RENEWABLE ENERGY SOLUTIONS FOR NIGERIA'S POWER SUPPLY CHALLENGES: EVIDENCE FROM SOUTHWEST NIGERIA

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ABSTRACT

Nigeria persistently faces power outages due to frequent national grid failures, adversely impacting businesses and the socioeconomic well-being of families, exacerbated by the elevated electricity costs from independent power sources. The study examined three objectives: assessing grid failures and their economic ramifications, investigating the role of renewable energy in alleviating frustrations and identifying hurdles to renewable energy. A quantitative study approach was utilised, employing simple random sampling to select 5000 participants (businesses and households) in Lagos and Ogun states. The research indicated that corporate expenditures increased significantly due to recurrent national grid failures, which led to reliance on alternative power supply. It was discovered that renewable electricity sources significantly have the potential to exacerbate frustrations arising from inconsistent electricity supply. The study highlighted that significant obstacles to renewable energy integration in Nigeria include high setup investment prices, insufficient technical expertise, absence of legislation mandating integration, inadequate understanding of advantages, and limited access to technologies. Consequently, to tackle the electricity problem in Nigeria, incorporating renewable energy offers a feasible strategy to alleviate the detrimental impacts of grid failures while promoting environmental and economic advancement. Therefore, it recommended that the government establish mandatory renewable energy integration, public awareness campaigns, subsidised finance mechanisms, training for a competent technical workforce, and scalable public-private collaboration initiatives.

Keywords: *Renewable Energy, National Grid Failure, Alternative Power Generation, Energy Adoption Barriers.*

1. INTRODUCTION

The global energy landscape has undergone significant transformation in recent decades, driven by escalating environmental concerns and the pursuit of sustainable development, with renewable energy emerging as a solution to this issue, reducing greenhouse gas emissions, mitigating climate change, and diversifying energy sources. The IEA reported that as of 2023, renewable energy accounted for about 30% of global electricity generation, with solar, wind and hydroelectric power stations being significant contributors.

The International Renewable Energy Agency (IRENA) projects that over 35% of global electricity generation will derive from renewable sources by 2025, underscoring the increasing significance of renewable energy in the global energy landscape as energy demands evolve (IRENA, 2023). Hassan, Viktor, Al-Musawi, Ali, Algburi, Alzoubi, and Jaszczur (2024) noted that the rise in renewable energy use is attributed to heightened erratic power outages and awareness of the need to reduce fossil fuel usage, a primary contributor to global greenhouse gas emissions in recent decades.

A comprehensive examination of Africa's potential for renewable energy development offers insights into both the opportunities and the outlook within this sector of the continent. Africa has abundant renewable resources, particularly sun, wind, and hydropower, possessing one of the greatest solar belt regions globally, presenting significant opportunities for heat and energy production. As of 2023, Africa attracted merely 0.6% of global renewable energy investments, indicating that the continent, particularly Abu Dhabi, is significantly underutilising its renewable energy potential (Zero Carbon Analytics, 2023; Lahrech, Abu-Hijleh, & Aldabbas, 2024). In 2022, Africa generated a significant amount of renewable energy, with prominent contributors including South Africa, Morocco, and Egypt; South Africa has focused on wind and solar initiatives to reduce its coal reliance, and Morocco aims for renewable energy to account for 52% of the entire supply by 2030 (Adebiyi, & Moloi, 2024; Bouabid, Sleptchenko, & Mouline, 2019). Another significant contribution stemming from continuous resources indicates that Morocco has always prioritised renewable energy; evidence of this is the Noor Ouarzazate Solar Complex, one of the largest solar power facilities globally (Kyei, Boateng, & Frimpong, 2025). Comparable initiatives indicate that the continent possesses significant potential; nonetheless, Africa faces challenges deploying renewable energy due to infrastructure limitations, inadequate funding, and ineffective laws.

Nigeria, Africa's most populous nation with over two hundred million people, has consistently confronted a significant energy deficit. The energy sector predominantly relies on fossil fuels, particularly oil and natural gas, constituting over 70% of the nation's electricity generation (Felix, 2024). This renders Nigeria susceptible to global oil price fluctuations and poses a significant difficulty regarding the heightened carbon emissions associated with fossil fuel-based energy sources. The IRENA study conducted in 2023 indicated a significant investment potential in renewable energy, particularly solar, wind, hydro, and biomass power in Nigeria. Solar energy holds significant potential for Nigeria due to the country's high average solar irradiation of 5.44 kWh/m^2 and PVOUT of 4.30 kWh/kWp (SolarBuy, 2024). Nonetheless, the sector remains underdeveloped in Nigeria, with limited access to electricity through solar energy systems for many individuals. According to Statista (2024), Nigeria's overall solar energy market in 2023 exceeded one billion dollars, with approximately two million solar systems deployed in the country,

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indicating a burgeoning opportunity for using renewable energy sources in Nigeria as a sustainable solution to power supply issues.

Hydropower presents the most significant potential for Nigeria, estimated at 14,750 MW; however, just 17 per cent of this has been actualised, and there are proposals to build other large hydropower facilities (Fasipe, Izinyon, & Ehiorobo, 2021). Hydroelectric power possesses the capacity to deliver a substantial energy supply to the country; nevertheless, it faces challenges such as variability in water availability and, consequently, energy production. On the other hand, wind energy represents another potentially significant sustainable energy source for Nigeria. The country has not fully harnessed wind power, although certain regions, particularly in the northeast, have been identified as possessing a favourable wind power index.

Despite numerous studies suggesting the potential to generate over 1,000MW of wind energy in Nigeria (Ogunjo, Olusola, & Olusegun, 2023), investment in wind power infrastructure remains inadequate. Consequently, biomass is an additional energy source in Nigeria, particularly within the agricultural sector, where substantial organic waste is generated. Agricultural residues, timber, and animal excrement, as components of biomass energy, could augment the electric power supply in rural regions while facilitating appropriate waste management. Thus, investment in renewable energy, especially solar power, can enable uninterrupted electrical access for individuals, thereby increasing their living conditions and augmenting opportunities for economic growth. It is essential to acknowledge that renewable energy is pivotal in addressing the energy deprivation widespread in Nigeria, where a significant portion of the population lacks access to uninterrupted electricity. The study evaluates renewable energy resources' capacity to address Nigeria's energy deficiencies.

Problem statement

The Nigerian energy sector encounters continuous obstacles that impede its ability to provide reliable energy to the populace, exacerbated by its reliance on fossil fuels. The National Grid supplies electricity to the Nigerian power sector, notorious for frequent disruptions. The Transmission Company of Nigeria (TCN) reported that Nigeria experienced 105 instances of grid breakdown from 2015 to 2024 (Premium Times, 2024).

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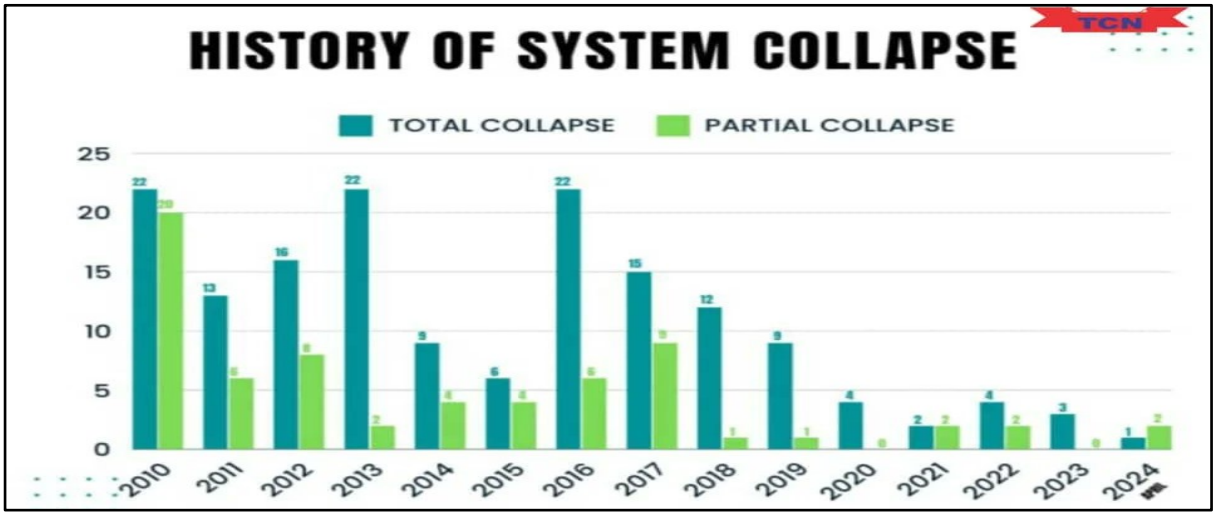

105 instances of grid breakdown

Source: *Premium Times (2024) - https://www.premiumtimesng.com/news/top-news/69069)*

In 2023, the Nigerian power system experienced numerous outages, resulting in extended periods of electrical deprivation for millions of Nigerians. Grid failures persisted until 2024, and the situation deteriorated further, even as early as January 2025, leading to significant economic repercussions, including reduced productivity and constrained foreign direct investment. The Nigerian energy sector has encountered ongoing challenges that impede its ability to provide reliable energy to the populace, exacerbated by its reliance on fossil fuels. The National Grid supplies electricity to the Nigerian power sector, notorious for frequent disruptions. In 2023, the Nigerian power sector experienced numerous outages, resulting in extended durations without energy for millions of Nigerians. Grid failures persisted until 2024, and the situation deteriorated further in 2025, leading to significant economic repercussions, including reduced productivity and constrained foreign direct investment.

In 2023, the Nigerian national grid experienced over 10 outages, leaving parts of the country without power for days and impacting critical industries, including healthcare, education, manufacturing, and commerce. The World Bank reveals that Nigeria's electricity generation in 2023 was just 5,000 MW however, the nation's demand surpassed 25,000 MW (World Bank, 2023). Hence, the power energy system functions below its capacity, with load shedding and power rationing frequently occurring. The problems have been intensified by increased demand levels on the grid with less investment. The Nigerian government's absence of strategic direction for the electrical sector has impeded advancements in the reliability and capacity of the Nigerian power system. In 2024, grid instability increased, leading to 12 system breakdowns that affected power distribution in certain sections of the country for prolonged periods (ThisDay, 2025). In May 2024, the grid breakdown incapacitated Lagos and other areas in Nigeria, leaving them without power for over 48 hours, which caused a disaster for millions of businesses and residences. In October of the same year, the grid failure affected the northern regions, hindering most agricultural

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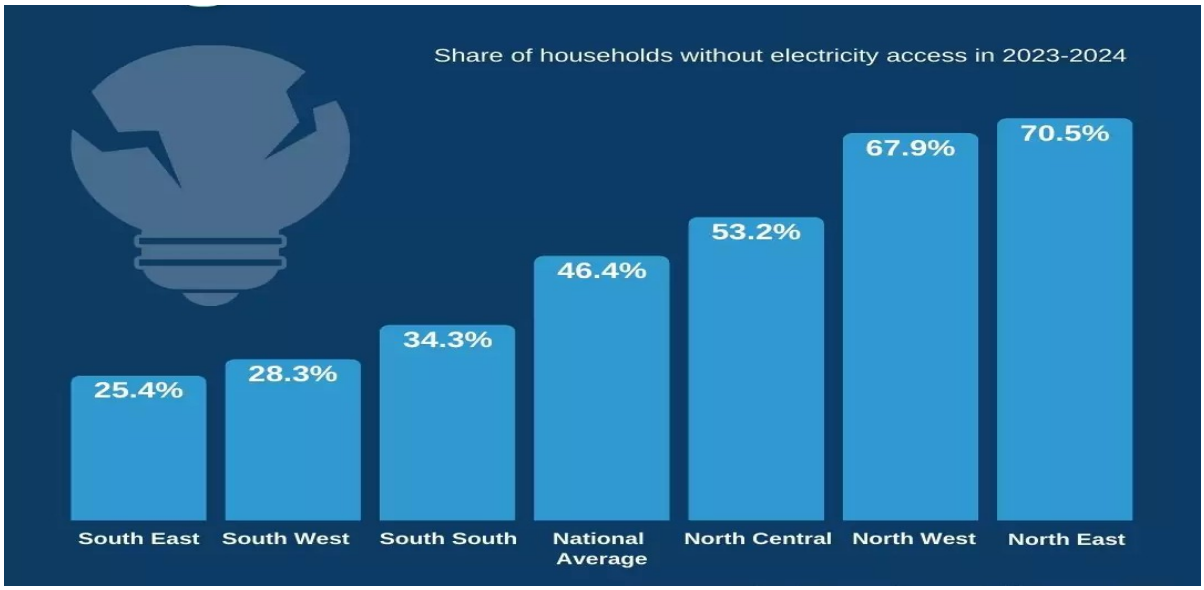
operations during their peak productive phase. These disruptions highlighted the vulnerability of the national grid and the pressing necessity for renewable energy sources.

A poll conducted by Intelpoint indicates that around fifty per cent of Nigerian households experience electrical supply problems. The regions most impacted are as follows: South East (25.4%), South West (28.3%), South-South (34.3%), North Central (53.2%), North West (67.9%), and North East (70.5%) (Intelpoint, 2025).



Geographical percentages of households without electricity in Nigeria

Source: *Intelpoint (2025) - https://intelpoint.co/insights/71-of-households-in-nigerias-north-east-lack)*

In January 2025, the Nigerian national grid failed, resulting in power outages in certain areas of Lagos and Ogun State, leaving residents in total darkness without electricity for over 72 hours, highlighting the compromised condition of the grid system. These figures demonstrate a necessity for involvement from the president, the minister of power, and other policymakers to reform the electrical sector in Nigeria. Ibrahim (2025) noted that the Nigerian government has insufficiently tackled power issues and advancements in achieving a varied energy mix by implementing renewable energy technology. Hence, this study investigates the persistent failures of Nigeria's national grid and their effect on elevated business costs associated with alternative power generation, the capacity of renewable energy sources to alleviate the stress linked to Nigeria's inconsistent power supply, and the principal obstacles to the adoption and implementation of renewable energy technologies in Nigeria.

Research Objectives

i. Assess the recurrent failure of Nigeria's national grid and its impact on increased business expenses on alternative power generation.

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ii. Explore the potential of renewable energy sources in reducing the frustrations related to Nigeria's erratic power supply
iii. Identify the key challenges to adopting and implementing renewable energy technologies in Nigeria.

2. LITERATURE REVIEW

Conceptual Review

Recurrent Failure of Nigeria's National Grid

The electricity supply system in Nigeria, managed by the Transmission Company of Nigeria (TCN), continually fails to satisfy the increasing power demand, resulting in frequent outages caused by recurrent national grid failures. The collapses are linked to the interruption of electricity supply to houses, businesses, and the entire provision of public services statewide. Oladipo (2023) observed that in 2023 and 2024, the national grid experienced substantial breakdowns, with more than 10 instances of grid failure occurring in 2023 alone. The outages caused by inadequate maintenance and insufficient investment in efficiency upgrades resulted in millions of Nigerians enduring prolonged electricity deprivation, which showed no improvement after merely ten days into 2025 (Sahara Reporters, 2025). The recurrence of these failures is attributable to several intricate factors, including insufficient investment, ageing power plants, thermal power stations vulnerable to fuel supply and technical complications, amongst others (Charamba, Kumba, & Makepa, 2025). Nevertheless, comparable factors such as the maintenance of transmission lines and overload contribute to the system's fragility. The cumulative effect results in a power deficit, hindering Nigeria's ability to ensure dependable electricity delivery. Uche, Ogwuda, and Asuku (2024) observed that governance challenges, including corruption and deficiencies in policy execution, are some reasons why the national grid cannot effectively manage power demand, leading to recurrent collapse. Indeed, these recurrent blackouts have severe consequences in addition to the inconvenience experienced by individuals, businesses, and industries, as the instabilities inherent in our electricity infrastructure hinder economic growth, diminish productivity, and impede industrialisation. These continuous power outages persistently impact manufacturing entities in Nigeria, necessitating costly and environmentally detrimental backup generators. According to a survey, 80% of the electricity for Nigerian businesses is derived from privately financed petrol and diesel generators. A study revealed that offices and houses in Lagos incur an astonishing N750 million daily on generator energy. As of 2021, around 22 million small-sized generators were operational countrywide, with over 60% in Lagos (ThisDay 2023).

Increased Business Expenses on Alternative Power Generation

The recurrent failures of Nigeria's national grid, leading to continuous blackouts, have emerged as a substantial obstacle to the operations of numerous organisations, especially those in sectors that depend

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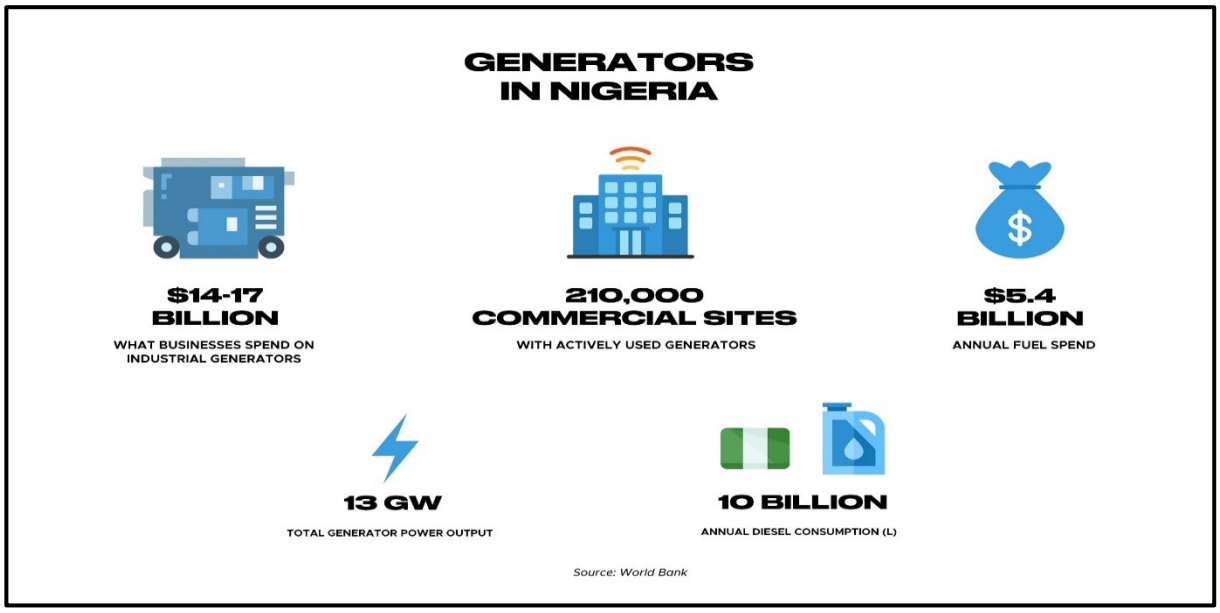
predominantly on electricity as a vital resource for functioning. Nigerian enterprises suffer significant costs on backup power sources, including diesel generators, inverters, and solar power systems. The National Bureau of Statistics (2024) reports that more than 70% of organisations in Nigeria depend on generators, which constitute an expensive power source. Generators necessitate fuel, and Nigeria's constant rise in fuel prices renders these expenses exorbitant, especially for small and medium-sized firms (SMEs). Olusola (2024) asserted that MSMEs in Lagos spent more than N5.3 trillion on fuel for generators in 2024. In addition, aside from fluctuating fuel prices, other expenses encompass the maintenance and repair of generators, which have emerged as ancillary business expenses. These charges are recouped from the clients, with strenuous coupled with the already burdensome conditions of the Nigerian economy. Hence, Organisations dedicate a considerable portion of their annual profit to generator maintenance; this supplementary expense greatly strains enterprises working with slim profit margins.

Furthermore, the costs linked to electricity generation via alternative sources contribute to an inflationary situation, intensifying pressure on investment as prospective investors retreat from Nigeria due to elevated operating expenses. A failure to supply electricity in sectors from manufacturing to warehousing, where power is essential, leads to heightened costs. A 2021 survey in Nigeria revealed that companies invested $14.17 billion in industrial generators, with over 210,000 commercial establishments utilising these generators daily, $5.4 billion was expended on fuelling generators, and N10 billion was allocated annually for diesel use (Daystar Power, 2021).



Alternative power supply usage

Source: Daystar Power (2021) *-https://www.daystar-power.com/news-post/the-3-hidden-costs-of-nigerias-erratic)*

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Renewable Energy Sources

Recurrent energy crises can be effectively addressed using renewable energy sources such as solar, wind, hydropower, and biomass rather than relying excessively on fossil fuels (Solangi & Magazzino, 2025). This more environmentally sustainable solution mitigates the economic and environmental issues linked to traditional energy generation. Renewable energy, particularly solar electricity, is present in Nigeria but minimally. The substantial solar irradiation year-round indicates a significant national potential for solar electricity, which should be leveraged. Although less developed than solar and hydroelectric power, wind energy is a renewable energy source that can complement both in an energy system (Nascimento, Oliveira, Marujo, Saavedra, & Freitas, 2025). Nonetheless, wind energy has issues associated with substantial prices and the necessity for additional infrastructure. Notably, Nigeria possesses a considerable capacity for hydroelectric electricity, yet this resource encounters obstacles to environmental and social issues associated with dam development. However, large-scale power stations like the Kainji and Jebba hydroelectric dams have consistently experienced an energy shortfall in hydroelectric power supply across various country regions. Biomass energy is also a renewable power resource with significant development potential in Nigeria, particularly in rural regions abundant in agricultural waste (Abouallal, Idrissi, Dkhireche, & Touhami, 2025). Biomass can serve for cooking, heating, and energy, diminishing the need for firewood and charcoal and contributing to deforestation and air pollution. Nonetheless, implementing renewable energy sources in Nigeria faces challenges such as insufficient funding, inadequate infrastructure, ineffective policies, and a scarcity of skilled labour (Onuh, Ejiga, Abah, Onuh, Idogho, & Omale, 2024). Nigeria has significant solar energy potential, estimated at over 427,000 MW, yet only 112 MW was generated in 2023 due to the limited solar power installations (Statista, 2023). The potential of renewable energy to mitigate the declining energy situation in Nigeria is evident; therefore, sustained investment and policy support for deploying renewable systems remain paramount priorities. Accordingly, despite a substantial population exceeding 220 million, only approximately 500,000 individuals in Nigeria have solar systems installed in their residences (PSC-Solar UK, 2022).

Frustrations Related to Nigeria's Erratic Power Supply

Inconsistent electricity supply remains pervasive in Nigeria, frustrating the population, including citizens, entrepreneurs, and investors (Nneze, Ezeodili, & Nze, 2024). Nigeria, the greatest nation in Africa by gross domestic product, generates an average of 5,000-7,000 MW for a population of over 200 million (Stephanie, Abubakar, & Ademola, 2024). This energy shortfall has extensive adverse implications, ranging from decreased productivity to diminished living standards, undermining efficiency and leading to discontentment. Accordingly, Nigerians experience frustrations due to the expenses linked to the erratic power supply, as all businesses and households predominantly depend on standby generators. According to

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a report by the International Energy Agency (2022), on average, Nigerians expend over $14 billion annually on generator fuel; this expense diminishes profitability, hinders business growth, and impedes job creation. This results in elevated living expenses as households allocate a significant percentage of their income to generator fuelling and maintenance (Audu, Ilevbare, & Yusufu, 2024).

Another major concern is about industrial development and FDI attraction. Firms in Nigeria use less than optimum capacity because of recurrent power blackouts. According to a report by the Manufacturers Association of Nigeria (MAN) in 2023, power-related issues contributed as much as 40% to manufacturing expenses (Punchng, 2022). This undermines Nigeria's comparative advantage and scares potential international investors. Many multinational firms do not wish to venture into Nigeria because securing a reliable energy source often dwarfs every other expense. As a result, it restricts the FDI, which is crucial in boosting the country's economy. Additionally, recurrent power failure impacts the socio-environment, worsening the situation and leading to frustrations. Long-term use of generators produces noise and distorts air quality, negatively impacting the population's health. According to WHO (2022), breathing in the fumes from generators contributes to the rate of respiratory illnesses in Nigeria; also, pollution of the environment through the improper dumping of generator waste makes the country's ecological problems worse than they already are (Odeyale, Oke, Falana, Adeoye, Ogunsola, & Marizu, 2023).

The frustrations arising from inconsistent power supply also impact the digital economy and educational sectors. The growing utilization of online platforms for education and business activities renders power interruptions a significant impediment to accessing vital services. Students and remote professionals frequently encounter difficulty adhering to deadlines, resulting in diminished production and lost opportunities. On the other hand, Ogunode, Olabisi, & Adetayo (2025) noted that public discontent with Nigeria's power sector is exacerbated by perceived inefficiency and corruption. Throughout the years, billions of dollars have been allocated to Nigeria's power industry, including contributions from the World Bank, the African Development Bank, and the U.S. Agency for International Development (USAID). Over the past five years, the World Bank allocated more than $2 billion to the Nigerian power sector, while the African Development Bank contributed $410 million to a transmission project and an extra $200 million via the Rural Electrification Agency (REA) (Nigeria's Energy Transition Plan, 2022); however, advancements have been minimal, as numerous Nigerians contend that the government embezzles these funds. The sector's absence of openness and accountability has engendered pervasive scepticism over governmental efforts to mitigate the situation.

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Theoretical Review

Technology Acceptance Model (TAM)

Davis (1989) introduced the Technology acceptability Model (TAM), which elucidates the determinants influencing the acceptability of novel technologies. The factors influencing the acceptance or rejection of technology are crucial for policy and commercial decision-making, underscoring the significance of this model in the discourse on renewable energy adoption in Nigeria. The Technology Acceptance Model (TAM) asserts that two principal criteria affect technology adoption: perceived ease of use (PEOU) and perceived usefulness (PU). Thus, individuals' technology adoption is influenced by their perceived ease of use and usefulness, as articulated by the Technology Acceptance Model (TAM). These variables are pertinent to renewable energy sources, including solar and wind power. If the Nigerian government, businesses, and families evaluate the perceived ease of use (PEOU) of renewable energy systems and assess the perceived usefulness (PU), recognizing a distinct advantage in cost or dependability compared to the national grid, then the technologies would be embraced.

In Nigeria's power supply dilemma, insufficient electricity consumption is also attributed to TAM, highlighting the reluctance to use renewable energy sources. The high installation costs of renewable energy systems are a significant barrier that may impede their adoption despite potential long-term benefits. Survey indicates that a significant portion of the Nigerian population views renewable energy sources as expensive and challenging to maintain. This reluctance to adopt new technology exacerbates the nation's energy deficiency. Thus, the Technology Acceptance Model (TAM) asserts that environmental factors, including governmental policies and support, financial rebates and incentives, and infrastructure, influence the Perceived Ease of Use (PEU) and Perceived Usefulness (PU) of renewable energy technology. Hence, renewable energy utilization in Nigeria remains suboptimal due to insufficient technological advancement and inadequate infrastructure for distribution, coupled with limited governmental backing for renewable energy initiatives.

Diffusion of Innovations Theory (DOI)

The diffusion of innovation theory, developed by Rogers in 1962, describes how and why innovations diffuse throughout a society. This theory is crucial for elucidating the adoption and dissemination of renewable energy technology within Nigeria, where infrastructural, cultural, and economic elements affect the speed and extent of their acceptance. Rogers posits that inventions are disseminated through five fundamental stages: knowledge, persuasion, choice, implementation, and confirmation. The preliminary phase of renewable energy in Nigeria is the awareness stage, wherein individuals and organizations recognize the presence of renewable energy sources, such as solar and wind. The persuasion stage denotes

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the development of attitudes and views of the innovation, influenced by media, peer groups, or governmental initiatives related to the innovation. The decision-making phase is the final stage in which individuals or organizations choose renewable energy solutions based on perceived advantages such as cost, reliability, and environmental impact.

A fundamental aspect of the DOI theory is the classification of adopters into five categories: creators, early adopters, early majority adopters, late majority adopters, and laggards. In Nigeria, using renewable energy sources is primarily associated with inventors and early majority adopters, notably large enterprises and urban elites, who have financial means and access to information. The late majority and laggards, often consisting of rural populations or low-income individuals, refrain from adopting new technologies due to perceived difficulties that they find unacceptable to overcome. The DOI theory also includes opinion leaders, change agents in the adoption process, and principal stakeholders across Nigeria, who encompass policymakers, electrical providers, and international organizations concerned with advocating renewable energy utilization, awareness enhancement, and collaboration with local populations.

Empirical Review

Yusuf and Adeyemi (2019) conducted a cross-sectional study on the factors influencing the adoption of renewable energy technologies in Lagos, Nigeria. The study's sample survey was administered to 385 micro and small enterprises. The authors observed that micro and small enterprises (MSEs) constitute a catalyst for Nigeria's economic growth; nonetheless, their energy use significantly influences climate change as fossil fuels remain the preferred source for electricity generation, despite the growing global recognition of the necessity to adopt renewable energy technology. The analysis utilising logit regression revealed that awareness and knowledge of renewable energy, effective government policies, peer influence, trust, the development of renewable energy markets, and technology acceptance positively and significantly affect the willingness of micro and small enterprises (MSEs) to adopt renewable energy technologies.

Akinmoladun, Olayanju, and Oladosu (2024) conducted a study to identify the determinants influencing the adoption of renewable energy technologies in Nigeria, specifically focusing on solar and wind energy. The objectives were to investigate the obstacles that impede the adoption of renewable energy and assess the potential contribution of renewable energy sources in addressing Nigeria's energy crisis. The survey employed a quantitative research design with 300 respondents, including company owners, households, and energy specialists from various regions of Nigeria. Inferential statistical techniques (regression analysis) were employed to test the hypotheses with barriers as predictors of the likelihood of adopting renewable energy as the dependent variable. The observations indicated that respondents regarded

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renewable energy sources as advantageous for reducing dependence on the national grid; however, high startup costs, lack of government support, and insufficient basic facilities were statistically significant factors influencing the implementation of renewable energy. The study revealed that existing practices and methodologies require significantly enhanced supportive policies, augmented money, and greater public awareness to address these obstacles effectively.

Ojo (2023) studied the "Economic, social, Political, and Technological Factors Affecting the Advancement of Solar Power in Nigeria." The research sought to identify obstacles to adopting solar energy and assess potential outcomes addressing these hurdles. Qualitative and quantitative research methodologies were integrated into the study's design, data collection, and analysis. The qualitative component of the study involved targeted interviews with forty deliberately chosen players in the energy sector, including government officials, energy experts, and energy entrepreneurs. During these interviews, participants were queried regarding their assessment of the impediments to solar energy utilisation and potential strategies for mitigating these challenges through governmental and institutional efforts, as well as private sector involvement. The quantitative phase involved surveying 250 individuals, including residential and commercial consumers, regarding their perceptions of solar energy and the potential obstacles to its adoption. Thematic analysis was employed to identify financial challenges, inadequate facilities, and political uncertainty. The data was subsequently analysed using inferential statistics, such as chi-square, to assess whether a significant link exists between perceived hurdles to solar power adoption. The study identified several problems, including elevated installation costs, inadequate government support, and restricted access to financing. The study indicated that for solar power to expand in Nigeria over the next decade via consumer adoption, increased investment in infrastructure, more stable governmental policies, and improved consumer financial models are essential.

In their qualitative literature analysis, Ogunyemi and Nwachukwu (2023) investigated how renewable energy sources, particularly solar and wind power, could help alleviate Nigeria's power outage. The study included a literature evaluation of existing research on renewable energy uptake in Nigeria. The gathered data comprised published case studies, governmental reports, and scholarly articles that the researchers utilised to summarise the principal results and emerging trends related to renewable energy in Nigeria. The evaluation focused exclusively on renewable energy projects that had been planned, finished, or were in progress, examining their successes, deficiencies, and the challenges encountered during implementation. Consequently, the results indicated that while solar and wind energy exhibit significant potential for electricity generation and addressing Nigeria's energy demands, they encounter several challenges, including substantial startup costs, inconsistent governmental policies, and inadequate infrastructure for renewable energy systems.

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Tunde and Adesanya (2023) conducted a study examining the impact of power failures in Nigeria on businesses and the utilisation of backup energy sources such as generators and solar energy. The research assessed the expenses associated with alternative energy sources for organisations. A summative cross-sectional survey methodology distributed 200 questionnaires to firm proprietors in the manufacturing, retail, and service sectors. The survey enquired about the frequency of power outages, the alternative power sources utilised during blackouts, and the associated costs of employing these sources. The questionnaires employed planned and unstructured questions to provide comprehensive insights into how various firms react to power interruptions. The research results indicated that frequent interruptions in the Nigerian power grid compelled firms to increase their expenditure on backup power supplies. The predominant usage was diesel generators, resulting in elevated operational costs. Companies that adopted solar energy reported decreased operational expenses and enhanced, stable power supply. Research indicates that reliance on backup power systems, particularly diesel generators, has become costly for businesses. Still, a viable alternative exists to use renewable energy, namely solar power.

Olayanju and Oloyede (2024) investigated the psychological and emotional effects of Nigeria's erratic energy supply on its citizens. The study measured the extent of discomfort caused by power outages and assessed its effects on daily activities, employment, and productivity. A qualitative methodology incorporated in-depth interviews with 50 individuals from diverse socio-economic backgrounds. The participants were asked to express the effects of recurrent power outages on their personal lives, professional endeavours, and emotional well-being. The researchers disseminated 300 questionnaires to evaluate power outages' psychological and emotional impacts. The findings indicated that power outages significantly intensified mental distress and stress among Nigerians, with many individuals reporting emotions of anxiety, anger, and helplessness. The study revealed that erratic power supply negatively affected productivity, particularly in urban areas experiencing frequent outages.

3. METHODOLOGY

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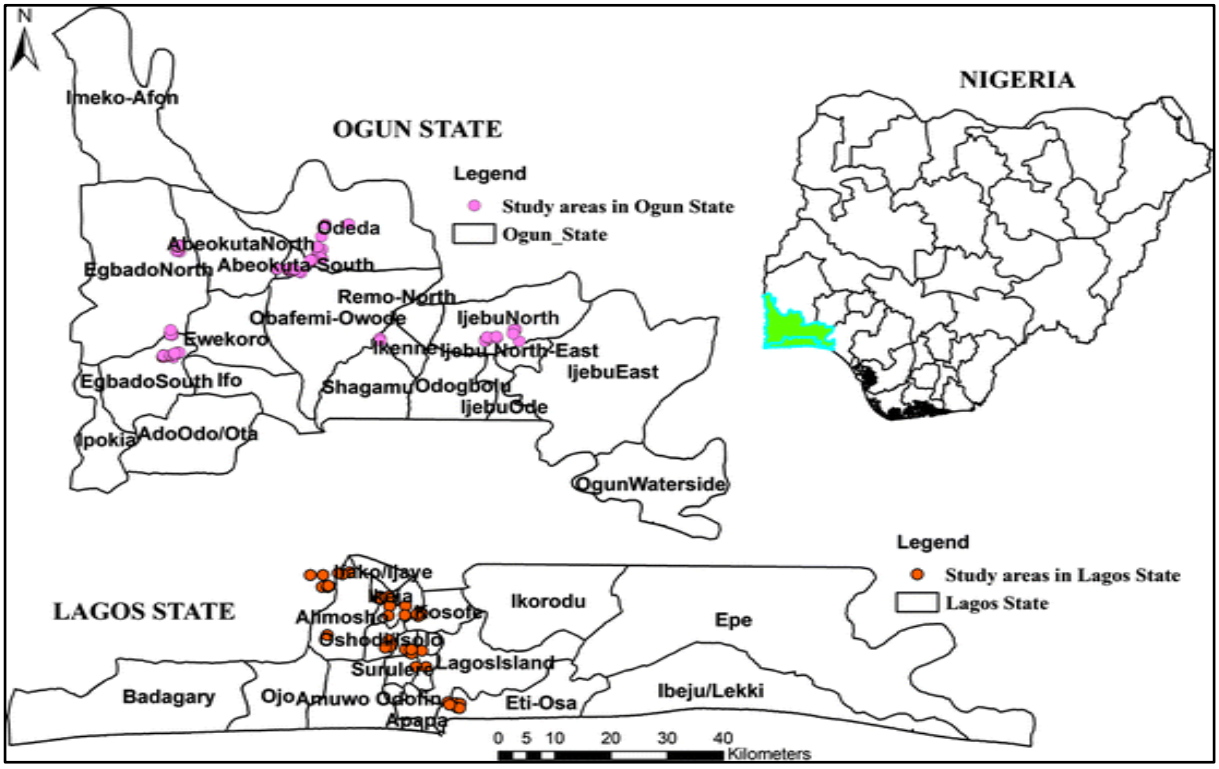

Map of Nigeria showing the study area (Lagos and Ogun state - Southwest Nigeria)

The study employed a quantitative methodology utilising a survey instrument. This research comprised 5,000 individuals (businesses and residents) from selected regions of Lagos and Ogun states in Nigeria. The researchers employed simple random sampling to guarantee that both firms and residents had an equal probability of selection, reducing bias and enhancing the applicability of the findings to the general population. The research investigated three objectives; the first objective analysed businesses' perspectives on the persistent deficiencies of Nigeria's national grid and its impact on increased business operational costs stemming from alternative power generation. The second and third objectives were addressed by both businesses and residents, resulting in a thorough comprehension of varied viewpoints regarding the capacity of renewable energy sources to mitigate grievances related to Nigeria's erratic power supply while also pinpointing the principal obstacles to the adoption and implementation of renewable energy technologies in Nigeria, which was essential for drawing substantial conclusions.

Importantly, the survey instruments were tested in a pilot study with 50 participants to ensure their validity and reliability. This allowed for identifying design issues, such as ambiguous questions and data collection problems, and the necessary adjustments before the full-scale study. The reliability of the instruments was evaluated using Cronbach's Alpha, which yielded a satisfactory result of 0.833. This degree of internal consistency guaranteed that the data collected from businesses and residents was reliable and precise. Further, data was gathered using standardised questionnaires disseminated to online and offline participants

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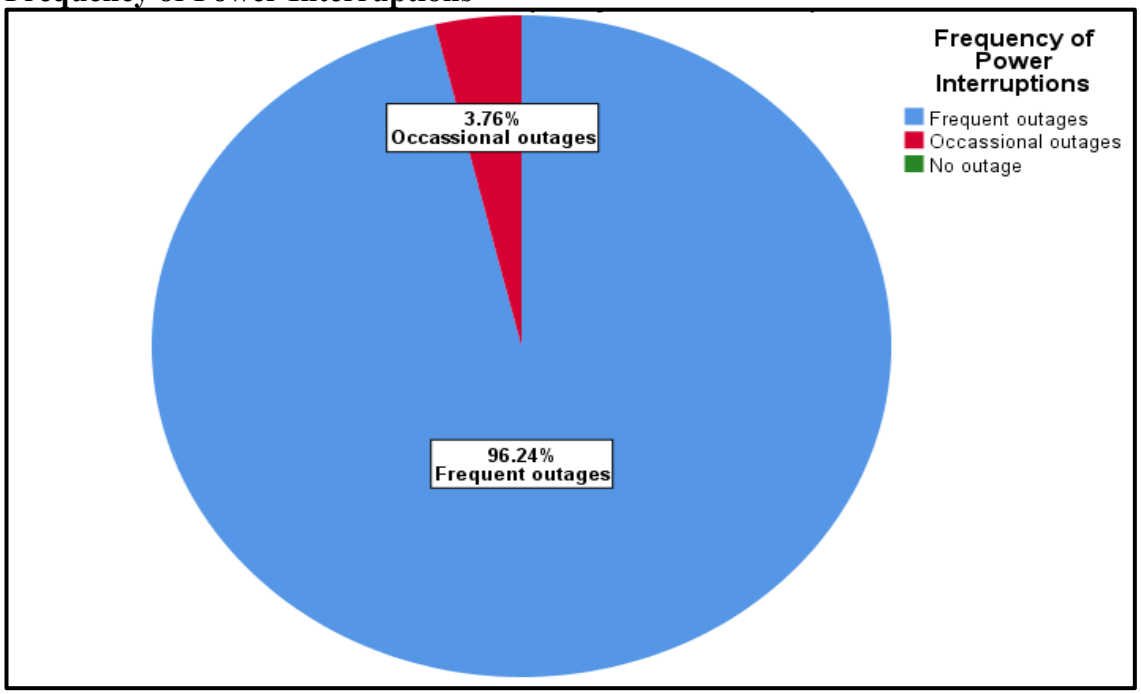
via several landlord associations. Both approaches accommodated the preferences of varied participants and enhanced the achievement of a high response rate. To maintain ethical standards, participants were apprised of the study's goal and agreed before their involvement in the survey. The obtained data was analysed using SPSS and presented through inferential statistics (regression analysis), which were employed to evaluate research objectives one and two. Regression analysis was selected for its efficacy in evaluating intricate correlations between observable and latent variables. Conversely, descriptive statistics (for study aim three) illustrate the frequency and percentage of replies across various types of firms and residents. This method was selected for its clarity in aggregating and presenting data and elucidating response trends and patterns.

RESULTS AND DISCUSSIONS

Participants Perception

Frequency of Power Interruptions



Expenditure on Alternative Power Generation

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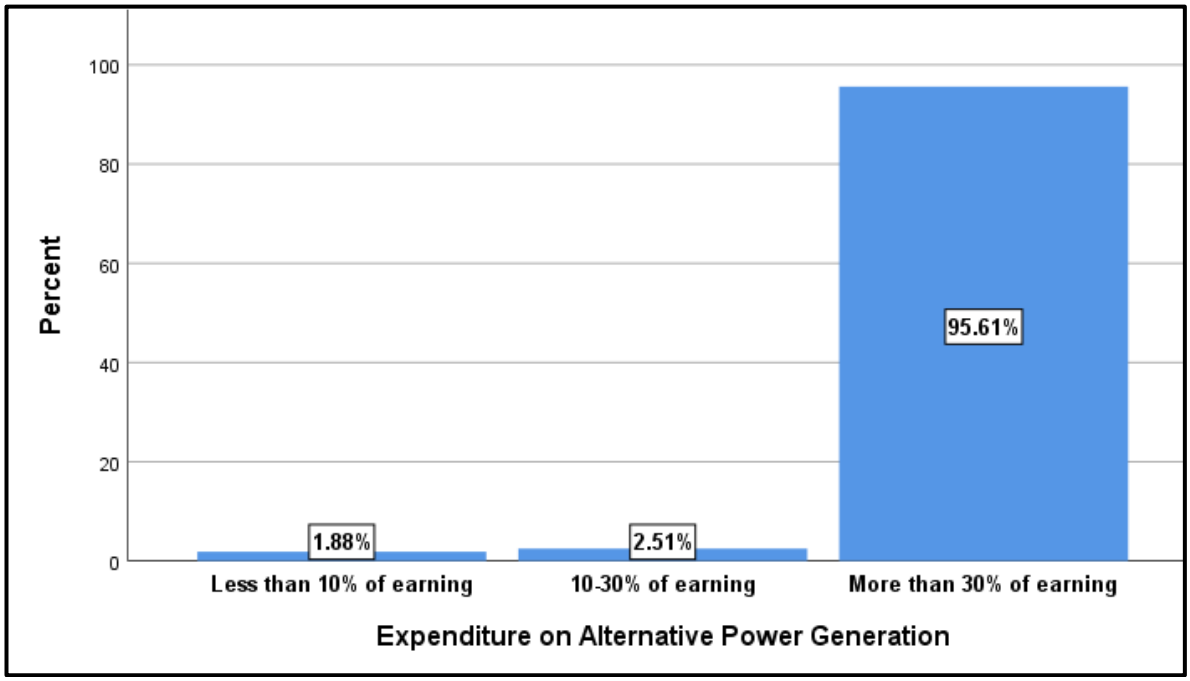
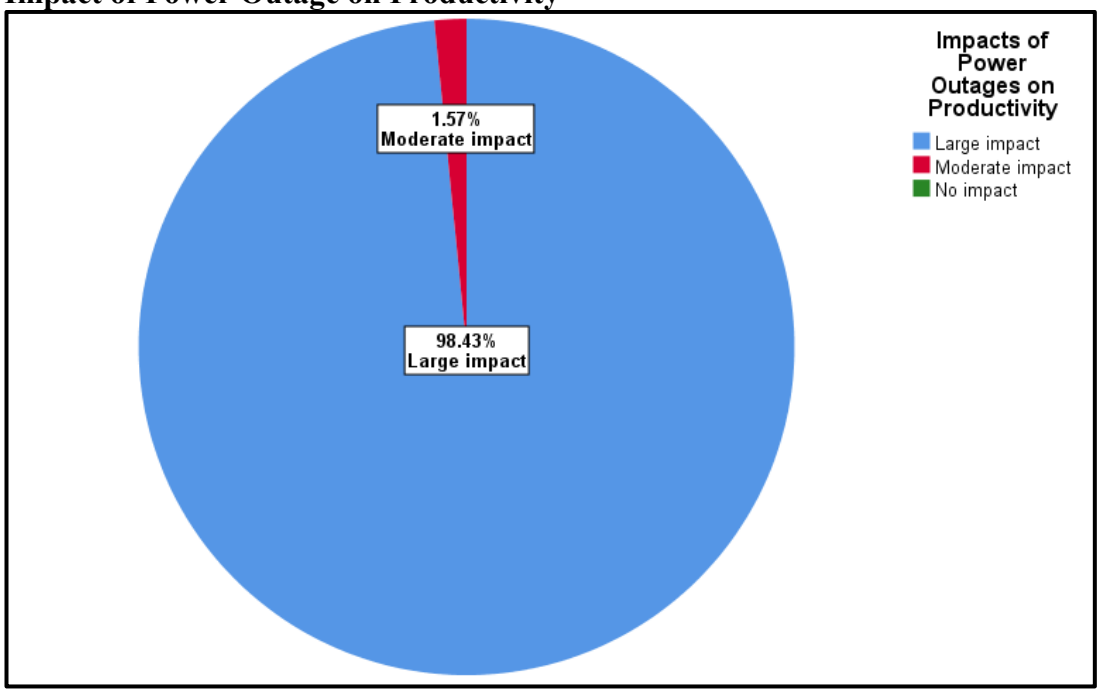


Impact of Power Outage on Productivity



Government Campaign on Renewable Energy Solutions

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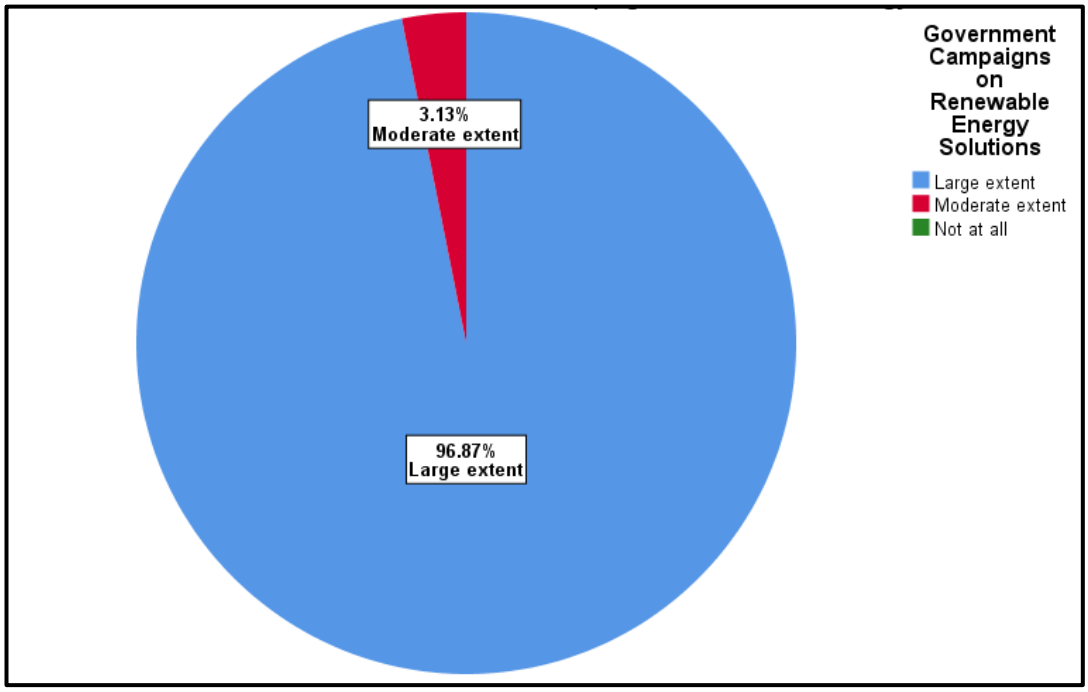
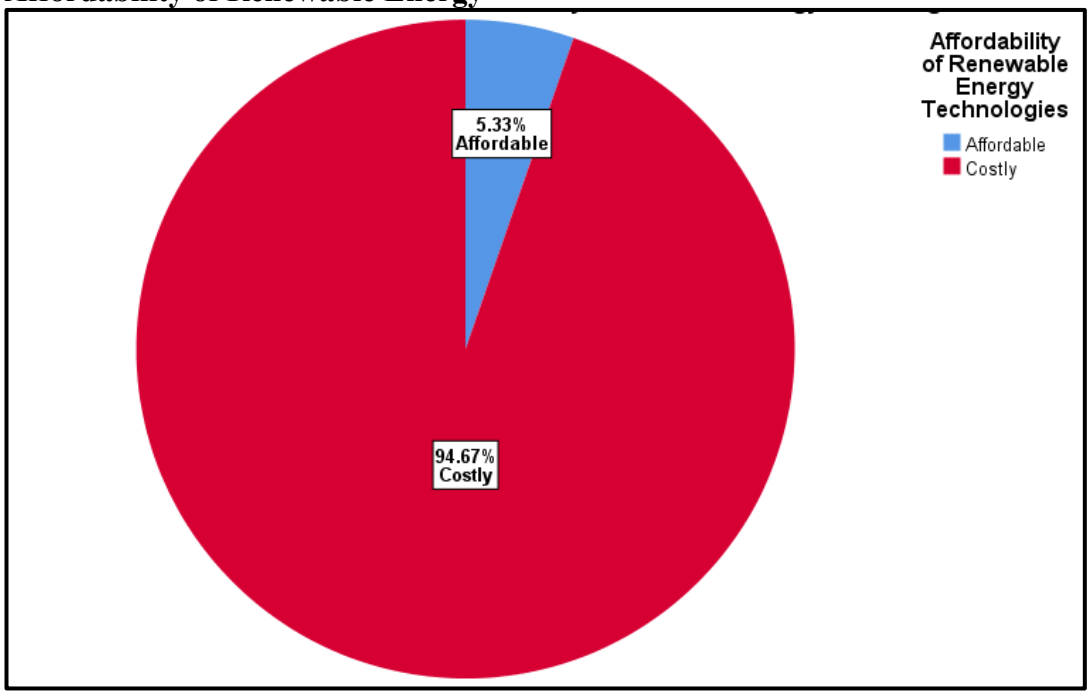


Affordability of Renewable Energy



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Research Objectives (Results)

Assessment of the recurrent failure of Nigeria's national grid and its impact on increased business expenses on alternative power generation

Model Summary[b]				ANOVA	Coefficients[a]
Model	R	R Square	Adjusted R Square	Sig.	Sig.
1	.868[a]	.752	.649	.000[b]	.000

a. Predictors: (Constant), Recurrent Failure of Nigeria's National Grid
b. Dependent Variable: Increased Business Expenses on Alternative Power Generation

The model summary analysis demonstrates a consistently strong positive link between Nigeria's National Grid Failure and the increasing company operational expenses associated with alternative power production, as indicated by the correlation coefficient, R = 0.868. This indicates that, while the national grid continues to hinder an efficient power supply solution, businesses and residents, are perpetually compelled to rely on generators for electricity. The R Square value is 0.752, indicating that 75.2% of company spending on alternate electricity variability is attributable to recurring grid failures. The ANOVA table exhibits statistical significance with a p-value of 0.000, implying that the rise in expenses resulting from grid failure is not random. The findings suggest that enterprises are raising fuel prices, generator maintenance costs, and other overhead expenses while residents incur substantial household bills concurrently due to expenditures on backup power sources. At the national level, these failures exert further strain on the Nigerian economy, diminish corporate profitability, and impose further budgetary burdens on the populace.

Exploration of the potential of renewable energy sources in reducing the frustrations related to Nigeria's erratic power supply.

Model Summary[b]				ANOVA	Coefficients[a]
Model	R	R Square	Adjusted R Square	Sig.	Sig.
1	.923[a]	.851	.748	.000[b]	.000

a. Predictors: (Constant), Renewable Energy Sources
b. Dependent Variable: Frustrations Related to Nigeria Erratic Power Supply

The model demonstrates that renewable energy sources significantly diminish annoyance caused by an unreliable power supply in Nigeria, with a correlation coefficient 0.923. The R Square value (.851) signifies that 85.1% of the observed diminished frustrations among businesses and households can be ascribed to the availability of renewable energy. The Adjusted R Square (.748) signifies that the model's

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robustness persisted after considering numerous factors. Additionally, The ANOVA and coefficient results corroborate the connection, indicating substantial significance (p-value = .000); hence, renewable energy can effectively mitigate the frustration linked to unreliable power supply in Lagos, Ogun, and other areas of Nigeria. Businesses in these states encounter operational inefficiencies and reduced capacity due to an unstable power supply in their daily operations.

key challenges to adopting and implementing renewable energy technologies in Nigeria

Statements	SD	D	N	A	SA
High purchase cost	7.8%	6.3%	8.5%	36.4%	41.1%
Lack of technical expertise for maintenance	4.4%	7.2%	14.1%	42.3%	32.0%
Absence of policies on mandatory installation	4.7%	8.2%	7.5%	50.8%	28.8%
Lack of awareness of renewable energy benefits	3.8%	3.8%	7.2%	45.1%	40.1%
Unavailability of renewable energy resources	3.8%	3.8%	7.2%	43.6%	41.7%

The study indicates a strong consensus on several problems obstructing the use of renewable energy in Nigeria, with 77.5% of respondents seeing high purchase costs as a significant impediment. This highlights that the capital expenditures related to technology, such as solar panels, inverters, or wind turbines, are unattainable for most businesses or homes. A significant majority (74.3%) of respondents concurred that a primary issue with renewable energy systems is the deficiency of technical professionals for maintaining renewable energy systems. Insufficiently trained workers for installing, maintaining, and repairing renewable energy technologies result in premature and accelerated deterioration of these systems. In Nigeria, particularly when technical education in renewable energy is nascent, businesses and residents suffer, incurring higher costs and functioning sub-optimally due to inadequate technicians.

The absence of clear and definitive policies regarding the use of renewable energy is an additional issue, according to 79.6% of respondents. There is no well-known regulating body for easy application of renewable energy in Nigeria's residential, commercial, and industrial settings. Furthermore, 85.2% of respondents indicated that insufficient information regarding the benefits of renewable energy hinders using renewable sources. Most individuals are unaware of the comprehensive return on investment, other advantages of renewable energy, and the detrimental effects of continuous fuel utilisation. Moreover, a limited selection of renewable energy technology was a concern for 85.3 per cent of respondents. This difficulty has emerged from inadequate supply chain and distribution networks, hindering Nigerians' access to various renewable energy choices, including solar panels, batteries, wind turbines, etc.

CONCLUSION AND RECOMMENDATIONS

This study investigates renewable energy as an effective solution to the inconsistent power supply in Nigeria. Investigation reveals a strong and positive association between national grid failures in Nigeria

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and the rising operational costs for companies due to dependence on alternative power sources since firms incur substantial fuel, generators, and other overheads. At a macroeconomic level, inadequacies in the power systems amplify adverse effects on the economy, reducing business revenue and elevating household expenditures. Resolving these grid concerns would mitigate financial pressures and improve Nigeria's economic conditions and export potential. Furthermore, significant evidence was established indicating a correlation between the utilisation of renewable energy and the reduced frustrations encountered by individuals due to an erratic power supply. This highlights the potential of power reform by adopting and implementing renewable energy to reduce frustrations and lessen stress among citizens and companies. The study further identifies additional limitations to the adoption of renewable energy technologies in Nigeria, including high initial costs, insufficient resources for equipment maintenance, lack of standardised policies and compliance measures, limited awareness of the benefits of renewable energy and returns on investment, and restricted access to a diverse array of renewable energy technologies in Nigeria. *Consequently, the following recommendations are proposed:*

1) The government should implement mandatory regulations requiring the incorporation of renewable energy systems in all residential, commercial, and industrial buildings.
2) The government should enhance public knowledge of the benefits of renewable energy to facilitate its adoption.
3) The government should facilitate funding through concessional mechanisms, including subsidised interest rates for purchasers of renewable energy systems.
4) To expand capacity, technical training programs should be established to cultivate a proficient workforce for effectively installing and maintaining renewable energy systems, addressing the deficiency in technical expertise.
5) Governments should promote the Public-Private Partnership (PPP) model for executing large-scale renewable energy projects.

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