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The Urgency of the Need for Energy Transition in Africa: A Case Study of Ghana

Dominic Kwesi Eduah, PhD.
Ghana National Petroleum Corporation

ABSTRACTS

Africa faces a critical energy challenge characterized by a heavy reliance on fossil fuels, limited electricity access — especially in rural areas - and underinvestment in renewable energy infrastructure. This paper examines the urgency of the energy transition across the continent, using Ghana as a case study. While nations such as Kenya and Ethiopia have advanced in their use of renewable energy, Ghana still relies heavily on fossil fuels due to challenges in infrastructure, national programs, and financing. Around 80% of the population in Ghana has access to electricity, but the disparity in the access of electricity between urban and rural areas remains an outstanding issue. This study paper calls attention to how the reliance on fossil fuels not only impacts energy security but also leads to Ghana's economic instability and environmental harm. The research paper suggests an actionable swift shift towards sustainable energy through heightened investments in renewable sources, the establishment of more robust policy frameworks, and enhanced energy efficiency to properly address this issue. For Ghana, effective strategies include broadening renewable energy capabilities, updating infrastructure, promoting private sector participation, and implementing regulatory reforms that offer support. A successful transition would foster inclusive economic development across Africa in addition to ensuring cleaner, more reliable energy.

Keywords: Energy, Transition, Africa, Ghana, Renewable.

INTRODUCTION TO THE ENERGY SITUATION IN AFRICA

Africa's energy situation is characterized by a lack of access to modern energy services, overreliance on fossil fuels, and limited investment in renewable energy sources, all of which have significant economic, social, and environmental impacts that necessitate a transition to a more sustainable and renewable energy system.

Nigeria is Africa's major oil producer and relies mainly on fossil fuels for energy production. However, Nigeria possesses considerable potential for harnessing renewable energy resources, including solar, wind, and hydropower. In Nigeria, access to electricity is still in short supply, particularly in rural areas of the country (IEA, 2020).

South Africa has one of the most advanced energy infrastructures in Africa, utilizing a diverse combination of energy sources, including coal, nuclear, renewable energy, and the like. Despite South Africa's growing shift towards renewable energy, the country continues to face challenges related to affordability, environmental sustainability, and energy security (Eberhard et al., 2021).

The republic of Kenya has made significant progress in expanding access to electricity, with electrification rates increasing from 27% in 2013 to 75% in 2020. Kenya also invests heavily in renewable energy sources, including geothermal, wind, and solar power (IEA, 2020).

Ethiopia has great potential in renewable energy sources, especially hydropower, and has invested heavily in this sector. The country is also leveraging other renewable energy sources, such as geothermal and wind power (Alemayehu et al., 2020).

Tanzania relies heavily on biomass for energy production and has limited access to electricity, particularly in rural areas. The country has notable potentials for renewable energy sources, specifically solar and wind power, and has made a notable effort to promote the development of renewable energy (Haji et al., 2021).

Regarding Ghana, it is worth noting that the country has significant potentials in renewable energy sources, including solar, wind, and hydropower, and has made efforts to promote its development. However, several factors still limit access to electricity, especially in rural areas (Kemausuor et al., 2018). It has been indicated by The World Bank that Ghana's transmission and distribution infrastructure is fragile and inadequate to meet the country's growing electricity demand. The World Bank noted that only about 80% of Ghana's population has access to electricity, and many rural areas still lack basic electricity infrastructure (World Bank, 2020). Rural areas of Ghana often lack the financial means to pay for electrical connections. The International Renewable Energy Agency (IRENA) revealed through a study that rural electrification is often financially unsustainable due to low population densities and high connectivity costs, which can be a barrier to private sector investment (IRENA, 2018). Rural areas in Ghana are less densely populated than urban areas, making it more expensive for power companies to expand their services to these areas. According to a United Nations Development Programme (UNDP) study, rural electrification is not a priority, as private investors tend to focus on urban markets (UNDP, 2020).

Again, many rural communities in Ghana rely on conventional energy sources, such as wood, charcoal, and kerosene, for cooking and lighting. This is due to high electricity costs and poor infrastructure in rural areas. The International Energy Agency (IEA) reports that more than 80% of Ghanaian households use biomass for cooking (IEA, 2019). Finally, the Government of Ghana has attempted to expand access to electricity in rural areas, but progress has been slow. The World Bank notes that the government has taken several measures to promote rural electrification, including the establishment of the Rural Electrification Authority and the introduction of feed-in tariffs to encourage private-sector investment (World Bank).

It is worth noting that Ghana heavily relies on fossil fuels for energy production (Kemausuor et al., 2018). According to the International Energy Agency (IEA), fossil fuels account for over 85% of Ghana's total energy utilization, with oil and gas being the primary sources of energy (IEA, 2019). There are several reasons why Ghana depends on fossil fuels for energy production. Ghana lacks adequate infrastructure for renewable energy sources, including solar, wind, and hydropower. To this effect, the country has had to rely on fossil fuel to meet its growing energy needs. Again, Ghana's population is growing, and so is its energy demand. The country's industrial and commercial sectors are also expanding, leading to an increase in electricity

demand. Fossil fuels are the most reliable and straightforward source of energy to meet this growing energy demand.

Additionally, Ghana has a firm infrastructure for fossil fuel-based energy production. Also, Ghana has many oil and gas fields and thermal power plants that rely on natural gas and diesel to generate electricity. These existing infrastructure assets have facilitated Ghana's continued reliance on fossil fuels for energy generation. Renewable energy projects often require significant upfront investments. This can be particularly challenging for countries like Ghana, which have limited financial resources. As a result, governments have been compelled to rely on foreign investment and aid to finance their limited renewable energy projects. It is worth noting that, despite Ghana's reliance on fossil fuels, the government has made efforts to promote renewable energy sources. In 2011, Ghana introduced a renewable energy policy aimed at increasing the share of renewable energy in the country's energy mix. The strategy aimed to reach 10% renewable energy by 2020, but the country failed to meet that target. Ghana has also introduced feed-in tariffs to encourage investment in renewable energy projects, but progress has been slow.

In general, the strength of the African energy situation lies in the region's vast potential for renewable energy sources, including solar, wind, and hydropower. The International Renewable Energy Agency has stated that Africa possesses some of the world's best renewable energy resources, and by harnessing this potential, we can reduce greenhouse gas emissions while increasing energy reliability. It can provide high and affordable energy (IRENA, 2021).

However, Africa's energy situation also has significant weaknesses, particularly in rural areas, where millions of people lack access to modern energy services. According to the International Energy Agency (IEA), approximately 580 million people in Africa lacked access to electricity in 2019 (IEA, 2020). Overreliance on fossil fuels, particularly coal and oil, is a significant weakness in Africa's energy situation, contributing to air pollution, climate change, and health issues.

THE NEED FOR ENERGY TRANSITION IN AFRICA

Given the energy situation in Africa, the energy transition is the right path. Energy transition is a shift from traditional fossil fuel-based energy systems to sustainable and renewable energy sources. This shift is crucial in combating climate change, reducing greenhouse gas emissions, and ensuring a reliable and affordable energy supply for future generations. The energy transition is a crucial step towards a sustainable future, providing reliable and affordable energy while reducing greenhouse gas emissions. The energy transition involves transitioning from traditional fossil fuel-based energy systems to more sustainable and renewable energy sources. This transition is a complex process involving politics, technology, and social innovation. The energy transition is crucial for addressing the shortcomings of Africa's energy situation and achieving a more sustainable and renewable energy system. The energy transition involves moving from traditional fossil fuel-based energy systems to more sustainable and renewable energy sources. This transition will reduce greenhouse gas emissions, boost economic development, and improve public health while providing a reliable and affordable energy supply.

Africa requires an energy transition for several key reasons. First, many African countries heavily rely on fossil fuels, particularly oil and gas, making them vulnerable to global oil price

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volatility and supply disruptions (International Energy Agency, 2020). Second, access to electricity remains restricted in most parts of Africa, especially in rural areas, and the existing electricity infrastructure is often inadequate to meet the continent's growing energy needs (International Energy Agency, 2020). Third, the use of fossil fuels to generate energy contributes to air pollution and greenhouse gas emissions, negatively impacting the environment and contributing to climate change (Amankwah-Amoah, 2020).

Regarding Ghana, the country needs an energy transition for several reasons. First, the country is heavily dependent on fossil fuels, especially oil and gas, making it vulnerable to global oil price volatility and supply disruptions (Amankwah-Amoah, 2020). Ghana is a net importer of oil and gas, relying on other countries for its energy needs. Ghana's oil and gas imports make up the bulk of its energy supply. Ghana imported more than 4 million tons of petroleum products in 2019, accounting for 65% of total oil consumption (U.S. Energy Information Administration, 2021). This reliance on imports makes Ghana vulnerable to fluctuations in global oil prices. Ghana has substantial oil and gas reserves, but its domestic production is limited. The country's oil production has declined in recent years, registering a 12.0% increase in 2020 due to the COVID-19 pandemic (Ghana Petroleum Commission, 2021). This restricted local production makes Ghana increasingly dependent on oil and gas imports, further increasing its vulnerability to supply disruptions. Ghana's heavy reliance on oil and gas for power generation is a result of its lack of diversification in its energy mix. Ghana has limited infrastructure for renewable energy sources, including solar, wind, and hydropower. This absence of diversification suggests that any disruption to the oil and gas supply chain could have a significant effect on the country's energy supply. Fluctuations in oil prices and supply disruptions worldwide can have a significant impact on Ghana's economy. Oil and gas exports constitute a significant portion of the country's export and government revenues. Disruptions to oil and gas supply chains can reduce export revenues and government revenues, impacting the economy as a whole.

Second, access to electricity remains scarce, especially in rural areas, and the existing electricity infrastructure is outdated and insufficient to meet the country's growing energy needs (Kemausuor et al., 2018). Ghana's current power generation capacity is insufficient to meet the country's growing energy needs. Ghana's population has surpassed 30 million, and the economy is expanding, necessitating increased energy to power industries, homes, and businesses. However, the installed capacity of Ghana's power plants is insufficient to meet the country's energy needs, resulting in frequent blackouts and load shedding. Ghana's power infrastructure is outdated and requires upgrading to enhance reliability and efficiency. Much of the country's transmission and distribution grid is outdated, leading to frequent breakdowns and power outages. Aging infrastructure also suggests that systems are less efficient at transferring power from the source to the end user, causing power loss along the way. Lack of investment in the power sector also contributes to Ghana's inadequate power infrastructure. Over the years, very little investment has been made in this area, resulting in a lack of funds to maintain and improve the existing infrastructure. Low levels of investment also limit Ghana's ability to build new power plants and expand its grid, thereby reducing access to electricity for more people.

Third, the country's reliance on fossil fuels for energy production has a negative impact on the environment, leading to air pollution and greenhouse gas emissions (Kemausuor et al., 2018).

The use of fossil fuels, including oil and coal, to generate electricity releases significant amounts of pollutants into the atmosphere, resulting in air pollution. Particulate matter, sulfur dioxide, nitrogen oxides, and other toxic gas emissions from power plants can have serious health consequences, including respiratory disease and cancer. Ghana's reliance on fossil fuels for power generation significantly contributes to greenhouse gas emissions, a major contributor to climate change. The country's energy sector, which primarily relies on fossil fuels to generate electricity, accounts for approximately 18% of the country's total greenhouse gas emissions. Furthermore, fossil fuel extraction, transportation, and processing have significant environmental impacts, including oil spills, water pollution, and land degradation (African Development Bank Group, 2021; Adu-Asare, Yaw, et al., 2020).

A shift to renewable energy sources, such as wind, solar, and hydropower, would reduce Ghana's dependence on fossil fuels, improve energy security and access, and decrease the country's carbon footprint, thereby contributing to these goals (Kemausuor et al., 2018; Amankwah-Amoah, 2020).

STRATEGIES TO ENHANCE AFRICA'S ENERGY TRANSITION PROCESS

Africa can improve its energy transition process by implementing a range of strategies, including increasing investment in renewable energy sources, promoting energy efficiency policies, and strengthening energy policy frameworks.

A key approach to enhancing the energy transition process is to invest in renewable energy sources, including solar, wind, and hydropower. This includes developing the infrastructure necessary to promote the deployment of renewable energy technologies and ensure the grid can integrate these energy sources. Additionally, efforts should be made to reduce the cost of renewable energy technologies and make them more accessible to a broader audience.

Another key strategy is to promote energy efficiency measures, such as improving building insulation, encouraging the use of energy-efficient appliances, and promoting the adoption of energy-efficient modes of transportation. These measures will help reduce energy demand and improve energy security.

Ultimately, African governments must work to strengthen their energy policy frameworks to support the energy transition process. This may include implementing regulatory frameworks that provide incentives for the adoption of energy efficiency measures, promote investment in renewable energy sources, and support the research and development of new energy technologies.

Regarding Ghana, the country has made significant progress in the energy sector in recent years, with a focus on diversifying its energy mix and promoting renewable energy sources. However, the energy transition still requires action. Ghana needs to develop actionable strategies to achieve the energy transition.

First, increasing investment in renewable energy sources, such as wind, solar, and hydropower, to reduce Ghana's dependence on fossil fuels is an activity the country needs to undertake. This includes developing policies and regulations to support investment in renewable energy sources, including tax incentives, feed-in tariffs, and other financial mechanisms. This

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encourages private sector investment in renewable energy and accelerates the deployment of renewable energy projects. It also requires capacity building within the renewable energy sector through training and education programs to support the development, implementation, and preservation of renewable energy projects. Again, Ghana needs to develop the necessary underlying structures to help the deployment of renewable energy technologies, like lines of transmission and energy storage systems, to ensure the consolidation of renewable energy sources into the electricity grid. Partnering with international agencies and donors to access both funding and technical support for renewable energy projects will help Ghana reduce its reliance on fossil fuels and improve investment in renewable energy sources such as solar, wind, and hydropower. Again, Ghana needs to promote energy efficiency measures by developing and implementing energy efficiency policies and regulations such as building codes, labeling schemes, and energy standards. In addition, Ghana needs to educate households, businesses, and government agencies about the benefits of energy efficiency and how to achieve it through behavior change, technology adoption, and design. Ghana should also provide incentives and financing options to encourage energy efficiency investments, such as subsidies, low-interest loans, and tax breaks for energy-efficient appliances and appliances. Capacity building in the area of energy efficiency is needed through training and development programs to support the development, implementation, and maintenance of energy efficiency measures. In addition, Ghana should strive to strengthen the energy efficiency market by developing robust supply chains for energy-efficient products and services while supporting the growth of energy service companies and other energy-efficient companies. These strategies will help reduce energy demand and improve energy security.

It is becoming increasingly important for Ghana to strengthen its energy policy framework to support the energy transition process. This includes implementing regulatory frameworks that promote investment in renewable energy, incentivize the introduction of energy efficiency measures, and support research and development of new energy technologies. The comprehensive development and implementation of energy policies that impact the entire energy sector, including generation, transmission, distribution, and transportation, are critical. Additionally, Ghana should promote private sector investment in the energy sector through policies that create a stable and predictable regulatory environment, including feed-in tariffs, tax incentives, and other financing mechanisms. Again, it must establish a regulator with the powers to implement and enforce energy policies and regulations, as well as to oversee the performance of all the participants or companies in the energy sector which serves as another major strategy for Ghana.

Additionally, Ghana needs to improve its energy storage infrastructure to facilitate the integration of intermittent renewable energy sources into the grid, thereby ensuring a stable and reliable electricity supply. This requires developing a comprehensive energy storage strategy that includes objectives, targets, and implementation plans for divergent energy storage technologies types, such as hydroelectricity storage, batteries, and pumped and stored thermal energy. In addition, Ghana should encourage the private sector to invest in energy storage infrastructure through policies that provide a stable and foreseeable regulatory environment, such as electricity tariffs, tax incentives, and other financial mechanisms. Furthermore, Ghana must conduct a thorough study of its current grid infrastructure to determine the best location and kind of energy storage facilities needed to allow the consolidation of renewable energy sources. It becomes important to establish regulatory

frameworks that allow energy storage technologies to enter the electricity market, such as providing clear rules for the transportation and payment of stored energy.

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