Renewable Energy Penetration in Warri Metropolis

Oyeleke Oluwaseun Oyerinde

ABSTRACT

Energy plays an important role in the economic growth, development and security of any nation. Despite having abundant supply of both renewable and nonrenewable energy resources, Nigeria still experiences acute shortage of energy supply to its populace. Currently, the country depends largely on its fossil fuels derived from the Niger Delta region with attendant negative environmental impacts in the area. It is advocated that a switch to renewable sources will eradicate or at least ameliorate some of the environmental challenges. This study attempts to gauge the feasibility and potential of renewable energy (RE) to become a substitute or at the minimum a significant complement to fossil fuels in Nigeria with focus on Niger Delta. As such, attempt is made to assess the current degree of penetration of RE by measuring the level of awareness and utilization as well as identifying factors affecting utilization in the region using Warri metropolis as a case study. 232 survey questionnaires was deployed in the four local government areas - Okpe, Udu, Uvwie and Ughelli-North - that makes up the metropolis across households, commercial ventures and industries with 180 retrieved. Results show that awareness is highest among households at 66% and lowest for commercial ventures and industry at 30%. Utilization was generally low at 23% across households while none of the commercial ventures and industries sampled utilizes RE with most citing cost of installation and maintenance viz a viz their power requirement as a major factor. ANOVA shows there is no significant difference in behavior across locations while chi square test affirms that RE utilization is a function of awareness. Outcome points to need for greater awareness campaign and cost reduction of RE technologies.

Keywords: Energy Awareness, Energy Penetration, Energy Utilization, Niger Delta, Renewable Energy.

Published Online: March 30, 2021

ISSN: 2684-446X

DOI :10.24018/ejgeo.2021.2.2.122

Oyeleke Oluwaseun Oyerinde*

Department of Environmental Management and Toxicology, Federal University of Petroleum Resources Effurun, Delta State, Nigeria.

(e-mail: oyerinde.oyeleke@fupre.edu.ng)

**Corresponding Author*

I. INTRODUCTION

Energy is often defined as the ability to do work. Energy is used to achieve everyday activities such as transportation, cooking, preservation lighting among others. On the basis of availability or renewability, there are two broad classes of energy; non-renewable and renewable energy [1].

Non-renewable energy resources are energy resources that cannot be replenished and cannot be available for future need once they are depleted. They are generally utilized much faster than nature can replenish them mainly because their rate of formation is extremely slow. Examples include solid minerals and fossil fuels. Renewable energy on the other hand is naturally replenished on a human timescale. These include sunlight, wind, rain, tides, waves, and geothermal heat [2].

For the purpose of this study, penetration refers to the degree or extent of utilization of particular renewable energy by energy consumers within a defined area at a specific period. It includes percentage relative to the total amount of users and the quantity utilized by the consumers. That is, the amount of the utilization of energy generated from renewable resource like sun, wind, water among others.

Over the years, Nigeria, Niger Delta region inclusive, has experienced and suffered different issues of insufficient energy which has impacted the inhabitants negatively. This is because energy plays a crucial role in the lives of the

people. Ceaseless flow energy supply is paramount for all nations today. Future economic growth and development depends on long-term availability of energy from sources that are affordable, accessible, and environmentally friendly [3].

The energy crunch, which has overwhelmed Nigeria for a long time is dire and has largely contributed to the incidence of poverty by grounding numerous industrial and commercial activities. Aside the huge income loss and prevalent unemployment from destruction of farmlands, pollution of water sources, and disruption of other ecosystem services from oil spills, it has also resulted in health hazards due to the exposure to carbon emissions from gas flares in the Niger Delta worsened by persistent use of generators in different households and business enterprises.

RE is considered to be environmentally friendly because they are not burned unlike the fossil fuels, they do not release pollutants into the atmosphere. Hence, they provide a cleaner and healthier environment. Studies have shown that the Niger Delta is endowed in renewable energy sources, which can be exploited to solve all energy related problems facing the Niger Delta region [4]–[6]. Most studies on renewable energy in Nigeria focuses on potentials of various RE resources and forms from supply side usually at macro level [7]–[10]. There is paucity of surveys conducted at micro level focusing on consumer or end-user side.

In view of these, it is therefore the focus of this study to

C. Data Analysis

Data generated was analyzed using descriptive, analysis of variance (ANOVA) to test for significance in pattern and chi square to test for dependence.

IV. DISCUSSION OF RESULT

A. Household Socio-Economic Characteristics

A total of 232 questionnaires were deployed with a total of 180 retrieved, 100 for households and 80 for commerce and industry.

TABLE III: HOUSEHOLD SOCIO-ECONOMIC CHARACTERISTICS

	Uvwie	Okpe	Ughelli North	Udu
Gender				
Male	18(64.3%)	16(76.2%)	19(63.3%)	9(42.9%)
Female	10(35.7%)	5(23.8%)	11(36.7%)	12(57.1%)
Age Group				
18–25 years	2(7.1%)	5(23.8%)	7(23.3%)	8(38.1%)
26–30 years	13(46.4%)	9(42.9%)	9(30%)	8(38.1%)
31–40 years	13(46.4%)	7(33.3%)	8(26.7%)	5(23.8%)
41 years & above			6(20%)	
Education				
Primary Education	1(3.6%)		2(6.7%)	1(4.8%)
Secondary Education	11(39.3%)	9(42.9%)	9(30%)	7(33.3%)
Higher Education	16(57.1%)	11(52.4%)	19(63.3%)	11(52.4%)
Others		1(4.8%)		2(9.5%)
Occupation				
Civil Servant		3(14.3%)	2(6.7%)	2(9.5%)
Self Employed	5(17.9%)	13(61.9%)	21(70%)	14(66.7%)
Traders	15(53.6%)	2(9.5%)		
Unemployed	3(10.7%)	2(9.5%)	4(13.3%)	5(23.8%)
Others	5(17.9%)	1(4.8%)	3(10%)	
Total	28	21	30	21

From Table III, more males were encountered in all the four LGAs except Udu LGA. The highest age group recorded among the four LGAs is 2630 years, while the least age group was found to be from 41 years and above. Table III further indicates that the highest level of education attained across the four LGAs is Higher education. The occupational status of the respondents from all LGAs showed Self-employed as the highest, followed by trading. with the least form of occupation to be Unemployed across the four locations.

B. Renewable Energy Awareness

TABLE IV: RENEWABLE ENERGY AWARENESS IN HOUSEHOLDS

	Uvwie	Okpe	Ughelli North	Udu
Awareness				
Yes	18(63.3%)	16(76.2%)	22(73.3%)	10(47.6%)
No	10(35.7%)	5(23.8%)	8(26.7%)	11(52.4%)
Source				
Media	14(50%)	14(66.7%)	21(70%)	9(42.9%)
NGO	3(10.7%)	3(14.3%)	0	1(4.8%)
Others	1(3.6%)	1(4.8%)	2(6.7%)	0
None	10(35.7%)	3(14.3%)	7(23.3%)	11(23.3%)
Total	28	21	30	21

Table IV shows that 66% of the entire population in the study area are aware of RE with highest being 76% at Okpe and least at Udu with 47.6%. Source reveals that the media is the most influential source of information on renewable energy. Other sources include NGOs and worship centers.

Fig 3. Renewable Energy Awareness in Commercial Ventures and Industries.

Fig. 3 shows that awareness is generally low among commercial and industrial operators, at 30%, compared to households (66%). It is highest at Okpe and least in Uvwie.

Test for Variation in the Level of Renewable Energy Awareness among Locations and Attributes of the Four LGAs.

TABLE V: ANOVA TEST FOR VARIATION IN RENEWABLE ENERGY AWARENESS ACROSS HOUSEHOLDS

Households	Awareness				
	Mean	Std Dev.	F	Df	P-Value
Uvwie	2.04	.838	2.648	27	.116
Okpe	2.00	.837	1.541	20	.230
Ughelli -North	2.00	.830	0.241	29	.628
Udu	2.00	.837	0.263	20	.614

Significant at 0.05 level.

The ANOVA result presented in Table VI shows that there is no significant difference between the location's household attributes.

TABLE VI: TEST FOR VARIATION IN RENEWABLE ENERGY AWARENESS ACROSS COMMERCIAL VENTURES/INDUSTRIES

Commercial/Industry	Awareness				
	Mean	Std Dev.	F	df	P-value
Uvwie	3.24	1.751	0.210	16	.653
Okpe	3.40	1.765	0.873	14	.367
UGHELLI -NORTH	3.15	1.679	1.257	32	.271
UDU	3.40	1.765	0.116	14	.739

Significant at 0.05 level.

The ANOVA result presented in Table VI shows that there is no significant difference in level of renewable energy awareness across the Four LGAs commercial ventures/industries.

C. Renewable Energy Utilization

Table VII below show that only 23% of households surveyed make use of RE which is primarily wood across the four LGAs. Expenditure is also demonstrated to be less than N5,000 monthly in all the households.

TABLE VII: RENEWABLE ENERGY UTILIZATION IN HOUSEHOLDS

	Uvwie	Okpe	Ughelli North	Udu
<i>Usage</i>				
Yes	9(32.1%)	4(19%)	9(30%)	1(4.8%)
No	19(67.9%)	17(81%)	21(70%)	20(95.2%)
<i>Re Energy Type</i>				
Wood	1(100%)	2(100%)	4(100%)	1(100%)
<i>Re Expenditure</i>				
Below N4900	1(100%)	2(100%)	4(100%)	1(100%)
<i>Total</i>	28	21	30	21

Fig. 4. Household Utilization of Renewable Energy.

TABLE VIII: RENEWABLE ENERGY UTILIZATION OF THE FOUR LGAA FOR COMMERCIAL VENTURE AND INDUSTRIES

	Uvwie	Okpe	Ughelli North	Udu
<i>Utilization</i>				
Yes	0	0	0	0
No	17(100%)	15(100%)	33(100%)	15(100%)
<i>Total</i>	17	15	33	15

Table VIII indicates that, no commercial venture/ industries across the four locations utilize renewable energy.

Test for Variation in the Utilization of Renewable Energy among Locations and Attributes of the Four LGAs.

TABLE IX: TEST FOR VARIATION IN RENEWABLE ENERGY UTILIZATION ACROSS HOUSEHOLDS

Households	Utilization				
	Mean	Std Dev.	F	df	P-value
Uvwie	2.04	.838	1.717	27	.202
Okpe	2.00	.837	0.429	20	.521
Ughelli –North	2.00	.830	6.931	29	.014
Udu	2.00	.837	0.000	20	1.000

Significant at 0.05 level.

The ANOVA result presented in Table IX indicates that there is no significant difference in the utilization among Uvwie, Okpe and Udu. However significant difference exists between the attributes in Ughelli-North as a result of the uneven distribution in Ekredjebor attribute.

D. Relationship between Awareness and Utilization

TABLE X: TEST FOR DEPENDENCE BETWEEN AWARENESS AND UTILIZATION OF RENEWABLE ENERGY ACROSS HOUSEHOLDS IN THE FOUR LGAS

	X ²	df	Sig.
Uvwie	7.368	1	.007
Okpe	1.544	1	.241
Ughelli-North	4.675	1	.031
Udu	1.155	1	.283

Significant at 0.05 level.

From Table X, significant difference exists within the household LGA of Uvwie and Ughelli-North. This further tells us that the utilization of renewable energy the two LGAs is independent of their level of awareness. Okpe and Udu LGA shows there is no significant difference between their level of awareness and utilization. Thus, utilization of renewable energy is dependent on the awareness of renewable energy by Okpe and Udu LGA.

V. CONCLUSION

The level of awareness in the commercial and industrial sectors is very low as they have little or no idea about RE. Households that are aware of RE technologies hardly utilize, they rely mainly on the non- renewable forms of energy to cope with their daily energy needs. The generally low awareness and extremely low utilization levels point to minimal penetration of renewable energy in the study area. This is partly due to low level of sensitization on renewable energy to the public and cost of installation and maintenance. Clearly, a lot need to be done in terms of increasing RE awareness through aggressive publicity campaigns and stimulating utilization via attractive incentives for it to become a viable alternative or complement to fossil fuels in Niger Delta in the near future.

REFERENCES

- [1] A. Helmenstine (2018). Energy Definitions and Examples (Science). <https://sciencenotes.org/energy-definitions-examples/> Accessed 5th February 2021.
- [2] O. Ellaban, H. Abu-Rub and B. Frede (2014). "Renewable Energy Resources: Current Status, Future Prospects and their Enabling Technology". *Renewable and Sustainable Energy Reviews*, Vol. 39, 748-764. https://www.academia.edu/10612104/Renewable_energy_resources_Current_status_future_prospects_and_their_enabling_technology.
- [3] E.O. Diemuodeke and T.A. Briggs (2018). "Policy Pathways for Renewable and Sustainable Energy Utilisation in Rural Coastline Communities in the Niger Delta Zone of Nigeria". *Energy Reports* Vol. 4, 638–644. <https://www.sciencedirect.com/science/article/pii/S2352484718300921>.
- [4] E.O. Diemuodeke, I. Addo, C.O.C., Oko, and Y. Mulugetta (2017). "Domestic Energy Demand Assessment of Coastline Rural Communities with Solar Electrification". *Energy Policy Research*. 4 (1), 1–9. <https://www.tandfonline.com/doi/full/10.1080/23815639.2017.1280431>
- [5] C.O. Nwokocha, U.K. Okoro, and C.I. Usoh (2018). "Photovoltaics in Nigeria Awareness, Attitude and expected Benefit based on a Qualitative Survey across Regions". *Renewable Energy, Elsevier*, 116, 176–182. <https://ideas.repec.org/a/eee/renene/v116y2018ipap176-182.html>.
- [6] C.O. Okoye, O.B. Taylan, and K. Derek (2016). "Solar Energy Potentials in Strategically located Cities in Nigeria: Review, Resource Assessment and PV System Design". *Renewable and Sustainable Energy Review*. 55, 550–566. <https://www.sciencedirect.com/science/article/abs/pii/S1364032115012332>
- [7] J.F.K. Akinbami, M.O. Ilori, T.O. Oyebisi, I.O. Akinwunmi, and O. Adeoti (2001). "Biogas Energy Use in Nigeria: Current Status, Future Prospects and Policy Implications". *Renewable and Sustainable Energy Review*, (5)1, 97-112. <https://www.sciencedirect.com/science/article/abs/pii/S1364032100000058>
- [8] S.O. Oyedepo, T. Uwoghien, P.O. Babalola, S.C. Nwanya, O. Kilanko, R.O. Leramo, A.K. Aworinde, T. Adekeye, J.A. Oyeibanji and O.A. Abidakun (2019). "Assessment of Decentralized Electricity Production from Hybrid Renewable Energy Sources for Sustainable Energy Development in Nigeria". *De Gruyter, Open Eng*, 9, 72–89.

<https://www.degruyter.com/document/doi/10.1515/eng-2019-0009/html>.

- [9] C.C. Uzoma, C.E. Nnaji, C.N. Ibeto, C.G. Okpara, O.O. Nwoke, I.O. Obi, G.O. Unachukwu, and O.U. Oparaku (2011). "Renewable Energy Penetration in Nigeria: A Study of the South-East Zone". *Continental J. Environmental Sciences* 5 (1), 1–5.
https://www.researchgate.net/publication/215909831_Renewable_energy_penetration_in_Nigeria_A_study_of_the_South-East_Zone.
- [10] S.I. Sofimieari and M.W. Mustafa (2018). "Evaluation of Renewable Energy Resources Potential for Satisfying Electricity Needs in the Niger Delta Region". *ARPJ Journal of Engineering and Applied Sciences*. (13)12, 3907 – 3913.
https://www.researchgate.net/publication/326320091_Evaluation_of_renewable_energy_resources_potential_for_satisfying_electricity_needs_in_the_Niger_Delta_Region.
- [11] S. Kundu, T. Matthew, I.S. Janet and A. Ternege (2015). "Retrospective study of Disease Incidence and Other Clinical Conditions Diagnosed Owned Dogs in Delta State, Nigeria". *Journal of Advanced Veterinary and Animal Research*, 2, 435-449.
https://www.researchgate.net/publication/307718358_Retrospective_study_of_disease_incidence_and_other_clinical_conditions_diagnosed_in_owned_dogs_in_Delta_State_Nigeria.
- [12] National Population Commission (NPC) (2006). Nigeria National Census: Population Distribution by Sex, State, LGAs and Senatorial District: 2006 Census Priority Tables Vol. 3.
<http://www.population.gov.ng/index.php/publications/140-population-distribution-by-sex-state-lgas-and-senatorial-district-2006-census-priority-tables-vol-3>.
- [13] National Population Commission (2018). National Demographic and Health Survey (NDHS).
<https://drive.google.com/file/d/1Y9dm9Mhr1KjLj9asOYuXkutGIXW8wY06/view>.