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Research

Influence of socioeconomic Status on the Acceptance and Optimization of Renewable Energy for Sustainable Power Supply in Umunneochi

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Abstract: Socioeconomic status influences consumption behavior, technological adoption, lifestyle choices, and access to public services. The study examined the influence of socioeconomic status on the acceptance and optimization of renewable energy for sustainable power supply in Umunneochi. Quantitative approach rooted on positivism paradigm was adopted for the study, which was anchored on the Technology Acceptance Model (TAM). The population of the study consists of the entire residence of Umunneochi LGA, Abia State which is estimated at 239,952 according to City population projection 2025. The sample size of the study is 700 residences of Umunneochi who are 18years and above. Structured questionnaire was used for data collection. Mean and standard deviation was used to answer the research questions, while ANOVA were used to test the null hypotheses at 0.05 level of significance. The study revealed that, the willingness to pay for renewable energy as alternative source of power supply is high among residence of Umunneochi, however, income, education, and occupation has significant influence on the level of acceptance, while only occupation had significant influence on optimization of renewable energy for sustainable power supply in Umunneochi (P>0.05). The study recommended that, the federal and state government should subsidize renewable energy for residence or provide installment payment plans for residence as income is the major determinant of acceptance of renewable energy as source of alternative power supply.

Keywords: Socioeconomic Status, Electricity, Acceptance, Optimization, Sustainable Power Supply, Renewable Energy.

1.1 Introduction

Energy remains a critical driver of socio-economic development, industrialization, and improved quality of life across nations. Sustainable access to reliable electricity

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supports economic productivity, healthcare delivery, education, communication, and technological innovation. However, Nigeria continues to experience persistent electricity supply deficits despite its enormous natural and human resources. The country's power sector is characterized by inadequate generation capacity, unstable transmission networks, poor distribution infrastructure, and frequent grid collapses, resulting in chronic energy insecurity for households and industries (Abubakar et al., 2024). Nigeria's electricity generation has historically depended heavily on fossil fuels, particularly gas-fired thermal plants and hydroelectric power. Nevertheless, the growing population, urbanization, industrial expansion, and rising energy demand have exposed the inability of conventional energy sources to adequately meet national electricity needs. Consequently, millions of Nigerians rely on alternative energy sources such as diesel generators, kerosene, fuelwood, and charcoal, which contribute significantly to environmental degradation, greenhouse gas emissions, and public health challenges (Adeleke et al., 2022).

Renewable energy has emerged globally as a viable solution for achieving sustainable energy security and environmental sustainability. Renewable energy sources such as solar, wind, biomass, geothermal, and small hydropower offer cleaner, affordable, and environmentally sustainable alternatives to fossil fuels. In Nigeria, renewable energy resources are abundant due to favorable climatic and geographical conditions. The country possesses enormous solar radiation potential, especially in the northern regions, substantial wind resources in coastal and highland areas, extensive biomass resources from agricultural activities, and numerous small hydro opportunities (Unegbu et al., 2025). Among renewable technologies, solar photovoltaic systems have gained increasing attention in Nigeria because of declining installation costs, improved technological efficiency, and the growing unreliability of the national grid. Solar mini-grids and decentralized renewable systems have become important alternatives for rural electrification and energy access, particularly in underserved communities where grid extension is economically difficult (Carabajal et al., 2024). Furthermore, the increasing instability of Nigeria's national grid and rising fuel prices have intensified public interest in renewable energy solutions, especially solar technologies.

Despite these opportunities, renewable energy adoption and optimization in Nigeria remain relatively low compared to global standards. The acceptance and effective utilization of renewable energy technologies are influenced by several interrelated factors, including economic conditions, policy frameworks, educational attainment, technological

awareness, infrastructure availability, cultural perceptions, and social inequalities. Among these factors, socioeconomic status plays a significant role in shaping access to renewable technologies, willingness to adopt clean energy solutions, and the capacity to optimize their utilization for sustainable power supply.

Socioeconomic status generally refers to an individual's or household's economic and social position relative to others, usually measured through income level, educational attainment, occupation, social class, and living standards. Individuals with higher socioeconomic status are often more capable of financing renewable energy installations, accessing technical knowledge, maintaining energy systems, and investing in energy-efficient technologies. Conversely, low-income households may experience barriers such as high installation costs, inadequate financing opportunities, limited technical literacy, and poor awareness of renewable energy benefits (Umoru et al., 2026).

The relationship between socioeconomic status and renewable energy adoption has become increasingly important within the context of sustainable development. Existing studies indicate that income inequality, poverty levels, employment patterns, and educational disparities significantly affect renewable energy acceptance and deployment in developing countries. In Nigeria, renewable energy adoption appears to be concentrated among urban residents, middle-income earners, institutions, and commercial enterprises, while rural and low-income populations still rely heavily on traditional biomass and fossil-fuel-based energy systems (Wali et al., 2025). The optimization of renewable energy technologies also extends beyond mere adoption. Optimization involves the efficient, consistent, and productive utilization of renewable energy systems to achieve maximum socio-economic and environmental benefits. This includes proper maintenance, integration into productive economic activities, efficient storage systems, technical management, and long-term sustainability of renewable infrastructure. Socioeconomic inequalities may significantly influence the ability of users to optimize renewable systems due to disparities in technical expertise, financing capacity, and access to support services.

In addition, behavioral attitudes, social perceptions, cultural beliefs, and public trust strongly influence renewable energy acceptance in Nigeria. Studies have shown that awareness, perceived benefits, peer influence, and government support policies significantly shape people's willingness to adopt renewable technologies (Ashinze et al., 2021). These behavioral factors are often interconnected with socioeconomic conditions, as education and income levels influence access to information and technology acceptance.

The growing global commitment toward sustainable development and climate change mitigation has further intensified the need for renewable energy transition in Nigeria. International frameworks such as the United Nations Sustainable Development Goals (SDGs), particularly Goal 7 on affordable and clean energy, emphasize universal access to sustainable, reliable, and modern energy systems. Achieving these goals requires a better understanding of the socioeconomic factors influencing renewable energy acceptance and optimization within developing economies like Nigeria.

Against this background, this study investigates the influence of socioeconomic status on the acceptance and optimization of renewable energy for sustainable power supply in Nigeria. The study seeks to contribute to existing literature by examining how income, education, occupation, social awareness, and related socioeconomic indicators affect renewable energy adoption patterns and sustainable utilization. The findings are expected to provide useful insights for policymakers, energy planners, development agencies, and private investors seeking to improve renewable energy accessibility, affordability, and sustainability across different socio-economic groups in Nigeria.

1.2 Purpose of the Study

The main purpose of the study is to examine the Influence of socioeconomic Status on the Acceptance and Optimization of Renewable Energy for Sustainable Power Supply in Umunneochi. The specific purposes of the study are:

i. Examine the influence of income status on the extent of acceptance of renewable energy as alternative source of power supply among residence of Umunneochi
ii. Examine the influence of income status on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi
iii. Examine the influence of level of education on the extent of acceptance of renewable energy as alternative source of power supply among residence of Umunneochi
iv. Examine the influence of level of education on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi
v. Examine the influence of occupation on the extent of acceptance of renewable energy as alternative source of power supply among residence of Umunneochi
vi. Examine the influence of occupation on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi

1.3 Hypotheses

The following null hypotheses were formulated to guide the study and will be tested at 0.05 level of significance:

i. Income status has no significant influence on the extent of acceptance of renewable energy as alternative source of power supply among residence of Umunneochi
ii. Income status has no significant influence on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi
iii. Level of education has no significant influence on the extent of acceptance of renewable energy as alternative source of power supply among residence of Umunneochi
iv. Level of education has no significant influence on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi
v. Occupation has no significant influence on the extent of renewable energy as alternative source of power supply among residence of Umunneochi
vi. Occupation has no significant influence on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi

2.0 Literature Review

Renewable energy refers to energy derived from naturally replenishing sources that are continuously available within the environment. These sources include solar energy, wind energy, hydropower, biomass, geothermal energy, and tidal energy. Unlike fossil fuels, renewable energy sources produce minimal greenhouse gas emissions and contribute significantly to environmental sustainability and climate change mitigation. Renewable energy technologies are increasingly recognized as strategic solutions for improving energy security, reducing dependence on imported fuels, and promoting sustainable economic development. Globally, renewable energy has become central to energy transition policies because of rising environmental concerns associated with fossil fuel consumption. The transition toward clean energy systems has accelerated due to technological innovations, declining production costs, and increased awareness of environmental sustainability. In developing countries such as Nigeria, renewable energy presents enormous opportunities for addressing electricity shortages, expanding rural electrification, and supporting socio-economic transformation.

Nigeria possesses substantial renewable energy resources capable of meeting national electricity demand if adequately harnessed. Solar energy remains the most promising renewable resource due to Nigeria's high solar irradiation levels throughout the year. Biomass energy also offers significant potential because of extensive agricultural activities and organic waste generation. Wind and small hydropower resources further complement the country's renewable energy portfolio (Unegbu et al., 2025). Socioeconomic status is a multidimensional concept that reflects individuals' or households' relative economic and social positions within society. It commonly includes indicators such as income level, educational attainment, occupational status, wealth, and access to social opportunities.

Even while renewable energy systems have a lot of promise in rural areas, a number of obstacles still prevent renewable energy technologies from being widely adopted and optimized. One of the most critical challenges is the high initial cost associated with the acquisition and installation of renewable energy equipment. The cost of solar home systems in Nigeria, for example, can range from approximately $300 to $1,500, making them unaffordable for many rural households with limited financial resources (Ken Research, 2025). In many communities, renewable energy systems are perceived as expensive, complex, or unreliable, which discourages potential users from embracing these technologies (Climate Scorecard, 2025).

Beyond financial and technological constraints, social and economic factors like income level, educational attainment, occupation, and household characteristics often determines households' ability to invest in alternative energy solutions and their willingness to adopt new technologies. Households with higher income levels or better educational backgrounds tend to demonstrate greater awareness of renewable energy benefits and are more capable of affording installation costs. Conversely, low-income households may perceive renewable energy technologies as luxury products reserved for wealthier individuals, thereby limiting their adoption in marginalized communities (Climate Scorecard, 2025). Empirical studies on rural energy adoption further suggest that factors such as income, social networks, and community associations significantly influence households' willingness to adopt solar energy technologies (Ganiyu, et al., 2024).

Energy consumption patterns vary considerably across socioeconomic groups. High-income households generally consume more electricity due to greater ownership of electrical appliances and higher living standards. They are also more likely to invest in

alternative energy technologies such as solar photovoltaic systems, energy storage devices, and smart energy solutions. Conversely, low-income households often depend on traditional biomass, kerosene, or fuelwood due to affordability constraints and limited access to modern energy infrastructure. Studies on household energy consumption in Nigeria indicate that income, education, family size, urbanization, and employment status significantly affect energy utilization patterns (Abubakar et al., 2024). Households with higher socioeconomic status demonstrate greater capacity to transition toward cleaner and more sustainable energy alternatives because they possess better financial and informational resources.

In Nigeria, renewable energy acceptance has grown steadily due to increasing dissatisfaction with the unreliable national grid and rising fuel prices. Solar energy systems have become increasingly popular among households, businesses, schools, healthcare facilities, and rural communities seeking alternative power solutions. However, the extent of adoption varies significantly across socioeconomic groups and geographical regions. Ashinze et al. (2021) found that perceived benefits, environmental concern, behavioral attitudes, and social influence significantly affect renewable energy adoption intentions in Nigeria. Similarly, Odedosu (2025) emphasized that awareness, trust in technology, peer-group influence, and supportive policies strongly shape renewable energy acceptance among underserved populations. Furthermore, Wali et al. (2025) observed that socioeconomic characteristics such as income level, education, and occupational status significantly influence solar energy adoption and installed capacity in urban Nigeria. Households with stable incomes and higher educational attainment were more likely to install larger and more efficient solar systems.

Several empirical studies have examined the relationship between socioeconomic factors and renewable energy adoption. Income remains one of the strongest predictors of renewable energy acceptance because renewable technologies often require substantial initial investment despite their long-term cost benefits. High-income earners are more capable of purchasing solar panels, inverters, batteries, and related infrastructure. Adeleke et al. (2022) found that poverty status significantly affects households' willingness to pay for renewable energy technologies in Southwestern Nigeria. Poor households demonstrated lower capacity to invest in renewable technologies despite recognizing their potential benefits. Similarly, Umoru et al. (2026) reported that income inequality, energy costs, and employment structures negatively influence renewable energy adoption in Nigeria.

Educational attainment also plays a critical role in renewable energy adoption. Educated individuals are more likely to understand the environmental and economic benefits of renewable technologies, possess better technological literacy, and demonstrate greater openness to innovation. Education enhances awareness of climate change, sustainable development, and energy efficiency practices.

Occupation and employment status equally influence renewable energy adoption. Individuals employed in stable formal sectors generally possess greater financial capacity and access to financing mechanisms for renewable energy investments. Business owners and entrepreneurs often adopt renewable energy systems to reduce operational costs associated with unstable grid supply and expensive diesel generators. Urban-rural disparities further affect renewable energy utilization in Nigeria. Urban residents typically have better access to renewable energy markets, technical expertise, maintenance services, and financial institutions. Rural communities, despite their high need for electricity access, often face infrastructural challenges, poor financing opportunities, and limited awareness. Empirical studies on renewable energy adoption in Nigeria reveal mixed findings regarding the influence of socioeconomic variables. Wali et al. (2025) found strong positive relationships between income level, educational attainment, and solar energy adoption in Kano State. Similarly, Ashinze et al. (2021) reported that behavioral attitudes and perceived benefits significantly predict renewable energy purchase intentions.

Umoru et al. (2026) established that income inequality and fossil-fuel employment structures negatively affect renewable energy transition in Nigeria. Their findings suggest that socioeconomic inequalities constitute major barriers to sustainable energy transition. Adeleke et al. (2022) further revealed that poverty significantly reduces households' willingness to pay for renewable technologies. In rural areas, limited income opportunities and poor access to credit facilities constrain renewable energy adoption despite high demand for electricity. Despite increasing scholarly attention, existing literature has focused more on renewable energy adoption than optimization and sustainable utilization. Limited studies have comprehensively examined how socioeconomic status affects both acceptance and optimization of renewable energy technologies in Nigeria. This study therefore seeks to bridge this gap by providing a holistic analysis of the socioeconomic determinants influencing renewable energy acceptance and optimization for sustainable power supply.

3.0 RESEARCH METHOD

The design used for this study is descriptive survey. A descriptive survey is one in which a group of people or items is studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group. According to Mole (2019) descriptive survey aims at collecting data on, and describing in a systematic manner, the characteristics, features or facts about a given population. Descriptive survey is therefore considered suitable for this study because it will be based on the opinions and views of residence of Umunneochi local government area of Abia state on their level of acceptance and optimization of renewable energy for sustainable power supply in Umunneochi. The population of the study is the entire residence of Umunneochi local government area of Abia state. The population of the study consists of the entire residence of Umunneochi LGA, Abia State which is estimated at 239,952 according to Citypopulation projection 2025. The sample size of the study is 700 residences of Umunneochi who are 18years and above. Structured questionnaire was used for data collection. ANOVA was used to test the null hypotheses at 0.05 level of significance.

4.0 Results

A total of 676 residence of Umunneochi responded to the survey, indicating 96.6% return rate which was considered high for the analysis. Both online and print questionnaires were distributed to the residences across the different towns and villages in Umunneochi local government area of Abia State.

Hypothesis 4.1: Income status has no significant influence on the extent of acceptance of renewable energy as alternative source of power supply among residence of Umunneochi as shown in table 5.1.

Table 4.1: *Summary of Anova on the Influence of Income Status on the Extent of Acceptance of Renewable Energy as Alternative Source of Power Supply Among Residence of Umunneochi*

	Sum of Squares	**df**	**Mean Square**	**F**	**P-Value**	**Decision**
Between Groups	2.337	4	.584	5.098	.000	Significant
Within Groups	76.895	671	.115			
Total	79.232	675				

P<0.05; **S:** Significant; **NS:** Not Significant

Table 4.1, shows that the ANOVA F-value of 5.098 is significant at 0.000. Since the significant value of 0.000 is less than 0.05 level of significance at which the null hypothesis was tested, the null hypothesis is therefore rejected. Hence, Income status has a significant influence on the extent of acceptance of renewable energy as alternative source of power supply among residence of Umunneochi.

Hypothesis 4.2: Income status has no significant influence on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi, shown in table 4.2.

Table 4.2: *Summary Of Anova on The Influence of Income Status on The Extent of Optimization of Renewable Energy as Alternative Source of Power Supply Among Residence of Umunneochi*

	Sum of Squares	**df**	**Mean Square**	**F**	**P-Value**	**Decision**
Between Groups	.853	4	.213	1.915	0.106	
Within Groups	74.723	671	.111			Not Significant
Total	75.576	675				

P<0.05; **S:** Significant; **NS:** Not Significant

Table 4.2, shows that the ANOVA F-value of 1.915 is significant at 0.106. Since the significant value of 0.106 is greater than 0.05 level of significance at which the null hypothesis was tested, the null hypothesis is therefore upheld. Hence, Income status has no significant influence on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi.

Hypothesis 4.3: Level of education has no significant influence on the extent of acceptance of renewable energy as alternative source of power supply among residence of Umunneochi, shown in table 4.3.

Table 4.3: *Summary of Anova on the Influence of Level of Education on the Extent of Acceptance of Renewable Energy as Alternative Source of Power Supply Among Residence of Umunneochi*

	Sum of Squares	**df**	**Mean Square**	**F**	**P-Value**	**Decision**
Between Groups	2.901	3	.967	8.512	0.000	
Within Groups	76.331	672	.114			Significant
Total	**79.232**	**675**				

P<0.05; **S:** Significant; **NS:** Not Significant

Table 4.3, shows that the ANOVA F-value of 8.512 is significant at 0.000. Since the significant value of 0.000 is less than 0.05 level of significance at which the null hypothesis was tested, the null hypothesis is therefore rejected. Hence, Level of education has a significant influence on the extent of acceptance of renewable energy as alternative source of power supply among residence of Umunneochi.

Hypothesis 4.4: Level of education has no significant influence on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi, as shown in table 4.4.

Table 4.4: *Summary Of Anova on the Influence of Level of Education on the Extent of Optimization of Renewable Energy as Alternative Source of Power Supply Among Residence of Umunneochi*

	Sum of Squares	**df**	**Mean Square**	**F**	**P-Value**	**Decision**
Between Groups	.760	3	.253	2.274	0.079	Not Significant
Within Groups	74.817	672	.111			
Total	75.576	675				

P<0.05; **S:** Significant; **NS:** Not Significant

Table 4.4 shows that the ANOVA F-value of 2.274 is significant at 0. 079. Since the significant value of 0. 079 is greater than 0.05 level of significance at which the null hypothesis was tested, the null hypothesis is therefore upheld. Hence, level of education has

no significant influence on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi

Hypothesis 4.5: Occupation has no significant influence on the extent of Acceptance of renewable energy as alternative source of power supply among residence of Umunneochi, shown in table 4.5.

Table 4.5: *Summary of Anova on the Influence of Occupation on the Extent of Acceptance of Renewable Energy as Alternative Source of Power Supply Among Residence of Umunneochi*

	Sum of Squares	**df**	**Mean Square**	**F**	**P-Value**	**Decision**
Between Groups	1.756	6	.293	2.527	0.020	Significant
Within Groups	77.476	669	.116			
Total	79.232	675				

P<0.05; **S:** Significant; **NS:** Not Significant

Table 4.5, shows that the ANOVA F-value of 2.527 is significant at 0.020. Since the significant value of 0.020 is less than 0.05 level of significance at which the null hypothesis was tested, the null hypothesis is therefore rejected. Hence, occupation has a significant influence on the extent of Acceptance of renewable energy as alternative source of power supply among residence of Umunneochi.

Hypothesis 4.6: Occupation has no significant influence on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi, as in table 4.6.

Table 4.6: *Summary of Anova on the Influence of Occupation on the Extent of Optimization of Renewable Energy as Alternative Source of Power Supply Among Residence of Umunneochi*

	Sum of Squares	**df**	**Mean Square**	**F**	**P-Value**	**Decision**
Between Groups	2.416	6	.403	3.682	0.001	Significant
Within Groups	73.160	669	.109			
Total	75.576	675				

P<0.05; **S:** Significant; **NS:** Not Significant

Table 4.6 shows that the ANOVA F-value of 3.682 is significant at 0. 001. Since the significant value of 0.001 is lesser than 0.05 level of significance at which the null hypothesis was tested, the null hypothesis is therefore upheld. Hence, occupation has a significant influence on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi.

5.0 DISCUSSION OF THE FINDINGS

The findings of the study showed that, socioeconomic variables such as income status, level of education and occupation has a significant influence on the extent of acceptance of renewable energy as alternative source of power supply among residence of Umunneochi. This implies that, the willingness to adopt and use solar energy as an alternative source of power supply among residence of Umunneochi local government area is influenced by their income status, level of education and occupation. This is in accordance with the findings of Ganiyu, et al. (2024) who found out that, factors such as income, social networks, and education significantly influence rural households' willingness to adopt solar energy technologies as alternative power supply. Economic considerations play a major role in determining the acceptance of renewable energy technologies. The findings also relates to the earlier findings of Adeyeye et al. (2021) who found that factors such as income level, education, age, and household characteristics significantly influence consumer willingness to adopt renewable energy solutions.

The findings of the study revealed that only occupation has a significant influence on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi, while income status and level of education has no significant influence on the extent of optimization of renewable energy as alternative source of power supply among residence of Umunneochi. The findings is not surprising as residence into occupation that requires constant power supply are likely to optimize renewable energy as alternative source of power supply than residence whose occupation do not require much power supply. The findings of the study is in accordance with that of Sunday and Mutah (2024) who found out that, socioeconomic status influence the adoption of solar energy technologies in Nigeria

6.0 Conclusion and Recommendation

The persistent inadequacy of electricity supply in Nigeria has intensified the search for alternative and sustainable energy sources, particularly renewable energy technologies

such as solar, wind, biomass, and mini-hydro systems. The study examined the Influence of socioeconomic Status on the Acceptance and Optimization of Renewable Energy for Sustainable Power Supply in Umunneochi. Socioeconomic status such as income level, educational level and occupation strongly influence the level of acceptance of renewable energy as alternative source of sustainable power supply among residence of Umunneochi, however, only occupation influence the level of optimization of solar energy as alternative source of sustainable power supply among residence of Umunneochi. The findings underscore the importance of improving socioeconomic conditions and implementing supportive policies to enhance renewable energy adoption in rural and semi-urban communities. Renewable energy technologies possess enormous potential for addressing Nigeria's electricity challenges and promoting sustainable development

The study suggested the following recommendations:

1. Government should provide subsidies and financial incentives to reduce the cost of renewable energy technologies;
2. Financial institutions should introduce affordable loan schemes for renewable energy acquisition;
3. Public awareness campaigns should be intensified to educate residents on the benefits and utilization of renewable energy systems;
4. Renewable energy education should be integrated into community development programs;
5. Vocational and technical training programs should be organized to improve local capacity for renewable energy installation and maintenance.

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