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Assessing the Need for Renewable Energy Strategies and Locally Sourced Materials Towards Achieving Sustainable Architecture in Niger Delta, Nigeria.

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ABSTRACT

Sustainability is an important factor to be considered in everyday contribution and operations of buildings. The need for energy consumption in buildings to keep intact heating, ventilating, air conditioning, lightning, etc. can not be overlooked or downplayed. It's like a weighing balance, for it to be stable, the weight of the right balance with that of the left with nothing of importance left behind. Comfort is needed in every facility and one of the core ideas of architecture is to enhance comfort to its end users. A builder is like a piece of architecture we dwell in. therefore, the choice of materials and source of energy should be critically considered. The constant emission of C02 and burning of fossils has been on the increase as we embrace civilization and detrimental just as incomplete knowledge could be as deadly and detrimental as no knowledge.it becomes paramount we embrace several ways of achieving same maximal level of comfort with minimal or zero carbon consumption which its materialization has been perceived to be achievable by examining the use of renewal energy strategies combined with locally sourced materials. Anything you are not able to sustain in the future is not sustainable. Therefore, for any piece of architecture to be in use, it must be sustainable. The natural environment exists first before the built environment, to achieve a sustainable environment we must study the natural environment and design in harmony with it. ahead could lead to an immitigable disaster therefore if becomes imperative that these locally sourced materials in the natural environment to be intentionally used and considered in our day to day and renewable energy strategies to be strategically incorporated to replace other sources of energy from and within the building. So there will be a significant drop in the carbon footprint.

(Keywords: sustainable-Architecture, Renewable energy, locally-sourced-materials, Niger Delta, Building Materials).

1.0 INTRODUCTION

Sustainable architecture is a necessity in our world today, as energy consumption and burning of fossil is on the increase. Renewable energy strategies has proved to mitigate the adverse effect of pollution that has emerged from greenhouse gases, yet still carrying out activities that would have been achieved by burning of fossil.

Material choice in buildings plays great role towards achieving sustainable architecture. The natural environment has been distorted in the quest for creating a conducive environment for man and his architectures, nevertheless, the built environment could be intentionally built to integrate and blend with the natural environment not necessary in the case of biophilic approach but the material choice should be such that won't fight against the natural environment and will be able to stand the test of time.

Different climate zones have their uniqueness and distinct characteristics which plays a great role in their architecture and choice of materials for building construction. What best suits a particular climate might be challenging to another climate.

2.0 LITERATURE REVIEW

STUDY AREA

Firstly, Niger Delta is the delta of the Niger River sitting directly on the gulf of guinea on the Atlantic Ocean in Nigeria.

The Niger Delta is located in the southern part of Nigeria and majorly comprises of all the states in the south-south geopolitical zones and one state from the south west geopolitical zone and two states from the south east geopolitical zone.

All states in the Niger Delta are;

1. Abia State (south-East geopolitical zone)
2. Akwa Ibom (South-South geopolitical zone)
3. Bayelsa State South-South geopolitical zone)
4. Cross River South-South geopolitical zone)
5. Delta State (South-South geopolitical zone)
6. Edo State (South-South geopolitical zone)
7. Imo (South-East Geopolitical Zone)
8. Ondo (South-West Geopolitical Zone)
9. Rivers State (South-South Geopolitical Zone)

Niger Delta comprises of nine states that cuts across different geopolitical zones and also covers people with diverse culture, languages and building patterns with their unique availability of locally sourced materials for building construction.

Nevertheless, the Niger Delta earlier comprises of just Bayelsa, Delta and Rivers before the addition of other six states in the year 2000.

2.1 Renewable energy strategies that could be utilized in Niger Delta.

Niger Delta cut across various states, and they have distinct characteristics nevertheless, the common sourced include:

Similar studies in the Niger Delta Zone have identified other renewable energy sources e.g.: energy from the ocean temperature, energy from solar heat, energy from flowing river stream, energy from …….wave and energy from ocean wave, which all have proven energy generation technologies (Oko, 2016).

Climate change is of a great challenge to many parts of Niger Delta due to constant exploration of crude oil and gas, high population and total dependence on agricultural produce, weak adaptability level, need for adequate, affordable and sustainable energy.

Generally, the renewable energy technology includes;

1. Hydropower- Large and small (MW)
2. Biomass (MW)
3. Solar (PV/Thermal)
4. Wind Electricity

2.2 Utilization of Renewable Energy Sources

Adequate Studies have indicated that the Niger Delta region is blessed with renewable energy sources which can be harnessed to solve all energy related challenges in the Niger delta region. (Diemuodeke et al., 2017, Ohunakim et al.,2014,Nwokocha et al.,2018,GIZ, 2015, Diemuodeke et al., 2016, Okoye et al., 2016). As estimated, Niger Delta region receives averaged solar energy of about 4.13kwh – 4.71 kWh annually and this is considerably little compared to the vast possibility. Renewable energy sources could be effectively utilized if given adequate consideration due to the presence of water; hydropower could be utilized. Including that of biomass, solar and wind. They could all be harvested to ensure a safe and sustainable environment.

2.3 Challenges in the use of Renewable Energies

The following, among others, are some of the difficulties faced by the sector:

• Technical expertise

• Institutional and policy issues

• Cultural and social problems

• Financial and Economic Challenges

• Marketing Issues

As a result, the usage of renewable energies needs to be adequately considered and included into the Niger Delta's institutional and policy-making processes.

2.4 Available Building materials in the region

1. Clay
2. Mud
3. Thatch
4. Bamboo
5. Palm frond
6. Timber.
7. Palm frond and Vegetable Products.

2.5 Utilization of locally sourced building materials

Locally sourced building materials can be gotten from different state across the Niger delta, Nigeria and they have been in use for many years. However, the utilization of locally derived resources has decreased drastically as a result of civilization. These materials best suits the climate of the region and enhances sustainability.

2.6 Challenges in the use of locally sourced building materials.

There are several challenges faced in the use of locally sourced building materials and some that have been used years ago and issued that were faced.

Some of the challenges encountered in the use of locally sourced building materials include

1. **Adverse Climatic Conditions**

Locally sourced materials have high possibility of withstanding climatic conditions because they are processed from the natural environment, it blends with the climate of the region.

Due to the recent climatic changes it becomes necessary assessments are given to the use of locally sourced building materials and the reactions encountered compared to previous years.

2. **Termite**

Some locally sourced building materials can be affected by termites and other insects that is why it is necessary proper treatment of materials are made before use.

3. **Technical Know how**

Most persons that were trained on how to effectively make use of these materials in terms of manufacturing and installing are old now and some passed on without raising the knowledge and skill to the new generations because a lot of persons have seen these pattern as obsolete due to invention and technology.

Nevertheless, these processes could be improved on and have presentable use of locally sourced building materials that suits the societal trends.

4. **Disaster**

Disaster could be natural or manmade. Disasters could be detrimental to buildings made of locally sourced building materials like flood, tornadoes etc. could wash off the materials and pull off roofs.

Designing against disaster will require high level of technicality due to the properties of these materials and their ability to withstand disaster including fire. Howbeit, if adequate attention is given to the use of these materials a lot of these issues would be resolved as it would be the focus of the building industry.

3.0 RESEARCH METHODOLOGY

The South-South geopolitical zone, as well as parts of the South-West and South-East, make up the Niger Delta. These nine states share many similarities as well as their own unique qualities. According to the National Population Commission's 2006 report, the Niger Delta's population is estimated to be 31,224,587.

This population, which is anticipated to be growing, will depend on energy to carry out daily tasks efficiently and to live comfortably in developed areas.

The approach for putting these findings and approaches into practice involved researching readily available materials that improve sustainable architecture, renewable energy strategies, and environmental sustainability, as well as speaking with experts in the field.

4.0 DATA PRESENTATION AND ANALYSIS

The table below shows the current energy resources in Nigeria. The energy resources in Nigeria include: crude oil, natural gas, coal, tar sand and renewable (biomass, hydro, solar, wind and others).

S/no	Resources Type	Reserves (Natural Units)	Production/Consumption
1	Large Hydropower	11,500MW	1,900MW
2	small Hydropower	3,500MW	30MW
3	Solar Radiation	3.5 - 7.0 KWh/m2 /day	2MW
4	Wind	(2-4)m/s at 10m height	Negligible
5	Biomass	Fuel-wood	11 Million hectares of forest and wood land

Source: Energy Commission of Nigeria (1992); Edirin and Nosa (2012).

The NREEEP projected to significantly increase the production of renewable energy to 30GW by 2030, Hydropower, wind and solar was the immediate priority by the policy.

Table 2. Overview of National Renewable Energy and Energy Efficiency Policy (NREEEP)

s/no	**RESOURCES**	**2012** CAPACITY	**2015** CAPACITY	**2020** CAPACITY	**2030** CAPACITY
1	Hydro	1938.00	2121.00	4549.00	4626.96
2	Hydro	60.18	140.00	1607.22	8173.81
3	Solar	-	55.00	631.41	3211.14
4	Biomass	10	50.00	57.40	291.92
5	Wind	1985.18	2438.00	8188.20	23134.80

Source: Federal Ministry of power, Nigeria 2015.

From the table above we can clearly see that targets have been set up to 2030 which is seven (7) years from now but that these policies has not been implemented to make adequate use of these renewable energy sources. Many sustainable energy interventions in the Niger Delta failed because of incompetent policy decisions.

5.0 INTERPRETATION AND DISCUSSION OF FINDINGS.

5.1 Relationship between Renewable Energy Strategies and Locally Sourced Materials in Achieving Energy Efficiency in Buildings.

Environmental sustainability ought to be in prospect in everything that has to deal with the environment. The built environment plays a major role in the sustainability of the environment at large.

The Natural environment is in itself sustainable, but for it to be comfortable for man to dwell in, Architects and other professionals needed to design and build conductive environment within the environment, but it becomes a bane when the built environment does not interrelate and blend with the natural environment, because some things integrated into the design, fights the originality of the environment especially in providing energy for the building to function effectively, this concern gave rise to the introduction of integrating renewable energy strategies into the built environment which makes the occupant of the building comfortable and at the same time saves the environment from degradation.

Renewable strategies establish a balance between the built environment and the natural environment, and eco-friendly design should be encouraged both now and in the future. CO2 emissions and greenhouse gas effects, which are mostly caused by the construction and operation of buildings, are one of the factors contributing to the climate crisis.

Utilize micro-encapsulated phase transition materials to actively capture solar radiation and store it until it is required for utilization.

This project does not only contribute through reference alone but if these strategies to be worked on are adopted the project is to feel and experience at the same time and it would be triggered to becoming a solution or one of the solutions towards the quest of getting a safer environment, this time through the use of renewable energy strategies with locally sourced materials in the design process and construction.

5.2 Renewable Energy Strategies

The use of solar energy is very important as it majorly used based on photo thermal conversation. Therefore, solar utilization strategy is presently used in Architecture. Through passive solar energy utilization with the locally sourced building materials, the building could collect and store solar radiation heat in the cold season and maintain a reasonable heating temperature in the room which in a way form of enhancing energy efficiency. Though this passive solar houses are low cost and easily maintained it could also be challenged with poor indoor comfort and high-temperature fluctuations. Solar ventilation cooling strategy is an effective way to make use of solar energy, as it is used for dehumidification, cooling and removal of harmful gases.

Geothermal utilization strategy; Geothermal is a combination of two words, Geo (Earth), thermal (heat) therefore, Geothermal energy is the heat that could be found in rocks or below the surface, this could be effective in the generation of electricity for cooling and heating in the building, the heat strategy could either make use of sources which could be; soil surface source water surface source or groundwater source. Biomass energy utilization strategy has some factors that influences it.

These energies could be integrated into the design from the site planning stage, Architectural design stage, layout and other special designs depending on the particular type of strategy to be introduced. While integrating these strategies into the building could be combined with the use of locally sourced materials at the roof, walls installation of solar collector panels, photovoltaic panels etc.

Sustainability should be intentionally considered to achieve energy efficiency while combing these renewable energy strategies with locally sourced building materials.

Conclusion

This study critically examined the need for renewable energy strategies and availability of locally sourced building materials. Using Niger Delta as study area, the study shows availability of the locally sourced building materials which includes; clay, mud, timber, bamboo, thatch etc.

As years advanced the use of locally sourced building materials has been on declined irrespective of the abundance of these materials. While the renewable sources of energies include; Solar, Hydro, Biomass etc. and it usage is considered to be effective and safer compared to the use of fossil having sustainable architecture in prospect.

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