International Developmental Assistance and Catalyzing Renewable Energy Access and Emissions Reduction in Nigeria

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Abstract

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More than half of extremely poor Nigerians live in rural areas where the deprivation of access to basic social infrastructure such as access to reliable electricity is at its highest. About 140 million Nigerians, or around 71% of the population, do not have access to energy. Bridging Nigeria's energy deficits with a net zero target and lifting millions of Nigerians out of poverty requires enormous resources from diversified energy mix such from renewable energy and technical knowledge that cannot be sourced locally. Nigeria needs to explore encourage and maintain international bi-lateral and multilateral relationships as avenues to tap international development assistance in the form of aid and foreign direct investments for renewable energy. International development partners like the GIZ have worked in Nigeria since 1974, and operated country offices in Nigeria's capital since 2004. GIZ's projects have provided advisory services to enhance access to, use of, and investments in renewable energy, energy efficiency, and rural electrification in order to address the problem of irregular power supplies. This assistance includes the twin goals of increasing access to solar energy and to reduce carbon emissions. This thesis evaluates whether GIZ-supported efforts have increased access to renewable energy, and reduced carbon emissions. The research found out that GIZ investments have contributed indirectly to increasing renewable energy access in Nigeria between 2015 and 2022 with no evidence of carbon emissions' reduction.

Dedication

I dedicate this thesis to my late dad, Mr. Christian N.N. Amaefula, who, in the midst of family indigency saw the vision and provided my siblings and I with the direction to pursue education.

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I extend my deepest appreciation to my advisor, Dr. Geoffrey D. Dabelko. His mentorship, follow ups and insightful feedback guided me through the complexities of this research. To my esteemed committee members, Dr. Sarah Davis, and Dr. Thomas Smucker, I express my sincere gratitude for their invaluable guidance and constructive criticism for this thesis research. I am also profoundly grateful to Dr. Natalie Kruse Daniels for providing me with a graduate assistantship to support my study at Ohio University.

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Table of Contents

List of Tables

List of Figures

Chapter One: Introduction

1.1 Nigeria's Energy Poverty

Of the total 216.7 million Nigerians, 32% live in extreme poverty (World Data Lab, 2022). More than half of the extremely poor Nigerians live in rural areas where the deprivation of access to basic social infrastructure such as access to reliable electricity is at its highest (John, 2023). According to the World Bank, only 57% of Nigeria's population in 2021 has access to grid electricity. Various literature has given diverse opinion about energy deficit in Nigeria. For example, (Prosper Africa, n.d.) states that forty-three percent of Nigerians do not have access to grid electricity and most of those are in rural areas. Babalola et al. (2022) assert that approximately 38% of the Nigerian population lacks access to the national grid, and only 30% of the rural population has access to electricity.

Ajaja (2022) quantifies the population of Nigerian lacking access to energy when he reports that in Nigeria, 92 million people do not have access to power, which is the worst in the world. World Economic Forum quoted International Energy Agency by saying "According to the International Energy Agency, about 140 million Nigerians, or around 71% of the population, do not have access to energy" (World Economic Forum, 2023). Energy in this case is total energy and not limited to renewable energy but combination of energy for various uses, mainly electricity for lighting and other energy uses, but does not include energy for operating auto and air vehicles.

According to Sasu, (2022), in 2019, over 62% of Nigeria's population has access to electricity while the rural areas had the highest percentage of people without access to electricity. The bulk of households without electricity dwell in the North of the country, while the South has the lowest number. Figure 1 below show electricity access in Nigeria

in 2019, by area. Uzoho (2023) reports that Nigeria has been recognized as the country with the greatest number of people without access to electricity, with 86 million of its over 216 million population living without power as of 2021, according to a joint assessment by numerous international agencies. It stated that closing the power access gap, particularly for individuals living in poor and remote areas, would necessitate an annual rate of growth of one point per year beginning in 2021, nearly doubling the current rate. In comparing Nigeria with a sister African country, Uzoho (2023) stated that Nigeria is placed first in this survey, followed by the Democratic Republic of the Congo (76 million) and Ethiopia (55 million).

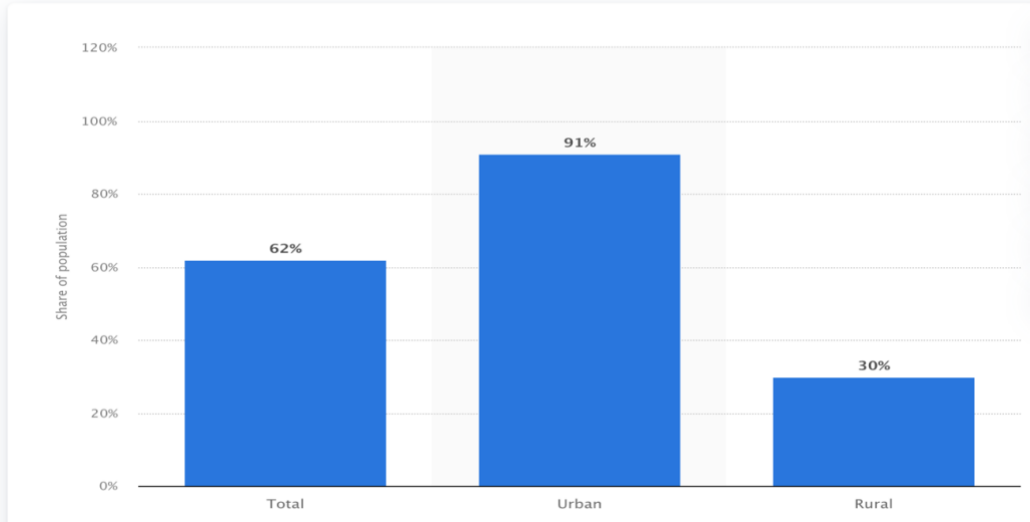

Figure 1: Electricity Access in Nigeria in 2019, by Area.
Source: (Sasu, 2022).

This shortfall makes Nigeria the country with the largest energy access deficit in the world (Nasir, 2021). Nigeria is a significant player in Africa and will have a significant impact on the future of the continent as its population is expected to treble to over 400 million by 2050 (Sasu, 2023). Nigeria has enormous resource potential for solar energy,

hydropower, and bioenergy (Brimmo et al., 2017). These energy resources would be essential to enabling economic growth, expanding the availability of modern energy services, and fostering sustainable development not only in Nigeria but also throughout Africa. A summary of the most important macroeconomic and energy system indicators is provided in Table 1 below. The data help to characterize the people and economy that the Nigerian energy system supports the country's energy policy decisions as well (NBS, 2020; SE4ALL, 2021; World Bank, 2021).

Table 1: Key Economic and Energy Sector Data for Nigeria

Indicator	2021
Population	213.4 million
Urban population	48% of total population
Land area (total)	923 000 square kilometres
Gross domestic product (GDP)	USD 441 billion (2021)
Per capita GDP	USD 2.450 (2021) per capita
Access to electricity (% of population)	60% overall (urban: 86%; rural: 41%)
Access to clean cooking technologies (% of population)	18%

Source: (Sasu, 2023)

With a population over 216 million, the Federal Republic of Nigeria is the most populous nation in Africa and has the continent's highest GDP (Olawole, 2020). In 2015, Nigeria's total final energy consumption (TFEC) was about 2.1 exajoules (EJ), or about 9% of the TFEC in Africa. According to Ley, Gaines, and Ghatikar (2015), traditional biomass and fossil fuels currently account for a large portion of Nigeria's energy production. Nigeria is the eighth-largest crude oil exporter and the world's 13th largest producer overall, (African Vault, 2015 and Investopedia, 2019). Figure 2 below explores the energy context of Nigeria in terms of how energy is currently used in each sector of the energy system. It also sheds light on recent key national energy policies that are shaping

the near-term expansion of the energy sector. These system and policies serve as the basis for the energy pathways examined in this research.

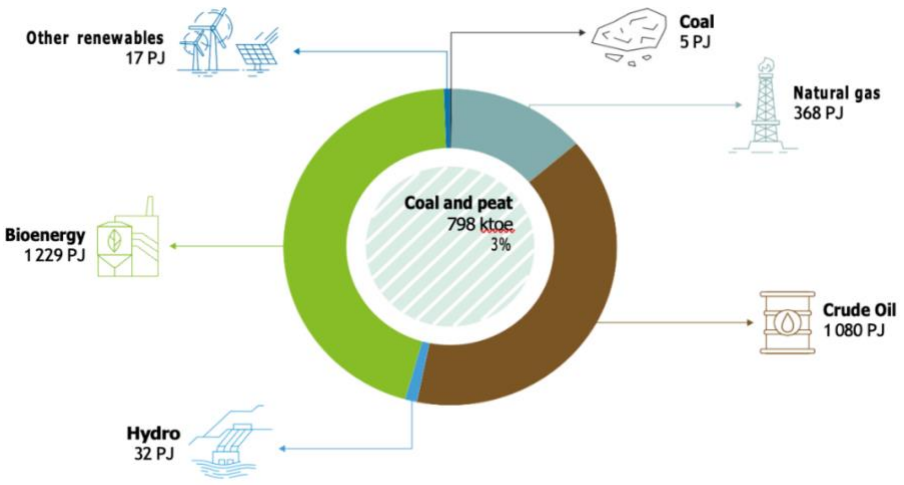

Figure 2: Nigerian Primary Energy Supply In 2015 Base Year
Note: PJ = petajoules. Source: IRENA (2023)

With renewables accounting for only 17 petajoules (PJ), it is an obvious indication renewable energy in Nigeria is still underdeveloped. These energy sources have significant potential to help Nigeria to achieve increases access to energy and carbon emission reductions.

The lack of reliable power is a significant constraint for the economy's growth and development as citizens and businesses in Nigeria experience an economic loss estimated at $26.2 billion annually as a result of poor electricity access (Nasir, 2021). According to a report by Heinrich Boell Stiftung Nigeria (2019), the functionality of basic public services and utilities such as better health services, access to water, education, agriculture, is dependent on access to steady electricity (Ede et al., 2019). Energy access has the potential to remove households from poverty. According to Diallo & Kouame Moussa

(2020), access to electricity has a beneficial and considerable impact on household consumption per capita. They infer that household consumption per capita rises by 5.2 to 23.3% when power is accessible. Hence, they conclude that a direct correlation between regional poverty rates and power availability rates does exist. This position also aligns with the findings of Okwanya & Abah (2018) that increasing energy consumption leads to a decline in poverty levels.

Since 2014, Nigeria's federal government has actively commissioned electrification projects through the Rural Electrification Agency (ITA, 2023). However, connection to the electricity network does not imply actual access to electricity supply in a reliable way. The 57% of Nigerians connected to the national electricity grid are largely met with poor unreliable electricity supply. Report by (Oxford Institute for Energy Studies, 2019) states that, annually, only 3,000-4,500 MW are accessible due to gas shortages, breakdowns, water scarcity, and commercial and grid constraints.

The shortcoming is because the current grid generation capacity is about 4,500 megawatts (as against an installed capacity of 12,000 megawatts). Total demand stands at around 35,000 to 40,000 megawatts. More than 80% of the actual power needs of on-grid consumers are met by using expensive diesel and petrol-fueled back-up generators (Yetano Roche et al., 2019). Given poor grid access, over 22 million small gasoline generators are used to power households and small businesses in Nigeria (Dalberg, 2019). Domestic and business consumers spend an estimated $14 billion yearly to power 14GW of small-scale diesel and petrol-generating units as a result of the insufficient availability of electricity. (Economic Confidential, 2022). Additionally, the Manufacturers Association of Nigeria (MAN) claims that 40% of the cost of conducting business in the nation is related to power generation. (Tunji, 2022). Beyond the economic cost of these fossil-fuel generators, these

generators are harmful to the health of the users. These generators are viewed as causing approximately 1,500 deaths per year from inhaling generator smoke and carbon monoxide; increasing the chances of lung cancer by 70% and causing hearing impairment in 2 of 3 users (Eweka et al., 2022). According to Dalberg, (2019), the World

Bank estimates that the use of fossil fuel generators contributes to more than 6.1 million metric tons of annual carbon emissions. Nigeria's energy shortage and poverty rates also help to explain why more than 21 million Nigerian households depend on traditional fuels such as firewood, charcoal, and kerosene for lighting, and heating, causing approximately 79,000 deaths annually, mostly women and children. (Clean Cooking Alliance, n.d.).

Chapter Two: Literature Review

2.1 Nigeria's Energy Mix

The IEA 50 report (2021) shows that total energy supply (TES) refers to all the energy produced in or imported into a country, less what is exported or stored. Total energy supply is also the total amount of energy available for all operations on the country's territory, with the exception of international aviation and maritime bunkers. It includes energy requirements for energy transformation (including the generation of electricity from combustible fuels), energy sector operations, transmission and distribution losses, final energy consumption (industry, transportation, households, services, agriculture, etc.), and the use of fossil fuel products for non-energy purposes, e.g., in the chemical industry (Eurostat, 2022).

It indicates the total amount of energy required to supply end users across the country. Some of these energy sources are used directly, while the majority are converted into fuels or electricity for final use. Energy production encompasses all fossil fuels that have been dug and mined and may be burned to generate electricity or used as fuel, as well as energy generated by nuclear fission and renewable power sources such as hydro, wind, and solar PV, as Nunez (2022) corroborates.

Bioenergy, which encompasses both modern and traditional sources, such as the combustion of municipal trash, is also a significant domestic energy source in many nations. In Nigeria, energy resources include crude oil, natural gas, coal, tar sand, and renewables (biomass, hydro, solar, wind, small and medium hydro power (SMHP), liquid hydrocarbons production (LHP) etc.) in the overall energy portfolio (Utazi, 2014). Crude oil and natural gas remain the dominant commercial energy sources, as they are the most developed source of fossil energy in the country (*Nigeria Energy Overview*, 2020). Also,

figures 3 4, 5 and 6 show the Nigeria's energy mix on Grid with 4.5GW in 2016, 9GW in 2019, 10GW in 2020 and projected 30GW in 2030 respectively.

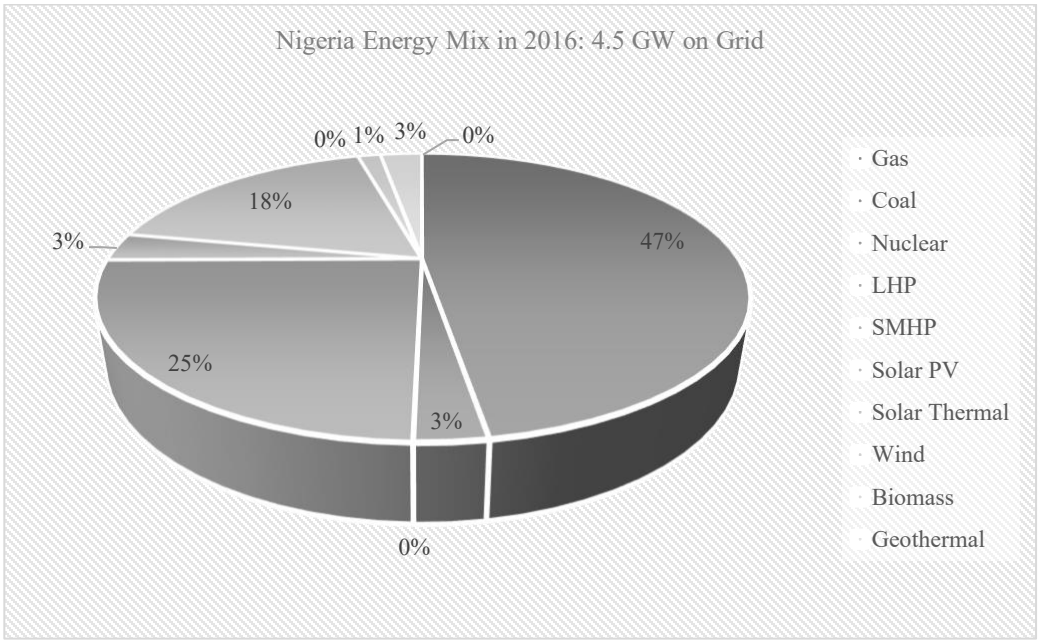

Figure 3*: *Chart of Energy Mix Available in Nigeria in 2016 With 4.5 GW on Grid
Source: (SE4ALL, 2015)

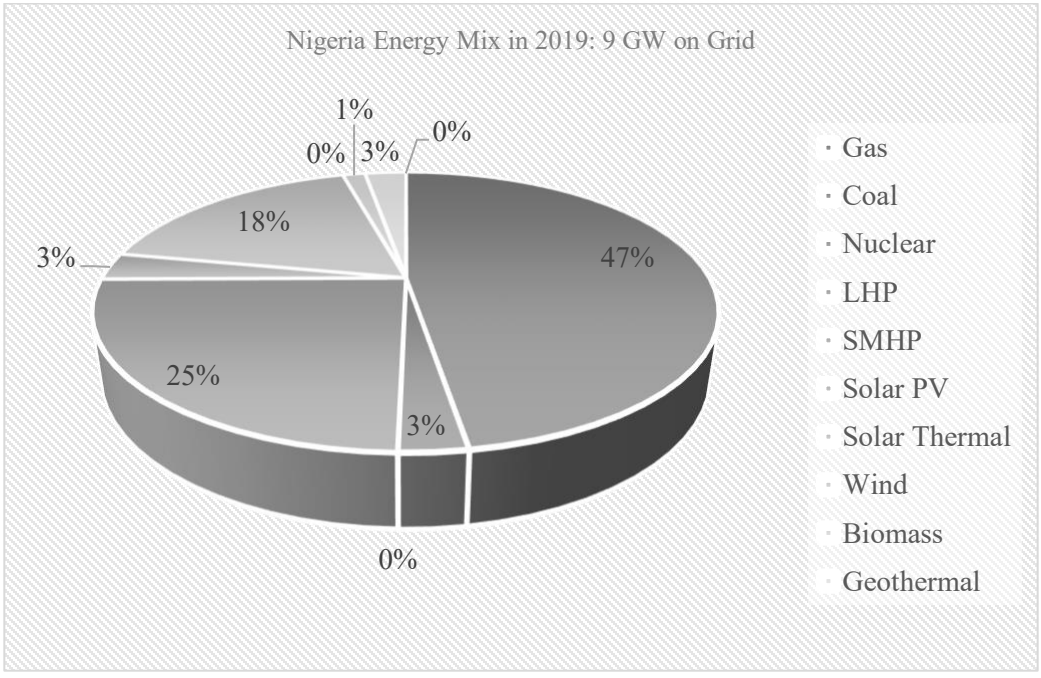

Figure 4: Chart of Energy Mix Available in Nigeria in 2016 With 4.5 GW on Grid
Source: (SE4ALL, 2015)

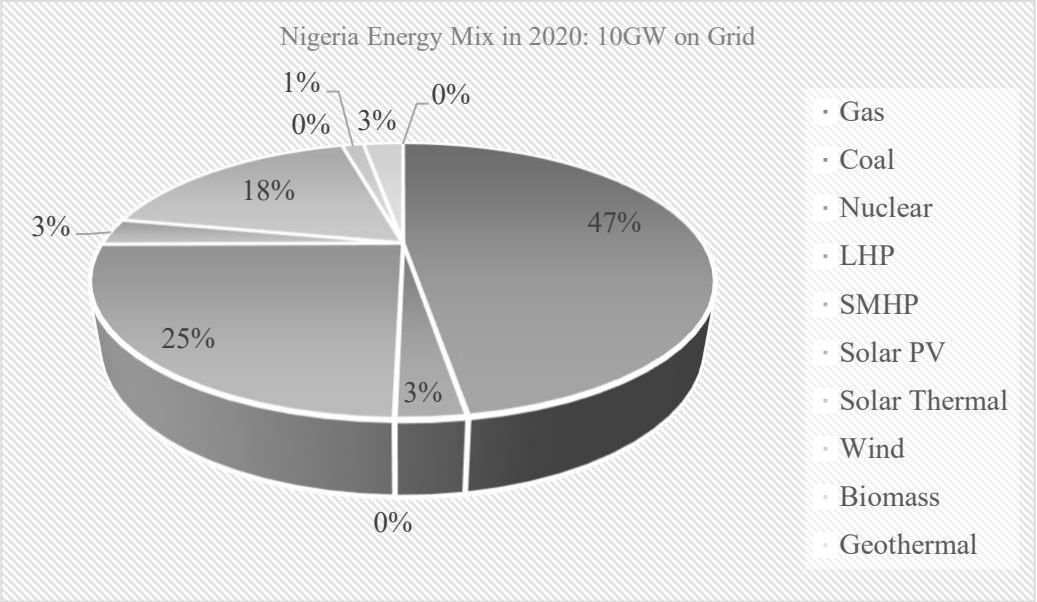

Figure 5**: **Chart of Energy Mix Available in Nigeria in 2016 With 4.5 GW on Grid
Source: (SE4ALL, 2015)

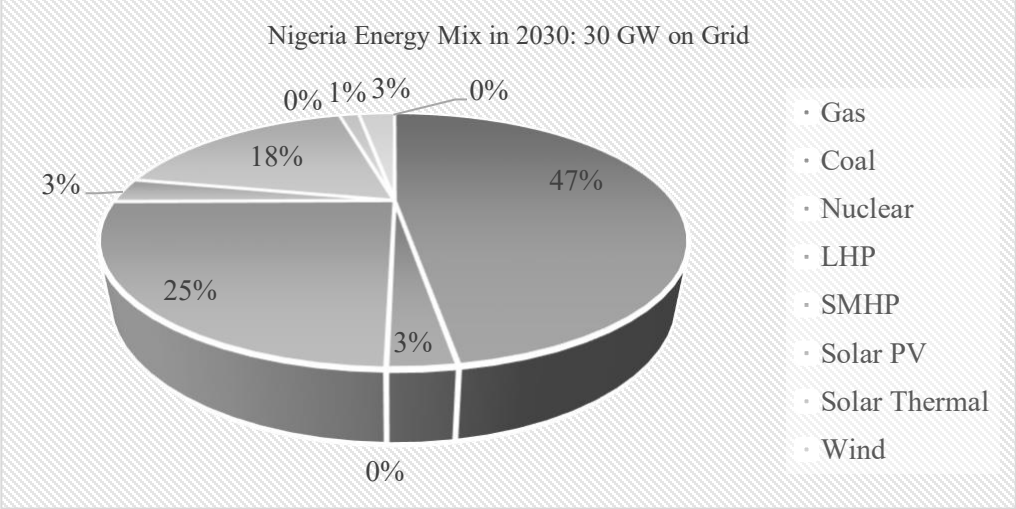

Figure 6**: **Chart of Energy Mix Available in Nigeria in 2016 With 4.5 GW on Grid
Source: (SE4ALL, 2015)

2.2 Advancing Renewable Energy in Nigeria

Nigeria has the potential to provide sustainable energy for its population by utilizing its plentiful, untapped renewable resources World Economic Forum, (2023b).

Nigeria has a rare opportunity to create a renewable-based sustainable energy system that promotes socioeconomic recovery and development, addresses climatic issues, and achieves energy security (IRENA, 2023). To avoid being trapped into long-lasting fossil fuel infrastructure investments like natural gas pipelines that exist in Nigeria, advancing the energy transition necessitates a shift and scaling-up of investments in the short term (IRENA, 2023).

Cozzi et al. (2022) said that the United Nations' Sustainable Development Goal 7 is to "ensure access to affordable, reliable, and modern energy for all by 2030," which includes universal access to electricity and clean cooking, increasing the share of renewables in the energy mix, and doubling the rate of improvement in energy efficiency. Renewable energy technology, ranging from wind and solar to hydropower, tidal, geothermal, and biomass, provide numerous environmental and economic benefits. By definition, they do not use fossil fuels, resulting in low or zero greenhouse gas emissions and pollution.

Other researchers have investigated German assistance for renewable energy transitions in different countries. They asked similar questions regarding German donors and energy transitions. Marquardt et al. (2015) discovered that initiatives in Morocco and the Philippines make it difficult to determine the impact of donor assistance for renewable energy transitions, though this support can raise awareness of alternative energy options. These findings are consistent with the challenge of determining whether the assistance generates improved access or reduced emissions in the Nigeria scenario. Donors have long promoted renewables in developing nations, but the link between isolated projects and energy system reforms is still not fully understood (Marquardt et al., 2015).

Investments in renewable technologies have the additional benefit of encouraging employment and economic growth, bringing the globe closer to a low-carbon economy (GEF, 2024). Nigeria is blessed with numerous renewable energy resources such as hydroelectric, solar, wind, tidal, and biomass, thus there is a need to harness these resources and create a new energy future for the country. In this aspect, the government is responsible for making renewable energy available and cheap to everyone (Oyedepo, 2012).

Renewable energy sources can meet over 60% of Nigeria's energy consumption by 2050, saving 40% on natural gas and 65% on oil (Iruoma, 2023), but when compared to projected energy policies, the usage of natural gas and oil is much less in 2050 This decline would have severe effects on infrastructure investments in fossil fuels and raises the risk of stranded assets. According to IRENA's research, between 2030 and 2050, renewable energy can supply 47% and 57% of primary energy needs in Nigeria, respectively. Since the amount of electricity in total energy consumption is expected to roughly double by 2050, electrification will be crucial in obtaining higher renewable energy supplies. Compared to the traditional route, investing in renewables will be more cost-effective.

2.3 Carbon Emission

According to the Nigerian Energy Transition Plan as shown in Figure 6 below, the total GHG emissions of Nigeria in 2020 is estimated at ~275MtCO2e, with 65% related to energy consumption and industrial processes. The power sector emitted approximately 48MtCO2e in 2020; Off-grid diesel/petrol generator use and on-grid gas combustion in power plants are the main sources of emissions in this industry. Cooking including urban, rural, and commercial cooking represents about 22% of the total emission with approximately 40MtCO2e from cooking with traditional fuels such as firewood, charcoal

and kerosene. Transportation represents about 24% of the total emission with 43MtCO2e (Nigeria Energy Transition Plan, 2022). This is depicted with figure 7 below:

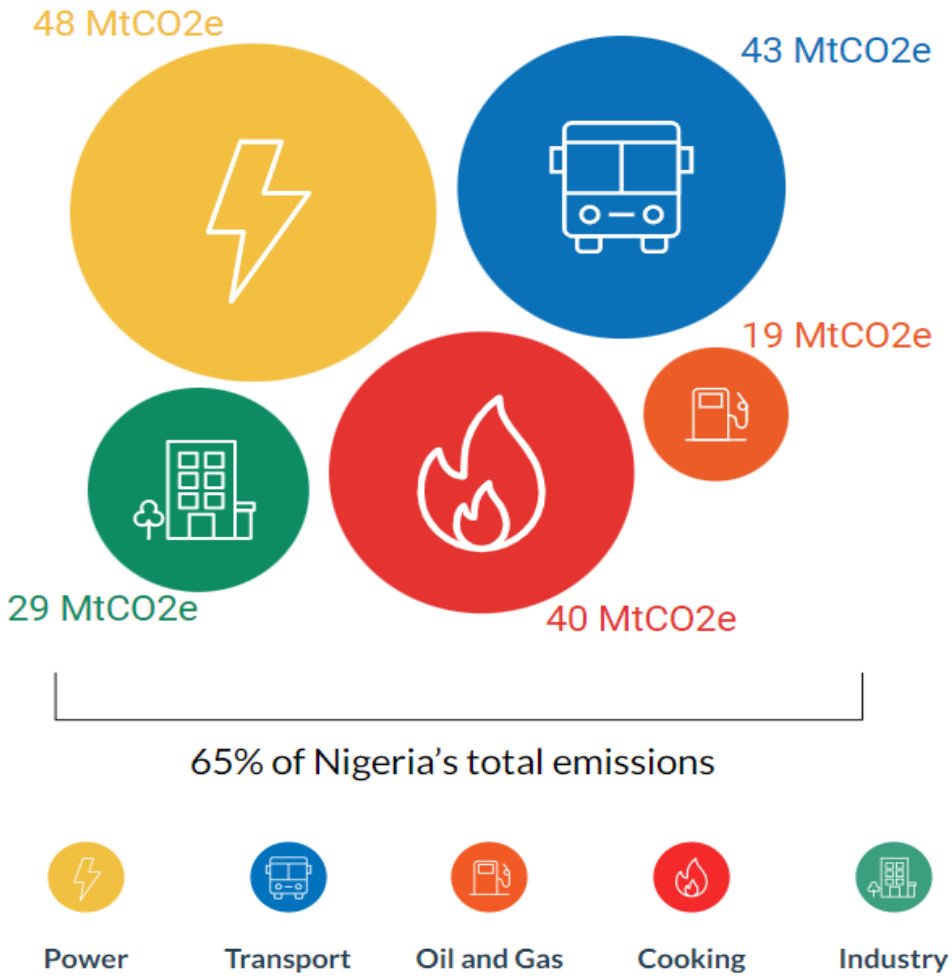

Figure 7: Nigerian Emission Rate Across Key Sectors in 2020
Source: Nigeria Energy Transition Plan, 2022.

The total carbon dioxide (CO2) emissions from the energy sector will rise from 119 million tons (Mt) in 2015 to 201 Mt in 2030 and 516 Mt in 2050, an increase that is more than three times faster than that (IRENA, 2023). The major contributor to CO2 emissions in the energy sector in 2015 was electricity production. However, due to the enormous expansion of the fossil-fueled transport system, by 2030 the transport sector overtakes all

other energy-related sectors as the largest producer of CO2 emissions, a position it is expected to hold until 2050 (IRENA, 2023). Transport emissions make up 47% of all energy sector emissions in 2030 and rise to 59% in 2050. The rapid expansion of renewable energy technology deployment in the power sector, which is cost-effective to install at scale even without additional incentives, can be ascribed to the fall in the percentage of the power sector in overall CO2 emissions from the energy sector.

The majority of greenhouse gas emissions that contribute to climate change are caused by energy, primarily by the use of fossil fuels. Mitigating climate change requires lowering the flow of heat-trapping greenhouse gases into the atmosphere. Despite attempts to cut emissions, global CO2 emissions remain far greater than what is required to avert the worst effects of climate change (European Environment Agency, 2023). The figures presented above are for CO2 emissions from fuel burning in the energy sector. They exclude other significant sources of energy-related greenhouse gas emissions, such as methane leaks from oil and gas activities, which are more difficult to quantify. The Greenhouse Gas Emissions from Energy Data Explorer provides more detailed estimates for most countries and areas (IEA 50, 2021).

2.4 Impact of Foreign Assistant/Aid on Clean Energy Access and Carbon Emission

Most of the significant worldwide concerns of the twenty-first century are connected to energy and an economical and stable energy supply is vital for any country's economy (US EPA, 2022). Energy, its availability, cost, emissions, and other effects have an impact on all of these issues, including the reduction of poverty, climate change, ecosystem management, global health, and security (AfDB, n.d.). Unfortunately, the way that energy systems are currently set up does not successfully help the world achieve the majority of its goals. Energy systems would need to undergo significant change in order to

contribute to the fulfillment of these objectives (such as stabilizing greenhouse gas emissions at levels agreed upon by the United Nations Framework Convention on Climate Change, assisting nations in achieving universal energy access by 2030, and improving energy security) (United Nations, 2022).

Foreign aid will unavoidably play a significant part in this endeavor, as it will be necessary to undertake this change on a global and cooperative basis. Global Government Forum, (2023) put this way; “Overseas development aid will also be critical in helping countries go to net zero through the construction of clean energy and other sustainable infrastructure”. In a world that is changing quickly, there is need to examine some of the difficulties faced by foreign aid to the energy industry as well as the adjustments it had made to remain relevant and efficient (Gomez-Echeverri, 2013).

Does foreign assistance/aid, energy access and carbon emission have a relationship? Sharma et al. (2019) examined the relationship between foreign aid, growth, remittances, and carbon dioxide (CO2) emissions using historical data from Nepal, one of South Asia's top receivers of aid. Examining this matter is especially crucial because policymakers in the least developed nations are becoming more and more worried about the growing dependence on energy imports, particularly fossil fuels, and rising CO2 emissions. Their empirical findings, indicate that the coefficient for foreign aid (AID) variable is found to be negative and statistically significant, suggesting that development assistance has helped reduce CO2 emissions Sharma et al. (2019). How does foreign aid lower CO2 emissions? To answer this question, one must look at that component of aid that is directed towards hydro- and solar-power generation, biogas, and environmental-awareness programs. Unfortunately, aid data are not available at that level of disaggregation for Nepal. However, the authors cited that - “approximately 70% of the total

population has access to electricity, of which 25% uses off-grid solutions such as solar and micro-hydro power." These projects are largely funded by the donor community and may have made some contribution to a fall in CO2 emissions, as the consumption of renewable energy (in tons of oil equivalents) surged from 64 tons in 2008–2009 to 166 tons in 2012–2013 and further to 292.49 tons by 2015–2016.

In conclusion, while financial development and higher income raise CO2 emissions, more foreign aid and remittances can decrease them (Sharma et al., 2019). These findings highlight the significance of market mechanisms for managing economic growth and increasing income in order to reduce CO2 emissions without compromising competitiveness.

Although it is argued that more assistance inflows have been linked to higher CO2 emissions in developing nations, there is no proof that aid has any impact on CO2 emissions in recipient nations (Kretschmer et al., 2013). However, there is mounting evidence that other factors, such as income level, better economic growth, trade openness, and financial development, as well as aid, also contribute to CO2 emissions (Zhang, 2011; Ozturk and Acaravci, 2013). But aside from Zhang (2011), Ozturk and Acaravci (2013), and Shahbaz et al. (2016), there is still a dearth of empirical evidence, particularly in the case-study approach that takes into consideration national characteristics. The majority of research that are currently available rely on cross-sectional data, which groups together nations with various characteristics and yields conflicting findings.

Mahalik et al. (2020) investigates the relative effectiveness of total foreign aid and foreign energy aid inflows on CO2 emissions in India over the period of 1978–2014. The results show that there is an important long-term relationship between the variables. It was observed from the thesis that foreign assistance inflows, globalization, and energy

consumption all considerably lower CO2 emissions. However, foreign energy aid was found to increase CO2 emission, when a large fraction of the aid is invested in fossil-based technology or foreign energy aid in clean energy is not translating to adoption in clean energy. Their finding recommends that the Indian government should put more emphasis on attracting overall foreign help than on attracting foreign energy aid in order to improve environmental quality. Given the potential for total foreign aid to influence India's environmental quality, one may argue that a larger portion of total foreign aid should be used to fund long-term investments in clean energy projects that will increase environmental sustainability for a developing nation like India. However (Ikegami, 2021) asked how much does energy aid reduce beneficiaries' CO2 emissions intensity?

H-Holer (2013) stated that it is possible to use foreign aid effectively for the conservation of the environment. However, there is still much space for improvement. His analysis also supported the idea that many renewable energy and efficiency initiatives in developing nations would not have been implemented without Official Development Assistance (ODA) and other types of development aid, leading to increased greenhouse gas emissions. A comprehensive and legally binding global environmental agreement for climate protection that reflects the UNFCCC principle of "our common but differentiated responsibilities" will be essential for effective and efficient climate change mitigation in developing countries, despite the recent rapid decline in the cost of renewable technologies. H-Holer, (2013) concluded that Future ODA levels reflect how determined the international community is to prevent harmful anthropogenic interference with the climate system.

Atteridge and Savvidou (2019) opined that, the majority of Small Island Developing States (SIDS) place a high premium on energy since it is entwined with social,

economic, and environmental issues. Islands also have a strong interest in the transition to cleaner energy because they are particularly vulnerable to the effects of climate change. Many SIDS experience heavy fiscal burdens associated with imported fuels; some have very low access rates to electricity; and many islands have very low electricity access rates. Atteridge and Savvidou (2019) also examined whether energy aid has increased in response to international commitments to help developing countries combat climate change and whether this is supporting renewable energy, whether finance has been targeted to different recipient countries based on either their income status or their rate of access to electricity and whether this rate has significantly increased over time, and whether financial commitments are actually being met.

They use the information on financial support provided to 37 SIDS reported by bilateral and multilateral sources to the Development Assistance Committee of the Organization for Economic Cooperation and Development, mostly for the period 2002–2016. Over 5700 energy-related transactions from 2002 to 2016 are included in their investigation. The World Bank's Open Data portal provides information on each nation's population and rate of access to energy. Although financing for oil-fired power plants and other non-renewables has not decreased since 2009, they have noticed a trend in favor of renewables, particularly solar power. On a per capita and overall basis, energy assistance is not distributed equally among SIDS (Atteridge and Savvidou, 2019). The allocations given to different nations and the income or energy access gaps have nothing in common, and among the nations with the biggest gaps, increases in power access have been gradual.

Low disbursement rates are also noted, which may indicate implementation issues. Atteridge and Savvidou (2019) conclude that to help SIDS overcome their substantial energy issues, it is urgently necessary to increase both the quantity and quality of aid.

Although the trend towards increasing funding for renewable energy is beneficial, its efficacy might be constrained by low disbursement levels and little support for enhancing local human and institutional skills.

Access to electricity in Africa continues to trail behind targets set in Sustainable Development Goal 7 of Affordable and Clean Energy despite recent improvements. Mbiankeu Nguea et al. (2022) used a panel data set spanning 36 African nations from 2000 to 2017 to examine how Foreign Direct Investment (FDI), remittances, and foreign aid affect access to electricity. The findings demonstrate the importance of FDI and remittances in boosting access to power. They also discover that although FDI and international aid widen the gap between urban and rural areas' access to energy, remittances do the opposite. The results from Mbiankeu Nguea et al. (2022) remain robust when they perform sub-regional analyses. The study did not have disaggregated data for foreign aid across 36 countries hence the proportion of foreign energy aid to the total aid is unknown. The findings when applied to energy specifically may have the shortcoming of impacts being most likely insignificant in areas where the larger volume of aid is often tilted towards health, agriculture and human right issues compared to climate. Thus, there is expectation of comparative equivalence or equality and possible inverse relationship between trends in overall foreign aid and energy access. Hence the need for more specific study on energy specific aid on more relatable data on energy access and emission reduction – climate change impact.

In their 2022 study, Munyanyi & Awaworyi (2022) look at how foreign aid affects energy poverty. They discovered that aid reduces the likelihood of energy poverty using data from Senegal's subnational aid program and data from five rounds of the Demographic and Health Surveys (DHS). Their key findings demonstrate a 3.3 % reduction in the chance

of being energy poor for residents who live within 25 kilometers of a renewable energy's aid project. This conclusion stands up to a variety of sensitivity testing. Additionally, they look at four possible ways that aid could affect energy poverty: income poverty, education, health, and economic growth. They discover that income poverty, education, and economic growth are all ways that aid can influence energy poverty. The study however did not use disaggregated data on foreign aid and specifics on the type of energy accessed by the sampled population so as to inform possible size in emission reduction.

For the least developed nations in particular, foreign aid and technology transfer are crucial tools for achieving the Sustainable Development Goals and supporting climate change adaptation and mitigation (UNSDGs, 2015). The key to increasing access to contemporary energy services and reducing climate change is the deployment of devices capturing renewable energy flows and efficiency improvements, which International Energy Agency (2021) outlines as a cost-effective and economically productive path toward a clean, dynamic, and resilient energy economy dominated by renewables such as solar and wind rather than fossil fuels. In Nigeria in particular, efforts are being made to initiate renewable energy programs into Nigeria's energy mix (Nigeria's Energy Sector, 2015). Nigeria's Renewable energy master plan 2005 (REMP) aims to boot electrification rates from 42% in 2005 to 60% in 2025 and 75% 2025, parallel to the overall rise in power supply from renewable energy sources. However, it is crucial to keep in mind that government has not yet approved REMP or turned it into legislation regulating the growth of renewable energy sources. Support for renewable energy, however, has until recently been considered as foreign aid's stepchild, and its effectiveness has been called into question (Rogner, 2013).

2.5 Statement of Research Problem

According to Federal Ministry of Finance and Budget and Planning, (2023), the United Nations Population Fund (UNFPF) has reported that by 2050, the Nigeria's population of over 216.7 million people will have increased to over 400 million people, rising at an average yearly rate of approximately 3%. The consequence of this rise would be evidenced in the widening of the country's energy deficits, rising carbon emissions, a deepening of extremely poor population and more emerging socioeconomic, political, and environmental conflicts. Deliberate collaborative efforts to increase the country's energy access in a manner that reduces carbon emission needs to be put in place urgently, and the Department of Climate Change, Federal Ministry of Environment, Nigeria, (2021) hoped this vision will promote sustainable development and provide climate-proofed economic development through multi-stakeholder engagement.

Nigeria accepted and signed the 2015 Paris Agreement, pledging to cut greenhouse gas emissions to keep global average temperature increase below 2°C (Federal Ministry of Environment, Abuja, 2021). It is developing its energy system in accordance with these objectives. Nigeria has vowed to unconditionally reduce emissions by 20% under a business-as-usual scenario by 2030 in its Nationally Determined Contribution (NDC) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in 2021. Nigeria revised its conditional reduction commitment, increasing it from 45% to 47% subject to adequate financial support, technological transfer, and capacity building. Also, Nigerian President Muhammadu Buhari vowed to reduce emissions to net zero by 2060 at the 26th Conference of the Parties (COP26) (IRENA, 2023). Against this backdrop, the Nigerian Energy Support Programme (NESP) offers guidance to the Nigerian government on how to effectively provide its citizens with sustainable electricity. NESP

accomplishes this through encouraging financial investments in energy efficiency, renewable energy, and rural electrification. This NESP is divided into four sections: policy reform and on-grid renewable energy, energy efficiency, rural electrification and sustainable energy access, and capacity building and training (NESP, 2015).

Nigeria's Renewable Energy Master Plan (REMP) seeks to increase the supply of renewable electricity from 13% of total electricity generation in 2015 to 23% in 2025 and 36% by 2030 (IEA, 2013). Renewable electricity would then account for 10% of Nigerian total energy consumption by 2025. The Renewable Energy Roadmap (REmap) estimates that producing roughly 178,000 megawatts of renewable energy by 2050 will cost an estimated $1.22 trillion (IEA/IRENA Renewables Policies Database, July 2013). These actions will be increasing clean energy access and also reducing emissions. It however depends on the adequacy and effectiveness of financial supports, technology transfer, and capacity building. These are categories of support the GIZ has provided for the Nigerian energy sector since 2013 (GIZ GmbH, 2015). These efforts require extensive scrutiny to extract lessons for replication and scalability for both the Nigerian stakeholders, international investors, and development partners, especially as Nigeria draws close to 2025 where it hopes to have secured 23% of renewable energy generation.

2.6 Funding Gaps and Call for Foreign Support

Energy efficiency and renewable energy are still underdeveloped in Nigeria. However, recent approvals of the National Renewable Energy and Energy Efficiency Policy (NREEEP) and the Vision 30:30:30, which calls for the installation of 30 Gigawatt by 2030 with a share of 30% renewables, represent optimistic policy developments (GIZ, 2021). Yet, about 55% of the populace do not have access to grid-connected electricity (GIZ, 2021). The percentage even reaches 60% energy deficit in rural areas (Weber, 2021),

which implies more energy poverty in rural areas than the urban areas. In recognition of these challenges and identifying rural areas as a priority for the growth and development of the country, the Federal Government of Nigeria in its Rural Electrification Strategy and Implementation Plan (RESIP) of 2016 set the ambitious goals of making reliable electricity available to 75 % of the population by 2020 and increasing this to 100% by 2040.

The Plan estimates that achieving the 2020 target of 75% electrification will require between $687.8 million USD and $1.09 billion USD and the cost of electricity service extension to rural households from 2020 to 2040 to be between $1.09 billion USD and $1.79 billion USD – an implied $54 million USD, to ($90 million) per year. To meet this enormous funding gap annually, the Electric Power Sector Reform Act (EPSRA) 2005 established the Rural Electrification Agency (REA). Under Section 88 (12) of the EPSRA, different sources of funds such as statutory remittances from the Nigeria Electricity Regulatory Commission (NERC), budgetary appropriations and grants, loans and technical assistance from international development financial institution (DFI) are to be channeled into the Rural Electrification Fund (REF) of the REA for the purpose of promoting and stimulating rural electrification schemes/programs through grid extensions, mini-grid and solar home systems (SHS) implementation. (Federal Ministry of Power, Works, and Housing, 2016).

Between 2017 and 2020, DFIs such as the World Bank, the African Development Bank and the European Union's Nigerian Energy Support Program (NESP) implemented by the German Agency for International Development (GIZ) have contributed in the form of technical and financial assistance to the rural electrification schemes in Nigeria to the tune of EUR15.3 million through the Mini-Grid Accelerator Schemes (MAS) and the Interconnected Mini-Grid Accelerator Scheme (IMAS). The MAS tender (EUR 12 million)

aimed to promote productive-use business models for mini-grids electrifying 21,000 connections including residential, public, commercial, and productive users at an affordable tariff. The IMAS is a nationwide non-site-specific open competitive tender (EUR 3.3 million), it targets developers who can build a sustainable business model to provide stable electricity to grid-connected but poorly served communities in Nigeria (a minimum of 15,000 customers).

However, with this international funding and technical assistance, the sector performance for renewable energy adoption in Nigeria seems to be rather slow and sluggish. For instance, figure 8 presents data from the World Bank on Nigeria's renewable energy electricity generations shows a trend of its declines at a rate of 1.1% dating back from 2011 to 2015 (World Bank, 2019).

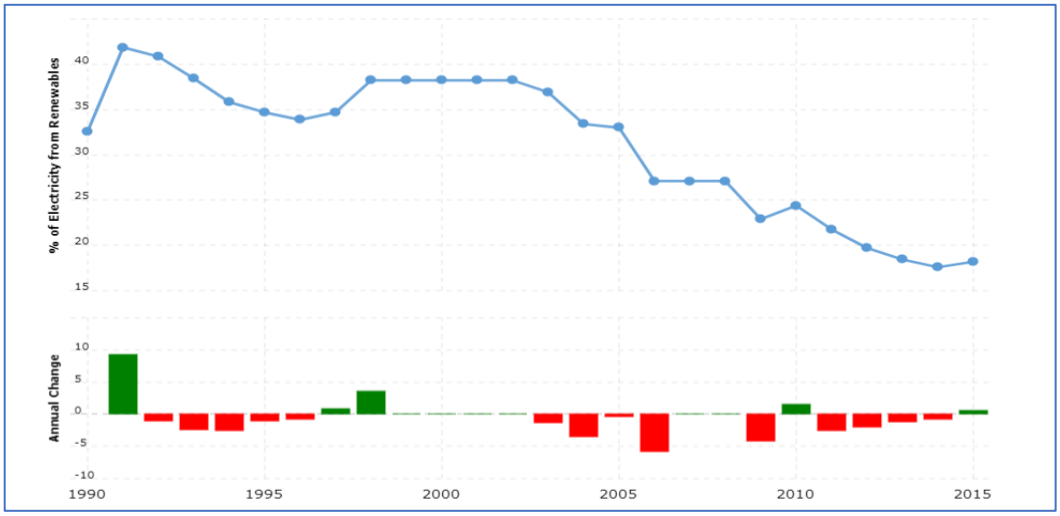

Figure 8: Nigeria Renewable Energy 1990-2023
Source: World Bank Development Indicator. 2023.

This poses questions as to their level of significance in improving energy access, reducing carbon emission and the challenges confronting the development partners in the renewable energy sector in improving energy access and carbon emission reduction in

Nigeria. Undoubtedly, Nigeria's environmental and social viability are threatened by both climate change and energy poverty and its energy status is awful and creates a significant dilemma (Nwozor et al., 2019). Nigeria is particularly susceptible to the consequences of climate change as a developing country with a fast-expanding population growth. In order to alleviate the serious effects of climate change and promote sustainable economic development, it is widely acknowledged that the Federal Government of Nigeria and development partners must take rapid strategic action.

Nigeria has pledged to attain net-zero emissions by the year 2060 at the COP26 United Nations Climate Change Conference in 2021 (Olurounbi, 2021). A massive and unprecedented switch from fossil fuels to renewable energy sources like wind and solar are necessary to achieve this, as is providing clean, affordable, and dependable energy for the almost 90 million Nigerians who currently lack it. The Nigeria's Energy Transition Plan (ETP), a locally developed, data-backed, comprehensive approach intended to jointly address energy poverty and the climate change challenge, has been launched by the Federal Government of Nigeria on August 24, 2022, to highlight the means of meeting the net zero target by 2060 (NIGERIA AGENDA 2050, n.d.). The main objectives of the ETP are:

1. Lifting 100 million Nigerians out of poverty and driving economic growth
2. Bringing modern energy services to the full population
3. Managing the expected long-term job loss in the oil sector due to the reduced global fossil-fuel demand
4. Playing a leadership role for Africa by promoting a fair, inclusive, and equitable energy transition in Africa that will include Gas as a “transitionary fuel.”
5. Streamlining existing and new government-related energy transition initiatives

The transition between 2021 and 2060 will cost approximately $410 billion in additional funding (and $1.9 trillion overall), (The National Council on Climate Change, n.d.) or an average of $10 billion each year throughout the course of the time to achieve net zero and achieve its goals. The Nigerian government is calling on international financiers, donors, and other development partners to contribute to the fulfilment of the Energy Transition Plan (SEforALL, 2021). The successful contribution of development partners in Nigeria's net zero journey will largely depend on the impact of the international development assistants in navigating the Nigerian peculiarities and delivering sound technical projects and programs that are translating into more energy access and a reduction in carbon emission.

2.7 GIZ's Renewable Energy Investments in Nigeria

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) works with developing nations, emerging markets, and industrialized nations to implement international cooperation for sustainable development. GIZ provides practical, long-lasting, and successful solutions for processes of political, economic, and social change. Current and future generations can only live secure and respectable lives, according to GIZ, if social responsibility, ecological balance, political engagement, and economic capability are all combined (GIZ & ECOWAS Country Brochure, 2021). In order to guarantee that partner country capacities grow over time and that project results are sustainable for the future generation around the world, GIZ collaborates with local partners to design learning processes and then implements them together.

Since 1974, GIZ has operated in Nigeria. It has field offices in 18 sub-national states in addition to its main offices in Abuja. As of December 2019, GIZ had 416 employees. It collaborates with the Nigerian government to explain, negotiate, and put into

practice its ideas for growth and reform. GIZ concentrates on boosting national organizations' and individuals' capacities. The German Federal Ministry for Economic Cooperation and Development (BMZ), the European Union, additional German Ministries, the German Foreign Office, Nigerian institutions, as well as global organizations like the Bill and Melinda Gates Foundation, commission GIZ to carry out work in Nigeria (GIZ & ECOWAS Country Brochure, 2021)

On behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) and with co-financing by the European Union (EU), the Nigerian Energy Support Program (NESP) is supporting the Nigerian Federal Ministry of Power (FMP) and other public and private partners to improve access to sustainable energy in Nigeria through series of programs and projects such as:

1. Project Development Program (PDP)
2. Supporting renewable sources of energy at universities in Nigeria
3. Development partnership with Schneider Electric
4. Nigerian Energy Support Program (NESP I)
5. Nigerian Energy Support Program II (NESP II)

According to the (GIZ NESP Factsheets, 2022), the NESP I (2013 - 2018) and NESP II (2017 - 2023) with budgets of €24.5 million and €48 million respectively, have activities focused on the following topics:

1. Policy Reform and On-Grid Renewable Energy: The program is supporting implementation of the Electric Power Sector Reform Act, while helping to improve the legal framework for investment in renewable energy. Key stakeholders in the sector are also supported to coordinate and harmonize activities.

2. **Energy Efficiency:** The program is contributing to drawing up strategies and standards for energy efficiency in accordance with international best practice, and to encourage implementation via support mechanisms and demonstration projects.

3. **Rural Electrification and Sustainable Energy Access:** This program supports a standardized approach at national level to planning and promoting rural electrification. Five federal states are being supported to produce electrification plans and develop a data management system. The electrification of off-grid villages, social facilities and small businesses are designed to demonstrate how renewable energy can contribute to providing electricity access to rural areas.

4. **Capacity Development:** Strengthening the capacity of organizations for training delivery is focus of NESP. The National Power Training Institute of Nigeria (NAPTIN) and other training institutes are being assisted to deliver a range of training courses on renewable energy and energy efficiency for engineers, architects, and technicians. Interventions will also train selected professionals of partner institutions and enhance capacities of the power sector as whole.

The NESP II focuses on supporting Nigeria in utilizing the potentials of energy efficiency, integrating renewable energy into the grid, and further scaling rural electrification. This renewable energy is often used as clean energy which Dayo (2008) summarizes as investment in ecologically friendly energy sources and technology. The overarching aim is targeted at the provision of reliable, affordable, and sustainable energy for the Nigerian people.

This support includes provision of energy to disadvantaged parts of the population that have not had access to modern energy services before. NESP II implements a multi-

level approach by combining advisory on energy policy, economy, and technical knowledge for a wide range of stakeholders. The NESP II components are tasked with:

1. Electrification planning and data assessment as a basis for policy reviews and to provide private sector market intelligence.

2. Improving access to sustainable energy (on- and off-grid) through strengthening regulations and systems operations regarding the feed-in of large scale solar as well as providing 130,000 people in rural areas with solar power.

3. Enabling an environment for investments in RE/EE through energy efficiency measures in buildings and industries, access to finance and quality standards the (GIZ NESP Factsheets, 2022).

There is a need for a publicly accessible analysis of the impact and experience of international development partners like the GIZ. The GIZ experience is particularly valuable in the context of larger questions about the utility of foreign aid to increase access and reduce emissions. GIZ's experience has led to knowledge and understanding about the challenges of the Nigerian renewable energy sector that should be analyzed. Lessons can also be learned from GIZ – as an international donor and partner working in Nigeria. In analyzing this thesis, the anticipation is to find out if GIZ efforts are improving clean energy access and cutting emissions. It also has the potential to inform other development partners on ways to design development supports in renewable energy and emission reduction, as well as inform foreign climate investors about climate finance tools options vis-à-vis clean energy access and emission reductions. Although not the primary questions under investigation, this thesis may also provide reflections on available work force and areas where technical support from international development partners can be channeled.

2.8 Research Questions

The Nigerian government has consistently had donations, grants, and loans from international development partners as a primary source of promoting and advancing renewable energy adoption in the country for increased energy access, emission reduction, job and skill creation and energizing economies, as seen in the country's Electric Power Sector Reform Act (EPSRA) 2005 and the Energy Transition Plan 2022 – 2060. Therefore, there is the need to evaluate the impact of international development assistance in the sector. The work of GIZ as it relates to renewable energy access and emission reduction provides a focused example of a foreign aid donor providing assistance towards these goals. Based on these, GIZ investments and plans with the Nigerian government, this thesis investigates two questions:

The specific questions of the study are:

1. Have GIZ investments increased renewable energy access in Nigeria between 2015 and 2022?

2. Have GIZ investments resulted in emission reductions in Nigeria between 2015 and 2022?

In order to help answer these two primary questions, this thesis will investigate how GIZ is providing financial support, technical transfer, and building local capacity in Nigeria; what is the size and type of foreign assistant provided by the GIZ to increase clean energy access and emission reduction in Nigeria between 2015 to 2022; what are the challenges confronting GIZ in the implementation of their support to Nigeria to increasing renewable energy technology and emission reduction; how is GIZ navigating through these challenges and how are the growing private sector players in the Nigerian renewable sectors responding to the support offered by the GIZ in the area of technical capacity

support and increasing financial access? These findings will enable further examination of critical questions for researchers and practitioners.

2.9 Objectives of the Research

1. To examine the impact of GIZ support programs on the capacities of growing renewable energy players in Nigeria; specifically, among members of key associations in the renewable energy sectors and ascertain how this has translated to increase clean energy access, and emission reduction.

2. To identify challenges in Nigeria that confronts the GIZ in the successful implementation of their clean energy and emission reduction project and programs, and efforts overcome the challenges.

3. Finally, to use the research to inform policy makers on how they can influence foreign aid to best address more support for renewable energy and emissions reduction in Nigeria.

2.10 Conclusion

In conclusion, though numerous studies have looked at the impact of foreign aid on clean energy access and emission reduction, a good majority of these studies depended on limited or unavailable disaggregated data on foreign aid and energy data. Many studies have simply used overall foreign aid data as a proxy in comparing the impact of aid on renewable energy access and emission reduction. In developing regions like Africa where the volume of energy aid, relative to overall foreign aid is most likely very small. The tendency may be to overestimate projected impacts. Hence, it is necessary to consider the impact of program specific impacts of foreign aid on energy access and emission reduction. Such program specific aid impact is largely missing in the literature. Thus, this thesis will help to address the gap.

Chapter Three: Methodology of the Study

3.1 Background

The thesis focused on the activities of GIZ Nigeria as regards to their support programs in the areas of renewable energy access and emission reduction in Nigeria. The thesis covered the periods of 2015 to 2022. The choice of this period is informed by the target period of Nigeria's Renewable Energy Master Plan (REMP), which seeks to increase the supply of renewable electricity from 13% of total electricity generation in 2015 to 23% in 2025.

Apart from the GIZ related program and the Nigerian government public expenditure on renewable energy, electrification with supports from the World Bank, and the African Development Bank, the GIZ funded, and implementation program remains one of the largest programs that supposedly laid the foundation for the implementation of most renewable energy programs in the country. Thus, this thesis reviewed GIZ efforts within the set policy period of 2015 and 2022.

The thesis employed qualitative data approaches, including both primary and secondary data for analysis. For the primary data, we employed both target interview. Key informant interview was conducted with GIZ program staff on their clean energy access program – NESP (at least one GIZ senior program person), top government officials of the Rural Electrification Agency (REA) and the Federal Ministry of Power. In response to the official letters and follows-up calls, GIZ remained committed to the thesis and promised to create time in a nearest future to conduct the interview as many of its officials were on the fields in the last 4 months. The Rural Electrification Agency (REA) was able to afford the thesis an interview in March 2023. Interviews were executed through virtual mechanisms (such as Teams and WhatsApp platforms). Secondary data were sourced from sector

regulations and laws, annual budget appropriations, off-grid development reports, journal publications, NERC reports, REA presentations, magazines, and related studies.

Qualitative data approaches included both primary and secondary data for analysis. This was primarily because the study's research questions necessitated an in-depth examination of a phenomenon, with the goal of generating responses from participants who have extensive expertise or are in a position to give accurate information about the subject (Winchester, 2016).

This study's application of qualitative research methods would enable the creation of meaning through the investigation, description, and discovery of potentially concealed discoveries (Wisdom and Creswell 2013). According to Wisdom and Creswell (2013), qualitative research is a type of study that avoids statistical analysis and instead uses inductive reasoning to interpret words, categories, images, or ideas. The creation of a comprehensive perspective of a phenomenon is typically hampered by the deep angle that qualitative research attains.

3.2 Sampling and Data Collation

For the primary data, I interviewed 4 relevant experts drawn from different sectors such as the international development partner, two different government officials and the civil society organization to ensure diversity of perspectives and avoid bias. Emails, letters, phone calls and WhatsApp messages were sent to 10 potential respondents from the selected relevant organization. The limitation to just 4 interviews was in part due to an unwillingness to participate in interviews and provide responses. One of the potential respondents from GIZ stated that they are an implementing agency and have to follow certain reporting standards and stated that their funders want them to use M&E data only

for particular reasons, suggesting the challenge of his inability to provide relevant response for this research.

The key informants were drawn specifically from GIZ program staff on their clean energy access program, top government officials of the Rural Electrification Agency (REA) the Federal Ministry of Power and a civil society organization from nonprofit as shown in Table 2.

Each interview lasted between forty and sixty minutes, with an average duration of one hour. Although my interviews took place between June and July 2023. I limited the scope of my interview questions to the years 2015–2022 in order to manage the research within the mapped timeframe. Since interview respondents were all based in Nigeria, the four respondents were interviewed via video conference through a virtual mechanism such as Teams and Zoom. To ensure anonymity according to approved IRB ethics, I coded respondents using the letter IR with an integer based on their index among all respondents. For instance, the code for the first interview respondent was IR1, the second was IR2, and so forth. I focused my interview conversations on the financial provisions and utilization between donor and recipient for analytical framework of energy access and emission reduction. I also covered other pertinent matters that have an impact on renewable energy access and emissions reductions in Nigeria. By using this method of gathering qualitative data, researchers can minimize leading question bias and obtain thorough, high-quality information from participants in a semi-structured interview setting. (Geddes et al., 2018).

Table 2: Interview Respondents

No.	Organization	Role	Date
1.	REA	Technical Adviser to the MD/CEO	March, 2023
2.	GIZ	Head, Sustainable Access (On-and Off-Grid), Deputy Head of Programs, NESP	June, 2023
3.	Civil Society Organization	Energy & Climate Specialist	October, 2023
4.	Federal Ministry of Power	Assistant Director, Renewable Energy and Access to power	November 2023

Additionally, I used government papers and sources to map the development of renewable energy policy in Nigeria. There were two phases to this research. In order to build a database that would serve as a guide for my empirical study of the evolution of renewable energy policy in Nigeria, I first carried out a thorough search for important laws, regulatory frameworks, and renewable energy policies. I looked through the websites of the GIZ, GIZ published reports, the Federal Ministry of Power (MoP), the Ministry of Environment (MoE), the Nigerian Electricity Regulatory Commission (NERC) reports, Nigeria's sector regulations and laws, off-grid development reports, journal publications and the Energy Commission of Nigeria (ECN) for information on Nigeria. These sources served as the secondary data. Secondary data can help save time, resources, and money (LexisNexis, n.d.). Obtaining secondary data is often less expensive than conducting your own research because you do not have to duplicate potentially costly research effort that is already available.

In analyzing data from the secondary sources, I examined the potential for energy transition in Nigeria by reviewing the extent of renewables in the electricity matrix. Secondly, I examined how energy policies have changed over time, paying particular

attention to how GIZ's frameworks and policy instruments have helped or impeded the adoption of low-carbon energy technology for a period between of 2015 to 2022. As a result, I evaluated the financing levers from GIZ influencing renewable energy projects using a thorough analytical approach, concentrating on energy access and possibility of carbon emissions reductions.

By examining additional peer-reviewed publications and official reports on the energy policy in Nigeria, I triangulated the database for the research. Second, by identifying the main goals of GIZ's renewable energy policy tools, like technical supports, and funding limits in Nigeria, I was able to synthesize the policies. In order to determine policy criteria and enabling conditions for promoting the clean energy transition and determine carbon emission reductions, I lastly reviewed the scientific literature that has already been published. I concentrated on the funding sources from GIZ's alone that are outlined in the background of the study.

3.3 Data Analysis

To provide a preliminary analysis of the data gathered, inductive coding was done line-by-line. As recommended by Williams and Moser (2019). Inductive coding is a qualitative research method that enables researchers to create categories, themes, and patterns from raw data without previous preconceptions or established categories (Solution, 2023). The application of an inductive coding procedure involved a top-down coding strategy which was applied to the transcripts from the conducted interviews. The primary aim for the code was to identify unique themes for categorization of the open coding phase, which was the first step. Axial coding was used at the second phase to further refine and classify each theme and derive unique sub themes and in order to isolate and condense codes that are pertinent to addressing the research. Axial coding is a more

concentrated and systematic analysis of data to determine links between categories and subcategories discovered during the open coding phase. Axial coding seeks to develop links and interconnections between concepts, investigating how they relate to one another and contribute to the entire phenomenon under consideration (UCONN, 2023).

The development of relationships within the codes produced was also made easier by the axial coding. Subsequently, themes were derived, and idea mapping was carried out to illustrate the connections among the data and the concepts that emerged from the codes. The codes and were used to analyze the research.

3.4 Validation

Data collected was validated using triangulation. Triangulation was carried out on data gathered to ensure that quality standards are met, and error is minimized in the data collation. The study used follow-up questions to explore and verify words not properly understood from interview transcripts. Triangulation is also carried out by combining participant observation such as from the civil society with responses from interviews (Fontana and Frey, 2000). Data gathered from interviews were compared and verified with published data such as reports from GIZ, NERC, MoP and REA report's opinion from media publications on energy access and carbon emissions in Nigeria. The next form of validation that was undertaken in the study was with two different participants. Responses from one participant particularly from the GIZ official was confirmed from another respondents from REA as both agreed that they are project partners. Selective coding which would have served for a superior themes' abstraction and theoretical expansion was precluded due limited sample size from interviewees.

3.5 Ethics

The Ohio University Institutional Review Board has approved this study (IRB #22-E-270). Every participant gave their informed consent upon presented with consent letter without signature. There was no payment or other incentive offered in exchange for study participation. Their participations were entirely voluntary.

The research maintains confidentiality and anonymity, particularly when sharing sensitive material and respondents were not put under any pressure to participate on the interview. For example, A contacted potential respondent from the international development partners such as GIZ declined to participate and sited illegible to provide information on the operations of the organization. The survey only published the institutions associated with respondents, not their names.

3.6 Delimitations

Though it was posited that there are several other international development partners providing funding and various other supports for renewable energy in Nigeria, this research focused only on the supports from the GIZ. Also, while it is discovered that GIZ is involved in other projects and interventions in Nigeria, this research limited his inquiry on GIZ's funding support for renewable energy.

3.7 Significance

Result will be shared with the practitioners in renewable energy sector. First, policy makers can use it to influence/leverage foreign aid to best address more support for renewable energy and emission reductions in Nigeria. The findings highlight the need of creating interactive, collaborative information transfer mechanisms, as well as cultivating relationships with policy decision-makers, practitioners, and politicians (Dobbins et al., 2007). The Nigeria policy makers at the energy sector can adopt the finding to better engage

the international developments partners in making requests of project implementations and evaluate their progresses in meeting set targets of energy renewable energy deployments and carbo emission reductions. Nigeria has been experiencing very slow growth in renewable energy production and energy transition. The rise of renewables in globally is not much evident in Nigeria, which poses a concern for the nation as a whole. This impeded progress toward government efforts to energy access, carbon emission targets and climate change mitigation.

The research outlines the specific policies impeding renewable energy growth, the stakeholders who contribute to it, and the solutions that can be implemented to change the situation. The findings also let the international development partners know if they are meeting targets of partnership's in fulfilling promise and pledges.

3.8 Limitations

Access for data collation for this research posed a challenge for this research. It was difficult to get in touch with prospective participants who participated as interview respondent (IR). Initial primary data gathering took place during the festive period and most of the participants had planned to travel for the season. The plan to travel to various locations in the study area to meet the interview was hindered by lack of funds.

Correspondence to potential interview respondents encountered unfulfilled promises of response. Another contacted respondent from the GIZ said "I am afraid I am not authorized to speak on this subject. I would think such enquiries should be made at our Country Office. However, I will ask my Head of Component and come back to you please. Sorry for my late responses as I have been away on an assignment." He did not respond as promised.

In addition, the bureaucratic bottlenecks affected participation from the government officials. Most of them expressed concerns about getting approval from the management before granting the interview as they were skeptical to provide what they called "organization's classified information". Expected feedback from the frequent email and WhatsApp communications for appointment were delayed, thereby extending the duration of data gathering for the research. Also, assigning only one delegate from an organization to respond to my interview limited sample size from each organization mapped for this research.

At last, it was difficult to access the responds in one period like in one month or even a period of two month, rather accessing them took several months apart from accessing each respondent from each participating organization, including the GIZ, Rural Electrification Agency (REA), Federal Ministry of power (MoP) and the Civil Society Organization particularly from a nonprofit who was mapped as neutral observer of renewable energy access in Nigeria.

3.9 Study Area

The study area for this research is the Federal Republic of Nigeria. Nigeria is a federal constitutional republic with 36 states and the Federal Capital Territory of Abuja. The country is located in West Africa, bordering the Republic of Benin in the west, Chad and Cameroon in the east, and Niger in the north. Its Atlantic shore goes along the Gulf of Guinea in the South (NESP, 2015b). This area was chosen due to relevant need based on hypothetical notion that international development organizations consider it politically, socially, and economical strategic for development but lacks adequate energy infrastructure for development. However, with promises of international development assistant for renewable energy, this research aims at investigating if those promises are met.

3.9.1 Geography

Nigeria is located in the West African area, between longitudes 3 and 14 degrees and latitudes 4 and 14 degrees. It has a land mass of 923,768 square kilometers. It is bordered to the north by the Republics of Niger and Tchad; to the west by the Republic of Benin; and to the east by the Republic of Cameroon, which extends all the way to the Atlantic Ocean, which defines the southern boundary of Nigerian territory. The country's 800 kilometers of coastline give it the potential to be a nautical force. Nigeria has a wealth of land suitable for agricultural, industrial, and commercial enterprises (Nigeria High Commission United Kingdom, n.d.). The country's geography varies from lowlands near the coast and in the lower Niger Valley to high plateaus in the north and mountains on the eastern border.

Abuja has served as the nation's capital since 1991. Nigeria is approximately 1,200 kilometers wide from east to west and 1,050 kilometers wide from north to south (NESP, 2015). The country's geography varies from lowlands near the coast and in the lower Niger Valley to high plateaus in the north and mountains on the eastern border. The country is divided by two major rivers: the Niger and the Benue. The ecology ranges from tropical forest in the south to savannah in the north, and finally to the sub-Sahel zone. The Federal Republic of Nigeria is divided into six geopolitical zones and 36 federal states. Map 1 below shows the physical map of Nigeria. It is a country with multi religious, multi ethnic and multi-cultural diversity.

3.9.2 Climate

Temperatures are very high throughout the country, with very little fluctuation in seasonal and diurnal ranges (22-36t) (Yusuf et al., 2017). There are two basic seasons: the rainy season (April-October) and the dry season (November-March). The dry season

begins with Harmattan, a dry chilly spell that lasts until February and is characterized by lower temperatures, a dusty and hazy atmosphere caused by North-Easterly winds blowing from the Arabian Peninsula across the Sahara; the second half of the dry season, February to March, is the hottest period of the year, with temperatures ranging from 33 to 38 degrees Celsius. The rainy season's extremes are felt on the southeastern coast, where yearly rainfall can reach 330cm, whilst the dry season's extremes, in aridity and high temperatures, are felt in the country's north third.

Rainfall has the greatest influence on weather in Nigeria, as most sections of the nation have two distinct seasons, wet and dry, with only the Jos Plateau experiencing mild temperatures due to its topographical relief (Climate Change Knowledge Portal, 2021). The rest of Nigeria has much greater temperatures throughout the year; it is also worth noting that temperatures fluctuate more within a single day than between seasons (Nigeria Weather, 2011).

3.9.3 Vegetation

There are two broad vegetation types: forests and savanna, which correspond to the rainfall distribution of a wetter south and a drier north (FAO, n.d.). Each has three versions, which run in nearly parallel bands across the country from east to west. Forests Savanna Saline water swamp Guinea Savanna Freshwater swamp Sudan Savanna Tropical (high) evergreen Sahel savanna. Rainforest. There is additional mountain vegetation in the remote high plateau regions of the country's far east (Jos, Mambilla, and Obudu). The savanna, particularly Guinea and Sudan, is the primary grain, grass, tuber, vegetable, and cotton producing region. The tropical evergreen rain forest belt supports timber production and forest growth, as well as cassava cultivation and fruit tree plantations such as citrus, oil palm, cocoa, and rubber.

3.9.4 Demography

Nigeria, with a population of over 200 million, is Africa's most populated country and the world's seventh most populous country (World Bank, 2019). According to the United Nations, one in every six Africans is Nigerian. It is a regional power, one of the "Next Eleven" economies, and a member of the Commonwealth. The present population density differs between Nigerian states. States in the northeast and northwest tend to be less inhabited. Lagos is the only state with over 1,171 individuals per square kilometer (World Population Review, 2023), with a population rate of 2,695 persons/km² and a total population of 9,113,605 in 2006. The population growth rate is expected to be between 2.5 and 2.7% per year for the next 20 years. Nigeria's population is projected to reach 310 million by 2035 (NESP, 2015).

3.9.5 Economy

Nigeria is Africa's largest economy, with a GDP of more than USD 500 billion that gradually rose to more than 7% per year between 2005 and 2014 (ISS/African Futures with AUDA-NEPAD, 2024). This expansion was mostly driven by non-oil sectors such as financial services, telecommunications, and entertainment. However, this growth has slowed in 2015 (Kay, 2014).

According to Nigeria is the world's 26th largest economy, and the largest in Africa (African Growth Institute, n.d.), where it is the leading oil exporter and has the most natural gas reserves. As a result of its 2014 rebasing effort, Nigeria's GDP almost doubled from US$270 billion in 2013 to US$510 billion in 2014, and its economy has become more services orientated (approximately 61% of GDP in 2016).

According to Ministry of Foreign Affairs, Headquarters - Abuja (2024), the Nigerian economy continues to suffer from inadequate diversification following the start

of commercial oil production in the late 1950s and the collapse of the young manufacturing sector in the mid-1980s. The top five economic drivers are agriculture, trade, oil and gas, information & communications, and manufacturing. These top five sectors account for over 70% of overall GDP (NBS, 2020).

3.9.6 Regional Contest

Davies (2029) describes Nigeria as the West Africa's economic and population powerhouse. It accounts for 55% of West African GDP, with Lagos having a higher GDP than Ghana (AfDB, 2020). Nigeria's rebased GDP ranks it as the greatest economy in Africa and the 26th largest in the world (Thomas, n.d.). Nigeria is a driving force on the continent thanks to its strategic and financial leadership in the Economic Community of West African States (ECOWAS). Nigeria is also a member of the West African Power Pool (WAPP), a specialized ECOWAS entity. The goal of WAPP is to ensure regional power system integration and the establishment of a regional electricity market. It includes both public and private generation, transmission, and distribution companies.

Chapter Four: Results

4.1 Introduction

This chapter presents the results from the data and discusses the progression and role of GIZ in providing funding supports to Nigeria for renewable energy. It uses the themes derived from the coded data to objectively analyse the data. It also shows the adoption of secondary data from relevant sources to support the data from the primary sources. The following text provides insights into the dynamics of international donor investments in renewable energy in Nigeria. By coding the text, I can identify essential parts, create a thematic code, and delve into overarching topics and subthemes to address the two relevant research questions about access to renewable energy availability and carbon reductions in Nigeria.

4. 2. The Bilateral Relationship and the Role of GIZ in Nigeria

Due the established bilateral relationship that exist between GIZ and Nigeria, the role of GIZ in Nigeria is not limited to provision of funding for renewable energy only. A respondent from the GIZ confirms that “bilateral relationship is essentially to provide technical and financial assistance to Nigeria on renewable energy, energy efficiency, rural Electrification, and e-mobility”.

Ngubane et al. (2021) reports that GIZ embarks on energy project in Nigeria through the Nigerian Energy Support Program (NESP) which is a technical assistance initiative co-funded by the European Union and Germany's Federal Ministry for Economic Cooperation and Development (BMZ). It is carried out by the (GIZ) in partnership with the Nigeria’s Federal Ministry of Power. The program's goal is to enable and encourage investments in the Nigerian domestic market for renewable energy, energy efficiency, and

rural electrification. GIZ catalyzes the renewable energy market to attract the necessary capital and investment.

Part of GIZ's assistance to Nigeria for renewable energy aims to improve access to financing for bankable renewable energy and energy efficiency projects. GIZ also aims at fostering investments in renewable energy and energy efficiency, as well as boosting access to electricity for poor rural populations. "We catalyze the renewable energy market to attract right funding and investment" says a respondent from GIZ.

4.3 Types of GIZ Assistance to Nigeria

Response from GIZ respondent indicated that GIZ carries out both technical and direct financial assistant to Nigeria. The GIZ respondent responded with "both" when asked the types of assistance that GIZ provides to Nigeria for renewable energy. Under the Nigerian Energy Support Program (NESP), development assistance from GIZ is not limited to providing direct funding for renewable energy projects and investments. Against this context, the Nigerian Energy Support Program (NESP) advises the Nigerian government on how to deliver reliable and sustainable electricity to its citizens. The NESP accomplishes this by encouraging investments in renewable energy, energy efficiency, and rural electrification.

4.4 Technical Assistance

The technical assistance program takes a multi-level approach, assisting federal government institutions with policy and regulatory frameworks, collaborating with state governments and distribution companies (DISCOs) on electrification planning, and working with communities and the private sector on concrete pilot projects. Capacity development and training are cross-cutting issues (NESP, 2015). The technical assistance is categorized into four components which include the following:

- Policy Reform and on-Grid Renewable Energy

The federal government enacted the 'National Renewable Energy and Energy Efficiency Policy,' which established explicit targets for renewable energy and efficiency. The Federal Ministry of Power formed a clean energy department and, with the assistance of NESP, is developing a competitive bidding mechanism for renewable energy projects. (NESP, 2015).

- Energy Efficiency

NESP developed a Building Energy Efficiency Guideline, which instructs architects on how to construct energy-efficient structures. A pilot project for solar water heaters is being developed at a boarding school in Jos. It will offer 1,000 pupils with hot water and demonstrate the commercial potential of solar water heating in Nigeria.

- Rural Electrification and Sustainable Energy Access

Rural Electrification and Sustainable Energy Access: NESP created a mini-grid regulation and helped construct the Rural Electrification Strategy and Plan. NESP established the Mini-Grid Business Accelerator Facility to electrify 10,000 people through mini-grid initiatives in the five partner states.

- Capacity Development and Training

NESP has created four training courses to promote skill development in the renewable energy market. The initiative has established a training partnership network consisting of 11 training academies and research institutions to deliver these courses. NESP has provided assistance to the National Power Training Institute of Nigeria (NAPTIN) in its organizational development process (NESP, 2015). Figure 9 below illustrates the four components of the technical assistance of Nigerian Energy Support Programme (NESP).

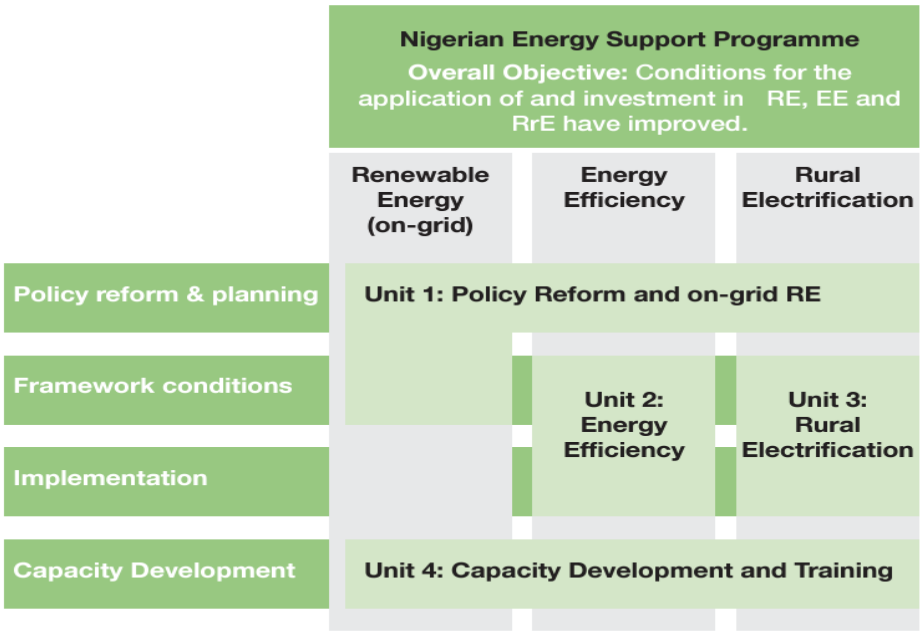

Figure 9: Nigerian Energy Support Programme
Source: GIZ NESP Report, 2015

While admitting "we go to international investment… Nigeria is the largest market in the world now in the energy sector", the respondent from the Federal Ministry of Power confirms the provision of technical assistance by GIZ for renewable energy in Nigeria. However, he disagrees that GIZ provides direct financial assistance for renewable energy access in Nigeria. "No, as I said, GIZ is a technical assistant program, so it is more into capacity development, but we as a ministry and government, we insisted that there should be one or two programs or projects" said the respondent from GIZ. Respondent from Rural Electrification Agency (REA) asserts that GIZ is just one of the international development partners that provide funding assistance for renewable energy in Nigeria. "Several international agencies provide funds and technical assistance to the Nigerian government for renewable energy projects, including the UK Infrastructure Advisory Fund, the World

Bank, the African Development Bank, the United Nations, and GIZ". "Over the past few years we've seen like an influx of financing, mainly in the mainly technical assistance, but also some elements of grants and as well from both", admitted by respondent from the civil society organization.

Responses from the REA official corroborates responses from the other respondents and the secondary data sources and confirms that GIZ provides technical support for various aspects of renewable energy projects, including feasibility studies, technical audits, and development of planning frameworks. "Technical Support means it will help you with the technical aspect carry out feasibility studies, develop an OBC (Outline Business Case) document." Support the developers directly with equipment dollars." GIZ respondent confirmed thus "yes, we provide in-kind grants mostly, which target direct equipment procurement for project implementation."

4.5 Direct Financial Assistance From GIZ for Renewable Energy in Nigeria

German Government and EU Bilateral intervention dated back to 1974. Since then, GIZ as an implementing partner has been supporting Nigerian Government with technical and financial assistance in many ways. GIZ has provided over EUR 75million covering technical assistance and project development. This financial assistance has occurred since 2013 (almost 10 years now). Response from GIZ shows that the current cumulative portfolio is over EUR 411million across 40 project/program interventions in the country. Major support for Renewable energy started in 2013 with EUR 24.5million. The respondent from the Federal Ministry of Power could not ascertain the exact amount provided to them by GIZ for renewable energy in Nigeria. "And I'm not sure of the total amount for that interconnected mini-grid, but it's something I can find out" responded by MOP staff. Chime (2021) reports that the NESP is a renewable energy project co-financed

by the EU and the German government, carried out by the GIZ and the Federal Ministry of Power.

It seeks to promote investments in renewable energy in Nigeria and improve access to electricity for underserved rural populations. Figure 10 shows a graphical representation of provided funds for renewable energy in Nigeria. The plan was initially funded with 20 million euros, and with the latest award, the total financing now stands at EUR 35 million from the EU and EUR 13 million from the German Federal Ministry of Economic Cooperation and Development (BMZ). Chime (2021) admits that specifically, "EUR 13 million from the German Federal Ministry of Economic Cooperation and Development (BMZ) is provided for renewable energy investment in Nigeria."

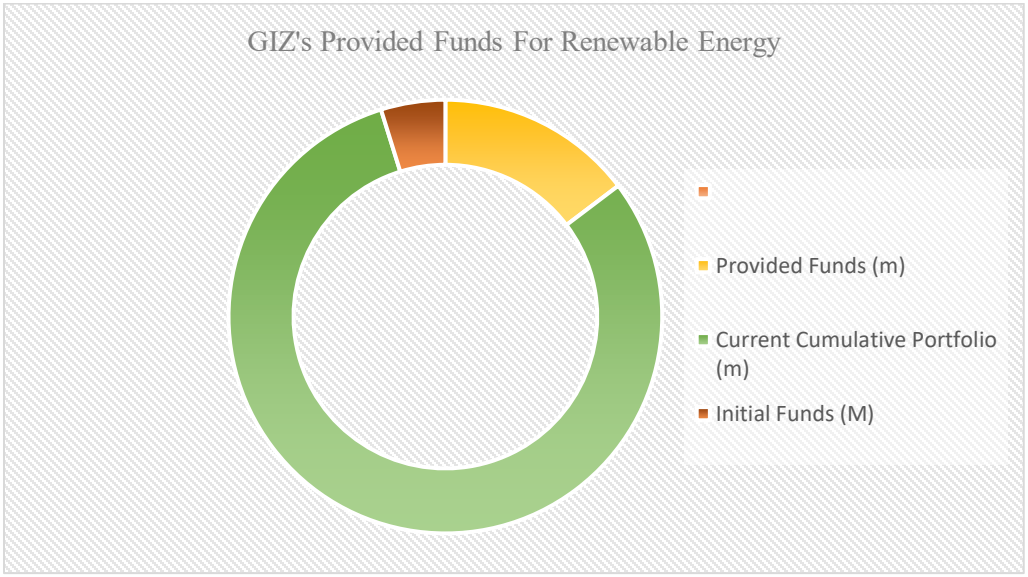

Figure 10: Provided Funds from GIZ for Renewable Energy in Nigeria
Source: GIZ, 2019

4.6 Recipients of Funding Allocation From GIZ

GIZ's targets the federal government, state government, local government, or non-government organizations for development assistance in catalyzing renewable energy in Nigeria. Response from GIZ official states that "all" receive assistance from the GIZ. GIZ (2019) reports that the Nigerian-German Energy Partnership (NGEP) has created an economically feasible way of electrifying Nigerian institutions with solar power. The German Federal Foreign Office coordinates the bilateral commission between Nigeria and Germany, which includes NGEP. This model provides access to clean, affordable electricity while allowing for a combination of private and public funding. It specifically mentions that "The University of Ibadan is one of the prototype initiatives. From there, the integrated expert will find additional Nigerian universities where the solar electrification approach may be implemented and create a feasible business model". This is an indication that GIZ provides development assistance for renewable to academic institutions in Nigeria. NESP (2015) reports that technical assistance program takes a multi-level approach, assisting federal government institutions with policy and regulatory frameworks, collaborating with state governments and distribution companies (DISCOs) on electrification planning, and working with communities and the private sector on concrete pilot projects. University of Ibadan is the recipient of assistance from GIZ as a primary target with no mention of specific amount for the project. The project is under the project of scaling up of universities in Nigeria between December 2017 to August 2020. GIZ'S NESP project also implemented their projects in some states in Nigeria which serve as pilot with a provided funds to the tune of EUR 24.5m. The project is stipulate for a period of 5 years. While with the funding budget of EUR 48, the NESP projected partnered with the Nigeria's Federal Ministry of Power (MoP) as shown by Table 3 below.

Table 3: GIZ NESP Program with Federal Ministry of Power

Project Name	Nigeria Energy Support Programme (NESP)	Nigeria Energy Support Programme (NESP) II
Funded By	European Union and GIZ	European Union and GIZ
Region	Nigeria	Nigeria
Budget	EUR 24.5million	EUR 48 million
Beneficiary Institution	Federal Ministry of Power and partner institutions	Federal Ministry of Power and further partner
Partner States	Sokoto, Niger, Plateau, Cross River and Ogun	
Duration	March 2013 -February 2018	December 2027-May 2023
Lead Executing Agency		GIZ

Source: GIZ NESP Report, 2015 and 2021

GIZ, (2022) reports that the lead executing agency are the Federal Ministry of Budget and National Planning and Federal Ministry of Power. Rural Electrification Agency (REA) admits they receive development assistance from the GIZ. Response from the civil society organization precludes receiving direct assistance from the GIZ for renewable energy in Nigeria, but admits GIZ works with Nigerian government ministries, departments, and agencies (MDAs). However, GIZ respondent states that GIZ competitively select private sector that they provide funding assistance for renewable energy in Nigeria.

4.7 Implementation and Monitoring

In implementing renewable energy in Nigeria with development assistance from the GIZ, (GIZ, 2021) reports that "in 2013, the European Union and the German Federal Ministry of Economic Cooperation and Development (BMZ) co-funded the Nigerian Energy Support Programme (NESP) to encourage investments in renewable energy and energy efficiency, as well as increase access to sustainable electricity.

Through the NEST 11, The approach of GIZ in implementing renewable energy access in Nigeria is in assisting Nigeria in realizing the benefits of energy efficiency, incorporating renewable energy into the grid, and expanding rural electrification. The overarching goal is to provide reliable, inexpensive, and sustainable energy to the Nigerian people. This includes providing energy to disadvantaged segments of the population that previously lacked access to modern energy services. NESP II takes a multi-level strategy, providing guidance on energy policy, economics, and technical knowledge to a wide range of stakeholders.

Interview response form GIZ staff indicates that they also conduct post-project monitoring to ensure project delivered on their promises. “We’ve created a central data monitoring system to track performance of the projects. GIZ collaborates with Nigerian authorities to implement renewable energy projects, including the development of planning tools and databases to identify and plan initiatives effectively” said the respondent from GIZ. This serves as part of the means they deploy their development assistance in implementing renewable programs in Nigeria. Rural Electrification Agency (REA) admits collaboration with sponsors such as GIZ and the Power Africa-Nigeria Power Sector Program to implement innovative business models. For example, REA is collaborating with GIZ to establish an interconnected mini-grid. As part of this effort, the REA is collaborating with the regulator, NERC, to amend the present mini-grid laws, raising the barrier for these mini-grids to 5MW from 1MW. This will encourage further investment, particularly from major clean energy providers (Okoro, 2023). In addition, the interview response from REA respondent states “So we used it to incentivize private sector investment in renewable energy technology”. "It supports us in the work to develop the framework for the project and see how we can have access to the database, and it helps us

in identification and planning and implementation of our projects" says the respondent from REA.

4.8 Project Duration

Implementing renewable energy in Nigeria with provided development assistance from GIZ is planned with stipulated timeline. Though GIZ' has longstanding support to Nigeria since 1974, they have a focused approach to renewable energy from 2013., said the respondent from GIZ. Implementation and monitoring are joint efforts with the Federal Government, private sector involvement, and post-project monitoring. The ongoing NESP III phase is spanning from 2023 to 2026.

Responses from the interviews have different timelines for the implementation of renewable energy in Nigeria with provided funding assistance from the GIZ. Respondents from GIZ and REA admitted that Nigerian Energy Support Programme (NESP) started from 2015. “The partnership between GIZ and Nigeria spans back to the initiation of the Nigeria Electrification Support Program (NESP) around 2015. "Back when the NESP started around 2015", said respondents from GIZ and REA. The REA respondent also admits that they actually started the third phase of the projects which will help in assisting in unlocking the potentials in the renewable energy and energy efficiency sector by bringing in investment." This statement did not specify the project timeline.

Interview respondent from REA conforms with “yes, absolutely. For renewable energy projects, each one, each program comes with the timeline. And yeah, specific targets as well as social. There's always a timeline for more projects basically. Overall, our timeline is to see how we can improve access to like 90% by 2050.

4.9 Renewable Energy Access in Nigeria with Development Assistance From GIZ

In answering the question of if development assistance from GIZ increased access to renewable energy, responses from the interviews do not give explicit accountability for renewable energy access in Nigeria. Secondary data such as the GIZ's NESP report emphasized that the technical assistance program from the GIZ takes a multi-level approach, assisting federal government institutions with policy and regulatory frameworks, collaborating with state governments and distribution companies (DISCOs) on electrification planning, and working with communities and the private sector on concrete pilot projects (NESP, 2015).

The Scaling up University was supported by the German Foreign Office to boost the electrification of Nigerian universities and to prepare engineering students to use solar technologies. In 2017, Nigeria implemented an electrification program. The program is part of the Nigerian-German Energy Partnership (NGEP), a bilateral commission between the Nigerian and German governments. The goal is to improve chosen universities' access to solar electricity while also developing solar modules for engineering curriculum and training courses at the University of Ibadan's solar training center. In the long run, the initiative contributes significantly to establishing job possibilities in the increasing future market of renewable energies. GIZ (2019) highlights provision of a solar mini-grid project that was implemented with the support of NESP in 2017.

The University of Ibadan is one of the prototype initiatives. From there, the integrated expert will identify additional Nigerian universities where the solar electrification approach may be implemented and establish a feasible business model (GIZ, 2019). Respondent from REA confirms deployment of renewable energy projects in the universities "and this is just to ensure that the universities enjoy reliable, reliable electricity

supply, otherwise, we wouldn't deploy in the universities because you find universities and in the open areas and we are also doing the energizing."

In a prior project, Nigeria's first hybrid solar/wind system was erected as a demonstration and training facility at NAPTIN's training center in Kainji, with a capacity of 26 kilowatts. The three specific mentions of renewable energy access from GIZ assistance are show with the Table 4 below.

Table 4: Reported Renewable Energy Projects by GIZ

S/No	Recipient	Type of Renewable Energy	Capacity	Period
1.	University of Ibadan, Oyo State	Solar power	10 Megawatts	2017 - 2020
2.	NAPTIN Training Center, Kainji, Niger State	Hybrid Solar and Wind	26 Kilowatts	2015
3.	Gbamu Gbamu Ogun State	Solar mini-grid	85 Kilowatts	Nil

Source: GIZ NESP Reports 2015 and 2019

4.10 Carbon Emissions' Reduction From Development Assistance From GIZ

Carbon emissions' reduction is one of the two major research questions that this research is trying to answer. Trace, (2023) defines emission reduction as the process of reducing greenhouse gas (GHG) emissions produced by an individual, business, or country. These gases include CO2, methane, nitrous oxide, and HFCs. GHGs are the gases that trap heat and warm the planet, and as such, they are a crucial focus in the fight against climate change (Nunez, 2019). GHGs are the gases that trap heat and warm the planet, and as such, they are a crucial focus in the fight against climate change (Chandler, 2023).

When discussing about emission reduction, it could be in other words referred to as 'carbon neutral' and 'net zero'. This addresses specific to the reduction of CO2 emissions

from an individual, business, or country's CO2 emissions, but not other greenhouse gases. Focusing on Carbon emission reduction. Trace (2023) expanded the explanation as the decrease of CO2 emissions from individuals, businesses, or countries, not other greenhouse gases. IEA (2022) reports that the new Nigeria's NDC pledges to eliminate flaring by 2030, as opposed to the previous version's commitment to "work towards ending" flaring by 2030. The NDC also pledges to cut fugitive methane emissions from oil and gas operations by 60 percent by 2031. According to the NDC, fugitive emissions account for 36% of GHG emissions from the energy sector, which accounts for 60% of the country's overall emissions. Thus, a 60% reduction would account for around 13% of Nigeria's total GHG emissions.

In this research, we are looking at the carbon emission reduction from Nigeria as a country. Interview responses did not provide any explicit response of carbon emissions from the renewable energy interventions from the GIZ. While respondent from GIZ, REA, MoP do not report carbon emissions' reduction from the development assistance from the GIZ, response from the civil society organization mentions that "the promotion of renewable energy aligns with efforts to reduce emissions and combat climate change". Secondary data from GIZ published reports and websites do not have any data that documents carbon emissions reduction in Nigeria.

4.11 Challenges of Renewable Energy Implementation in Nigeria

Efforts from the GIZ the development partner and the Assistance recipients such as the Ministry of Power, Rural Electrification Agency (REA) reported experiencing challenges in receiving assistance and implementing renewable energy programs. Respondent from the GIZ states that general challenges in mitigating project implementation include macroeconomics, global supply chain, forex scarcity, a shortage

of working capital for developers, an unstable management structure with utility providers, insecurity and inaccessibility of potential sites, and other factors all contribute to project implementation issues.

Response from REA highlights timeline as one of the challenges they face. “That the timeline, the time it takes to unlock the amount of information is the amount of activity you require to put into the documentation and processing of that particular support, probably that that is one, one major bottleneck” said the REA respondent. The response also listed bureaucratic processes, lengthy timelines, and the complexity of documentation and processing as bottlenecks in accessing funds. Deployment of projects faces challenges such as land acquisition, community agreements, and bureaucratic hurdles. These obstacles delay project execution but are viewed as surmountable by the Rural Electrification Agency as stated by REA respondent.

Data from interview with Ministry of Power indicates obstacles encountered in implementing renewable energy projects with assistance from the GIZ, such as bureaucratic hurdles and political resistance, stringent conditions for funding and the need for low-interest loans to attract investment. Political changes impact project implementation and bureaucratic inefficiencies. Geographical disparities: Reference to challenges in project allocation and implementation across different regions of Nigeria. MoP states that "we usually have challenges where you have grant/loan which is blended. Most of the time, if we meet the criteria, the loans come." Table 5 summarizes the challenges encountered in renewable energy implementation in Nigeria with assistance from GIZ.

Table 5: Summary of Challenges of Renewable Energy Implementation with GIZ

Geographical Disparities	GIZ	REA	MoP	CSO
Bureaucratic Hurdles	GIZ	REA	MoP	
Global Supply Chain	GIZ			
Political Resistance	GIZ		MoP	
Forex Scarcity	GIZ			
Shortage of Working Capital for Developers	GIZ			
Stringent Condition in Accessing Funds			MoP	
Unstable Management Structure with Utility Providers	GIZ			
Insecurity	GIZ			
Inaccessibility of Potential Sites	GIZ			
Timeline		REA		
Complexity of Documentation and Processing		REA		
Limitation of Flexibility				CSO
Land Acquisition		REA		
Community Agreements		REA		
Others	GIZ			

Chapter 5: Discussions

5.1 Discussion

Findings from the results show GIZ has established bilateral relationship with Nigeria that existed since 1974 and since 2004, GIZ has maintained a country office in Abuja, the capital city GIZ, (2019a). the activities of GIZ in Nigeria is not limited to provision of funding energy projects but include rural development, sustainable infrastructure, security, reconstruction and peace, social development, economic development and employment, governance and democracy, environment and climate change and project evaluation.

GIZ supports Nigeria renewable energy program through Nigerian Energy Support Programme (NESP). NESP assists Nigeria in realizing the benefits of energy efficiency, incorporating renewable energy into the grid, and expanding rural electrification. The overarching goal is to provide reliable, inexpensive, and sustainable energy to the Nigerian people. this includes providing energy to disadvantaged segments of the population that previously lacked access to modern energy services. It takes a multi-level strategy, providing guidance on energy policy, economics, and technical knowledge to a wide range of stakeholders.

Findings show the development assistance provided by GIZ to Nigeria for renewable energy come in two ways, including technical and funding assistance. The majority of GIZ's interventions in Nigeria focuses on technical assistance such as rural electrification and sustainable energy access, Capacity Development and Training, policy reform and energy efficiency. None of the respondents listed any direct renewable energy projects. However, reports from secondary data reveal three renewable energy installations

which include University of Ibadan, Oyo State, mini grid and NAPTIN in Kainji, Niger State, and 85kw Mini Grid in Gbam Gbam, Ogun State, there are no specific and direct funding for physical renewable energy infrastructure.

For the project at University of Ibadan, the renewable energy which GIZ, (2019b) described as "The Nigerian-German Energy Partnership (NGEP) has created an economically sustainable way to electrifying Nigerian institutions using solar electricity". This project is identified as a "10MW $15 million solar plant electrification plant at the University of Ibadan. The University of Ibadan is noted for frequent power outages and a lack of water, which has resulted in periodic student demonstrations. The plant is part of the Nigeria-German Energy Partnership and is being built under the auspices of the German International Cooperation Organisation (GIZ)" (Fatunde, 2019). The University of Ibadan planned to develop a private-sector-funded Solar Lab. The technical management of this lab will be overseen by an integrated specialist. The specialist develops teaching ways for incorporating solar information into engineering science curricula (GIZ, 2019b). It is not clear these efforts have been completed. While the NAPTIN in Kainji is a Nigeria's first hybrid solar/wind system which has been erected as a demonstration and training facility at NAPTIN's training center in Kainji, with a capacity of 26 kilowatts, the mini grid at Gbam Gbam is co-funded by three different funding partners as shown by Figure 11 below. Therefore, the specific amount contributed by GIZ is not available. Renewable energy has different components. EDF, (2021) listed type of renewable energy as solar, wind, hydro, tidal, geothermal, biomass.

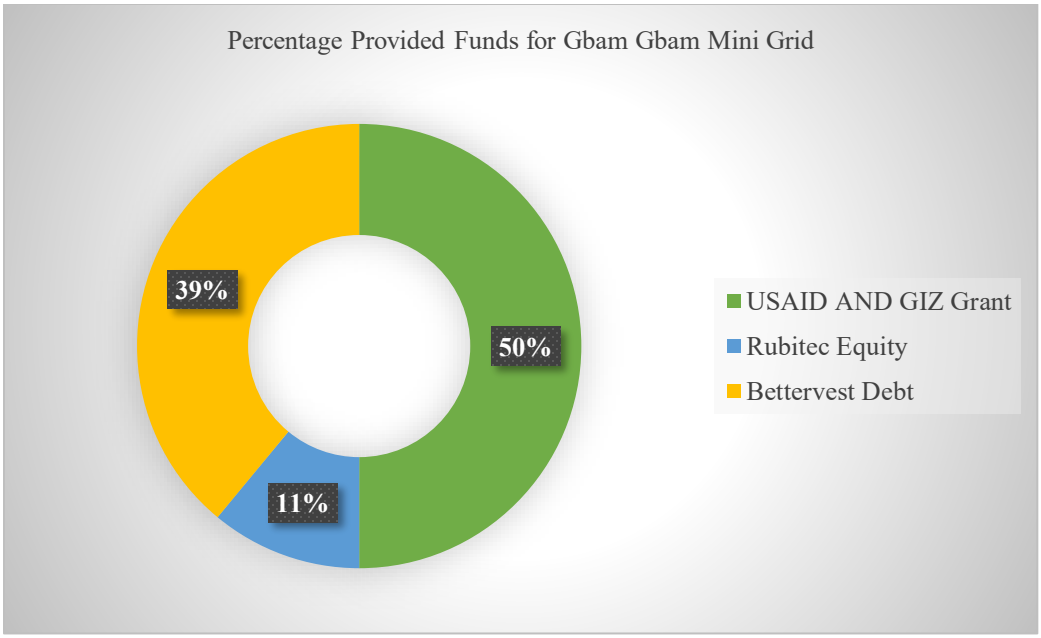

Figure 11: Percentage of Provided Funds for Gbam Gbam Mini Grid
Source: (Faleye et al., 2020)

Finding from both primary and secondary data did not specify the type of renewable energy that GIZ provides assistant for. In most secondary data, the use the terms "energy and electrification" tops the narratives which generalizes the energy intervention they embark on in Nigeria, as a result, it is difficult to disaggregate the specific amount of funds that go into renewable energy in Nigeria, let alone the type of renewable energy.

Rural electrification Agency (REA) and Federal Ministry of Power which have direct interface with GIZ as ministry and agent of Nigerian government have no concrete evidence of renewable energy deployment from provided funds from the GIZ except in the area of technical assistance. Federal Ministry of Power would have preferred if pledged funds are given to them for direct renewable energy interventions than channeling all the funds to "paper work".

The response from the civil society shows that there is appreciation of technical support from the GIZ, but development assistance is not flexible enough, therefore, it does not address specific needs of renewable energy access in Nigeria. Responses show dissatisfactions from unavailability of physical renewable energy access from provided development assistance from the GIZ but emphasized on other international funding partners as the ones making impact in renewable energy access in Nigeria. For example, World Bank, (2023) states that the World Bank approved the Nigeria Distributed Access through Renewable Energy Scale-up (DARES) project, which is funded by a $750 million International Development Association (IDA) credit and will leverage over $1 billion in private capital as well as significant parallel financing from development partners, including $100 million from the Global Energy Alliance for People and Planet and $200 million from the Japan International Cooperation Agency. Other development partners involved in the program include the United States Agency for International Development (USAID), the German Development Agency (GIZ), SEforAll, and the African Development Bank (AfDB).

Responses from interviews show that not all funding for renewable energy in Nigeria come directly from GIZ but provided by the European Union (EU) which partners with GIZ to carry out their programs and projects in Nigeria. The assertion of Chime, (2021) on provision of EUR 35 million runs contrary to the interview response from GIZ and the secondary data reports from GIZ which state that EUR 24.5m since 2013. Rather, Chime (2021) specifically mentions EUR 13 million as the funds provided directly by GIZ for renewable energy in Nigeria.

GIZ's NESP has the plan to provide technical, financial, and legal assistance to the Nigerian government in securing 2,000 MW of grid-connected PV solar electricity by

2020. Energy audits were conducted in two pilot industries to help implement the ISO 50001 Energy Management System Standard. This will result in annual energy savings of more than 6,200,000 kilowatt-hours. NESP funds six mini-grid projects in five partner states, providing 10,000 people with access to sustainable electricity. The program's rural electrification modeling assists the country in implementing a plan to offer power to nearly 50 million people through grid connections (GIZ, 2017). Interview respondents did not provide direct response that supports this claim.

Though part of GIZ strategic mission through NESP is to monitors the implementation of NDCs, mid-term development goals, and operational plans to achieve low-carbon emissions (Richter, 2022), however, the absence of response on carbon emissions' reductions from all respondents and secondary data is a clear indication that there are no metrics put in place to measure carbon emissions' reductions from GIZ. Not particularly from the development assistance from the GIZ but from other agencies that are carrying out renewable energy programs in Nigeria.

The only hope of carbon emissions reductions lies in promises and pledges made by Nigerian government through the National Determined Contributions (NDC) and its recent plan to restart discussions about international transition support to create a "new deal on climate finance" that focuses on clear, data-driven, action-backed, ambitious yet feasible emission-reduction commitments from developing countries like Nigeria, supported by clear financial commitments from development partners (Nigeria ETP, 2022). Over the next few decades, the energy transition will cost about $1.9 trillion by 2026 including $410 billion above projected usual. To jumpstart the ETP's implementation, Nigeria hopes to raise an initial $10 billion support package every year ahead of COP 27 through a program of "Incremental Investments from 2021 to 2060" to reach net zero.

The conversations highlight concern regarding the fulfillment of promised funds by international donors, including GIZ. Despite specific project documents outlining support, challenges in unlocking opportunities and accessing funds persist. It is obvious from the responses that both GIZ and Nigerian partners face challenges in implementing their renewable exergy plans and receiving direct funds for renewable energy access respectively. However, flexibility is needed to map out specific funds that address deployment of renewable energy access and provide metrics that measure the amount of reduced carbon emission from the renewable energy access with provided development assistance from the GIZ.

The interviews shed light on the complexities of renewable energy development in Nigeria, highlighting both progresses made, and challenges faced. GIZ investments, along with support from other donor agencies, play a crucial role in advancing renewable energy access and emission reductions. However, bureaucratic hurdles, political changes, and funding constraints pose significant obstacles to project implementation. Addressing these challenges and fostering international partnerships are essential steps in realizing Nigeria's renewable energy potential and achieving sustainable development goals.

5.2 Impediments

This research encountered some difficulties in getting access to information based on an unwillingness and the unavailability of planned interview respondents. Efforts to secure more participants for interviews that would have provide relevant responses were resisted by some. As a result, only 4 persons participated in interviews. Some interviews agreed to interviews but later made themselves unavailable. Others indicated they did not have permission to speak on the subject, bound by their funders policy to use only M&E data for a particular reason that was not explained in detail. Still others did not fulfil their

promises of responding to email correspondence after promising to do so. Key considerations for the future research agenda must take into the account that it will likely continue to be difficult to gather information on results from interviews. Efforts at monitoring and evaluation, transparency, and results reporting will be essential to tracking progress in renewable energy developments in Nigeria including ones supported by international donors.

5.3 Conclusion

The data and analysis in this thesis offer insights into the impact of GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) investments in renewable energy access in Nigeria between 2015 and 2022. The findings revolve around the effectiveness of GIZ support, challenges faced in accessing funds, deployment of renewable energy projects, and future plans. Through coding, key themes and subthemes are identified to answer the research questions posed.

Regarding the research question of whether GTZ funding for was tied to increasing renewable energy access in Nigeria, the analysis indicates that GIZ's investments in renewable energy in Nigeria, starting in 2013, involve a multifaceted approach. The bilateral relationship, spanning several decades, has evolved to focus on catalyzing the renewable energy market. GIZ provides both financial and technical support to various recipients, including government entities such as the Rural Electrification Agency (REA) and the Federal Ministry of Power. There is no response of any provision of funding support to non-governmental organizations to deploy renewable energy in Nigeria. Implementation is monitored through joint efforts, and despite challenges, GIZ has committed to an ongoing third phase (NESP III) until 2026. Therefore, while GIZ may be

supporting the policy environment, there was no direct data to support specific attributable increased access to renewable energy in Nigeria.

The second research question 2 asked if GIZ investments resulted in emission reductions in Nigeria between 2015 and 2022. The conclusion from this research is that the provided responses do not explicitly address emission reductions. Furthermore, the promised provision of funds to a 10MW project for University of Ibadan does not show robust ambition for carbon emission reductions even with the robust funds budgeted for the project. Finding evidence for real emission reduction and energy access from the investment of GIZ on renewable energy in Nigeria remained difficult. While the focus is on GIZ's investments in renewable energy development, this research found no direct mention of emission reduction goals or outcomes.

However, the presentation of the support for renewable energ implied that increased renewable energy access could contribute to emission reductions indirectly. Without specific data or discussions on emission reduction metrics, it is challenging to draw a conclusive answer to research question two on reduced emissions. Additional information or data on emission reductions would be necessary for a comprehensive assessment. The dialogues underscore the significant impact of GIZ investments in increasing renewable energy access in Nigeria, despite challenges in accessing and deploying funds. Alternative funding sources, coupled with government and private sector interventions, complement donor support in advancing renewable energy initiatives. However, ongoing collaboration and research are essential to address challenges and achieve sustainable energy goals in Nigeria.

From the analysis, it can be deduced that GIZ investments have likely contributed indirectly to increasing renewable energy access in Nigeria between 2015 and 2022, as

evidenced by their support for various renewable energy projects and technical assistance. However, the absence of specific data on emission reductions, poses as impediments to conclusively determine the impact of GIZ investments on reducing emissions in Nigeria during the specified period.

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Appendix A: Interview Protocol for Nigeria Government (Rural Electrification Agency (REA)

1. What is the mandate of your Ministry or Agency in the light of access to energy and emission reduction?

2. Considering Nigeria's electrification targets and use of renewable energy targets by 2025, do you think Nigeria is on track of achieving this goal? Please give reasons for your response.

3. Are they specific policies, program or policies targeted at increasing renewable energy access and reducing CO2 emission? If yes, what are these programs?

4. In the light of achieving these mandates and executing these programs, do you collaborate with international development partners to achieve this? If yes! Which organizations are these?

5. What relationship exist between your Ministry/Agency and the GIZ?

6. What type of supports do you receive from the GIZ as regards access to renewable energy and emission reduction?

7. Has the ministry received any funds for renewable energy access and emission reduction from the GIZ? How much and for how long has the MDA been receiving funds from GIZ?

8. How would you rate the level of support from the GIZ and why?

9. What type supports does the GIZ offer to your ministry/agency to

10. Are there existing deployments of funds for renewable energy projects in any part of Nigeria from the funding supports provided by GIZ?

11. What types of renewable energy are you using the funds for? (Solar, wind, hydro, thermal, etc.)

12. Do you have a timeline for project implementation of the renewable energy projects in Nigeria?

13. Are there challenges you are experiencing with the donor agencies in providing promised funds in Nigeria?

14. What implementation challenges confronts the joint implementation of GIZ related projects and program?

15. How would you rate the role of GIZ in terms of building and transferring capacities and technical knowledge in the area of renewable energy and emission reduction technologies?

16. Are the program and projects of the GIZ in RE access and emission reduction sustainable?

17. What frameworks have the GIZ supported the Nigerian government to put in place to ensure sustainability in RE access and emission reduction?

18. Which areas would your ministry/Agency want the GIZ and other development partners to focus their supports in the RE sector in the nearest future?

Appendix B: Interview Protocol for International Development Organization - GIZ

1. What relationships exist between your organization (GIZ) and Nigeria?
2. What are the objectives of your organization (GIZ) to promise provision of funds to Nigeria for renewable energy investment?
3. How long have GIZ been supporting with funds for renewable energy?
4. What type of supports do GIZ provide to Nigeria for renewable energy (Finances, technical etc.)
5. What entities do you provide the support to? (Nigeria federal government, state government, local government, or non-government organizations)
6. How much funds have GIZ provided to Nigeria so far for renewable energy?
7. How many years have you provided funds for renewable energy to Nigeria?
8. Are there reasons you have not provide funds to Nigeria?
9. Do you know if Nigeria has been using the provided funds for the targeted investments in renewable energy?
10. How do you track the actual implementation of your funding support to Nigeria on renewable energy and carbon emission's reduction?
11. Do you have a timeline for your funding support to Nigeria?
12. Are there challenges you are experiencing with the recipients of your funds in Nigeria?

Appendix C: Interview Protocol for Non-Governmental Organization and RE Associations

1. Based on you project interventions on public finance management and deploying renewable energy solutions, do you have information on international donor agencies for renewable energy to Nigeria?

2. Do you have physical record of renewable energy by Nigerian government from provided funds by international development agencies?

3. Can you tell how much funds you have tracked being received so far from the donor agency to Nigerian government for renewable energy?

4. Considering the level of promises made by the international donor agency to Nigeria for renewable energy investments, do you think the donor agencies have been faithful in providing the promised funds?

5. Are you familiar with the supports of GIZ in the Nigeria energy access space?

- What type of supports do they offer to energy access?
- How have you or your organization benefitted from GIZ trainings?
- What is the manner and magnitude of the support received from GIZ?
- How would you rate the contribution of GIZ to Nigeria energy access? And why? Any example will be appreciated?
- Any areas you think GIZ need to improve upon?

6. What types of renewable energy are you using the funds for? (Solar, wind, hydro, thermal, etc)

7. Do you think the promised amount and the provided amount match the scope of renewable energy investment you map for Nigeria?

8. If yes to number 9, what are the reasons for non-deployment of funds?

9. What do you think will happen if the donor agencies do not fulfil their promises or provide the exact amount of funds they promised?

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