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Assessment of Renewable Sources of Energy for Residential Estate in Lagos State

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Abstract:

The study investigated the use of renewable energy sources for residential estates in Lagos state; identified the available energy sources in the study area, determined the factors influencing the choice and utilization of renewable sources in the study area and examined the level of satisfaction derived from the chosen energy source by residents of Lagos state. The study was aimed at investigating the possibility of making energy available for residential estates dwellers from renewable energy sources so as to enhance uninterrupted energy supply and promote sustainability. To achieve the aim and objectives of the study, both primary and secondary data were used. The study made use of primary data collected by administration of e-questionnaire (google form) to building users. Data collected included energy source used by residents, the level of awareness of residents about various renewable sources, average amount of money spent on energy monthly, daily hours of energy supply, level of satisfaction derived from energy sources used. Data collected were analyzed using Statistical Package for Social it was analyzed using frequencies, mean score and tables. The result from the sources of energy used by residents in Lagos state revealed that 74% of buildings make use of generators alongside the energy provided from national grids. The result from the number of hours of energy supply daily revealed that residents only have access to electricity being an end use of energy for maximum of 8 hours. The level of awareness of residents revealed that 51.7%, 21.2%, 17.2%, 10.3%, 17.7% and 30.5% of the respondents are well informed about a possibility of generating energy from solar, wind, biomass, geothermal, biogas, and hydropower respectively. To promote the use of energy generated from renewables, the study made recommendations for intensified awareness schemes on the socioeconomic and environmental benefits of renewable energy sources, adequate investment in critical areas of renewable R&D and policy adjustments to create an investor friendly environment to attract greater renewable energy investment.

Keywords: *climatic conditions, building users, environmental benefit, renewable energy.*

Introduction

The importance of energy in life and all economic activities cannot be overemphasized. Energy, like food and water is vital and necessary. Over the years, it has played vital roles in development and civilization. It has been the cause of war between people who have sought throughout history to control access to energy resources. In the twentieth century, easy access to abundant, cheap and concentrated sources of energy contributed largely to faster economic development. The use of energy was revolutionized with the discovery of electricity, a carrier of energy and it is almost impossible to

imagine a modern age without electricity (Ngo, 2008).

The world's demand for energy is growing rapidly, with a surpassing demand for electricity. With an annual average growth rate of 2.8%, electricity will almost double between 1997 and 2020 as foreseen by IEA's World Energy Outlook. According to IEA, in 2010 relative to 1997, primary world energy supply was expected to increase by 30%, and by nearly 60% by 2020. Annual electricity demand grows unevenly in developed (projected to be 1.6% (OECD) countries) and developing countries (projected growth rate 4.6%). Since more than 1.6 billion people until recently have lived without the benefit of modern energy services, it should therefore be noted that the developing world is in urgent need of energy. Taking a close look at such increasing demands, the present growth pattern is invariably strongly influenced by the domination of fossil fuels (World Energy Council, 2004).

Energy plays an undeniable role in the economic growth and development of any nation. In poverty eradication or reduction, the impact of efficient energy supply cannot be over-emphasized. Future economic growth of any nation depends greatly on supply of affordable, accessible and environmental friendly energy (Suinday et al., 2018).

The geography of renewable energy is changing in ways that suggest a new era of geographic diversity. For example, wind power existed in only few countries in the 1990s but now thrives in over 82 countries. As countries like China, India, and South Korea continue to increase their commitments towards renewable energy, manufacturing leadership is beginning to shift from Europe to Asia. 40 percent of the world's solar PV supply was produced by China in 2009, 77 percent of the world's solar hot water collectors and 30 percent of the world's wind turbines. The increasing geographic diversity is boosting confidence that renewables are less vulnerable to policy or market dislocations in any specific country (REN21, 2010).

The fact that oil remains the dominant fuel source for electricity generation in the country is quite not surprising. According to IEA (International Energy Agency), in 2016, only 19% of the total primary energy supply in Nigeria came from oil and natural gas (combined). Just about 61% and 6% of the population has been recorded to have access to electricity and clean cooking equipment respectively in spite abundance of energy resources in the country (IEA, 2017). Even in the midst of population growth, the preceding confirms that Nigeria experiences a wide gap between energy supply and demand as well as diminishing purchasing power of citizens and lack of alternative energy sources. Increased rural urban migration and impacts of climate change among many others have heightened the country's energy challenges (Aarti, Nnaemeka, & Michael, 2019).

Nigeria's dependence on oil for energy is deepening deprivation in the development of her abundant renewable energy resources, which are environmentally friendly in terms of global warming, air and water pollution, clean and safe, more accessible and affordable energy that will engender sustainable development and also be a source of opportunity rather than oppression for the poor or less privileged and therefore a key step towards poverty reduction in Nigeria (Nnaji, Uzoma, & Chukwu, 2010). Despite the gross availability of renewable energy resources in reasonable quantity in the nation, it is rather unfortunate that these resources are still underutilized because Nigeria is yet to maximally exploit these enormous energy potentials with less or no environmental and climatic impacts. (Igbinovia, 2015). It is therefore expedient to explore other alternative aside the conventional source which is very limited. Renewable energy sources been limitless and environmentally friendly, will be assessed as an alternative solution to the lasting energy problem in the community. Economic and social development, healthier environment, income generation for local communities, capacity building, and development of local employment and expertise are other associated benefit that could be derived from the use of renewable energy (World Energy Council, 2004).

Research Methodology

The methodology was achieved using an online questionnaire as the research tool for data collection from designated respondents. This study was conducted in Lagos State, Nigeria and it has its state capital at Ikeja with a population of 13,903,620 as at 2006 census but boast a total population of 21,000,000 in 2016(retrieved from the national commission population of Nigeria, 2015). Lagos state is on latitude: 6^0 27' 55.5192" (6.6080^0) North and on longitude 3^0 24' 23.2128" (3.6218^0) East. It covers an immense area, coming in with a total of 1,171.28 square kilometers (452.23 square miles). With the population continuing to grow, and currently exceeding at least 17 million residents, the population density is around 6,871 residents per square kilometer (17,800 per square miles). Lagos states currently has a total number of 20 local governments.

Population of Study

The average occupancy in Lagos state is 4 persons per household, with projected total population been 17.5 million (retrieved from the national commission population of Nigeria, 2019).

The questionnaire was administered to 214 respondents comprising of residents from both Lagos Island and mainland. The questionnaires were filled across local government areas in the state. A total of 203 questionnaires were retrieved from the respondents across various areas of the state. Based on the research topic, the target population was limited to residents in Lagos State and the questionnaire was filled randomly in the study area.

Table 1. Location of Respondents with Quantity of Questionnaire Retrieved

S/N	Location of Respondents	Retrieved Questionnaries
1	Lagos Island	84
2	Lagos Mainland	118
3	Undecided	1
	Total	**203**

Source: Author's field survey, 2019.

The sampling technique adopted for this research was the random sampling technique, the questionnaire was filled by the respondents identified in the sample size.

Research Instrument

For the purpose of this research, questionnaire was used. Having considered the topic in relation to the study area, the conventional way of administering questionnaires through knocking at doors could not work especially on Lagos Island. Gaining access to the estates in consideration was a bit difficult. Hence, the need for a Google form. The form (questionnaire) was sent online and responses were analyzed after the required number had been met.

Method of Data Collection

Both primary and secondary data were sourced for accomplishing the study objectives. Primary data was obtained through a well-structured questionnaire which consist of both open and close ended questions to acquire the demographic information and other relevant information needed to achieve the objectives of the study. Secondary data was obtained from textbooks, journals, past research work, seminar papers and internet sources. The questionnaire was retrieved after few weeks and thereafter analyzed. For the purpose of this study, descriptive statistics analysis was used in analyzing the data gathered. Descriptive statistical analysis which involves the use of frequency distribution and percentages was used to determine the characteristics of the respondents and Spear men correlation was used to achieve the objectives of the study to assess renewable energy usage for residential estates in the study area, thus, testing for the hypothesis.

Results and Discussion

A total number of 214 responses were required for the scope of the research but only 203 responses were obtained. Table 2 provides information on the number of completed questionnaires among the respondents.

Table 2. Number of Completed Questionnaires Among the Respondents

Location of Respondents	Frequency	Percentage (%)
Lagos Island	118	58.1
Lagos Mainland	84	41.4
Undecided	1	0,5
Total	**203**	**100**

Source: Author's field survey, 2019.

Demographic Attributes of Respondents

The demographic characteristics of the questionnaire consists of solicited information such as, age range of the respondents, gender and age of the respondents.

Gender and Age of the Respondents

Approximately 57.6% of the respondents of the research questionnaire in the study area were males; 41.9% were females, while 0.5% of the respondents were undecided. The age distribution of the respondents is shown in Table 3.

Table 3. Age and Gender of Respondent

Age Categories	Frequency	Percentage (%)
Below 20	6	3
21-30	162	79.8
31-40	27	13.3
41-50	6	3
51-60	1	0.5
Undecided	1	0.5
Total	**203**	**100**
Gender	**Frequency**	**Percentage (%)**
Male	117	57.6
Female	85	41.9
Undecided	1	0.5
Total	**203**	**100**

Source: Author's field survey, 2019.

On the age range of respondents, it can be seen in Table 3 that, 6 (3%) of the respondents were below the age of twenty, 162 (79.8%) were between the age of twenty-one and thirty years, 27 (13.3%) were between the age of thirty-one and forty years, 6 (3%) were between the age of forty-one and fifty years, 1 (0.5%) were between the age of fifty-one and sixty years and 1 (0.5%) were undecided. The result shows that majority (93.1%) of the respondents were in the age group of 21 to 40 years, implying that they are in their youthful age, thus making them fit in knowledge to provide reliable information on energy, and renewables in particular.

Working status, Experience and Educational Qualification of Respondents

As shown in Table 4, about 111 (54.7%) of the respondents were working class in the study area, 17 (8.4%) were unemployed, 74 (36.5%) were students, 1 (0.5%) was undecided. From the results, 125 (61.6%) of the respondents were gradates having B.Tech or B.Sc or its equivalent, 17 (8.4%) were HND holders, 5 (1.5%) were OND holders, 21 (10.5%) were MSc. holders, 3 (1.5%) were NCE holders, 125 (61.6%) were SSCE holders and 31 (15.3%) was undecided. Since the respondents are needed to be learned to understand the need for energy supply in relation to their residency, hence, the responses given can be reliable since a larger percentage of the respondents are BSc. holders Also, 154 (75.9%) of the respondents have below 5years of work experience, 28 (13.8%) between 5 to 10 years, 8 (3.9%) between 11 to 15 years, 2 (1%) having over 20 years work experience and 11 (4.0%) were undecided.

Table 4. Working status, experience and educational qualification of respondent

Working Status	Frequency	Percentage (%)
Employed	111	54.7
Unemployed	17	8.4
Student	74	36.5
Undecided	1	0.5
Total	**203**	**100**
Working Experience	**Frequency**	**Percentage (%)**
Below 5 years	154	75.9
5-10 years	28	13.8
11-15 years	8	3.9
Above 20 years	2	1.0
Undecided	11	4.0
Total	**203**	**100**
Educational Qualification	**Frequency**	**Percentage (%)**
SSCE	31	15.3
NCE	3	1.5
OND	5	1.5

HND	5	1.5
B.Sc./B.Tech	125	61.6
MSc.	21	10.3
Undecided	1	0.5
Total	**203**	**100**

Source: Author's field survey, 2019.

Residential characteristics of respondents

From Table 5 (16.7%) of the respondents in the study area live in a bungalow, 69 (34%) lived in duplexes, 56 (27.6%) lived in flats, 34 (16.7%) lived in storey buildings, 4 (2%) lived in mansions, while just 6 (3%) were undecided. the result of the type of building showed that duplex has the highest frequency 69 (34%), this is because there seemed to be a lot of duplex buildings mostly in the axis of Lagos Island.

Table 5. Building Type and Years of Stay of Respondent

Building Type	Frequency	Percentage (%)
Bungalow	34	16.7
Duplex	69	34
Storey Building	34	16.7
Flat	56	27.6
Mansion	4	2
Undecided	6	3
Total	**203**	**100**
Year of stay in the location	**Frequency**	**Percentage (%)**
Below 5 years	101	49.8
5-10 years	34	16.7
11-15 years	20	9.9
16-20 years	11	5.4
Above 20 years	37	18.2
Total	**203**	**100**

Source: Author's field survey, 2019.

The result shows that approximately 101 (49.8%) of the respondents have lived in their location from 1-4 years, also 34 (16.7%) have lived in that location for a range of 5-10 years and 20 (9.9%) have remained in that area for a range of 11-15 years, 11 (5.4%) have lived for a range of 16-20 years, 37 (18.2%) had in the area for more than 20 years. The result indicates that the largest sample size 101 (49.8%) had lived in the study area for 1-4 years. This is due to the fact that Lagos is known to be an industrialized area, thus attracting population for business transaction which is responsible for the shortness of stay.

Identification of Energy Sources for Residents in Lagos state

This objective identified the energy sources for residents in Lagos State. In order to achieve this objective, potential sources of energy were identified and information were solicited on the energy source utilized by the building users. Table 6 shows the various energy needs sources used in Lagos state.

Table 6. Various Sources of Energy Supply

Sources of power	Mean	Rank
Generator	4.94	1
EEDC/IKEDC	4.93	2
Solar Panels	4.80	3
Wind	4.77	4
Hydropower	4.55	5
Biogas	4.51	6
Biomass	2.08	7
Geothermal	1.66	8

Source: Author's field survey, 2019.

The result of the analysis of the mean score of the various sources of energy reveals that generator with (MS = 4.94) is commonly used in the study area. Other sources of energy used in decreasing order include: EEDC/IKEDC (MS = 4.93), solar panels (MS = 4.80), wind (MS = 4.77), hydropower (MS = 4.55), Biogas (MS = 4.51), Biomass (MS = 2.08) and Geothermal (MS = 1.66). It can be deduced from the result of the analysis that geothermal, biomass, biogas, hydropower, wind is not widely used in the study area. Therefore, the available sources of power supply for residents in Lagos state are; generators, EEDC/IKEDC and solar panels.

Awareness Assessment

This section investigated the level of awareness of residents on the various renewable energy sources available in Lagos State. In order to achieve this, potential energy sources were identified and information were solicited on the awareness of the identified energy sources by the building users. The level of awareness

determines the usage and purchase of energy to meet energy needs. Table 7 shows the level of awareness on the various renewable energy sources available in Lagos State.

Table 7. Level of Awareness of Lagos State's Residents on the Various Renewable Energy Sources Available

Sources of power	Mean	Rank
Solar Panels	4.16	1
Hydropower	3.61	2
Wind	3.39	3
Biogas	3.15	4
Biomass	3.05	5
Geothermal	2.70	6

Source: Author's field survey, 2019.

The result of the analysis for the mean scores on the level of awareness of residents on the various renewable energy sources in Table .6 shows that solar panel has the highest level of awareness with (M.S = 4.16). The line of awareness in decreasing order are: hydropower (MS = 3.61), wind (MS = 3.39), biogas (MS = 3.15), biomass 3.05 (MS = 3.05) and geothermal (MS = 2.70). It can be deduced from the result of the analysis conducted that solar panel is becoming more utilized in the study area as shown in Table .5 which in turn results in it high level of awareness compared to other sources of energy supply.

Choice and Utilization Factors

This section investigated the factors influencing residents' choice and utilization of renewable energy sources in Lagos State. In order to achieve this objective, a number of factors were identified and information were solicited on these factors. Table 8 shows the result of the investigation carried out.

Table. 8: Factors Influencing the Choice and Utilization of Renewable Energy Sources in Lagos State

Discouraging Factors	Mean	Rank
High cost of purchase/installation	3.52	1
Lack of local manufacturing capacity	3.34	2
Lack of government incentives	3.33	3
Lack of appropriate loan option	3.17	4
Lack of suitable location	3.15	5
Unsatisfactory historical experiences	3.06	6
Insufficient technical experience in installation	3.00	7
Overall outlook of the building	2.66	8
Lack of awareness on renewable energy	2.40	9
Encouraging factors	**Mean**	**Rank**
Less environmental hazards	4.29	1
Ease of use	4.27	2
Favourable climatic conditions	4.22	3
Long life span of renewable energy sources	4.10	4
Low maintenance process and cost	3.98	5
Fairly good saving on energy bills	3.98	6
Stability of national policy	3.79	7
Future increase in electric bills	3.30	8

Source: Author's field survey, 2019.

Table 8 reveals that the major discouraging factor influencing choice and utilization of energy in Lagos State is high cost of purchase/installation (M.S = 3.52) and line of influence of the factors in decreasing order are: lack of local manufacturing capacity (MS = 3.34), lack of government incentives (MS = 3.33), lack of appropriate loan option (MS = 3.17), lack of suitable location (MS = 3.15), unsatisfactory historical experiences (MS = 3.06), insufficient technical experience in installation (MS = 3.00), overall outlook of the building (MS = 2.66), lack of awareness on renewable energy (MS = 2.40). However, there exist some encouraging factors influencing the choice and utilization of energy in the study area as well of which the major encouraging factor is less environmental hazards (MS = 4.29) and line of influence of the factors in decreasing order are: ease of use (MS = 4.27), favourable climatic conditions (MS = 4.22), long life span of renewable energy sources (MS =

4.10), low maintenance process and cost (MS = 3.98), fairly good saving on energy bills (3.98), stability of national policy (MS = 3.79) and future increase in electric bills (MS = 3.30). This shows that the major factor discouraging residents in the study area from choosing renewable energy sources is high cost of purchase/installation. It is followed by lack of local manufacturing capacity This implies that residents' decision on choosing renewable energy source over conventional source is greatly influenced by the financial capability of building users. In addition, the result shows that the major factor that would encourage residents to choose renewables are less environmental impact and ease of use respectively. Meanwhile, all factors were agreed to influence the choice and utilization of renewable energy sources in Lagos State. In view of this, various incentive schemes should be made available to assist residents in accruing for the initial purchase and installation cost. Similarly, enlightenment programmes should be intensified to increase residents' knowledge on the environmental benefits associated with the use of renewables.

Satisfaction Assessment

This objective investigated the satisfaction derived by residents of Lagos state from their chosen energy source. This objective was achieved by soliciting for responses to a number questions from the residents. The results are explained below:

Average Monthly Energy Expenditure

Table 9 reveals that 16 (7.9%) of the respondents pay below ₦2,000 monthly for energy bills to meet their building needs, 66 (32.5%) of the respondents pay between ₦2,000 and ₦5,000 monthly, 56 (27.6%), 22 (10.8%), and 17 (8.4%) of the respondents pay between ₦5,001 and ₦10,000, ₦10,001 and 15,000, and between ₦15,001 and ₦20,000 respectively. Also, 25 (12.3%) of the respondents pay above ₦20,000 monthly to meet energy needs, and 1 (0.5%) of the respondents could not decide how much exactly they spend monthly for energy bills. In addition, it can be inferred that a large percentage of people living in the study are spend above ₦25,000 to cater for their energy needs. The reason for this is not farfetched. From table 5.6, more than 70% of the target respondents make use of generators to generate energy. The cost of fueling and maintenance, has invariably, a disadvantageous effect on the expenses made by respondents on energy generation.

Table 9. Average Monthly Energy Expenditure

Amount	Frequency	Percentage (%)
Below ₦2,000	16	7.9
₦2,000-₦5,000	66	32.5
₦5,001-₦10,000	56	27.6
₦10,001-₦15,000	22	10.8
₦15,001-₦20,000	17	8.4
Above ₦20,000	25	12.3
Undecided	1	0.5
Total	**203**	**100**

Source: Author's field survey, 2019.

Number of Hours of Power Supply Per Day

Table 10 shows that 41 (20.2%) of the respondents were able to access power supply for less than 5 hours, 77 (37.9%) has access to power supply for an average of 5 to 8 hours daily, 41 20.2%) have access to power supply for an average of 9 to 12 hours, 16 (7.9%) has access to power supply for an average of 13 to 16 hours daily, 17 (7.4%) has access to power supply for an average of 17 to 20 hours daily while 13 (6.4%) has access to power supply for more than 13 hours than. From table 5.6, majority of the respondents were generator users, hence, it can be inferred that even with the use of generators, a larger percentage of the total sample size have access to power supply for maximum of 8hours daily.

Table 10: Number of Hours of Power Supply Per Day

Amount	Frequency	Percentage (%)
Below 5 hours	41	20.2
5-8 hours	77	37.9
9-12 hours	41	20.2
13-16 hours	16	7.9

17-20	17	7.4
21-24 hours	13	6.4
Total	**203**	**100**

Source: Author's field survey, 2019.

Level of Satisfaction Derived from the Number of Hours of Power Supply Daily

The result of the analysis on the level of satisfaction derived from the number of hours that power is being supplied is shown in Table 11. It reveals that 15 (7.4%) of the respondents were very satisfied with the number of hours which they have access to power supply while 19 (9.4%) were satisfied. More so, 47 (23.1%) were just satisfied, 66 (32.5%) were dissatisfied while 56(27.6%) were very dissatisfied. It can be inferred that a larger percentage of the total respondents were not satisfied with the number of hours that power is made available daily. It has been deduced from Table 10 that a larger percentage of the respondents only have access to energy supply for a maximum of 8 hours. This is regarded as being too low in comparison with the expenses incurred in generating the energy.

Table 11. Satisfaction Derived from the Number of Hours of Power Supply Daily

Amount	Frequency	Percentage (%)
Very satisfied	15	7.4
Satisfied	19	9.4
Just satisfied	47	23.1
Dissatisfied	66	32.5
Very dissatisfied	56	27.6
Total	**203**	**100**

Source: Author's field survey, 2019.

Expenses on Energy

Expenses incurred on energy usage is revealed Table 12 which shows that 50 (24.6%) of the total sample size regarded their expenses on energy as highly expensive while 115 (56.7%) regarded their expenses as being expensive. Furthermore, 29 (14.3%) and 8 (4.0) regarded their expenses as less expensive and not expensive respectively. Consequently, 1 (0.5%) remained undecided. We can deduct from this result that a larger percentage of the respondents in the study area regarded their expenses as being expensive. This is because over 70% of the respondents make use of generators to generate energy as shown in Table 6 and it requires high operational and maintenance cost.

Table 12. Expenses on Energy

Amount	Frequency	Percentage (%)
Highly expensive	50	24/6
Expensive	115	56.7
Less expensive	29	14.3
Not expensive	8	4.0
Undecided	1	0.5
Total	**203**	**100**

Source: Author's field survey, 2019.

Willingness to Change to a More Expensive and Environmentally Friendly Source of Energy

Table 13 reveals that 45 (22.2%) of the respondents strongly agreed to switching to a more environmentally friendly source of energy though expensive. Also, 78 (38.4%) agreed to switch to a more environmentally friendly source of energy. More so, 55 (27.1%) of the respondents were neutral about the offer, 19 (9.4%) disagreed to accept the offer while 6 (3.0%) strongly disagreed. From this result, it can be understood that a larger percentage of the respondents agreed to switch to a more environmentally friendly source of energy, though it is more expensive.

Table13. Willingness to Change to a More Expensive and Environmentally Friendly Source of Energy

Amount	Frequency	Percentage (%)
Strongly agree	45	22.2
Agree	78	38.4
Neutral	55	27.1
Disagree	19	9.4
Strongly disagree	6	3.0
Total	**203**	**100**

Source: Author's field survey, 2019.

It can be deduced that the sources of energy used by more than half of the respondents are not environmentally friendly and constitute to environmental degradation.

Sources of energy preferred

Table 14 shows that 152 (74.9%) of the respondents would love to switch to the use of solar panels, 14 (6.9%) would love to switch to the use of wind energy, only 3 (1.5%) of the respondents would love to switch to the use of generators, 16 (7.8%) of the respondents would love to switch Eko Electricity Distribution company/Ikeja Electricity Distribution Company, 17(8.2%) of the respondents would love to switch to the use biogas to generate energy while 1 (0.5%) of the respondents were undecided as to what energy source to switch to. From the analysis of the result, it can be concluded that the largest percentage of the respondents would prefer to switch to solar energy. This is partly due to the level of awareness of respondents about solar panels as shown in table 7.

Table 14. Preferred Source of Energy

Amount	Frequency	Percentage (%)
Solar energy	152	74.9
Wind energy	14	6.9
Generators	3	1.5
EEDC/IKEDC	16	7.8
Biogas	17	8.4
Undecided	1	0.5
Total	**203**	**100**

Source: Author's field survey, 2019.

Satisfaction with government involvement in energy distribution

The result of the analysis in Table 15 shows that 10 (4.9%) of the sample size were very satisfied with government's involvement in energy issues while 18 (8.9%) were satisfied with the general involvement of the government on matters concerning energy generation and distributions. More so, 60 (29.6%) were neutral about government's involvement in energy issues. (32.5%) of the respondents were dissatisfied while 49 (24.1%) of the respondents were very dissatisfied with the involvement of government in energy generation and distribution. It can be inferred from the analysis of this result that a larger percentage of the respondents were discontent with the general involvement of government in meeting the energy need of the people which reveals the wide range of generator use as shown in Table 6.

Table 15. Satisfaction with Government Involvement in Energy Distribution

Amount	Frequency	Percentage (%)
Very satisfied	10	4.9
Satisfied	18	8.9
Just satisfied	60	29.6
Dissatisfied	66	32.5
Very dissatisfied	49	24.1
Total	**203**	**100**

Source: Author's field survey, 2019.

Summary of Findings

This research assesses renewable sources of energy for residential estates in Lagos State. The study employed e- questionnaire (google form) generated through random sampling techniques. 214 questionnaires were required but a total of 203 questionnaires were retrieved, which constitutes 94.9% of the sample size. The building type cuts across the major building types of 16.7% bungalows, 34% duplexes, 27.6% flats, 2% mansion and 16.7% are storey buildings. The following findings were made from the result of the research;

1. There are seven sources of power supply available for the residents in the study area. These sources in order of their availability and functionality include, generator, Eko Electricity Distribution Company/ Ikeja Electricity Distribution Company, solar panels, wind, hydropower, biogas and geothermal.

2. The most reliable source of power for resident in the study area is generator. The level of functionality and reliability was measured for the sources of energy available to the respondents. Generator ranked first with a mean score of 4.94. this is due to the fact that its usage is controlled by the occupants with optimum

convenience, even though it has its limitation which is majorly environmental degradation. EEDC/IKEDC has a mean of 4.93 ranking second, solar panels with mean score 4.80 ranking third. Biomass and geothermal are rarely used as they both have mean scores 2.08 and 1.66 respectively.

3. The result on the level of awareness of residents on the various renewable energy sources in shows that solar panel has the highest level of awareness with 4.16 as the mean score (MS). The line of awareness in decreasing order are: hydropower (MS = 3.61), wind (MS = 3.39), biogas (MS = 3.15), biomass 3.05 (MS = 3.05) and geothermal (MS = 2.70).

4. The analysis also reveals that the major discouraging factor influencing choice and utilization of energy in Lagos State is high cost of purchase/installation (M.S = 3.52). The line of influence of the factors in decreasing order are: lack of local manufacturing capacity (MS = 3.34), lack of government incentives (MS = 3.33), lack of appropriate loan option (MS = 3.17), lack of suitable location (MS = 3.15), unsatisfactory historical experiences (MS = 3.06), insufficient technical experience in installation (MS = 3.00), overall outlook of the building (MS = 2.66), lack of awareness on renewable energy (MS = 2.40). However, there exist some encouraging factors influencing the choice and utilization of energy in the study. These in decreasing order of mean scores are: less environmental hazards (MS = 4.29), ease of use (MS = 4.27), favourable climatic conditions (MS = 4.22), long life span of renewable energy sources (MS = 4.10), low maintenance process and cost (MS = 3.98), fairly good saving on energy bills (3.98), stability of national policy (MS = 3.79) and future increase in electric bills (MS = 3.30).

5. The analysis on the level of satisfaction derived from the number of hours that power is being supplied reveals that 15 (7.4%) of the respondents were very satisfied with the number of hours which they have access to power supply while 19 (9.4%) were satisfied. More so, 47 (23.1%) were just satisfied, 66 (32.5%) were dissatisfied while 56(27.6%) were very dissatisfied.

Conclusion

Nigeria is a nation with abundance of both fossil and renewable fuels. Recently, the rate at which fuelwood is being exploited is alarming. It is rather unfortunate that with this high level deforestation, regeneration is very minute. If necessary measures are not put in place, fuelwood may longer be termed renewable in the country. The prejudice for fossil fuels to the neglect of the abundant renewable energy resources is often acknowledged as improper (Akinbami, 2001). The renewable potential base of Lagos state includes biomass (animal, agricultural and wood residues, fuelwood), solar, hydro, wind and geothermal with solar energy being the most exploited.

Renewable energy resources, if fully developed and well utilized, can be a powerful weapon for enhancing sustainable development in Lagos state. Epileptic energy supply is one of the major problems the state encounters as affirmed by 58.1% of the respondents who claimed to have access to power supply for less than 9 hours per day and 60% of these respondents were not satisfied with these number of hours of access to energy daily. For the crisis of energy to be largely resolved, government must harness the potentials of renewable energy resources that are abundant in state. This work identified the various sources of energy used in Lagos state in order of their availability and functionality. It has been discovered that over 70% of respondents use generators to supplement the energy transmitted through the national grid, which invariably constitute to environmental degradation. It is no surprise that 70.6% of the sample size would prefer to switch to a more environmentally friendly source of energy though expensive, with solar energy being the most preferred source.

References

Aarti, G., Nnaemeka, V. E., & Michael, O. D. (2019). Improving Nigeria's renewable energy policy design: A case study approach. *Energy Policy*, 89-100. https://doi.org/10.1016/j.enpol.2019.03.059

Akinbami, J.-F.K. (2001). Renewable Energy Resources and Technologies in Nigeria: Present Situation, Future Prospects And Policy Framework. *Mitigation and Adaptation Strategies for Global Change, 6,* 155–181. https://doi.org/10.1023/A:1011387516838

Bhat, A. (2019). *Research Design: Definition, Characteristics and Types*. Retrieved from https://www.questionpro.com/blog/research-design.

Igbinovia, F.O. (2015). *An Overview of Renewable Energy Potentials in Nigeria.* Prospects, Challenges and the Way Forward. Prague, Czech Republic.

Ngo, C. (2008). *Energy Resources, technologies and the environment* (3 ed.). London, United Kingdom: The Institution of Engineering and Technology, London, United Kingdom.

Ngo, C. (2010). *Energy resources, technologies and the environment.* London, United Kingdom: The institution of engineering and technology.

Nnaji, C. E., Uzoma, C. C., & Chukwu, J. O. (2010). The Role of Renewable Energy Resources in Poverty Alleviation and Sustainable Development in Nigeria. *Continental J. Social Sciences, 3*, 31 - 37.

REN21. (2010). *Renewables 2010 Global Status Report.* Paris: Renewable Energy Policy Network for the 21st Century.

Researchrundown. (2009). *Instrument, Validity, Reliability*. Retrieved from https://researchrundowns.com/quantitative-methods/instrument-validity-reliability/

Suinday , O. O., Olufemi, P. B., Stephen, C. N., Oluwaseun, K., Richard, O., Abraham, K. A., ... & Orobome, L. A. (2018). Towards a Sustainable Electricity Supply in Nigeria: The Role of Decentralized Renewable Energy System. *European Journal of Sustainable Development Research, 2(4),* 40-47. https://doi.org/10.20897/ejosdr/3908

WorldEnergyCouncil. (2004). *Renewable Energy Projects Handbook.* London, United Kingdom: World Energy Council.