ENERGY TRANSITION IN AFRICA: A BALANCED APPROACH FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

Africa possesses a wealth of renewable energy resources, including hydropower, solar, wind, and bioenergy. These resources present significant opportunities for the continent to embrace sustainable energy solutions. However, the underutilization of fossil fuels in Africa highlights the complexity of Africa's energy landscape. Many African countries rely heavily on fossil fuels, such as oil and natural gas, which are crucial for economic development and energy security. The challenge lies in balancing the need for energy access with the imperative to combat climate change. This paper argues for a pragmatic approach to energy transition in Africa – one that does not exclusively focus on renewable energy but incorporates fossil fuels where necessary. African nations can adopt a strategy that simultaneously pursues energy security, economic growth, and sustainability. By leveraging existing fossil fuel reserves responsibly, Africa can bridge its current energy gaps while gradually shifting to cleaner alternatives. The integration of renewable energy technologies must be supported by investments in infrastructure, policy frameworks, and international cooperation. The energy transition should be viewed not as an either/or scenario but as a spectrum of solutions tailored to the unique needs of African nations. A balanced approach enables African countries to harness the immediate benefits of their natural resources

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while positioning themselves as leaders in the green energy revolution. Moreover, Africa's journey can serve as a case study for other developing regions facing similar challenges. By navigating the delicate balance between fossil fuel dependence and renewable energy adoption, Africa has the potential to set a global precedent for sustainable energy transitions. African countries must seize this moment to contribute significantly to global climate change mitigation while securing their place in the emerging green economy. By doing so, they ensure not only economic resilience but also a meaningful role in shaping the future of energy on a global scale.

INTRODUCTION

Our planet – the land, the sea and the airspace- is not inhabited by only one nation. Our planet is shared by all states across the world.[2] Since the activities of a state not only affect the environmental domains of that state but also a significant portion of the world in its entirety, it has become necessary to institute international legal mechanisms to control the activities adversely affecting the global environment. For instance, the release of chlorofluorocarbons or greenhouse gases by one state, can have significant effects upon the environment of other states or in areas beyond the jurisdiction of the polluting state.[3] It is widely recognized that the planet faces serious environmental challenges that can only be addressed through international cooperation. Our planet faces imminent threats including acid rain, ozone depletion, climate change, loss of biodiversity and many more.[4] Since a major share of all these global environmental threats, especially climate change, are human-induced,[5] human activities need to be checked in order to deal with these challenges which serve as a real threat to the very existence of our planet.

In order to particularly deal with climate change, "The world is transitioning to a low-carbon economy".[6] This transition is what is often

2 Philippe Sands, and others, *Principles of International Environmental Law* (3rd edn, Cambridge University Press2012) 3.

3 Philip Allott, *Eunomia: New Order for a New World* (Oxford Academic 1990) para. 17.52.

4 Ibid.

5 Theophilus Acheampong 'The Energy Transition and Critical Minerals in Ghana: Opportunities and Governance Challenges' (Ghana Extractive Industries Transparency Initiative 2022) 1.

6 Victoria R. Nalule, 'How to Respond to Energy Transitions in Africa: Introducing the Energy Progression Dialogue' in Victoria R. Nalule (ed), *Energy Transitions and the Future of the African Energy Sector: Law, Policy and Governance* (Springer Nature Switzerland AG 2020) Chapter 2, Page 37.

referred to as "energy transition". Energy transitions, in this context, are therefore focused on the need to address climate change by shifting from fossil fuels or high carbon emitting energy sources like petroleum to renewable energy sources[7] such as wind energy, solar energy, thermal energy and hydroelectric power. The emergence of climate change also necessitates switching to new mobility solutions which contribute far less to global warming – for example, electric cars.[8]

At an international conference in October 1948, assisted by UNESCO, governments and non-governmental actors established the first major international organization to address environmental issues.[9] The conference established the International Union for the Protection of Nature (now the International Union for Conservation of Nature, or IUCN), to promote, amongst others, the preservation of wildlife and the natural environment.[10] Climate change in particular was not then a pressing issue. After 1948, however, hundreds of international conferences and treaties have been established to deal with climate change as a matter of urgency. The most significant of these include the 1972 Stockholm Conference, the 1981 Montevideo Programme, the 1982 World Charter for Nature,[11] 1980 World Conservation Strategy and 1991 'Caring for the Earth' Strategy which gave currency to the term 'sustainable development'.[12]

On May 9, 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was established with the main objective of stabilizing greenhouse gas concentrations in the atmosphere at a level that would effectively deal with the issue of climate change.[13] The UNFCCC created a Conference of the Parties (COP) and made it the Supreme Body of the Convention.[14] The COP was established to "keep under regular review the implementation of the Convention". On 12 December 2015, the COP convened in France, Paris, and adopted the Paris Agreement (PA). The primary objective of the PA is:

> "to strengthen the global response to the threat of climate change" and to maintain "the increase

7 Ibid.
8 Victoria R. Nalule, 'How to Respond to Energy Transitions in Africa: Introducing the Energy Progression Dialogue' in Victoria R. Nalule (ed), *Energy Transitions and the Future of the African Energy Sector: Law, Policy and Governance* (Springer Nature Switzerland AG 2020) Ch 2.
9 Ibid.
10 1977 Statutes, 18 IPE 8960; on the creation of the IUCN, see McCormick, Reclaiming Paradise, 31–6. In 1956, the IUPN was renamed the International Union for the Conservation of Nature and Natural Resources (IUCN).
11 Ibid 22-38.
12 Ibid 38.
13 United Nations Framework Convention on Climate Change (adopted on 9 May 1992) article 2.
14 Ibid. article 7(2).

> in the global average temperature to well below **2°C above pre-industrial levels** and pursuing efforts **to limit the temperature increase to 1.5°C above pre-industrial levels,** recognizing that this would significantly reduce the risks and impacts of climate change. (Emphasis mine)"[15]

Maintaining global temperature at 1.5°C and meeting net-zero goals call for a drastic reduction in greenhouse gas (GHG) emissions emanating from massive dependence on conventional (fossil) fuels.[16]

As at 25 October 2022, there were one hundred and ninety eight (198) signatories to the UNFCCC.[17] Out the 198 signatories to the UNFCCC, one hundred and ninety four (194) have signed the Paris Agreement.[18] It is interesting to note that all the fifty four (54) countries on the African continent have signed and ratified both the UNFCCC and the Paris Agreement.[19] Under the Paris Agreement, all parties to the agreement are required to make commitments in the form of Nationally Determined Contributions (NDCs) "to the global response to climate change".[20] All the African country signatories of the PA have communicated their individual NDCs to the Conference of the Parties (COP).

In 1992, when the UNFCCC was adopted at the Earth Summit in Rio de Janeiro in Brazil, over 170 countries adopted a Plan of Action called the "Agenda 21". It was "adopted as a non-binding blueprint and action plan for a global partnership for sustainable development."[21] After a series of international conferences and declarations such as the World Summit on Sustainable Development (WSSD) and its accompanying 2002 Johannesburg Declaration on Sustainable Development, the UN General Assembly adopted the 2030 Agenda for Sustainable Development which contains the seventeen (17) Sustainable Development Goals (SDGs).[22] Goal number thirteen (13) of the UN SDGs is to "take urgent action to combat climate change and its impacts"[23], Goal seven (7) of the UN SDGs is to

15 The Paris Agreement (adopted on 12 December 2015) article 2(1).
16 Ibid.
17 < https://unfccc.int/process/parties-non-party-stakeholders/parties-convention-and-observer-states> accessed 1 December 2023.
18 Ibid.
19 https://unfccc.int/process/parties-non-party-stakeholders/parties-convention-and-observer-states> accessed 1 December 2023.
20 United Nations Framework Convention on Climate Change (adopted on 9 May 1992) article 3.
21 Philippe Sands, and others, *Principles of International Environmental Law* (3rd edn, Cambridge University Press2012) 44.
22 Philippe Sands, and others, *Principles of International Environmental Law* (3rd edn, Cambridge University Press2012) 47.
23 See: https://sdgs.un.org/2030agenda (Accessed on 2 December 2023).

"Ensure access to affordable, reliable, sustainable and modern energy for all".[24] Goal eight-8 of the UN SDGs is to "…promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all".[25]

Against this backdrop, it is essential to have an overview of Africa's Energy and Development situation. As at the year 2019, half of Africa's population did not have access to electricity. About 75% of Africa's population lack access to clean cooking.[26] "This lack of access not only hamstrings economic growth but it also negatively impacts life expectancy and quality of life".[27] The International Energy Agency (IEA) has projected Africa's population to double by 2050.[28] The growing population, increase in urbanization, rapid industrialization and highly insufficient access to energy on the African continent has led to rapid excessive increase in energy demand. If Africa intends to meet this energy demand, it is imperative to utilize all its available energy resources including conventional or fossil fuels for a considerable time before it can effectively transition fully to alternative sources of energy that are sustainable. Some of these sustainable sources of energy which can serve as an alternative to fossil fuel are wind energy, solar energy and geothermal energy.

The development of Africa is highly dependent on the exploitation of its natural resources especially petroleum. To use the Republic of Ghana as an example, since petroleum was discovered in commercial quantities over ten (10) years ago, the production and exportation of oil and gas have provided significant growth to Ghana's economy.[29] From inception (2010), the total/cumulative petroleum revenue Ghana has generated amounts to $7.36 billion.[30]

Ghana currently has three (3) oil producing fields, namely Jubilee, TEN and the Sankofa Gye-Nyame (SGN) fields.[31] The Jubilee field alone contains approximately two (2) billion barrels of oil and 1.2 trillion cubic feet of natural gas.[32] Thus, with Ghana's cumulative production of oil from

24 Ibid.
25 See: https://sdgs.un.org/2030agenda (Accessed on 2 December 2023).
26 Ibid.
27 Ibid.
28 IEA,'Africa Energy Outlook 2019' (IEA 2019). See: <https://www.iea.org/reports/africa-energyoutlook-2019.>
29 Theophilus Acheampong and Thomas Kojo Stephens, 'Introduction' in Theophilus Acheampong and Thomas Kojo Stephens (eds), *Petroleum Resources Management in Africa: Lessons from Ten Years of Oil and Gas Production in Ghana* (Springer Nature Switzerland AG 2021) xii.
30 Public Interest and Accountability Committee, *2021 Annual Report* 20.
31 Ibid. 19.
32 George Yaw Owusu and M. Rutledge McCall, *In Pursuit Of Jubilee: A True Story Of The First Major Oil Discovery In Ghana* (Avenue Lane Press 2017) 93.

all the three operating fields since 2010 standing at around 500 million barrels, Ghana has not even cumulatively exploited a quarter of the Jubilee field alone. Also, in May 2021, Eni Ghana (a subsidiary of the Italian National Oil Company) discovered between 500 and 700 million barrels of oil in Ghana's Cape Three Point Block 4 which is yet to be developed and exploited.[33] This is to indicate how vast Ghana's unexploited petroleum resource is. Ghana is only a single African country, and it must be noted that Africa is a continent endowed with an unfathomable amount of petroleum reserve.

This analysis demonstrates the obvious fact that Africa needs to keep on exploiting all its natural resources or energy resources for a relatively longer time, especially fossil fuels, in order to achieve the 7th and 8th UN Sustainable Development Goals which are to "ensure access to affordable…energy" and to "promote…sustainable economic growth"[34] respectively.

African governments and policymakers are therefore "faced with the dilemma of addressing the energy and economic challenges on the continent and at the same time addressing the climate change challenges."[35] Should African governments focus on addressing climate change, which will mean forgoing a major part of its effort to achieve access to energy and economic growth, or rather focus on providing access to energy and economic growth to its people, which will mean flouting its international climate change commitments and putting the whole planet at an environmental and/or even existential risk? This paper seeks to suggest how Africa should deal with this dilemma.

THE IMPACT OF CLIMATE CHANGE AND THE GLOBAL RESPONSE: CHALLENGES, CONSEQUENCES, AND THE PATH TO ENERGY TRANSITION

Among all the planets in the universe, Earth is the most unique to the human experience because of its climate.[36] Planets Mercury and Venus are too hot for human habitation because they are extremely close to the Sun. Mars and the outer planets are all too far from the Sun and therefore are too cold for us. "Earth, therefore, is sometimes called the "Goldilocks Planet" because its climate is, as the old story goes, not too hot and not too

33 Ibid. 10.
34 Ibid 22.
35 Ibid 25.
36 Dana Desonie, *Climate: Causes and Effects of Climate Change* (Chelsea House Publishers 2008) x.

cold, but "just right."[37]

Climate Change

Climate Change refers to the "changes in the earth's weather, including changes in temperature, wind patterns and rainfall, especially the increase in the temperature of the earth's atmosphere that is caused by the increase of particular gases, especially carbon dioxide."[38] The United Nations Framework Convention on Climate Change (UNFCCC) has also defined Climate Change to mean "an alteration in the composition of the global atmosphere which is…observed over comparable time periods."[39] Climate, in this context, is simply the global atmosphere which has been observed over a comparable period. Any change in this global atmosphere is referred to as climate change. This means, there can be good or bad climate change. The climate change currently happening globally is a negative or unfavourable form of climate change and serves as a threat to the existence of our planet.

Earth's atmosphere is made up of Nitrogen, Oxygen, Water vapour, Carbon dioxide, Methane, Nitrous oxide, Ozone, Particles (dust, soot) and Chlorofluorocarbons.[40] Apart from Nitrogen, Oxygen and Water vapour, all the gases in the Earth's atmosphere are Greenhouse gases. Greenhouse gases (GHG) allow sunlight to pass through them but trap some of the heat that re-radiates from the planet's surface. This helps to create a temperate climate that has allowed the proliferation of numerous varieties of living organisms. When there is a higher concentration of GHG in the atmosphere, more of the heat re-radiating from the Earth's surface is trapped. Therefore, "higher levels of greenhouse gases warm the atmosphere while lower levels of greenhouse gases cool the atmosphere."[41]

Global Warming

When greenhouse gas levels rise, they trap more of the planet's re-radiated heat and cause global temperatures to rise. The escalating global temperatures over the past few decades is referred to as **"global warming."**[42] As has been defined above, any form of "changes in the earth's weather, including changes in temperature, wind patterns and rainfall" can be referred to as climate change. Whether the change in the weather is upward or downward, it is still climate change. Global

37 Ibid.
38 Oxford Dictionary 2022 See: https://www.oxfordlearnersdictionaries.com/definition/english/climate-change?q=climate+change Accessed on December 3, 2023.
39 United Nations Framework Convention on Climate Change (adopted on 9 May 1992) art 1(2).
40 Dana Desonie, *Climate: Causes and Effects of Climate Change* (Chelsea House Publishers 2008).
41 Ibid.
42 Dana Desonie, *Climate: Causes and Effects of Climate Change* (Chelsea House Publishers 2008).

warming, however, is solely the upward change in the weather on earth caused by the concentration of GHG on earth's surface. Global warming is a form, subset and consequence of climate change.

To effectively combat climate change, enormous financial commitments ought to be made. If no new fossil fuel projects are developed beyond those already under construction or approved for development (Low CCUS Case) because of the fight against climate change, up to $90 billion of existing coal and gas fired capacity could be stranded by 2030 and up to $400 billion by 2050 globally. When fossil fuels are left stranded, it will cost $15 trillion to find an alternative to fossil fuel, which will be exploiting renewable energy sources like wind and solar.

Considering the financial commitments involved in taking climate action, "environmental regulations should only be adopted where there is compelling scientific evidence that action is required to prevent environmental damage."[43] If the scientific evidence concerning the causes of climate change turns out to be unreliable, trillions of dollars may be lost for nothing. For this reason, the United Nations Environment Programme and the World Meteorological Organization (WMO), in 1988, established the Intergovernmental Panel on Climate Change (IPCC) to provide the scientific guidance necessary to take climate action. The IPCC, has undertaken and is still undertaking extensive studies to find the causes of climate change and how to combat it. The IPCC is scientifically certain about the human causes of climate change.[44]

In summary, human activities which inject CO2, methane and nitrous oxide[45] into the atmosphere are the primary cause of climate change. The global energy sector is the biggest contributor to Greenhouse Gas (GHG) emissions. The UNFCCC describes GHG emissions as the release of gaseous constituents, both natural and anthropogenic, into the atmosphere and these gases absorb and re-emit infrared radiation.[46] Currently, around 73% of global GHG emissions come from energy use, with most

43 Ibid 6.

44 Theophilus Acheampong, 'Leveraging clean energy to drive industrialisation in Sub-Saharan Africa: Imaginaries and Realities' in Ellen Davies and Claudia Serwaa Prempeh (eds), *From Rio to COP 26: A collection of essays on Africa's climate journey and the road ahead.* < https://www.researchgate.net/publication/361338650_Leveraging_clean_energy_to_drive_industrialisation_in_Sub-Saharan_Africa_Imaginaries_and_Realities > Accessed on December 5, 2024.

45 These are the main Greenhouse Gases (including fluorinated gases).

46 United Nations Framework Convention on Climate Change (adopted on 9 May 1992) article 1(4) and (5).

emissions generated from fossil fuels.[47] Carbon dioxide emissions from the combustion of fossil fuels, the production of cement, and agricultural and other land use (including deforestation) are widely considered to be the most significant contributors to the threat of climate change.[48] Scientific evidence suggests that continued increase in atmospheric concentrations of these greenhouse gases due to human activities will lead to an enhanced 'greenhouse effect' and global climatic change.[49]

The Effects of Climate Change

Why is the whole international community worried about climate change? Why not allow climate change to continue happening? The global community is worried because of the serious adverse effects of climate change. Due to climate change, many animals and plants will likely go extinct. The most vulnerable animals in this case are polar organisms because global warming is causing rapid melting of polar ice which serves as a habit for animals like polar bears. Eventually, animals in other climate zones will be at risk too. People depend on many of these vulnerable plants and animals for food and medicine.[50] Another reason why the international community is urgently concerned about climate change is that modern agriculture and human settlements depend on stable climate conditions. "A drastic change in climate, even on a smaller scale than those that have taken place earlier in Earth history, could destabilize human civilization."[51]

The adverse impact of global warming is already visible. Glaciers and polar ice caps are melting.[52] Winters are now shorter thanthey used to be and, as a result, some plants and animals are changing their seasonal behaviours. Coral reefs and forests are dying around the world. The weather is becoming warmer, causing floods and intense hurricanes. "According to climate model predictions, this is just the beginning."[53] Considering all these impacts, the global community indeed has reason to be very worried about climate change and its accompanying effects.

47 Theophilus Acheampong, 'Leveraging clean energy to drive industrialisation in Sub-Saharan Africa: Imaginaries and Realities' in Ellen Davies and Claudia Serwaa Prempeh (eds), *From Rio to COP 26: A collection of essays on Africa's climate journey and the road ahead.* < https://www.researchgate.net/publication/361338650_Leveraging_clean_energy_to_drive_industrialisation_in_Sub-Saharan_Africa_Imaginaries_and_Realities > Accessed on December 5, 2024.

48 Ibid.

49 Ibid.

50 Theophilus Acheampong, 'Leveraging clean energy to drive industrialisation in Sub-Saharan Africa: Imaginaries and Realities' in Ellen Davies and Claudia Serwaa Prempeh (eds), *From Rio to COP 26: A collection of essays on Africa's climate journey and the road ahead.* < https://www.researchgate.net/publication/361338650_Leveraging_clean_energy_to_drive_industrialisation_in_Sub-Saharan_Africa_Imaginaries_and_Realities > Accessed on December 5, 2024.

51 Ibid.

52 Ibid.

53 Ibid.

Despite contributing less than 3% of the energy-related carbon dioxide (CO_2) ever emitted worldwide in the history of human civilization, the African continent is one of the regions most adversely affected by the changing climate.[54] Africa is facing worsening drought, famine, flooding and heat waves. These effects are accompanied by the perennial problems of insecurity and civil unrest, and accelerating migration and displacements to flee these threats caused by climate change.

How to combat Climate Change

Both the 2015 Paris Agreement and the 1992 United Nations Framework Convention on Climate Change (UNFCCC) generally suggest that the way to combat climate change is to stabilize the greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.[55] However, the Paris Agreement provides a very specific way through which the world should respond to climate change. Article 2 of the Paris Agreement provides that in order to deal with climate change, the states around the world should collaborate to maintain "the increase in the global average temperature to well below 2°C above pre-industrial levels". It proceeds to provide that, after bringing the global average temperature to well below 2°C above pre-industrial levels, the world should proceed to make further "efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change".

Since the most significant contributor to the threat of climate change is "the combustion of fossil fuels",[56] then the production and usage of fossil fuels must be grossly reduced in order to deal with the issue of climate change. The combustion of petroleum emits CO2, a very significant cause of climate change, into the atmosphere.

Petroleum literally fuels the world.[57] So if the world really wants to do away with fossil fuels in order to combat climate change, then all the states around the world must collaborate to find a reliable alternative to petroleum. The world must transition from conventional energy sources like oil and gas to a new source of energy which is climate or environment friendly. This switch from hydrocarbons to a climate friendly source of

54 Theophilus Acheampong, 'Leveraging clean energy to drive industrialisation in Sub-Saharan Africa: Imaginaries and Realities' in Ellen Davies and Claudia Serwaa Prempeh (eds), *From Rio to COP 26: A collection of essays on Africa's climate journey and the road ahead.* < https://www.researchgate.net/publication/361338650_Leveraging_clean_energy_to_drive_industrialisation_in_Sub-Saharan_Africa_Imaginaries_and_Realities > Accessed on December 5, 2024.

55 Ibid.

56 Ibid.

57 Tim Boykett and others, 'Oil Contracts: How to read and understand them' (Times Up Press 2012).

energy is what, in this context, is termed as energy transition.

NET-ZERO EMISSION ENERGY TRANSITION: THE SHIFT FROM FOSSIL FUELS TO RENEWABLE ENERGY SOURCES

Understanding the fundamental meaning of the word "transition" is very important in understanding what energy transition is. The Oxford dictionary defines 'transition' as 'the process or a period of *changing* from one state or condition to another'.[58] Currently, there is no agreed definition of the term energy transition[59] but the International Renewable Energy Agency (IRENA), defines energy transition as a "pathway towards the transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century."[60]

Net-Zero Emission Energy Transition

This is a form of "energy resource transition" because it is a transition from one form of "energy which are extracted from the environment" to another. This is a transition from carbon emitting forms of energy like fossil fuels to more environmentally friendly forms of energy resources like solar and wind. The term Net-Zero Emission does not imply reducing CO2 in the atmosphere to 0% or reducing the usage of fossil fuels to zero percentage. Net zero means a huge decline in the use of fossil fuels.[61] Fossil fuels serve as 80% of the world's total energy supply. Net Zero is achieved if the fossil fuel energy supply falls from the current 80% to 20%.[62] After this extreme reduction in the supply of fossil fuels, about 70% of the global energy supply should come "from wind, solar, bioenergy, geothermal and hydro energy." Fouquet establishes that the consumption of a particular energy resource by a society (be it a country or the globe) should reach its peak (80%+) before it can be said that the society in question has successfully transitioned to that energy resource.[63] Solar should become the largest source of energy, accounting for one-fifth of energy supplies by 2050.[64] In the context of

58 Oxford Dictionary. 2019. available at: https://en.oxforddictionaries.com/definition/transition.
59 IRENA and AfDB, *Renewable Energy Market Analysis: Africa and Its Regions* (International Renewable Energy Agency and African Development Bank 2022) <www.irena.org/publications> Accessed on 23 February, 2024.
60 IRENA and AfDB, *Renewable Energy Market Analysis: Africa and Its Regions* (International Renewable Energy Agency and African Development Bank 2022) <www.irena.org/publications> Accessed on 23 February, 2024.
61 International Energy Agency, *Net Zero by 2050: A Roadmap for the Global Energy Sector* (IEA 2021) " <https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf> accessed on January 16, 2024 18.
62 Ibid.
63 Roger Fouquet, (2016) 'Historical energy transitions: speed, prices and system transformation' (2016) 22 Energy Research & Social Science<http://eprints.lse.ac.uk/67618/> accessed 8 December 2022.
64 Ibid.

the 1992 UNFCCC and the 2015 Paris Agreement, energy transition is "a pathway toward transforming the global energy sector **to net-zero** by 2050 and beyond..."[65]

History of Energy Transitions in Britain and the United States of America (U.S.A)

Food is the oldest form of energy for humans.[66] Since the beginning of humanity, humans have survived on food for energy and also fed their animals (livestock and farm animals) with food. In the last two hundred years, humans have come to rely on ever-increasing quantities of energy to fuel their rising numbers and improve standards of living.[67]

Before and during the Middle Ages (between the 4th and 15th centuries), the main sources of energy around the world were firewood, charcoal, animals, and human muscle power.[68] The energy sources during that ancient period were basically two; wood and food (food for humans and their animals). Until the Industrial Revolution, wood, wind, and water (renewable energy) were the primary energy resources.[69]

> Home heating and cooking was done from a family hearth using mainly wood. If someone wanted to move about, they walked, rode horses, or drove carts pulled by draft animals. Wind and water mills were used to grind grains and operate simple machinery but were not yet harnessed to industry.[70]

The first energy transition in Britain started when Great Britain began mining coal during the Elizabethan era (1558 - 1603).[71] Since then, the supply and consumption of coal grew exponentially. Faced with rising prices of wood and charcoal, Britain turned to coal. By 1860, 93 % of the energy used in England and Wales came from coal.[72] The transition from wood and food to coal was a very slow process and much of it happened before the Industrial Revolution. "Coal's share of energy generation in

65 Ibid.
66 Richard W. Unger, 'Introduction' in Richard W. Unger (ed), *Energy Transitions in History: Global Cases of Continuity and Change* (Rachael Carson Center Perspectives 2013) < https://www.environmentand-society.org/sites/default/files/2013_i2_web.pdf> accessed 8 December 2022.
67 Ibid.
68 Ibid 11.
69 Samuel A. Van Vactor, 'Historical Perspective on Energy Transitions' (2018) USAEE Working Paper < https://www.econ.cam.ac.uk/seminar-papers/Sam-Van-Vactor.pdf> December 12, 2023.
70 Samuel A. Van Vactor, 'Historical Perspective on Energy Transitions' (2018) USAEE Working Paper < https://www.econ.cam.ac.uk/seminar-papers/Sam-Van-Vactor.pdf> Accessed on December 12, 2024.
71 Ibid.
72 Samuel A. Van Vactor, 'Historical Perspective on Energy Transitions' (2018) USAEE Working Paper < https://www.econ.cam.ac.uk/seminar-papers/Sam-Van-Vactor.pdf> December 12, 2024

England and Wales rose from 10 percent in 1560 to 35 percent in 1660 and reached 64 percent in 1760, a date that is often taken to be the start of the Industrial Revolution."[73] Coal was the driver of the Industrial Revolution in Britain since it constituted 64% of the energy it expended when the Industrial Revolution began in 1760.

However, wood and food were still the major sources of energy in the United States (U.S). Even a century after the commencement of the Industrial Revolution in Britain, Energy consumption in the United States was 70 percent wood in 1870[74] as opposed to 64% coal within the borders of Britain in 1760.[75] Reliance on coal as a major source of energy reached its peak (70% consumption) in the U.S in 1900. Wood was the fuel of choice for locomotives in the first few decades of American railroads. It was available in abundance and relatively easy to burn. The shift to coal was a consequence of increasing wood prices (reflecting the growing scarcity of wood near urban areas and major lines) and decreasing coal prices as the coal industry grew. This sums up the first energy transition in Britain and the United States from wood, wind and food to coal.

The second significant energy transition happened right after the commercial discovery of crude oil in Pennsylvania (U.S) in 1859.[76] Prior to the commercial discovery of crude oil in 1859, lamp oil was acquired from oil seepages in the 1840's and the kerosene distillation market also grew in the early 1850's in the U.S.[77] In 1886, Karl Benz received the first ever automobile patent and in that same year, oil consumption reached 1% of the total energy consumption in the U.S.[78] By 1910, there were several commercial oil discoveries in Texas and across North America, Persia, Sumatra, Mexico, etc.[79] As a result of the mass discovery of crude oil and the introduction of the internal combustion automobile, oil shares in total energy consumption had reached 5% by 1908.[80] Coal was still the prevailing source of energy then in the U.S even though the discovered oil fields were cumulatively producing about 500,000 barrel of crude oil per day.

In 1927, oil consumption in the U.S made up 22% of the total energy

73 Ibid.
74 Peter A. O'Connor, 'Energy Transitions' (The Pardee Papers No. 12 2010).
75 Ibid.
76 Peter A. O'Connor, 'Energy Transitions' (The Pardee Papers No. 12 2010).
77 Abraham Gesner, *The Discovery of Kerosene* (The Channel, Ingenium Canada 2024). <https://ingeniumcanada.org/channel/articles/the-discovery-of-kerosene> Accessed on December 20, 2024.
78 BA Wells and KL Wells, *First Oil Book of 1860* (American Oil & Gas Historical Society 2020). See: <https://aoghs.org/oil-almanac/first-oil-book-of-1860> January 21, 2024.
79 Ibid.
80 Ibid.

consumption and the oil fields were yielding around 2.5 million barrels per day. By 1950, oil production had exceeded coal. The U.S oil production in 1950 was 5.4 million barrels per day. There was a very high demand of oil because of the domination of the transportation market by internal combustion engine cars. In 1950, the automobiles in the U.S was 6.5 million units.[81] By 1960, oil had completely overtaken coal as the major source of energy in the U.S. As a matter of fact, oil constituted 70% of the total energy consumption in the U.S.

Very similar to the United States, the United Kingdom and most parts of Europe, fully transitioned from coal to oil after the 1950s. This is when oil and electricity and the internal combustion engines replaced the older coal-based technologies.[82] Apart from the dominance of oil fuel-based technology in the United Kingdom (such as internal combustion engine), another cause of the decline in coal production and consumption and the surge in oil consumption in the United Kingdom was the increase in the price of coal in Britain.[83]

Contrasting Historical and Modern Energy Transitions: Economic Drivers vs. Climate Imperatives

As has already been noted, the three main causes of climate change over a period of two hundred years has been: (i) A change in the demand for energy services, (ii) The invention of new technology and the advancement of existing ones and (iii) The price of energy resources. One difference between the historical energy transition that happened in the western part of the world decades and centuries ago, and the current one which countries, corporate entities and individuals are supposed to contribute is that the former occurred due to the natural laws of economics and the latter is supposed to occur due to immediate mandatory means.

For instance, in the 19th century, America was not forced by threatening factors like climate change to transition from coal to hydrocarbons. The energy transition from coal to carbon was mostly due to the invention of hydrocarbon powered automobiles. The Americans who abandoned coal and started consuming hydrocarbons did not do so as a matter of obligation. They rather transitioned to the consumption of hydrocarbons because of the invention of automobiles and the cheaper price of discovered hydrocarbons.

81 BA Wells and KL Wells, *First Oil Book of 1860* (American Oil & Gas Historical Society 2020) <https://aoghs.org/oil-almanac/first-oil-book-of-1860> January 21, 2024.
82 Ibid 34.
83 BA Wells and KL Wells, *First Oil Book of 1860* (American Oil & Gas Historical Society 2020) <https://aoghs.org/oil-almanac/first-oil-book-of-1860> January 21, 2024. 3.

The current energy transition is not totally driven by the natural laws of economics but is mainly due to the existential threat facing our planet. We are not required to do away with fossil fuel because there is not enough fossil fuel for our consumption. In fact, only the hydrocarbons reserve in Africa can fuel the entire planet for a considerable period before it gets depleted. On one hand, the world currently consumes around 90 million barrels of oil a day, a quarter of it in the United States.[84] And on the other hand, there are over 1.3 trillion barrels of proven oil reserves in the world. Over 5% - 7% (65 billion barrels) of the world's reserve is found in Africa.

Despite these proven oil reserves, new discoveries are made almost every day. This means that although the fossil fuel reserves on the whole planet will certainly get exhausted at some point, it will definitely take a very long time before this occurs. This is to buttress the point that the signatories to the Paris Agreement have not undertaken to transition from fossil fuels to renewable sources of energy by 2050[85] because by 2050 fossil fuel will be at the brink of exhaustion. Parties to the Paris Agreement are transitioning to renewable sources of energy because the continuous consumption of fossil fuel will certainly worsen climate change and will, by 2050, have devastating repercussions on our planet, some of which are already suffered by many around the world.[86]

Another difference between the historical energy transition that happened in the U.S and Europe decades and centuries ago, and the current one which the signatories to the Paris Agreement are supposed to undertake is the time frame within which the transition is to reach its peak. During the Middle Ages (from 500 AD to the 16th Century) the main energy sources were firewood, charcoal, animals, and human muscle power. By 1860, 93 percent of the energy expended in England and Wales came from coal. "The transition was slow…. Coal's share of energy generation in England and Wales rose from 10 percent in 1560 to 35 percent in 1660 and reached 64 percent in 1760 and 93% by 1869."[87] On the other hand, energy transition in the modern sense is expected to occur within a relatively shorter period of time. As has been noted in the introduction to this paper, the international discussion on climate change and energy transition started a long time ago but the states actually came together to codify it into an international obligation in 2015 (the Paris Agreement). The Paris Agreement expects a

84 Ibid.
85 Ibid.
86 Dana Desonie, *Climate: Causes and Effects of Climate Change* (Chelsea House Publishers 2008). p.xii.
87 Richard W. Unger, 'Introduction' in Richard W. Unger (ed), *Energy Transitions in History: Global Cases of Continuity and Change* (Rachael Carson Center Perspectives 2013) < https://www.environmentandsociety.org/sites/default/files/2013_i2_web.pdf> accessed on 8 December 2022.

full transition from GHG emitting energy resources to renewable energy resources by 2050. The Paris Agreement is requiring the signatories and the world at large to transition within thirty-five (35) years, a process which previously occurred over the course of centuries.

Fossil Fuel Reserves in Africa: Distribution, Production, and Emerging Trends

In order to give an informed insight on how Africa should go about the current energy transition, it is necessary to have a look into the quantity of recoverable fossil fuel on the African continent. It must be noted that the energy outlook of all the 54 African countries cannot be exhaustively evaluated within the confines of this paper.

Out of all the oil and gas produced in the whole world from 2010 to 2019, an average of 8% occurred in Africa. Also, "Africa is home to 13% of the world's natural gas and 7% of the oil resources".[88]

The table below shows the reserves of fossil fuels and their distribution in Africa.

Table 4.0 Fossil Fuel Reserves in Africa as at 2011

Energy Resource Type	Reserves	Regional Distribution
Crude Oil	132.1 billion Barrels	Northern Africa: 53.2% Western Africa: 28.2% Central Africa: 16.9% Other Africa: 1.7%
Natural Gas	14.7 trillion m^3	Northern Africa: 55.8% Western Africa: 36.1% Other Africa: 8.2%
Coal	31,696 billion tonnes	Southern Africa: 95.2% Eastern Africa:1.6% Other Africa: 3.2%

Source: United Nations Economic Commission for Africa (2011)

As at 2011, over 80% and 90% of the oil and natural gas reserves respectively, were found in Northern and Western Africa. In the Northern part of Africa, Libya accounts for over 70% of the oil reserves and in the

88 International Energy Agency, *Africa Energy Outlook 2022* (International Energy Agency 2022).

same region, Algeria accounts for about 55% of the natural gas reserves.[89] Nigeria accounts for almost all the oil and natural gas reserves in Western Africa. Additionally, three countries – Libya, Nigeria and Angola – account for about 80% of the proven oil reserves in the continent.[90] "This distribution of energy resources across the continent becomes more uneven considering South Africa accounts for about 95% of the coal reserves in the continent."[91] The proven crude oil reserves in Africa are increasing with the proven crude oil reserves on the whole African continent increasing from 58.7 billion barrels in 1990 to 132.1 billion barrels in 2010.[92] According to the United Nations Economic Commission for Africa, "the recent increases in crude oil prices now make it economical to explore 'marginal' deposits. Today, exploration is taking place in many regions in Africa while countries such as Ghana, Uganda and Chad have already started drilling activities."[93]

Despite the fact that oil and gas production on the African continent started to dwindle since 2020 due to factors including the Covid-19 pandemic 2020 and the Russian Ukraine war,[94] the proven oil and gas reserves in Africa has been increasing exponentially. For instance, although the oil production in Angola and Nigeria decreased from 1.8 million barrels per day and 2.5 million per day in the year 2010 to 1.2 million barrels per day and 1.7 million barrels per day in the year 2021 respectively[95], more oil reserves have been discovered in these regions.[96]

Africa's Renewable Energy Potential: An Untapped Opportunity for Sustainable Growth

The International Renewable Energy Agency, IRENA, has identified hydropower, solar, wind, geothermal and modern bioenergy as the main renewable energy resources which will drive modern energy transition.[97]

89 United Nations Economic Commission for Africa, 'Fossil Fuels in Africa in the context of a Carbon Concentrated Future'African Climate Policy Centre Working Paper 12, 3.
90 Ibid.
91 Ibid.
92 United Nations Economic Commission for Africa, 'Fossil Fuels in Africa in the context of a Carbon Concentrated Future'African Climate Policy Centre Working Paper 12, 3.
93 Ibid.
94 United Nations Economic Commission for Africa, 'Fossil Fuels in Africa in the context of a Carbon Concentrated Future'African Climate Policy Centre Working Paper 12, 3.
95 International Energy Agency, *World Energy Outlook 2022* (IEA 2022) 336.
96 Theophilus Acheampong and Thomas Kojo Stephens, 'Introduction' in Theophilus Acheampong and Thomas Kojo Stephens (eds), *Petroleum Resources Management in Africa: Lessons from Ten Years of Oil and Gas Production in Ghana* (Springer Nature Switzerland AG 2021).
97 IRENA and AfDB, *Renewable Energy Market Analysis: Africa and Its Regions* (International Renewable Energy Agency and African Development Bank 2022) <www.irena.org/publications> Accessed on 23 February, 2024.

Apart from the fact that the African continent is heavily endowed with several of the critical minerals that are essential inputs for renewable energy and low-carbon technologies like electric batteries and wind turbines, including copper, cobalt and lithium, Africa is also home to vast renewable energy resource potential as will be demonstrated below.

1. *Hydropower*

Due to the presence of large rivers such as the Nile River on the African continent, hydropower has been used in Africa for many decades. As of 2022, the total hydropower plants installed in Africa was close to 131 gigawatts.[98] The largest committed hydropower project in Africa in 2022 was Ethiopia's Renaissance hydropower project (at around 6 GW).[99] Among all the renewable energy resources available on the African continent, hydropower is the most widely used. It is almost exclusively used to generate electricity. In 2019, hydropower accounted for 17.4% of all the electricity on the African continent, while its counterpartssolar, wind, geothermal and bioenergy cumulatively accounted for only 3.7%.[100]

Despite the impressive performance of hydropower in Africa's energy mix, it has not been exploited even to its most minimum potential. In 2014, the Delft University of Technology estimated the continent's unexploited hydropower potential to be 1,753 GW.[101] This implies that not even 10% of the total hydropower potential on the African continent has been exploited. Another very impressive fact about hydropower on the African continent is that hydropower production is almost evenly distributed across the continent. To demonstrate this: Africa's largest hydropower producers are (1) Ethiopia (Eastern Africa), (2) Angola (Central Africa), (3) South Africa (Southern Africa), (4) Egypt (Northern Africa), (5) the Democratic Republic of the Congo (Central Africa), (6) Zambia (Southern Africa), (7) Mozambique (Eastern Africa), (8) Nigeria (Western Africa), (9) the Sudan (Central Africa), (10) Morocco (Northern Africa) and (11) Ghana (Western Africa). To buttress the fact that hydro power is ubiquitous in Africa. The International Renewable Energy Agency, IRENA, noted that 41 of the 53 African countries had installed hydropower generation capacity.[102]

Evidence shows that the distribution of hydropower potential is not evenly distributed across the continent. For instance, out of the 1,753 GW

98 International Renewable Energy Agency, *Hydropower Installed Capacity in Africa* (IRENA 2021) <https://www.irena.org> Accessed on December 10, 2023.
99 Ibid.
100 International Hydropower Association, *2021 Hydropower Status Report* (IHA, 2021) <https://www.hydropower.org/publications/2021-hydropower-status-report> March 30, 2024.
101 Ibid.
102 Ibid 38

hydropower potential in Africa only about 24 GW is found in the Economic Community of West African States (ECOWAS).[103] Regrettably, out of the 24 GW potential of hydropower found in West Africa, only 16% of such hydropower potential energy resource had been exploited as at 2021.[104]

2. *Solar*

"The theoretical reserves of Africa's solar energy are estimated at 60,000,000 TWh/year, which accounts for almost 40% of the global total, thus making Africa the most sun-rich continent in the world."[105] This means every one hour the solar energy emitted by the sun onto the surface of Africa as a continent is "60,000,000 TWh/year". The potential of solar energy is enormous all over Africa to the extent that the African Union describes it as "almost unlimited".[106] The enormousness of solar energy in Africa is due to a variety of factors which include the proximity of the continent of Africa to the equator and the frequent dry bright days.[107] Solar potential tends to be more concentrated in Northern and Southern Africa. In the case of North Africa, a solar farm spanning just 0.3% of North Africa could meet the whole European Union's electricity consumption. Because of its ideal location in the Sunbelt region, Northern Africa has an abundance of solar energy.

Africa possesses some of the world's most promising potential for solar power generation because it is home to 60% of the best solar resources globally, yet only 1% of installed solar PV capacity.[108] The African continent receives annual average solar irradiation of 2,119 kilowatt hours per square metre (kWh/m2) with most countries across North, West and Southern Africa receiving an average in excess of 2,100 kWh/m2 annually. IRENA estimates the continent's solar technical potential at 7,900 GW **(assuming a 1% land-utilisation factor).**

3. *Wind*

It is estimated by the International Renewable Energy Agency, IRENA,

103 Victoria R. Nalule, 'How to Respond to Energy Transitions in Africa: Introducing the Energy Progression Dialogue' in Victoria R. Nalule (ed), *Energy Transitions and the Future of the African Energy Sector: Law, Policy and Governance* (Springer Nature Switzerland AG 2020).
104 Ibid.
105 Liu Zhenya, *Global Energy Interconnection*. (Elsevier Science 2015) 30.
106 Atlas of Energy Resources of Africa, <https://au.int/sites/default/files/documents/36067-doc-ica_-africa_energy_atlas_stc.pdf> March 30, 2024
107 Sustainable Investment Team, Schroders, 'The solar revolution in Africa.' (Schroders 2017) <https://www.schroders.com/en/insights/economics/ the-solar-revolution- in-africa/> Accessed December 20, 2023.
108 Ibid. 17.

that the potential of energy from wind amounts to 461 GW[109] (assuming a 1%land-utilisation factor), with Algeria, Ethiopia, Namibia and Mauritania possessing the greatest potential. Wind power facilities, like the other renewable energy resources, are unequally distributed across the continent, being tied to the geography of wind resources and policy interest in developing them. Wind power contributes substantially to some countries' electricity mix. Annual average wind speeds in North Africa and Southern Africa are high, reaching 7 meters per second (m/s).

Despite this overwhelming wind power generation potential on the continent, wind resources remain highly underexploited in Africa, in particular in parts of North Africa and the Sahel area. At the end of 2020, wind generation capacity in Africa amounted to only 6.5 GW out of the 461 GW wind power generation potential on the African continent. "Countries with significant generation capacity are South Africa, Morocco and Egypt, as well as Kenya, Ethiopia and Tunisia, which together account for over 95% of Africa's total wind generation capacity."[110]

4. ***Geothermal and Bioenergy***

According to the U.S Office of Efficiency and Renewable Energy (EERE), "geothermal energy is heat energy from the earth—Geo (earth) + thermal (heat)."[111] Wells, which may range from a few feet to several miles deep, can be drilled into underground reservoirs to tap steam and very hot water that can be brought to the surface for use in a variety of applications, including electricity generation, direct use, and heating and cooling.

Almost all Africa's geothermal resources are found in the East Africa Rift System (an active continental rift zone in East Africa), where an estimated 15 GW of potential remains untapped. At the end of 2020, Kenya was the only country in Africa which was a significant generator of electricity from geothermal power, with a generation capacity of about 830 MW. Ethiopia, the only other African country currently producing geothermal energy, operates a 7.3 MW geothermal plant which is a pilot plant. Also, according to the International Energy Agency (IEA,'Africa Energy Outlook 2019' (IEA 2019)), at the end of 2019, 1 GW of new geothermal capacity was being planned in Djibouti, Uganda and the United Republic of Tanzania.

Although biomass is the most widely used energy source on the continent, most of it is consumed for cooking, using inefficient traditional practices.

109 Ibid. 43.
110 Ibid.
111 See:https://www.energy.gov/eere/geothermal/geothermal-basics#:~:text=Geothermal%20energy%20is%20heat%20energy,depths%20below%20the%20earth's%20surface. January 10, 2024.

Modern uses for electricity generation represented only 1% of all renewable electricity generation in 2019, although it is not clear how much of the fuel was sustainably sourced. There are also prospects for using advanced biofuels in the transport sector in several African countries. The U.S. Energy Information Administration estimates that West Africa alone might possess the potential to produce over 100 megatons per year of agriculture residues that could be converted into biofuels like ethanol and biobutanolinto electricity.

In summary, Africa is endowed with vast amounts of renewable energy ranging from hydropower to bioenergy. It must be noted that the amount of renewable energy potentials observed above are the renewable energy which can harnessed over a period of one year. For instance, when the Delft University of Technology estimated that the unexploited hydropower potential in Africa is 1,753 GW, it meant that the hydropower which can be generated from the water bodies which flow throughout the continent of Africa over a period of one year is 1,753 GW. Africa's hydropower potential is almost 2,000 GW while only less than 10% has been developed and producing actual hydropower. Africa's solar technical potential is estimated to be about 7,900 GW (assuming a 1% land-utilization factor) out of which only 10.4 GW (constituting less than 1% of the continent's solar potential) has been tapped.

Furthermore, the wind potential in Africa is estimated to amount to 461 GW[112] (assuming a 1%land-utilisation factor) out of which only 6.5 GW (constituting less than 2% of the continent's wind potential) has been exploited. An estimated 15 GW of potential geothermal resources in Africa (constituting almost 100% of the geothermal resources in Africa) remains untapped. Lastly, when it comes to bioenergy, it is estimated that West Africa alone might possess the potential to produce over 100 megatons per year of agriculture residues that could be converted into biofuels like ethanol and biobutanol, or into electricity.

SHOULD AFRICA ABANDON ENERGY TRANSITION COMPLETELY?

This paper, of course, does not propose that Africa as a continent should not contribute to energy transition. As a matter of fact, most African states have already put measures in place to respond to climate change and fulfil their obligations under the Paris Agreement. For instance, Kenya has heavily invested in generating power using wind and solar energy

112 IRENA and AfDB (2022), Renewable Energy Market Analysis: Africa and Its Regions, International Renewable Energy Agency and African Development Bank, Abu Dhabi and Abidjan. Available for download: www.irena.org/publications 43.

by constructing significant wind and solar projects. Lake Turkana Wind Power project in Kenya which generates 310MW is currently the largest wind farm in Africa.[113]

Also, the Nigerian Federal Government (FNG) has made commendable efforts in raising funds for energy transition projects. In the 2017 and 2019, the FNG secured green bonds worth N10.69 billion and N15 billion respectively to fund environmental projects.[114] Ghana has also been making significant efforts to contribute to combat climate change. In 2019, Ghana's Energy Commission launched the Drive Electric Initiative (DEI) to promote the use of electric vehicles as an alternative medium of transportation in Ghana. The DEI has another specific objective of making sure that by 2020, there will be at least 100 electric vehicles in Ghana and 10 public charging outlets in Ghana.

Like it was made clear in the introduction to this paper, Africa is very committed to fighting climate change with almost all the countries in Africa having signed and ratified the United Nation Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. Almost all African states have submitted their Nationally Determined Contribution to the Conference of the Parties (COP) which is the governing body of the Paris Agreement.

It is rather proposed that African countries should find a way to simultaneously contribute to energy transition and still make the best of their fossil fuel reserve.

HOW AFRICA SHOULD APPROACH ENERGY TRANSITION

Should Africa Adopt 'Energy Progression' Over Rapid Energy Transition? Several approaches on how to deal with the dilemma between energy security and energy transition faced by African policymakers have been proposed by academics and experts in the energy and climate change discipline. One very notable way to approach energy transition in Africa was proposed by Victoria R. Nalule in a chapter she authored in a book titled ***"Energy Transitions and the Future of the African Energy Sector: Law, Policy and Governance".*** Nalule introduces a term called "Energy Progression". The main difference between "Energy Transition" and "Energy Progression" is that with the former, there is an accepted

113 Victoria R. Nalule, Pauline Anaman and Theophilus Acheampong, 'Energy Transition and Africa's Oil and Gas Resources: Challenges and Opportunities' in Theophilus Acheampong and Thomas Kojo Stephens (ed), *Petroleum Resources Management in Africa: Lessons from Ten Years of Oil and Gas Production in Ghana* (Springer Nature Switzerland AG 2021) 542.
114 Ibid 546.

international pressure on states to act very rapidly to combat climate change. Some of these pressures come from groups of people such as climate change activists who are interested in witnessing a fast transition.

Pressure from climate activism groups grew to the extent that some climate protesters have been jailed in democracies such as the United Kingdom.[115] Again, governments, fossil fuel firms and airlines are increasingly being met with climate lawsuits.[116] The Intergovernmental Panel on Climate Change (IPCC) has described climate litigation as one of several important new methods through which climate policy is being shaped globally.[117] As at 2023, there were more than about 2,500 lawsuits recorded globally, according to databases run by Columbia University's Sabin Center for Climate Change Law.[118] Out of all these climate lawsuits, more than 50% of them "have direct judicial outcomes that can be understood as favorable to climate action".[119]

These activism and climate lawsuits mount significant pressure on governments and policymakers to hastily transition from conventional energy resources to renewable sources without considering the adverse effect this rapid transition will have on their citizens. The pressure to quickly transition to renewable energy is not only coming from climate activists but from multinational and international institutions such as the European Investment Bank (EIB) which approved a policy to ban funding for oil, gas and coal projects at the end of 2021. Since 2013, the EIB has funded 13.4bn euros of fossil fuel projects. This means the ban on the funding of fossil fuel projects will put a lot of pressure on government and leave them with no other choice but to transition to renewable energy in spite of the possible consequences of a rapid transition.

In the course of introducing the concept of "Energy Progression", Nalule makes the point that economies such as Europe underwent energy

115 A climate activist called **Stephen Gingell was** jailed for six months after pleading guilty to taking part in a protest on a London road. See: Damian Gayle, 'Just Stop Oil activist jailed for six months for taking part in slow march' *The Guardian* (London, 15 December 2023) <https://www.theguardian.com/environment/2023/dec/15/just-stop-oil-activist-is-first-to-be-jailed-under-new-uk-protest-law> accessed 7 March 2024.

116 See: Isabella Kaminski, 'The legal battles changing the course of climate change' *BBC* (8 December 2023) <https://www.bbc.com/future/article/20231208-the-legal-battles-changing-the-course-of-climate-change> accessed on 7 March 2024.

117 IPCC, *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (Core Writing Team, H. Lee and J. Romero (eds.), IPCC 2023) <doi: 10.59327/IPCC/AR6-9789291691647> April 22, 2024.

118 The Global Climate Change Litigation Database, See: <https://climatecasechart.com/non-us-climate-change-litigation/> Accessed on April 23, 2024.

119 Joana Setzer and Catherine Higham, *Global Trends in Climate Change Litigation: 2023 Snapshot*(Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science 2023).

progression instead of energy transition in the nineteenth century. According to Nalule, the focus for European countries in the nineteenth century was to shift from wood and water power to coal, in the twentieth century the focus was to shift from coal to oil and in the twenty first century the focus is to shift from fossil fuels to renewable energy. One main reason Nalule is calling for the introduction of "energy progression" into the dialogue of climate change in Africa is that with the anticipated industrialization and urbanization, African countries will need massive energy, including fossil fuels, to tackle their energy needs.

With energy progression, extra attention must be given to the energy access challenges on the African continent, the role of fossil fuels in industrialization, the role of fossil fuels in urbanization, and the role of fossil fuels in meeting the domestic energy demand from the anticipated population growth. In this respect, while advocating for clean technology to utilize fossil fuels, it is advocated that more funding must be provided to support African countries develop and capitalize their fossil fuels and their renewable energy resources at the same time. This does not in any way mean that African countries should not embrace renewable energy; there are already efforts to deploy renewable energy and energy efficiency technologies on the African continent.

NAVIGATING ENERGY AND CLIMATE: POLICY FRAMEWORKS FOR SUSTAINABLE DEVELOPMENT IN AFRICA

(A) Regional Corporation should be fostered to ensure a proper distribution of renewable energy across the continent.

Africa is endowed with enormous renewable energy resources such as solar energy, wind, geothermal, hydropower and biomass. However, these energy resources are unevenly distributed across the continent. In ECOWAS, 90–95% of hydrocarbon potential is found in Nigeria. At the same time a number of ECOWAS Member States have not been able to achieve even up to a 30% efficiency level regarding access to affordable energy services despite their enormous energy resource potential.[120] This distribution of energy resources across the continent becomes even more uneven considering South Africa accounts for about 95% of the coal reserves on the continent.[121]

120 Victoria R. Nalule, 'How to Respond to Energy Transitions in Africa: Introducing the Energy Progression Dialogue' in Victoria R. Nalule (ed), *Energy Transitions and the Future of the African Energy Sector: Law, Policy and Governance* (Springer Nature Switzerland AG 2020).
121 Ibid.

African states have been able to collectively enact the Agreement establishing African Continental Free Trade Area (AfCFTA). AfCFTA has a general objective to, inter alia:

> create a single market for goods, services, facilitated by movement of persons in order to deepen the economic integration of the African continent and in accordance with the Pan African Vision of "An integrated, prosperous and peaceful Africa" enshrined in Agenda 2063".[122]

Article 3 of Protocol on Trade in Goods of the agreement establishing AfCFTA provides that "the provisions of this Protocol shall apply to trade in goods between the State Parties" and the Protocol on Trade in Service. AfCFTA seeks to create free movement of both goods and services with minimal interruption.

Renewable energy, such as solar and wind, can be classified differently depending on the context. On one hand, the physical components—like solar panels and wind turbines—are considered goods that can be bought, sold, and installed. These are manufactured products that facilitate renewable energy generation. On the other hand, the energy generated from these components functions as a service, continuously supplying electricity to power homes, businesses, and other facilities. Thus, renewable energy can be viewed as both a good (the equipment) and a service (the energy produced).

African states should thus make the most of AfCFTA to remove some of the restrictions that might hinder the generation and distribution of their unevenly distributed renewable energy.

(B) Carbon offsetting and carbon credit should be adopted to enable African countries exploit conventional energy for a considerable time.
Carbon credits are traded in carbon markets, where entities that reduce their emissions below a set cap can sell their excess allowances to others. Holders of carbon credits can also offset their carbon credits against the GHG gases they emit into the atmosphere. African countries can strategically utilize carbon credits to balance the need for economic development and the gradual transition from fossil fuels to renewable energy.

Reducing the usage of hydrocarbons is the most effective proven way

122 See: <https://au.int/sites/default/files/treaties/36437-treaty-consolidated_text_on_cfta_-_en.pdf> April 22, 2024

of combating climate change.[123] But even if the world stops using fossil fuels, the already emitted GHGs will continue to cause climate change[124] and some activities cannot be made carbon-free.[125] Carbon credits, which are exchangeable certificates, are implemented to allow the owner the right to emit a certain amount of carbon dioxide, with one carbon credit representing a ton of carbon dioxide. Carbon credits are sold on carbon markets. Carbon stored in ecosystems can be quantified and can be sold as credits, which the buyer will then use to offset emissions.

Taiwan has exemplified the adoption of carbon credit mechanisms through its Greenhouse Gas Reduction and Management Act, which sets emission reduction targets and proposes a cap-and-trade system.[126] Similarly, Kenya has successfully implemented the Mikoko Pamoja mangrove conservation and restoration project. This project includes over a hundred nationally-owned mangroves. Credits from the project are managed by Plan Vivo through an agreement with the community itself and not the Kenyan Central Government. Each year, thousands of credits are sold and this has generated massive income for the community for school construction projects, purchase of books, and the installation of water pumps.[127]

African states should individually establish a robust legal and regulatory framework to govern carbon credits and their corresponding markets. Currently, the environmental policies and regulations of African states have a deficit in relation to carbon credits. African lawmakers and policy makers should as soon as possible develop comprehensive policies and legal frameworks that include carbon credits as a key component. They can implement laws similar to Taiwan's Greenhouse Gas Reduction and Management Act to set clear emission reduction targets and establish a cap-and-trade system.

African states are also urged to put in place an institutional framework which will create regulatory bodies to oversee carbon credit transactions

123 Philippe Sands, and others, *Principles of International Environmental Law* (3rd edn, Cambridge University Press2012).

124 IPCC, *Climate Change 2022: Mitigation of Climate Change Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (Core Writing Team, P. R. Shukla and J. Skea (eds), IPCC 2022).

125 Teresa Hartmann and Douglas Broom, 'What are carbon credits and how can they help fight climate change?' (*World Economic Forum*, 12 November 2020) < https://www.weforum.org/agenda/2020/11/carbon-credits-what-how-fight-climate-change/?DAG=3&gclid=CjwKCAjw-7OlBhB8EiwAnoOEky5VOhRf-M1iATFzoXBX11HjV7cDYXojwJO7fVw1KerqVb0VtDYhKwBoCdSgQAvD_BwE> Accessed on January 20, 2024.

126 Fortunato Costantino, *Report on international voluntary and compulsory carbon markets with special emphasis to mechanisms applied in case of carbon farming and potential opportunities for Ukrainian developers*(United Nations Development Programme 2022) 51.

127 Lindsay Wylie, Ariana E. Sutton-Grier and Amber Moore, 'Keys to successful blue carbon projects: Lessons learned from global case studies' (2016) 65 Marine Policy 76.

and ensure transparency and accountability. This will also ensure the alignment of the carbon credit policies with international standards and frameworks like the Paris Agreement.

To incorporate carbon credits into their legal framework, African states need to establish comprehensive regimes that addresses challenges related to environmental, social, and governance (ESG) issues, as well as political control over carbon credits. To ensure accountability and transparency, African countries should strengthen their data collection systems. Additionally, to address political challenges associated with carbon project control and equitable distribution of benefits, African countries should empower local communities to create and manage carbon projects. This decentralized approach, similar to the Bazi Bay community model,[128] would allow communities to generate revenue from carbon credits and invest in local development projects, avoiding unnecessary bureaucracy and potential disadvantages associated with centralized control.
By strategically utilizing carbon credits, African countries can balance the use of fossil fuels with the gradual transition to renewable energy. This approach not only helps mitigate climate change but also supports sustainable development and improves the quality of life for local communities. Establishing a robust legal framework, creating and managing carbon projects, leveraging international support, and integrating carbon credits with development goals are essential steps in this process.

(C) **The promising potential of critical minerals should be seized by African states in the course their energy transition journey**
There is no settled definition of critical minerals, however, it is widely accepted that minerals are considered critical minerals if they are scarce and yet are very significant to the economy in which they are found or deposited. The supply of these minerals is geologically limited making it scarce with the potential of becoming very valuable. Some of the minerals considered critical are metals and semi-metals such as lithium, copper, cobalt and nickel that are essential in the manufacture of necessary tools needed for energy transition such as wind turbines, electric cars and solar panels.[129] Metals including copper, lithium, nickel, cobalt, manganese, and graphite are extremely essential to energy transition. They are particularly necessary for "sustaining battery longevity, performance, and energy density of all-electric vehicles (EV) motors, solar panels, and wind

128 Newton Kanhema, 'How Kenyan coastal villagers are cashing in on carbon credits' *Africa Renewal* (19 January 2023) < https://www.un.org/africarenewal/magazine/january-2023/how-kenyan-coastal-villagers-are-cashing-carbon-credits> Accessed on February 6, 2024.
129 Ibid.

turbines."[130]

To put things into perspective, 200kg of seven different metals are needed to manufacture a typical electronic vehicle. Comparatively, only 35-40kg of metals are required to make a conventional car (internal combustion engine). The metals needed for a conventional vehicle come from only two metals. This means more metals are required to manufacture the products and tools needed to achieve a full energy transition. For instance, to manufacture solar panels which have the potential of 1 gigawatt (GW) power capacity, you need around 18.5 tons of silver, 3,380 tons of polysilicon and 10,252 tons of aluminium.[131] This illustrates the fact that more critical minerals in the form of metals and semi-metals are required for energy transition. Hence, any state or entity requires critical minerals to sustain its industries, particularly those involved in manufacturing products essential for energy transition.

Ghana is one of the leading countries with a commercial scale of critical mineral reserves. Ghana has a bauxite reserve which is estimated at 900 million tons.[132] With the right infrastructure such as roads and railways going to and from the mining sites, Ghana can produce up to 10 million tons of bauxite a year. Some other African countries are also heavily endowed with critical minerals. South Africa is responsible for 75% of the world's total platinum production. Other African countries such as DR Congo, Rwanda and Uganda are known for cobalt and copper production.[133] DRC for instance, is endowed with 70% of the global cobalt reserves and produced 100,000 metric tonnes of global 140,000 metric tonnes in 2019.[134] Niger is responsible for about 44% of the uranium supply in Africa.[135]

Since Africa is heavily endowed with critical minerals and energy transition requires critical minerals to have a shot at succeeding, Africa as a continent can contribute to the green revolution. Electric vehicles and its batteries cannot be manufactured without critical minerals. In fact, electric vehicles represent a US$7 trillion market opportunity between 2020 and 2030 and

130 Theophilus Acheampong 'The Energy Transition and Critical Minerals in Ghana: Opportunities and Governance Challenges' (Ghana Extractive Industries Transparency Initiative 2022) 15.
131 Ibid.
132 Moses Mozart Dzawu, 'Ghana signs $1.2 billion deal to develop its bauxite resources' *Bloomberg* (16 September 2021) https://www.bloomberg.com/news/articles/2021-09-16/ghana-signs-1-2-billion-deal-to-develop-its-bauxite-resources accessed on 6 November 2024.
133 Moses Mozart Dzawu, 'Ghana signs $1.2 billion deal to develop its bauxite resources' *Bloomberg* (16 September 2021) https://www.bloomberg.com/news/articles/2021-09-16/ghana-signs-1-2-billion-deal-to-develop-its-bauxite-resources accessed on 6 November 2024.
134 Ibid.
135 Moses Mozart Dzawu, 'Ghana signs $1.2 billion deal to develop its bauxite resources' *Bloomberg* (16 September 2021) https://www.bloomberg.com/news/articles/2021-09-16/ghana-signs-1-2-billion-deal-to-develop-its-bauxite-resources accessed on 6 November 2024.

US$46 trillion between 2020 and 2050. Therefore, African countries should give serious consideration to how they can create economic value-addition and establish domestic jobs from this growth. Africa can capitalize on this emerging sector created by energy transition to retain significant value domestically. This will enable African countries to simultaneously generate significant income and also contribute to climate change at the same time. Revenue from these resources could be used to finance renewable energy projects which are essential for the energy transition.

(D)_African states should capitalize on natural gas in order to ensure energy security for the Africa population without contributing to the factors that cause climate change:

Africa is home to 13% of the world's total natural gas while 40% of all the gas discovered worldwide between 2010 and 2020 was in Africa.[136] More than 5000 BCM of natural gas resources has been discovered to date in Africa that has not yet been approved for development. Natural gas has been recognized as an environmentally preferable product (EPP) for energy transition.

Basically, 'environmentally preferable' products refer to products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose.[137] Natural gas is an EPP because compared to coal and oil, it remains the cleanest, less polluting and most hydrogen-rich of all hydrocarbon energy sources. Furthermore, the increased injection of natural gas in the primary energy mix contributed to over 40% reduction in CO2 intensity of oil equivalent energy use in the period between 1980 and 2014.[138]

The African continent holds around 488 trillion cubic feet (TCF) of proven gas reserves.[139] These reserves are distributed across the African continent.[140] Since Africa is facing severe energy insecurity, Africa has to utilize every energy resource at its disposal while promoting energy transition at the same time. Given that natural gas is the safest fossil fuel with minimal contributions to climate change, Africa should shift its focus

136 Ibid.

137 UNCTAD Secretariat, *Environmental Preferable Products (EPPs) as a Trade Opportunity for Developing Countries*(UNCTAD 1995).

138 Wael Hamid A. Moati, 'The Contribution of Natural Gas to the Sustainable Development Goals (SDGs): Arab Countries Case' (9th International Forum on Energy for Sustainable Development, Kyiv, 14 November 2018). <https://www.unece.org/energywelcome/areas-of-work/forum/annual-fora/2018/session-sof-the-9th-ifesd/14-nov/the-role-of-natural-gas-in achieving-sdgs.html.> Accesed on May 9, 2024.

139 BP Plc, *BP Statistical Review of World Energy 2018* (67th edn, 2018) 26.

140 Somik V. Lall, J. Vernon Henderson and Anthony J. Venables, *Africa's Cities: Opening Doors to the World* (World Bank 2017).

from conventional fuels like oil and invest more in natural gas exploitation.

One African country that has put in remarkable effort in relation to the development and exploitation of natural gas is Ghana. Ghana has recently announced exploration and production licensing rounds in relation to natural gas. It has made considerable progress in developing its domestic gas reserves from recent discoveries such as in the Sankofa and Gye Nyame fields, Offshore Cape Three Points (OCTP) area, and the Tweneboah-Enyennra-Ntomee (TEN), etc.[141]

CONCLUSION

In contemplating whether Africa should abandon energy transition entirely, this paper underscores a nuanced stance: Africa should not forsake its commitment to energy transition but rather pursue a balanced approach that integrates its abundant fossil fuel resources with sustainable energy initiatives. The efforts of various African nations, such as Kenya's investment in renewable energy infrastructure, Nigeria's issuance of green bonds, and Ghana's Drive Electric Initiative, demonstrate the continent's dedication to addressing climate change and fulfilling obligations under the Paris Agreement.

There is rather the need for a dual strategy. African countries face a unique dilemma between energy security and energy transition. While global pressures push for rapid shifts to renewable energy, Africa's developmental needs and energy demands necessitate a more measured approach. As proposed by Victoria R. Nalule, the concept of "Energy Progression" provides a more suitable framework for Africa, allowing for a gradual and integrated shift from fossil fuels to renewable energy, much like the historical energy progressions seen in Europe.

To achieve a balanced energy strategy, African states must adopt comprehensive policy and legal frameworks. The paper proposes the following:

1. Regional Cooperation: By leveraging agreements like the African Continental Free Trade Area (AfCFTA), African nations can facilitate the distribution of renewable energy resources across the continent. This cooperative approach can help mitigate the effects of the uneven distribution of energy resources and enhance energy access and efficiency.

141 The World Bank, *Ghana Sankofa Gas Project: Environmental and Social Impact Assessment* (World Bank 2015) http://documents.worldbank.org/curated/en/364231468185978766/Ghana-Sankofa-Gas-Project-Environmental-and-Social-Impact-Assessment Accessed March 4, 2024.

2. Carbon Offsetting: Implementing robust carbon credit systems can allow African countries to continue utilizing fossil fuels while mitigating their environmental impact. Establishing legal and regulatory frameworks for carbon credits, similar to those in Taiwan and Kenya, can ensure transparency and accountability, promoting sustainable development.

3. Exploiting Critical Minerals: Africa's rich deposits of critical minerals, essential for manufacturing renewable energy technologies, present a significant economic opportunity. By developing these resources domestically, African countries can generate substantial revenue and support their energy transition efforts. Investments in infrastructure and value-addition processes will be crucial in maximizing the benefits from these minerals.

4. Natural Gas Utilization: Natural gas, being the cleanest fossil fuel, offers a viable alternative to more polluting energy sources like coal and oil. With substantial natural gas reserves, African countries can ensure energy security while minimizing environmental harm. Strategic investments in natural gas infrastructure, as seen in Ghana, can enhance energy stability and support economic growth.

Africa's approach to energy transition must balance immediate developmental needs with long-term sustainability goals. This dual strategy recognizes the importance of both fossil fuels and renewable energy in addressing the continent's energy challenges. By fostering regional cooperation, implementing carbon offset mechanisms, capitalizing on critical minerals, and utilizing natural gas, African countries can sustainably secure their energy future.

This balanced approach not only aligns with global climate goals but also supports the continent's socioeconomic development. It ensures that Africa remains an active participant in the global fight against climate change while addressing the pressing energy needs of its growing population. As Africa progresses in its energy transition journey, it can serve as a model for other developing regions facing similar challenges, demonstrating that sustainable development and energy security can go hand in hand. Also, this approach will enable the continent to harness its vast energy potential for the benefit of its population. It is crucial that African countries seize this opportunity to play a significant role in the global effort to combat climate change while securing their position in the emerging green economy.