accounts for a further 24%. The cost of electricity generated by oil and gas is $0.18 per kilowatt-hour (kWh) and $0.08 per kWh, respectively, including indirect costs associated with carbon dioxide emissions.

Tanzania's government is currently implementing the National Rural Electrification Program (2013 – 2022) to increase the population's overall electricity access from 36% in 2014 to 50% by 2025 and at least 75% by 2033. Tanzania has several options for ensuring a low-cost, reliable energy supply while transitioning to a low-carbon, environmentally friendly future. Wind reserves are expected to have a total capacity of 450,000MW at a cost of $0.07 per kWh. Tanzania also has Africa's third-largest geothermal potential, but at a cost of approximately $0.13/kWh, which is more than double the continental average.[39] Similarly, the country has significant potential to generate electricity from biomass at a cost of $0.09 per kWh. Tanzania's utility-scale solar energy costs $0.09 per kilowatt-hour, significantly less than the global average. According to Tanzania's Natural Gas Policy, adopted in 2013, the country also aspires to develop a competitive natural gas economy that would make a significant contribution to the country's plans for broad-based growth and socio-economic change.[40]

4.2 Uganda, Kenya: Oil

(a) Uganda

Commercial quantities of oil were discovered in 2006 in Western Uganda's Albertine Graben region. Over 6.5bn barrels of oil equivalent (boe) have been found in the area, with 1.4bn boe potentially commercially recoverable[41]. Additionally, the country possesses 173 Bcf of natural gas. Rights to produce petroleum are held by MNCs; these include Tullow Uganda Operations Pty Limited, Total Exploration & Production Uganda B.V., and the China National

[37] Equinor, 2018. Block 2 Tanzania LNG Project. COS-180293. Rev. 2 - October 2018. [online] Available at: <https://www.equinor.com/content/dam/statoil/documents/where-we-are/equinor-block-2-project-121018.pdf> [Accessed 14 September 2021]

[38] IEA, IRENA, UNSD, World Bank, WHO. 2020. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC. © World Bank. License: Creative Commons Attribution—NonCommercial 3.0 IGO (CC BY-NC 3.0 IGO)

[39] IEA, IRENA, UNSD, World Bank, WHO. 2020. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC. © World Bank. License: Creative Commons Attribution—NonCommercial 3.0 IGO (CC BY-NC 3.0 IGO)

[40] United Republic of Tanzania. 2013. National Gas Policy [online] Available at: <http://www.tzdpg.or.tz/fileadmin/documents/dpg_internal/dpg_working_groups_clusters/cluster_1/Energy_and_Minerals/Key_Documents/Policy/Natural_Gas_Policy_-_Approved.pdf> [Accessed 16 September 2021]

[41] Republic of Uganda: Leveraging Oil and Gas Industry for the Development of a Competitive Private Sector in Uganda, March 25, 2015. at p.41 World Bank GTCDR AFRICA [online] Available at: <http://documents.worldbank.org/curated/en/521361468302082824/pdf/ACS125280REVIS0itive0Private0Sector.pdf> [Accessed 12 September 2021]

Offshore Oil Corporation (CNOOC) Uganda Limited. The country's population is still relatively poor, with GDP per capita currently standing at USD 794.3. In Uganda's 'Vision 2040', the Government puts the oil and gas industry at the forefront of growth plans, assisting the country to reach a middle-income economy status and achieving sustainable growth and development. In 2018-2019, it collected revenue amounting to Ugandan Shillings (UGX) 56.7bn ($15.1m) from petroleum operations and related activities[42]; since there is no production yet, this revenue comes from withholding taxes on contractors, VAT and excises on imported fuel.

The country has recently signed investment agreements to develop the East African Crude Oil Pipeline Project (EACOP) for a 1,443km heated oil pipeline to transport crude oil from Hoima in Uganda to the Chongoleani peninsula near Tanga port in Tanzania.[43] Since Uganda's oil is naturally waxy at room temperature, the pipeline will be electrically heated (about 80% by solar energy) to keep the oil in a liquid state, ensure energy efficiency, and reduce carbon emissions. The Ugandan cabinet approved the East African Crude Oil Pipeline Bill, which contains provisions for the effective implementation of the project[44]. The project benefits both countries through job creation, infrastructure development, local content, development of the trade corridors, technological transfer, all in linkages. The 'National Oil and Gas Policy for Uganda of 2008' aims to use oil and gas in the country's energy mix. As a safeguard, the policy calls for strategies to prohibit venting and restrict flaring of natural gas except in emergencies to mitigate the GHG emissions from the sector.

The 'National Oil and Gas Policy of 2008' aims to use oil and gas in the country's energy mix.[45] As a safeguard, however, the Policy calls for strategies for prohibiting venting and restrict flaring of natural gas except in emergencies to mitigate the GHG emissions from the sector. Further, on a clean energy path, it envisages that 30 % of the total electricity will come from solar power.

According to the World Bank, only *c.*41.3% of the population has access to electricity.[46] The Government has undertaken to support the development of the electricity sector, declaring it is key to the climate change mitigation efforts due to its potential to offset the rampant wood and charcoal, which are the drivers for massive deforestation. In addition, the

[42] Republic of Uganda, 'Report of the Auditor General to Parliament for the Financial Year Ended 30th June 2019.' Dec 2019, Office of the Auditor General Uganda. [online] Available at: <http://www.oag.go.ug/wp-content/uploads/2020/01/AG-Consolidated-Report-2019.pdf> [Accessed 12 September 2021]

[43] Shareholders of the EACOP are the Government of Uganda through its Uganda National Oil Company; the Government of Tanzania through the Tanzania Petroleum Development Corporation; and the three upstream IOCs – Total, CNOOC and Tullow. See Pau.go.ug. 2021. *The East African Crude Oil Pipeline (EACOP) Project – Petroleum Authority of Uganda (PAU).* [online] Available at: <https://www.pau.go.ug/the-east-african-crude-oil-pipeline-eacop-project/> [Accessed 12 September 2021]

[44] Musisi, F., 2021. *Cabinet okays oil pipeline draft law*. Daily Monitor. [online] Available at: <https://www.monitor.co.ug/uganda/news/national/cabinet-okays-oil-pipeline-draft-law-3536966> [Accessed 12 September 2021]

[45] National Oil and Gas Policy for Uganda of 2008 [online] Available at: <http://pau.go.ug/uploads/NATIONALOILANDGASPOLICYFORUGANDA.pdf> [Accessed 12 September 2021]

[46] World Bank, Sustainable Energy for All (SE4ALL) database from the SE4ALL Global Tracking Framework led jointly by the World Bank, International Energy Agency, and the Energy Sector Management Assistance Program. **License** : CC BY-4.0 [online] Available at: <https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=UG> [Accessed 13 September 2021]

development of the electricity sector will contribute to the increase of the electricity generation capacity from 729 Mega Watts in 2013 to 3200 Mega Watts by 2030.[47] Uganda also has a National Climate Change Policy (NCCP) of 2015 in place. Several legal enactments are already in place to address the problem of access to energy. These include the Atomic Energy Act, 2008; The Electricity Act, 1999; The Energy Policy of Uganda, 2002; The Renewable Energy Policy, 2007[48]; the National Biomass Energy Demand Strategy (BEDS), 2001-2010; and the National Climate Change Policy (NCCP) of 2015.

Furthermore, through 'Vision 2040' and the National Development Plan 2015/16-2019/2020, the Government of Uganda undertakes to develop and generate modern energy to drive the industry and service sectors. It also expressly recognises the weight of climate change. In that respect, it commits to promoting renewable forms of energy like wind, solar and biogas, and the other energy sources of hydropower, geothermal, nuclear, and thermal.[49] However, policy on renewable energy has not yet been formulated into an Act of Parliament to enable proper regulation and implementation.

(b) Kenya

Like Uganda, Kenya is an emerging oil and gas producer in East Africa. Exploration for petroleum in Kenya began in the Lamu Basin in the 1950s. The first commercially viable oil discovery in the Tertiary rift was not realised however until 2012, followed by substantial gas discoveries in the offshore Lamu Basin[50]. Over 86 wells have been drilled so far, with most of them in the Tertiary Rift. Tullow Plc and its partners have discovered about 4 billion (bn) boe reserves in the Lokichar sub-basin, with recoverable oil expected to be 750m boe.[51] According to its Early Oil Pilot Scheme, Kenya sold its first-ever oil export cargo in August 2019, with ChemChina getting a 240,000-barrel cargo sold at a $3.5/b discount to Brent.[52]

Despite this hydrocarbons activity, Kenya is already a regional and global leader in renewable energy development. These sources currently account for a major portion of the country's entire energy mix (85 %), owing to the utilisation of geothermal and hydro-power. Indeed, this East African country is on course to fulfil or perhaps even exceed its Paris Agreement commitment. Kenya has set itself a goal of generating 100 % renewable energy

[47] See, Ministry of Water and Environment: Uganda's Intended Nationally Determined Contribution (INDC), October 2015, p.8. [online] Available at: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Uganda%20First/INDC%20Uganda%20final%20%2014%20October%20%202015.pdf> [Accessed 12 September 2021]

[48]The Renewable Energy Policy, 2007. [online] Available at: <http://energyandminerals.go.ug/downloads/RENEWABLE%20ENERGY%20POLIC9-11-07.pdf> [Accessed 10 September 2021]

[49] See the Uganda Vision 2040, Chapter 4.2.3, pp. 72-74. [online] Available at: <http://npa.ug/wp-content/themes/npatheme/documents/vision2040.pdf>

[50] Nationaloil.co.ke. 2021. *Upstream – National Oil Corporation of Kenya*. [online] Available at: <https://nationaloil.co.ke/upstream/> [Accessed 12 September 2021]

[51] Ibid

[52] Robert Perkins, 2019. *Kenya's first crude exports 'well received' by oil market: Tullow CEO*. [Online] S &P Global Platts, OIL 07 Nov 2019 | 13:23 UTC Cape Town. [online] Available at: <https://www.spglobal.com/platts/en/market-insights/latest-news/oil/110719-kenyas-first-crude-exports-well-received-by-oil-market-tullow-ceo> [Accessed 1 July 2021]

power by 2030, which a broad technology mix will supplement[53]. Even though hydropower already contributes significantly to energy production, the Government is trying to increase solar, wind, thermal, and geothermal output in its long-term plans due to drought risk[54]. Over the following decade, geothermal power is projected to receive a high priority in public policy. Kenya is looking to attain these policy goals in several ways, one of which is through substantial public-private partnerships. In August 2019, the Kenyan Investment Authority and Meru County Government signed a memorandum of understanding with global renewable energy producers to build Africa's first large-scale hybrid wind, solar photvoltaic energy, and battery storage project, the Meru County Energy Park[55]. The park, whose construction began in January 2020, will generate up to 80MW of renewable energy with up to 20 wind turbines and over 40,000 solar panels. The park's electricity is anticipated to power 200,000 houses.[56]

Kenya expects to reach its long-term climate targets by harnessing renewable energy and achieving its long-term aim of becoming a middle-income country by the end of the decade. Part of this entails ensuring that all Kenyans have access to energy, and the country has made tremendous progress in this area. According to the World Bank's Tracking SDG 7 Energy Progress Report, Kenya was the fastest electrifying country in Sub-Saharan Africa between 2010 and 2017. This was primarily due to last-mile electrification programmes targeting informal settlements and rural areas during this time[57]. Kenya's energy Ministry reported that 75% of the country's population had access to electricity by the end of 2019. The Government aims to attain universal electricity access by 2022, making it one of the first Sub-Saharan African countries to achieve 100% electrification. Kenya has stated that it will require $15bn in investment in a variety of projects, including geothermal, generating, off-grid, energy efficiency, transmission, and distribution, to achieve this target, and is actively seeking investors[58]. Energy is also a key component of Kenya's 'Vision 2030', a long-term development strategy to make the country globally competitive, newly industrialised, middle-income, and affluent[59]. By 2030, the Vision aims to provide all inhabitants with a high quality of life in a clean and secure environment.

[53] Ministry of Energy and Petroleum 2015. Sustainable Energy for All Kenya Investment Prospectus: Pathways for Concerted Action toward Sustainable Energy for All by 2030. [online] Available at: <https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_AAs/Kenya_SE4ALL_AA_January_2016.pdf> [Accessed 12 September 2021]

[54] IRENA. 2015. Africa 2030: Roadmap for a Renewable Energy Future. IRENA, Abu Dhabi. [online] Available at: <www.irena.org/remap>

[55] ESI Africa, 2021. Kenya to host Africa's first large scale hybrid wind. [online] Available at: <https://www.esi-africa.com/industry-sectors/renewable-energy/kenya-to-host-africas-first-large-scale-hybrid-wind/> [Accessed 12 September 2021]

[56] Ibid

[57] IEA, IRENA, UNSD, World Bank, WHO. 2020. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC. © World Bank. License: Creative Commons Attribution—NonCommercial 3.0 IGO (CC BY-NC 3.0 IGO). 'Last-mile' is a term used in the SDG 7 progress report, used to describe the difficulty in getting people to their final destinations

[58] Global Trade Review (GTR). 2020. *Africa's renewable energy opportunity | Global Trade Review (GTR)*. [online] Available at: <https://www.gtreview.com/supplements/gtr-africa-2020/africas-renewable-energy-opportunity/> [Accessed 12 September 2021]

[59] Vision2030.go.ke. 2021. *Kenya Vision 2030 | Kenya Vision 2030*. [online] Available at: <https://vision2030.go.ke/> [Accessed 12 September 2021]

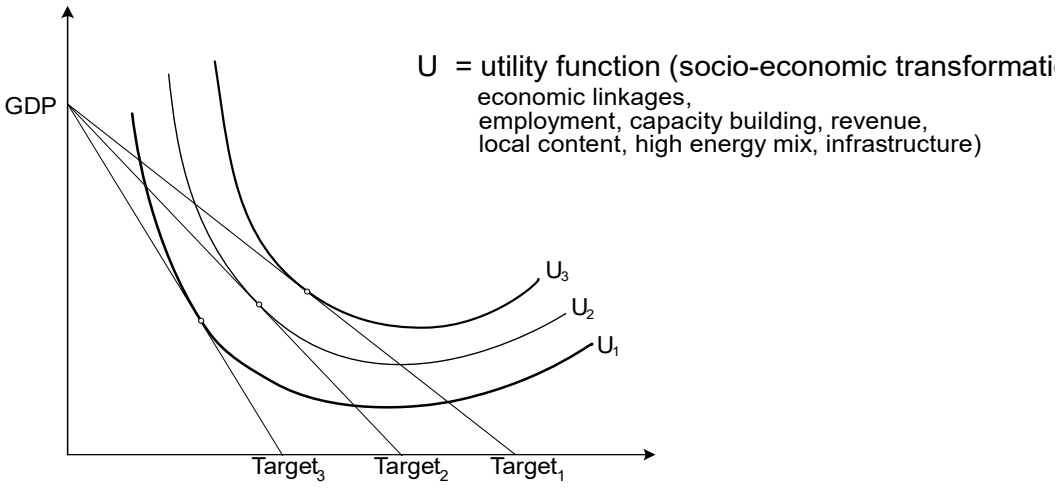
5. Sustainability vs. Utility

The main question asked at the outset was: *'how can nascent oil and gas producers address local and global energy sustainability demands*'? The overall challenge of the emerging oil and gas producers lies in balancing the sustainability[60] goals of the industry and the potential benefits/utility of the resources – 'to produce or not to produce and if so, how?' – taking into account the global climate change legal regime, and especially the Paris Agreement, and the ongoing shift from fossil fuels. This challenge is represented in *Figure 1* below, which shows the dilemma of the emerging oil and gas producers. Most resource-rich countries view their extractive sectors as vehicles for directly contributing to economic growth and technological capital. At the same time, the resultant revenues can be harnessed to finance key public investments, including human and infrastructure capital[61]. The countries want to maximise the utility benefits of the resources for their socio-economic transformation, including economic linkages, employment opportunities, capacity building, revenue maximisation, infrastructure development and contribution to the countries' energy mix. At the same time, they need to adhere to and meet the global energy transition goals. These two goals can be in conflict. An important policy choice is to decide which one to put first. It is thus a question of 'sustainability (especially environmental) *vis-à-vis* utility'. Utility, in this case, means the various social and economic benefits of the oil and gas resources which would potentially accrue to the producing countries.

[60] Sustainability is a long-term goal; it promotes activities that are defined by long-term social, economic, and environmental considerations rather than by short-term gains. On the other hand, sustainable development is the process of meeting the needs of the current generation without jeopardising the ability of future generations to meet their own, i.e., the pathways and processes necessary to achieve the sustainability goal. (*See* World Commission on Environment and Development, *Our Common Future* (Oxford University Press 1987))

[61] Cameron, P.D. and Stanley, M.C., 2017. *Oil, gas, and mining: a sourcebook for understanding the extractive industries*. The World Bank.

Figure 1: Showing the Sustainability and Utility Concerns of the Emerging Oil and Gas Producers



Source: Author's own illustration

The X-axis represents the transition/environmental sustainability targets. (The figure represents emerging oil and gas producers (mainly low-income counties with a low GDP constant on the Y-axis). Also, as the transition targets become stringent, the straight-line shifts towards the left. Then depending on the preference, the country may have different utility ambitions (U1, U2, U3). U3 has the highest utility, followed by U2 and then U1. On any utility curve, the combined socio-economic benefits are constant. If a country wants to enjoy U3, then the transition target is less, i.e. T1. It cannot enjoy U3 if the target is made more stringent, as in T2, where it can only enjoy utility U2. Similarly, in the most stringent case of T3, the country can only achieve U1).

Sub-Saharan Africa alone has approximately 1.2bn people, half of whom will be under 25 by 2050, representing a significant demographic challenge. The region also suffers from widespread energy poverty – a lack of access to adequate, affordable, reliable and sustainable high-quality energy[62]. In 2018, nearly half of Africans (600m people) lacked access to electricity, and around 80% of sub-Saharan African businesses had regular power outages, resulting in financial losses[63]. Furthermore, *c.*900m individuals, or more than 70% of the population, lack access to clean cooking[64]. Addressing the continuing lack of access to power and clean cooking and the instability of electricity supply is a significant problem for policymakers. The region is rich in human and natural resources, including oil and gas. These can generate inclusive growth and eradicate poverty, allowing Africans to live healthier and more prosperous lives.

[62] Che, X., Zhu, B. and Wang, P., 2021. Assessing global energy poverty: An integrated approach. *Energy Policy*, *149*, p.112099
[63] Africa Energy Outlook, 2019. World Energy Outlook Special Report. International Energy Agency
[64] Ibid

The utility function of the oil and gas industry is further illustrated in *Table 1* below. As the table shows, the mature field petroleum-producing countries like Nigeria, Angola and Ghana are generating massive revenues from exploiting the resources. In Nigeria, for instance, the industry contributes approximately 65% of the total government revenues. The emerging oil and gas producers like Uganda, Kenya, Mozambique, Tanzania and Senegal are also scaling up investments in the industry in order to gain from the numerous development opportunities presented by the petroleum sector, like their mature field producing counterparts. Tanzania alone will collect an estimated average government revenue of $2.3bn annually throughout the lifetime of gas production.

Table 1: Showing the Petroleum Utility Outlook in Selected Sub-Saharan Countries

Country	Resource / Reserves	Utility Outlook
Emerging Oil and Gas Producers		
UGANDA	Over 6.5 bn boe discovered, of which 1.4bn boe potentially commercially recoverable. It also has 173 Bcf of natural gas.	Concluded Final Investment Agreement with Tanzania and IOCs for the EACOP – $3.5bn estimated in Foreign Direct Investment. Uganda's 2008 National Oil and Gas Policy recommends first refining the discovered oil in-country to meet domestic and regional demand for petroleum products before considering exportation. In 2018, a development masterplan set out infrastructure including an international airport, a refinery, crude oil and product storage facilities, and a transmission hub.
TANZANIA	Proven natural gas reserves of 57 Tcf & at least 49.5 Tcf offshore in the Indian Ocean.	Estimated average government revenue of $2.3bn p.a. during the period of gas production.[65] Tanzania intends to begin construction on a $30bn LNG project that has been delayed for years in 2023.
KENYA	*c.*4bn barrels of crude oil reserves in the Lokichar sub-basin, with recoverable oil expected to be 750m boe.	Through its Early Oil Pilot Scheme, Kenya sold its first-ever oil export cargo in August 2019, with ChemChina getting a 240,000-barrel cargo sold at a $3.5/boe discount to Brent crude oil.
MOZAM-BIQUE	*c.*100 Tcf of proved natural gas reserves.	The gas projects are estimated to be worth $60bn in total, and 82% of the total gas production is exported to South Africa. The Mozambique LNG project's FID, which is estimated to cost approximately £15.5bn - $20bn, was made in June 2019. Construction on the integrated LNG project began in August 2019, with production scheduled to start in 2024.

[65] Scurfield, T. and Mihalyi, D., 2017. Uncertain potential: Managing Tanzania's gas revenues. *Dar es Salaam: Natural Resource Governance Institute*.

SENEGAL	Over 1bn boe and 40 Tcf of gas discovered - most of it shared with Mauritania.	First offshore oil production expected in 2023.
Countries with Mature Fields		
NIGERIA	92,000 bcf of proven gas reserves – about 44% offshore and 56% onshore. Approximately 30.1bn boe of proven reserves, nearly 70% of which are offshore.	Largest crude oil producer in Africa; Resources account for about 65% of total government revenues and 9% total GDP. The oil industry contributes more than 95% of the country's foreign revenue.
ANGOLA	Proven crude oil reserves of 7.783bn boe Proven natural gas reserves of 343bn cubic metres.	After Nigeria, Angola is Africa's second-largest oil production. The OPEC estimates that crude oil accounts for approximately 50% of the country's gross domestic product (GDP) and more than 89% of total exports.
GHANA	Estimated proven oil reserves of 2.5 bn boe, with 94% of the reserves offshore and the rest onshore. Oil production began in late 2010 from the Jubilee Field, estimated to hold about 460m boe of crude oil and 568 Bcf of natural gas.	Ghana produced 62.7m boe in 2018, according to the 2018 GHEITI Report, from three commercial fields: Jubilee, TEN (Tweneboa Enyenra Ntomme), and Sankofa-Gye Nyame. In 2018, associated gas production from the three fields totalled more than 90,000 mmscf. Oil and gas contributed 3.8% to the GDP in 2018 and accounts for 30% of Ghana's total exports by value.

Source: Author's own illustration

The COVID-19 Factor Africa's contribution to global greenhouse gas emissions is negligible, accounting for around 4% of worldwide emissions, with its largest polluters being Nigeria, Sudan, Angola, Kenya, South Africa, Ethiopia, Sudan, Tanzania, Angola, Cameroon, Kenya and Chad. While Africa is not the world's top emitter by any margin, it may well be the most affected by climate change in the long run. By 2100, temperature rises in Africa are predicted to be 1.5 times higher than the global average. When it comes to coping with the repercussions of climate change, humans are at a crossroads, with the coronavirus (COVID-19) worldwide pandemic wreaking havoc on the world for the larger part of 2020 and 2021. This crisis has had negative consequences for climate action and resilience development, in addition to causing a global public health catastrophe and an economic recession.

While immediate emissions reductions were achieved because of major world economies such as China, Europe, and the United States coming entering short pandemic-induced recessions, there is increased climate change vulnerability, with the priority being the protection of communities and economies from COVID-19. Developing nations alone face $220bn in economic losses, hurting education, food security, human rights, and livelihoods, expanding the economic gap between them and the world's wealthier nations, and pushing

over 420m people into abject poverty.[66] However, a World Bank study on the epidemic's impact on Africa estimated 13m Africans to fall below the poverty line by the end of 2020 in the best-case scenario, and 50m in the worst-case scenario, taking into account COVID-19.[67] The region's GDP per capita growth was expected to be 3-5% lower, implying that the proportion of Africans living on less than $1.9 would rise by two percentage points from 41.6% at the end of 2018 to 43.9% by the end of 2020, resulting in the first continental African recession in 25 years. Now more than ever, it can be argued, the group of economies in Sub-Saharan Africa, need the petroleum industry as a lever to recharge and power their social and economic development – the utility function. However, one of the notable effects of the COVID-19 pandemic has been to instigate calls for an accelerated energy transition among organisations and the international community advocating for green economic recovery.[68]

Why Sustainability is Urgent Indeed, global warming must be slowed in the near term because of its potentially disastrous effects on nature and humans[69]. Rising sea levels and extreme weather events such as floods, droughts, and brushfires are already affecting the environment. Higher temperatures in the future could have serious health repercussions for humans, and issues like food shortages and migration could have considerable political ramifications and possibly lead to civil upheaval.[70] The United Nations' Intergovernmental Panel on Climate Change (IPCC), which assesses climate change science, advises that global warming from pre-industrial levels must not exceed 1.5°C to avoid irreversible damage to the earth.[71] That is why, in 2015, 196 countries signed the Paris Agreement, the world's first comprehensive climate change agreement, pledging to reduce global warming by lowering emissions and taking other measures. These objectives cannot be reached unless the energy transition is completed. According to the IPCC, electricity and heat production account for 25% of CO_2 emissions. Agriculture, forestry, and other land use account for another 24%. Industry accounts for 21% of the total, while transportation contributes 14%, while fossil fuels account for over 60% of worldwide greenhouse gas emissions.

Overall, dealing with the repercussions of climate change is likely to prove expensive, and it is predicted that $1.8 trillion in worldwide investments will be required to prepare for the consequences of global warming. However, the reward could be much more significant. According to a previous UNFCCC research, the yearly worldwide cost of adaptation by 2030 in the sectors of agriculture, forestry and fisheries, water supply, human health, coastal

[66] UNDP, 'COVID-19: Looming crisis in developing countries threatens to devastate economies and ramp up inequality.' March 30, 2020, United Nations Development Programme. [online] Available at: <https://www.undp.org/content/undp/en/home/news-centre/news/2020/COVID19_Crisis_in_developing_countries_threatens_devastate_economies.html> [Accessed 12 September 2021]

[67] World Bank. 2020. World Bank Annual Report 2020. Washington, DC: World Bank. doi: 10.1596/978- 1-4648-1619-2

[68] Nakanwagi, S. and Rukundo, A.T., 2020. COVID-19 Pandemic Deranging Energy Transition in Uganda: Challenges and Prospects. *Global Energy Law and Sustainability*, *1*(2), pp.211-216

[69] Gills, B. and Morgan, J., 2020. Global climate emergency: After COP24, climate science, urgency, and the threat to humanity

[70] Koubi, V., 2019. Climate change and conflict. *Annual Review of Political Science*, *22*, pp.343-360

[71] Lyster, R., 2021. Climate Change Law (2019). *Yearbook of International Disaster Law Online*, *2*(1), pp.450-462.

zones, infrastructure, and ecosystems will be $49–171bn, with $27–66bn coming from developing nations alone. Disasters produced by weather and climate-related hazards cost the global economy $438 in 2017 and $215 in 2018[72]. Climate change will impact both human and environmental systems, including flooding, extreme heat, economic recession, exposure to infectious disease vectors, food and water insecurity, and infrastructure degradation[73]. While climate change poses a threat to global development as a whole, it is likely to impose a far greater burden on vulnerable people such as those whose livelihoods are dependent on rain-fed agriculture, forests, pastures, and coastal resources, as well as those who are poor[74]. As a result, low and middle-income countries face the disadvantage of carrying the brunt of the climate change cost while also attempting to alleviate high poverty levels and also try to boost economic growth. If climate action is not implemented by 2030, over 100m people in Sub-Saharan Africa and South Asia will be driven farther into poverty[75]. Furthermore, by 2050, *c.*143m people in Sub-Saharan Africa, South Asia, and Latin America will have become climate migrants to pursue less vulnerable regions to reside, potentially affecting individuals, families, and entire communities.[76]

[72] AON, 2019. Weather, Climate & Catastrophe Insight: 2018 Annual Report. AON PLC. [online] Available at : <http://thoughtleadership.aonbenfield.com/Documents/20190122-ab-if-annual-weather-climate-report-2018.pdf> [Accessed 12 September 2021]

[73] IPCC, 2018: Global Warming of 1.5°C.An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]

[74] Thomas, K., Hardy, R.D., Lazrus, H., Mendez, M., Orlove, B., Rivera-Collazo, I., Roberts, J.T., Rockman, M., Warner, B.P. and Winthrop, R., 2019. Explaining differential vulnerability to climate change: A social science review. *Wiley Interdisciplinary Reviews: Climate Change*, *10*(2), p.565

[75] Hallegatte, S., A. Vogt-Schilb, M. Bangalore, and J. Rozenberg, 2017. Unbreakable: Building the Resilience of the Poor in the Face of Natural Disasters. Climate Change and Development Series. Washington, DC. [online] Available at: <https://openknowledge.worldbank.org/handle/10986/25335> License: CC BY 3.0 IGO

[76] Clement, Viviane; Rigaud, Kanta Kumari; de Sherbinin, Alex; Jones, Bryan; Adamo, Susana; Schewe, Jacob; Sadiq, Nian; Shabahat, Elham. 2021. *Groundswell Part 2 : Acting on Internal Climate Migration*. World Bank, Washington, DC. © World Bank. [online] Available at <https://openknowledge.worldbank.org/handle/10986/36248> [Accessed 16 September 2021]

6. Recommendations and Conclusion

Many developing countries are not too keen on embracing regimes of global climate change regulation due to the close connection between economic growth and the causes and effects of climate change.[77] However, economic growth and development should not be at the expense of the environment, as this is a core element in the notion of sustainable development.[78] It has often been pointed out that developing countries are reluctant to adopt and enforce stringent environmental protection measures.[79] Sometimes this is sought to be excused by the belief that these countries should be allowed to pursue their development needs unhindered just like their developed counterparts did.[80] That view is even more apparent among the emerging petroleum producers even at a time when the risk of these states having stranded assets in the face of the a continuing energy transition is high.[81]

Developing countries, and especiallu nascent oil and gas producers such as Uganda, Kenya, Tanzania, Mozambique, and Senegal, should thus be allowed to evolve their own transition paths taking fully into account their unique growth needs and resources, as shown in *Section 3 and 4*. The recent International Energy Agency (IEA) report on the financing of transitions notes that countries are not striving for Net-Zero emissions by 2050 from the same starting point.[82] Further, the focus of transitions should be on developing economies. The majority of the growth in global emissions over the next two decades is expected to come from emerging and developing economies as they grow, industrialise and urbanise: an emissions growth rate estimated at 5 gigatonnes over the next two decades.

One of the measures to balance the utility of the industry with sustainability in the nascent oil and gas states requires a robust approach to the decarbonisation of the entire petroleum value chain. The primary source of CO_2 is the combustion of fossil fuels for energy, which is the most significant GHG responsible for climate change. Nonetheless, other potent gases like methane are emitted during the lifecycle of upstream and downstream petroleum activities. Decarbonisation of the *entire* value chain of the industry is thus necessary during the duration or lifecycle of the petroleum activities. In its report on methane regulation, the IEA identifies four significant pathways for decarbonising the oil and gas sector:[83] (1) the

[77] Patricia Birnie, Alan Boyle and Catherine Redgewell, '*International Law & the Environment*,' Third edition, Oxford University Press (2009), pp.335-336.
[78] See Principle 4 of the 1992 Rio Declaration on Environment and Development. [online] Available at <www.unesco.org/education/pdf/RIO_E.PDF> [Accessed 12 September 2021]
[79] Elli Louka, '*International Environmental Law: Fairness, Effectiveness, and World Order*,' Cambridge University Press (2006), p.29
[80] Ibid
[81] Ansari, D. and Holz, F., 2020. Between stranded assets and green transformation: Fossil-fuel-producing developing countries towards 2055. World Development, 130, p.104947.
[82] IEA, 2021. Financing clean energy transitions in emerging and developing economies, IEA, Paris. [online] Available <https://www.iea.org/reports/financing-clean-energy-transitions-in-emerging-and-developing-economies> [Accessed 16 September 2021
[83] IEA, 2021. Driving Down Methane Leaks from the Oil and Gas Industry. IEA, Paris. [online] Available https://www.iea.org/reports/driving-down-methane-leaks-from-the-oil-and-gas-industry> [Accessed 11 September 2021

Prescriptive Approach (e.g. permitting requirements, environmental impact assessments and mitigation, leak detection and repair requirements); (2) the Performance or Outcome-based Approach (e.g. national or sectoral reduction targets and plans; facility or company reduction targets, plans and emission standards; and flaring or venting standards); (3) the Economic Approach (e.g. emissions tax, economic incentives, loans and grants, and emissions trading; and (4) the Information-based Approach (e.g. through emissions estimates and quantification requirements, measurement and reporting requirements, information disclosure and record-keeping of emission-related information).

As mentioned above, some petroleum resources, particularly natural gas, have been identified as 'environmentally preferable products' and 'transitional fuels' for achieving a low-carbon future.[84] The IEA notes that natural gas is a critical component of the global energy mix. It is used in place of more polluting fuels like coal. It improves air quality and reduces carbon dioxide emissions[85]. The case study countries of Tanzania and Mozambique are taking a path that includes the development of their gas resources. These nascent oil and gas countries should consider investing in LNG as a short-term medium for emissions reduction, such as cooking. Like nuclear energy, which does not in the author's view fall within the ambit of renewable energy,[86] natural gas is similarly key in tackling energy access challenges in Africa in the energy transition era.

As much as the emerging petroleum producers desire to grow their fossil fuel sectors, there should be a systematic investment in renewable energies. There should be a balanced energy policy approach to accommodate the diversion of revenues from oil and gas investments to undertake investments in cleaner energy sources. In the long run, fossil fuels investments will be truncated. There is already a shift to green investment by leading corporations like Google, Tesla, Apple, BMW, Benz, etc., to meet their environmental, social and governance commitments. Even MNCs including IOCs are increasingly being legally and judicially mandated to limit their emissions – as in the recent Dutch ruling in the case of RDS. IRENA also notes that energy transition investments can boost GDP and create jobs during the Covid recovery phase from 2021 to 2023. By 2023, an accelerated energy transition could add *c.*5.5m additional jobs compared to current plans.[87]

Lastly, it is worth emphasising that developing nations, and even more so those in Sub-Saharan Africa, need to include the petroleum industry in their plans for their social and economic development – encompassed in the notion of Utility in their public policies. However, they should bear in mind the environmental sustainability concerns now permeating the sector and seek ways to limit the ills and increase the benefits, more so for the emerging oil and gas producers that must align their actions, approaches, beliefs and policies to fit in with the global energy transition. Nevertheless, with the ongoing race to Net-

[84] Safari, A., Das, N., Langhelle, O., Roy, J. and Assadi, M., 2019. Natural gas: A transition fuel for sustainable energy system transformation? *Energy Science & Engineering*, *7*(4), pp.1075-1094.

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[86] Nakanwagi, S., 2021. Nuclear Energy & Energy Transitions: Prospects, Challenges and Safeguards in Sub-Saharan Africa. In *Energy Transitions and the Future of the African Energy Sector* (pp. 113-137). Palgrave Macmillan, Cham.

[87] IRENA, 2020. The post-COVID recovery: An agenda for resilience, development, and equality. International Renewable Energy Agency, Abu Dhabi ISBN 978-92-9260-245-1

Zero by 2050, all countries must design and incorporate an energy transition path. Laws and policies therefore have to be shaped to factor in the peculiarities of the nascent petroleum states which seek to rely on their abundance of fossil fuels to sustain their respective economies and create a better future for their citizens.

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