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Impact of Renewable Energy Utilization on Economic Growth in Gwagwalada Area Council, Abuja, Nigeria

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ABSTRACT
Reliable and affordable energy is a fundamental driver of economic growth, yet Nigeria continues to experience chronic electricity shortages that constrain productivity at the grassroots level. This study examines the impact of renewable energy utilization on economic growth in Gwagwalada Area Council, Federal Capital Territory (FCT), Abuja, with specific attention to the level of renewable energy adoption, its contribution to economic activities, its effect on income generation and employment, and the challenges limiting its uptake. A descriptive survey research design was adopted, and a stratified random sample of 338 business operators, drawn from a target population of approximately 3,000 small-scale enterprises using Yamane's (1967) formula, was studied using a structured, validated and reliability-tested questionnaire (Cronbach's alpha = 0.81). Data were analyzed using descriptive statistics with the aid of SPSS version 25. The findings show that renewable energy utilization, particularly solar energy, is relatively high among respondents (grand mean = 3.09) and is increasingly adopted as an alternative to unreliable grid electricity. Renewable energy utilization was found to contribute positively to economic activities by reducing business downtime, increasing output, extending operating hours and improving service delivery (grand mean = 3.22), and to enhance income generation and employment by lowering energy expenditure, improving profit margins and supporting the growth of small-scale businesses (grand mean = 3.15). However, high installation costs, limited access to financing, maintenance difficulties, inadequate technical knowledge and insufficient government support remain significant barriers (grand mean = 3.24). The study concludes that renewable energy represents an important pathway for local economic development in areas underserved by the national grid, and recommends targeted financing schemes, cost-reducing incentives, technical-skills development and strengthened government support to accelerate adoption.
Keywords: Renewable energy; Solar energy; Economic growth; Income generation; Employment; Small-scale enterprises; Gwagwalada; Nigeria

1. INTRODUCTION
The global transition toward renewable energy has become increasingly vital in view of the urgency of climate change and the harmful effects of fossil-fuel dependency (Bariki, Akhigbe & Ismail, 2025: Al-Amin, et all, 2025). As nations strive to mitigate greenhouse-gas emissions, renewable sources such as solar, wind, hydroelectric and biomass power have emerged as viable alternatives offering both environmental and economic benefits, a shift that is particularly important in developing countries where energy poverty remains a barrier to growth (Umar, Magaji & Ismail, 2025). Globally, an estimated 789 million people still lack access to electricity, a problem most severe in sub-Saharan Africa (Bariki,

Emmanuel & Ismail, 2025; International Energy Agency [IEA], 2020). In Nigeria, overreliance on fossil fuels has produced high energy costs, power instability and environmental degradation, notwithstanding the country's status as Africa's largest crude-oil producer and its considerable renewable-energy potential (Sabiu, & Magaji, 2024).

Abuja, Nigeria's Federal Capital Territory, offers a valuable setting for examining the economic impact of renewable-energy adoption (Al-Amin, Magaji & Ismail, 2025). Since its designation as the capital in 1976, Abuja has experienced rapid urbanization and economic growth, yet continues to suffer from irregular electricity supply, underscoring the need for alternatives such as solar power given the region's high solar irradiance (Bariki, Matthew, & Ismail, 2025). Gwagwalada Area Council, within the FCT, has witnessed significant population growth and expanding commercial, agricultural, educational and informal-sector activity, all of which depend heavily on energy for efficient operation (Bariki, et all, 2025; Umar, Magaji & Ismail, 2025). Erratic grid supply has limited productivity and income generation in the area, prompting households, schools, health centres and businesses to increasingly adopt solar-energy systems to supplement or replace grid electricity (Sabiu, Ajayi, & Ismail, 2025; Al-Amin, et all, 2025).

Despite this growing adoption, empirical evidence on how renewable-energy utilization affects economic growth at the local-government level remains limited; most existing Nigerian studies focus on national or state-level analyses, overlooking the socio-economic dynamics of local government areas such as Gwagwalada. This study therefore examines the impact of renewable-energy utilization on economic growth in Gwagwalada Town, with the specific objectives of (i) examining the level of renewable-energy utilization in the area, (ii) assessing its contribution to economic activities, (iii) determining its effect on income generation and employment, and (iv) identifying the challenges affecting its utilization.

2. METHODOLOGY

2.1 Research design and study area

The study adopted a descriptive survey research design, appropriate for capturing the opinions, attitudes and characteristics of a defined population (Creswell, 2014). The study was conducted in Gwagwalada Area Council, one of the six area councils of the FCT, located approximately 55 km from Abuja city centre. The area is characterized by a growing population and a diversity of small-scale enterprises, including retail shops, tailoring businesses, barbing salons, cybercafés and food vendors, and has experienced persistently inconsistent electricity supply that affects business operations.

2.2 Population, sample size and sampling technique

The study population comprised business owners operating in Gwagwalada Town across retail trade, services, agro-processing and manufacturing, numbering approximately 3,000 small-scale businesses according to the Gwagwalada Area Council Business Directory (2023). Given the impracticality of studying the entire population, a sample size was determined using Taro Yamane's (1967) formula, $n = N / (1 + N(e)^2)$, with $N = 3{,}000$ and a margin of error $e = 0.05$, yielding a sample of 352 respondents. A stratified random sampling technique was employed, with strata based on business category (retail, service, manufacturing, agro-processing and other), to ensure representativeness across sectors.

2.3 Research instrument, validity and reliability

Data were collected using a structured questionnaire divided into five sections: (A) demographic data, (B) renewable-energy utilization in business operations, (C) impact on economic activities, (D) income generation and employment, and (E) challenges of renewable-energy utilization, combining closed-ended items with a 5-point Likert scale. Content validity was established through expert review by specialists in business administration and energy economics, followed by a pilot test involving 20 small-business owners in the neighbouring Kuje Area Council. Internal consistency of the Likert-scale items was assessed using Cronbach's alpha, yielding a coefficient of 0.81, indicating that the instrument was reliable for the main study (George & Mallery, 2003).

2.4 Data collection and analysis

Questionnaires were administered face-to-face by trained research assistants to improve response rates and allow clarification of items, with informed consent obtained prior to participation. Data were analyzed using descriptive statistics (frequencies, percentages and means) with the aid of SPSS version 25. For the Likert-scale items, responses were weighted as Strongly Agree = 4, Agree = 3, Disagree = 2 and Strongly Disagree = 1, and a criterion mean of 2.50 was adopted, such that an item mean at or above 2.50 was interpreted as agreement.

3. RESULTS

3.1 Demographic characteristics of respondents

Table 1. Demographic characteristics of respondents (n = 338).

Variable	Category	Frequency	Percentage (%)
Gender	Male	194	57.4
	Female	144	42.6
Age	18–25 years	61	18.0
	26–35 years	128	37.9
	36–45 years	94	27.8
	46 years and above	55	16.3
Education	Primary	28	8.3
	Secondary	116	34.3
	Tertiary	165	48.8
	Other	29	8.6
Business type	Retail	112	33.1
	Service	98	29.0
	Manufacturing	47	13.9
	Agro-processing	39	11.5
	Other	42	12.4
Years of operation	1–5 years	143	42.3
	6–10 years	101	29.9
	Above 10 years	63	18.6

Source: Field survey, 2026.

A total of 338 valid responses were analyzed. Table 1 shows that male respondents constituted 57.4% (n = 194) of the sample and female respondents 42.6% (n = 144). Respondents aged 26–35 years formed the largest age group (37.9%), followed by those aged 36–45 years (27.8%), 18–25 years (18.0%) and 46 years and above (16.3%), indicating that most respondents were within economically active age groups. Regarding educational qualification, 48.8% of respondents had attained tertiary education, 34.3% secondary education, 8.6% other qualifications and 8.3% primary education. By business type, retail enterprises constituted the largest share (33.1%), followed by services (29.0%), manufacturing (13.9%), agro-processing (11.5%) and other businesses (12.4%). In terms of years of operation, 42.3% of businesses had operated for 1–5 years, 29.9% for 6–10 years and 18.6% for more than 10 years.

3.2 Level of renewable-energy utilization

As shown in Table 2, all five items relating to the level of renewable-energy utilization recorded mean scores above the criterion mean of 2.50. Solar energy was identified as the most commonly used renewable source (mean = 3.29), followed by the use of renewable energy as an alternative to grid electricity (mean = 3.20). The lowest-rated item concerned the ready availability of renewable energy in the area (mean = 2.82), though it remained above the criterion mean. The grand mean of 3.09 indicates that respondents generally agreed that renewable-energy utilization is relatively high in Gwagwalada Area Council.

Table 2. Level of renewable-energy utilization (grand mean = 3.09). Source: Field survey, 2026.

3.3 Contribution to economic activities

Table 3 shows that all items on the contribution of renewable energy to economic activities recorded mean scores above 2.50. Reduction of downtime caused by power outages recorded the highest agreement, followed by improvements in business operations and service delivery. The grand mean of 3.22 indicates general agreement that renewable-energy utilization contributes positively to economic activities by reducing downtime, increasing output, extending operating hours and improving service delivery.

Table 3. Impact of renewable energy on economic activities (grand mean = 3.22). Source: Field survey, 2026.

Statement	SA	A	D	SD	Mean	Decision
Improved business operations	155	126	39	18	3.24	Agreed
Reduced downtime caused by power outages	142	128	40	20	3.16	Agreed
Increased daily business output	147	125	47	19	3.18	Agreed
Enabled longer working hours	118	139	55	26	3.03	Agreed
Improved service delivery	151	123	44	20	3.20	Agreed

3.4 Effect on income generation and employment

As presented in Table 4, all statements relating to income generation and employment recorded mean scores above the criterion mean. Support for the growth of small-scale businesses recorded the highest mean score (3.29), followed closely by the reduction of energy expenses (3.26). The lowest-rated item concerned job creation, which nonetheless remained above the criterion mean. The grand mean of 3.15 indicates that renewable-energy utilization is generally perceived as beneficial to income generation and employment.

Table 4. Renewable energy, income generation and employment (grand mean = 3.15). Source: Field survey, 2026

Statement	SA	A	D	SD	Mean	Decision
Increased income	132	137	49	20	3.13	Agreed
Reduced energy expenses	161	121	40	16	3.26	Agreed
Improved profit margin	137	132	51	18	3.15	Agreed
Enabled longer working hours	118	139	55	26	3.03	Agreed
Supports growth of small-scale businesses	159	131	36	12	3.29	Agreed

.3.5 Challenges affecting renewable-energy utilization

Table 5 shows that respondents agreed with all identified challenges affecting renewable-energy utilization. High installation cost was rated as the most significant barrier (mean = 3.46), followed by lack of access to financing (mean = 3.41), inadequate government support (mean = 3.21), maintenance difficulties (mean = 3.11) and limited technical knowledge (mean = 3.03). The grand mean of 3.24 confirms that these factors constitute significant barriers to renewable-energy adoption.

Table 5. Challenges affecting renewable-energy utilization (grand mean = 3.24). Source: Field survey, 2026.

Statement	SA	A	D	SD	Mean	Decision
High installation cost limits adoption	207	91	28	12	3.46	Agreed
Lack of access to financing is a challenge	193	104	29	12	3.41	Agreed
Maintenance of renewable systems is difficult	126	143	50	19	3.11	Agreed
Inadequate technical knowledge	116	139	61	22	3.03	Agreed
Government support is inadequate	155	119	45	19	3.21	Agreed

4. DISCUSSION

The finding that renewable-energy utilization is relatively high among respondents, with solar energy as the dominant source, reflects the growing role of solar power as an alternative to unreliable grid electricity in the study area. This is consistent with the broader literature identifying solar energy as an increasingly important decentralized energy solution in Nigeria (Akinwale & Ogundari, 2017; International Renewable Energy Agency [IRENA], 2020). The finding that renewable energy reduces downtime and improves business operations suggests that alternative energy sources can support the continuity of economic activities, particularly for businesses that depend on electricity for production, refrigeration, and information and communication technologies.

The positive effect on income generation is consistent with the view that reduced expenditure on conventional energy sources contributes to improved business profitability, a pathway also identified in prior empirical work linking renewable-energy consumption to economic outcomes (Apergis & Payne, 2010, 2014; Orisa, Ibe, & Nteegah, 2024). Finally, the finding that high installation costs and limited financing are the most significant barriers aligns with previous studies identifying high upfront costs, limited financing, technical limitations and inadequate institutional support as key constraints on renewable-energy deployment in Nigeria (IRENA, 2020; Owusu & Asumadu-Sarkodie, 2016).

5. CONCLUSION AND RECOMMENDATIONS

The study concludes that renewable-energy utilization, particularly solar energy, plays an important role in supporting economic activities in Gwagwalada Area Council. By reducing downtime and enabling businesses to operate for longer periods, renewable energy contributes to improved productivity, income generation and employment. However, these benefits are constrained by high acquisition and installation costs, limited access to finance, maintenance difficulties, inadequate technical expertise and insufficient institutional support. Increased utilization therefore requires coordinated policy, financing and technical-support mechanisms rather than reliance on individual adoption alone.

Based on these findings, the study recommends: (i) the establishment of affordable financing schemes, including low-interest loans and flexible repayment arrangements, to improve access to renewable-energy systems for households and small businesses; (ii) the introduction of tax incentives, subsidies and import-related measures to reduce the cost of solar panels, batteries and inverters; (iii) increased investment in technical and vocational training in solar installation, maintenance and repair; (iv) the strengthening of government policies and programmes promoting renewable-energy adoption at the grassroots level; (v) the establishment of accessible maintenance and after-sales service centres; and (vi) sustained public education on the economic benefits and financing opportunities associated with renewable energy. Future research should extend this analysis to other area councils of the FCT and adopt longitudinal designs to assess the long-term financial performance of businesses before and after renewable-energy adoption.

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