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PUBLIC PERCEPTION OF RENEWABLE ENERGY TRANSITION AND ENVIRONMENTAL SUSTAINABILITY IN PORT HARCOURT METROPOLIS

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Abstract
The study looked at how the public in Port Harcourt Metropolis felt about the switch to renewable energy and environmental sustainability. The design used was cross-sectional. Residents of Port Harcourt Metropolis made up the study's population. To guarantee fair representation of participants from all parts of the city, a sample size of 200 respondents was chosen using a straightforward random selection procedure. The "Public Perception of Renewable Energy Transition and Environmental Sustainability Questionnaire" (EMPLSQ), a structured questionnaire with a 4-point Likert scale, was used to gather data .Environmental management specialists verified the tool, and Cronbach Alpha yielded a reliability value of 0.87. Descriptive statistics (mean and standard deviation) were used to analyze the data.The findings showed that residents in Port Harcourt Metropolis have a moderate level of awareness of the renewable energy transition, which is important for promoting environmental sustainability. Renewable energy is impacted by issues like high installation costs, low awareness, bad government policies, and a lack of technical expertise. It was determined that even while the shift to renewable energy is seen favorably, current economic, technical, and institutional challenges limit its effective adoption for environmental sustainability in Port Harcourt Metropolis. It recommended among others that Policymakers should provide incentives, subsidies, and affordable financing options to reduce the high cost of renewable energy installation in Port Harcourt Metropolis.

Keywords: Public Perception, Renewable Energy, Transition, Environmental Sustainability, Metropolis, Environmental Management.

Introduction
The move to renewable energy is becoming more and more popular as a crucial route to environmental sustainability due to the growing worldwide concern over environmental degradation, climate change, and the depletion of fossil fuel resources. By lowering greenhouse gas emissions and encouraging sustainable resource use, renewable energy—which includes sources including solar, wind, hydro, biomass, and geothermal—offers greener substitutes for fossil fuels. In response to international environmental agreements and the pressing need to slow down climate change, many nations are implementing renewable energy technology (International Energy Agency [IEA], 2023). In order to maintain long-term ecological balance, enhance public health, and lessen environmental pollution, environmental sustainability emphasizes the prudent use of natural resources. In light of the environmental problems connected to the use of crude oil and gas, such as pollution and ecological deterioration, switching from fossil fuel dependence to renewable energy has become essential to accomplishing these goals (United Nations Environment Programme [UNEP], 2022). These issues are especially severe in Nigeria's oil-producing areas like Rivers State, where industrial pollutants, gas flaring, and oil spills have had a major negative influence on the quality of the environment (Okonkwo & Eze, 2021).
Due in large part to its reliance on fossil fuels and industrial activity, Port Harcourt Metropolis, a significant industrial center in Nigeria, nevertheless faces serious environmental issues such air

pollution, black soot, and inadequate waste management. Solar power and other renewable energy sources are increasingly gaining popularity, but their uptake is still quite low. Since awareness, attitudes, and socioeconomic factors affect acceptability and usage, public perception is crucial to the success of the renewable energy transition (Ozoegwu & Mgbemene, 2020). Renewable energy has the potential to improve environmental sustainability, but its widespread acceptance in Port Harcourt Metropolis is still hampered by low awareness, high installation costs, poor infrastructure, and minimal legislative support. The public's perception of the shift to renewable energy and its contribution to environmental sustainability must thus be investigated.This study therefore investigates public perception of renewable energy transition and environmental sustainability in Port Harcourt Metropolis, Rivers State.

Aim and Objectives of the study

The aim and objective of the study is to examine public perception of renewable energy transition and environmental sustainability in Port Harcourt Metropolis, Rivers State. The study is positioned to achieve the following objectives;

1. To examine the level of public awareness of renewable energy transition among residents.
2. To assess public perception of the role of renewable energy transition in promoting environmental sustainability.
3. To identify the challenges affecting the adoption of renewable energy for environmental sustainability.

Research Questions

The following questions guided the study;

1. What is the level of public awareness of renewable energy transition among residents?

2. How do residents perceive the role of renewable energy transition in promoting environmental sustainability?

3. What are the challenges affecting the adoption of renewable energy for environmental sustainability?

Literature Review

Conceptual Clarification

Renewable Energy

Several academics and international organizations have defined the term "renewable energy" according to its sources, sustainability, and environmental advantages. Renewable energy is defined by the International Energy Agency (IEA, 2023) as energy that can be extracted from naturally occurring processes that are constantly renewed, such as sunshine, wind, water flow, and geothermal heat, without diminishing the earth's resources. The International Renewable Energy Agency (IRENA, 2023) defines it as energy derived from natural sources—such as solar, wind, hydro, biomass, and ocean energy—that are supplied more quickly than they are used.

In another perspective, the United Nations Environment Programme (UNEP, 2022) defines renewable energy as energy generated from natural sources that have minimal environmental impact and significantly reduce greenhouse gas emissions compared to fossil fuels. Renewable energy is becoming a major priority in the shift toward sustainable development as worries about climate change, environmental degradation, and energy security continue to grow on a worldwide scale (International Energy Agency [IEA], 2023). In order to mitigate the negative consequences of climate change and reduce environmental pollution, renewable energy is essential. One of the main

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causes of carbon dioxide emissions, which fuel environmental instability and global warming, is the burning of fossil fuels. Renewable energy technologies, on the other hand, offer eco-friendly substitutes that lessen air pollution, preserve natural resources, and enhance public health. According to the United Nations Environment Programme (UNEP, 2022), the transition to renewable energy is essential for achieving long-term environmental sustainability and meeting global climate targets. Technological advancements have made renewable energy more efficient and cost-effective, particularly solar and wind energy systems. These developments have encouraged both developed and developing nations to integrate renewable energy into their national energy mix.

Renewable Energy Transition

The progressive move from fossil fuel-based energy systems to greener, more sustainable energy sources like solar, wind, hydro, biomass, and geothermal energy is known as the "renewable energy transition." It entails adjustments to patterns of energy production, distribution, and consumption with the goal of lowering pollution levels in the environment and fostering long-term sustainability. The pressing need to combat climate change, cut greenhouse gas emissions, and provide energy security for current and future generations is what is driving this shift (International Energy Agency [IEA], 2023).

Since reliance on fossil fuels has been shown to be a significant factor in environmental deterioration, global warming, and health-related issues, the idea of energy transition is essential to international sustainability initiatives. Therefore, the goal of the renewable energy transition is to replace high-carbon energy systems with ecologically acceptable, low-carbon alternatives. The United Nations Environment Programme (UNEP, 2022) states that this change is necessary to guarantee sustainable development and meet global climate goals.

Through policy changes, technical advancements, and investments in clean energy infrastructure, many nations have stepped up their attempts to switch to renewable energy in recent years.

While developing nations are gradually implementing renewable systems as a result of growing awareness and international assistance, developed nations have made great strides in incorporating renewable energy into their national grids. However, because to variations in economic capacity, technological advancement, and policy execution, the rate of transition differs by region (International Renewable Energy Agency [IRENA], 2023). Despite Nigeria's enormous potential for renewable energy, the country's shift to renewable energy is still in its early phases. Fossil fuels, especially gas and oil, continue to be the primary sources of electricity generation and industrial energy use in the energy industry.

Challenges such as inadequate infrastructure, high initial investment costs, weak policy enforcement, and limited technical expertise have slowed the transition process (Energy Commission of Nigeria, 2023).

Environmental Sustainability

Environmental sustainability refers to the responsible interaction with the environment in order to conserve natural resources, prevent environmental degradation, and ensure that ecological systems remain balanced for present and future generations. It emphasizes the efficient use of resources such as water, land, air, and energy while minimizing pollution and environmental damage. This concept is central to sustainable development and long-term environmental protection (United Nations Environment Programme [UNEP], 2022).

Environmental sustainability involves maintaining the health of ecosystems by reducing activities that contribute to climate change, deforestation, biodiversity loss, and pollution. It promotes practices that support environmental conservation, such as waste reduction, renewable energy use, and sustainable consumption patterns. According to the United Nations (2022), environmental

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sustainability is a key component of the global Sustainable Development Goals, particularly those aimed at climate action, clean energy, and sustainable cities.

In contemporary discourse, environmental sustainability is closely linked with human well-being, as environmental degradation directly affects public health, food security, and economic stability. Sustainable environmental management therefore seeks to balance economic development with environmental protection. The transition from fossil fuel-based systems to cleaner energy sources is one of the major strategies for achieving environmental sustainability globally (International Energy Agency [IEA], 2023). In developing countries like Nigeria, achieving environmental sustainability remains a major challenge due to rapid urbanization, industrial activities, and dependence on natural resource exploitation. Environmental issues such as air pollution, oil spills, deforestation, and poor waste management continue to threaten ecological stability, particularly in regions like the Niger Delta.

Renewable energy transition and Environmental sustainability

Renewable energy transition refers to the shift from fossil fuel-based energy systems to cleaner and more sustainable sources such as solar, wind, hydro, biomass, and geothermal energy. It is considered essential for environmental sustainability because it helps reduce greenhouse gas emissions, limits environmental pollution, and promotes efficient use of natural resources (International Energy Agency [IEA], 2023).

Environmental sustainability focuses on meeting present needs without compromising future generations' ability to meet theirs, through environmental protection, resource conservation, and ecological balance. Renewable energy supports this goal by reducing dependence on fossil fuels and improving environmental quality (United Nations Environment Programme [UNEP], 2022). Empirically, Adebayo and Uhunamure (2023) found that renewable energy significantly reduces CO_2 emissions, concluding that it improves environmental quality and sustainability. Similarly, Mbarek (2026) in his study on OECD countries found that renewable energy transition has a significant negative effect on CO_2 emissions, concluding that it enhances environmental sustainability through decarbonization. In addition, Meng, Sheng, and Akbar (2024) investigated BRICS countries and found a long-run relationship between renewable energy use and environmental sustainability, concluding that renewable energy transition reduces emissions and promotes long-term environmental balance.

Level of public awareness of renewable energy transition

This measures how well-informed people and communities are about the transition from fossil fuel-based energy systems to greener, more sustainable energy sources including solar, wind, hydro, and biomass. According to empirical data, public awareness is generally moderate, with growing exposure to renewable energy concepts, especially solar energy, but a shallow comprehension of expenses, technical specifications, and long-term advantages (Mbamalu, 2019). Education, media exposure, and urban-rural disparities all influence awareness in Nigeria, with urban dwellers generally exhibiting higher levels of knowledge than rural ones.

Additionally, research has demonstrated that although a large number of people are aware of renewable energy, this awareness does not always result in adoption or active involvement in the energy transition process. According to Abdullahi et al. (2026), adoption rates in Adamawa State remained low despite moderate awareness levels because of high installation prices and restricted financing choices. This implies that without institutional and financial assistance, awareness alone will not be enough to propel the shift to renewable energy.. Overall, empirical findings consistently show that while public awareness of renewable energy transition is growing, it remains uneven and does not necessarily result in behavioural change or adoption, largely due to economic,

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informational, and infrastructural constraints furthermore, Mbamalu (2019) conducted a survey in Lagos and Ogun States, Nigeria, using structured questionnaires to examine public awareness and adoption of renewable energy. The study found that although awareness levels were relatively high, actual adoption remained low due to high costs and weak policy support, indicating a gap between awareness and behavioural change. In the same vein, Adeleye et al. (2024) carried out a descriptive survey in Nigeria to assess public awareness and acceptability of renewable energy systems. The study revealed that respondents demonstrated moderate awareness, particularly of solar energy, but lacked sufficient technical knowledge and financial readiness to support widespread adoption of renewable energy technologies.

Perception of the role of renewable energy transition in promoting environmental sustainability

The way that people and communities perceive the contribution of renewable energy sources like solar, wind, hydro, and biomass in lowering environmental degradation, mitigating climate change, and fostering ecological balance is known as the perception of the role of renewable energy transition in promoting environmental sustainability. The public largely views renewable energy as an environmentally sustainable substitute for fossil fuels, according to empirical data. Growing knowledge of climate change, the advantages of reducing pollution, and the necessity of cleaner energy systems are major factors contributing to this favorable opinion.

In order to gauge popular opinion of renewable energy and its advantages for the environment, Ramos et al. (2020) performed a household survey in Spain. According to the study, respondents significantly linked renewable energy to lower greenhouse gas emissions and better environmental quality, demonstrating a high degree of environmental consciousness and support for energy transition policies. In a similar vein, Yadav and Pathak (2021) conducted a quantitative study in India to investigate how consumers see renewable energy technology. According to the study, the majority of participants thought renewable energy was essential to environmental sustainability, especially when it came to lowering air pollution and preserving natural resources.even though acceptance levels were impacted by financial considerations. Additionally, a survey study on public opinions regarding the development of renewable energy was carried out in China by Chen et al. (2022). The results demonstrated that although respondents voiced worries about energy reliability, they had a high positive opinion of the environmental benefits of renewable energy, particularly in terms of lowering carbon emissions and enhancing urban air quality. Accordingly, Ojo and Akinwale (2023) conducted a study in Nigeria utilizing structured questionnaires to gauge how the general people felt about environmental sustainability and renewable energy. According to the study, most respondents believed that renewable energy was crucial for sustainable development and environmental preservation, but complete faith in its efficacy was constrained by inadequate infrastructure.

Challenges that affect the adoption of renewable energy for environmental sustainability

Despite the widespread recognition that renewable energy is crucial for lowering greenhouse gas emissions and advancing environmental sustainability, its adoption is still sluggish in many developing nations because of a mix of behavioral and structural barriers. Despite the long-term economic and environmental advantages of renewable energy systems, a significant obstacle is the high initial cost of installation, which deters people and organizations from investing in them (Akinwale & Ologun, 2022). Furthermore, the ability to install, maintain, and effectively manage renewable energy technologies is diminished by a lack of technical expertise and competent labor (Ibrahim et al., 2023).

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Furthermore, weak government policies, poor financing options, and inconsistent incentives often hinder large-scale adoption of renewable energy systems (Okoye & Eze, 2021). Social factors such as low awareness and resistance to change also contribute to slow uptake, especially in rural communities where information is limited (Ibrahim et al., 2023).

Theoretical Framework

The study is anchored on Diffusion of Innovation Theory; the theory was propounded by Everett M. Rogers in 1962. The theory explains how new ideas, technologies, or innovations spread within a social system over time through communication channels. Rogers (2003) states that the adoption of any innovation is influenced by five main characteristics: relative advantage, compatibility, complexity, trialability and observability, which determine how quickly individuals accept or reject an innovation. He also identified five categories of adopters: innovators, early adopters, early majority, late majority, and laggards. Tornatzky and Klein (1982) argued that the perceived attributes of an innovation strongly influence its adoption, while Sahin (2006) emphasized that communication and social systems play a key role in how innovations spread. In addition, Lee (2010) noted that perceived environmental and economic benefits significantly enhance acceptance of renewable energy technologies.

The theory is relevant to this study because it explains how public perception influences the adoption of renewable energy for environmental sustainability in Port Harcourt Metropolis. It helps to show how awareness and perceived benefits of renewable energy affect residents' willingness to adopt technologies such as solar and wind energy, while also explaining resistance due to cost, complexity, or limited information.

Methodology

The study adopted cross-sectional survey research design, which enabled the collection of data at a single point in time to examine public perception of renewable energy transition and environmental sustainability in Port Harcourt Metropolis without manipulating variables. The population of the study comprised residents of Port Harcourt Metropolis. A sample size of 200 respondents was selected using a simple random sampling technique to ensure equal representation of participants from different areas within the metropolis. Data were collected using a structured questionnaire titled "Public Perception of Renewable Energy Transition and Environmental Sustainability Questionnaire" (EMPLSQ)measured on a 4-point Likert scale. The instrument was validated by experts in Environmental Management and a reliability index of 0.87 was obtained using the Cronbach Alpha. Data were analyzed using descriptive statistics (mean and standard deviation)

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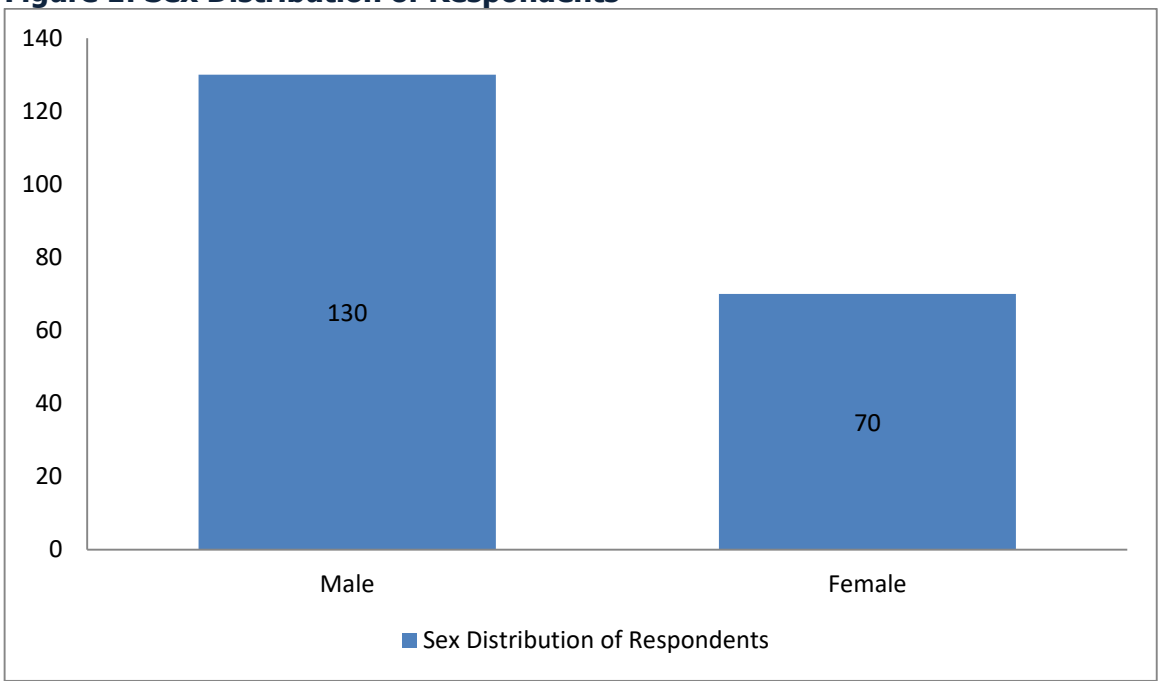
Results and Discussion

The results of the study are presented below

Figure 1: Sex Distribution of Respondents



The figure1 above shows the sex distribution of respondents with frequency. It shows that 130 respondents (65%) are male, while 70 respondents (35%) are female. The gender disparity observed in this study can be attributed to economic, sociocultural and other contextual factors prevalent in Port Harcourt metropolis and similar urban settings in Nigeria.

Research Question 1: What is the level of public awareness of renewable energy transition among residents?

Table 1: Mean of Respondents on the level of public awareness of renewable energy transition among residents

S/N	Items	Respondents (N=200)		
		$\bar{X}_1$	SD_1	Remarks
1.	I am aware of different types of renewable energy such as solar, wind, and hydro energy.	2.85	1.15	Moderate Awareness
2.	I understand the meaning of renewable energy transition.	2.75	1.04	Moderate Awareness
3.	I am aware that renewable energy helps to protect the environment.	2.25	0.99	Low Awareness
4.	I have received information about renewable energy through media, campaigns, or public education.	2.30	1.04	Low Awareness

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5.	I am aware that renewable energy can reduce dependence on fossil fuels	2.40	1.16	Low Awareness
	Criterion mean =2.50			
	Average	**2.51**	**1.08**	**Moderate Awareness**

1.00 – 1.49 = Very Low Awareness, 1.50 – 2.49 = Low Awareness, 2.50 – 3.49 = Moderate Awareness & 3.50 – 4.00 = High Awareness,

Table 1 above shows the level of public awareness of renewable energy transition among residents. In Item 1, the mean score of respondents is 2.85 which reveal a moderate awareness, indicating that respondents are fairly aware of different types of renewable energy such as solar, wind, and hydro energy. In Item 2, the mean score of respondents is 2.75 which reflect a moderate awareness, suggesting that respondents have a reasonable understanding of the meaning of renewable energy transition. In Item 3, the mean score of respondents is 2.25 which indicate a low awareness, implying that many respondents are not fully aware that renewable energy helps to protect the environment. Item 4, with a mean score of respondents is 2.30 which falls within the low awareness range, showing that respondents have limited exposure to information about renewable energy through media, campaigns, or public education. In Item 5, the mean score of respondents is 2.51 which fall within the moderate awareness range, indicating that respondents have a fair understanding that renewable energy can reduce dependence on fossil fuels. In summary, the average mean of respondents is 2.51, which indicate a moderate level of awareness**;** it means that residents have a basic understanding of renewable energy transition. However, the findings also suggest that awareness is not yet strong across all dimensions, particularly regarding environmental benefits and access to information sources.

Research Question 2: How do residents perceive the role of renewable energy transition in promoting environmental sustainability?

Table 2: Mean of Respondents on how residents perceive the role of renewable energy transition in promoting environmental sustainability

S/N	Items	Respondents (N=200)		
		$\bar{X}_1$	SD_1	Remarks
6.	Renewable energy transition helps to reduce environmental pollution in Port Harcourt Metropolis.	3.25	0.91	Agreed
7.	The use of renewable energy contributes to the reduction of climate change effects.	3.23	0.87	Agreed
8.	Renewable energy sources help to promote a cleaner and healthier environment.	2.60	1.10	Agreed
9.	Increased use of renewable energy can improve environmental sustainability for future generations.	2.90	1.03	Agreed

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10.	Renewable energy transition can reduce dependence on fossil fuels that damage the environment.	2.94	1.01	Agreed
	Criterion mean =2.50 Average	**2.98**	**.98**	**Agreed**

Legend **Scale**
$\bar{X}_1$=Mean 1.00—2.49= Disagree
SD1= Standard Deviation 2.50---4.00= Agree

Table 2 shows how residents perceive the role of renewable energy transition in promoting environmental sustainability. In Item 6, respondents have a mean score of 3.25**,** which implies that respondents agreed that renewable energy transition helps to reduce environmental pollution in Port Harcourt Metropolis. In Item 7, respondents recorded a mean score of 3.23, which revealed that respondents agreed that the use of renewable energy contributes to the reduction of climate change effects. In Item 8, the mean score of respondents is 2.60**,** which connotes that respondents agreed that renewable energy sources help to promote a cleaner and healthier environment. In Item 9, the mean of respondents is 2.90 which imply that respondents agreed that increased use of renewable energy can improve environmental sustainability for future generations. In Item 10, the mean of respondent is 2.94 which indicate that respondents agreed that renewable energy transition can reduce dependence on fossil fuels that damage the environment.
In summary, with the average mean of respondents 2.98 greater than the criterion mean of 2.50, the respondents agreed that renewable energy transition plays a significant role in promoting environmental sustainability in Port Harcourt Metropolis.

Research Question 3: What arethe challenges affecting the adoption of renewable energy for environmental sustainability

Table 3: Mean of Respondents on the challenges affecting the adoption of renewable energy for environmental sustainability

S/N	Items	Respondents (N=200)		
		$\bar{X}_1$	SD_1	Remarks
11.	The high cost of renewable energy systems discourages their adoption.	3.13	.96	Agreed
12.	Lack of adequate awareness limits the use of renewable energy technologies.	3.40	.75	Agreed
13.	Inadequate government policies and incentives hinder renewable energy adoption.	3.10	.91	Agreed
14.	Limited technical knowledge and skilled manpower affect the effective use of renewable energy.	3.00	.95	Agreed
15.	Poor infrastructure and limited financing options reduce the adoption of renewable energy for environmental sustainability. .	2.95	1.05	Agreed
	Criterion mean =2.50		**.92**	**Agreed**

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Average	**3.12**

Legend	**Scale**
$\bar{X}_1$=Mean	1.00—2.49= Disagree
SD1= Standard Deviation	2.50---4.00= Agree

Table 3 shows the challenges affecting the adoption of renewable energy for environmental sustainability. In Item 11, respondents have a mean score of 3.13, which implies that respondents agreed that the high cost of renewable energy systems discourages their adoption. In Item 12, respondents recorded a mean score of 3.40**,** which revealed that respondents agreed that lack of adequate awareness limits the use of renewable energy technologies. In Item 13, the mean score of respondents is 3.10, which connotes that respondents agreed that inadequate government policies and incentives hinder renewable energy adoption. In Item 14, the mean score of 3.00 shows that respondents agreed that limited technical knowledge and skilled manpower affect the effective use of renewable energy. In Item 15, the mean score of respondents is 3.12 which indicate that respondents agreed that poor infrastructure and limited financing options reduce the adoption of renewable energy for environmental sustainability.
In summary, with the average mean score of respondents 3.12**,** greater than the criterion mean, the respondents agreed on the challenges affect the adoption of renewable energy for environmental sustainability in Port Harcourt Metropolis.

Discussion of Findings

The first finding of the study shows that the public has a moderate level of awareness of renewable energy transition, indicating that residents have a basic understanding of renewable energy transition. However, the findings also suggest that awareness is not yet strong across all dimensions, particularly regarding environmental benefits and access to information sources. This finding is in agreement with Mbamalu (2019), who found that public awareness of renewable energy is generally moderate. Similarly, the finding agrees with Abdullahi et al. (2026), who reported that the level of awareness was moderate, although adoption rates remained low due to high installation costs and limited access to financing options.
The second finding of the study revealed that renewable energy transition promotes environmental sustainability by reducing pollution, minimizing climate change effects, promoting a cleaner environment, improving sustainability for future generations, and reducing dependence on fossil fuels. The finding is in tandem with the result of Ojo and Akinwale (2023), who stated that renewable energy is essential for environmental protection and sustainable development. Furthermore, the finding agrees with Ramos et al. (2020), who noted that renewable energy helps to reduce greenhouse gas emissions and improve environmental quality.
The third finding of the study reveals the challenges affecting the adoption of renewable energy for environmental sustainability. These challenges include high installation costs, lack of adequate awareness, inadequate government policies and incentives, limited technical knowledge and skilled manpower, as well as poor infrastructure and limited financing options. The finding is in consonance with Akinwale and Ologun (2022), who identified the high initial cost of installation as a major factor affecting the adoption of renewable energy. Similarly, the result agrees with Ibrahim et al. (2023),

who noted that limited technical knowledge and inadequate skilled manpower reduce the capacity for the installation, maintenance, and efficient management of renewable energy technologies, thereby affecting the adoption of renewable energy for environmental sustainability.

Conclusion

The findings of the study revealed that residents have a moderate level of awareness of renewable energy transition and perceive renewable energy as important for promoting environmental sustainability. Based on the findings of the study, it concludes that despite the positive perception of renewable energy transition, existing economic, technical, and institutional challenges limit its effective adoption for environmental sustainability in Port Harcourt Metropolis.

Recommendations

Based on the findings of the study the following recommendations are made;

1. Government and stakeholders should increase public awareness campaigns to improve understanding of renewable energy and its environmental benefits.
2. Policymakers should provide incentives, subsidies, and affordable financing options to reduce the high cost of renewable energy installation.
3. There is need to improve on skilled manpower and support renewable energy adoption through investment in technical training and infrastructure development

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