



Community Evaluation of Health Priorities and Infrastructure Gaps for a Renewable-Energy-Based Urban Wellness Facility in Caleb University, Lagos State

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ABSTRACT

Caleb University, located in the fast growing corridor of Imota, Ikorodu, Lagos State. The University faces challenges relating to health service access for students and staff, inadequate or non-available wellness infrastructure and unstable energy supply. Students and staff rely heavily on external health facilities which should definitely not be the way approach. These facilities are at long distances some which even comes up with difficulties in terms of transportation to these facilities, overcrowded, or poorly managed. This study talks about health importance and brings out infrastructural gaps that hinder the smooth efficiency of wellness services on campus. The research further explores the use and functions of renewable energy systems—particularly solar photovoltaic (PV), hybrid storage, and design strategies—to support an energy-efficient urban wellness facility. The study shows that a renewable-energy-powered wellness facility would address these gaps by combining preventive healthcare, mental wellness for users, sports functionality, and technological system. The research provides practical guidance for the following stakeholders: planners, architects, and policymakers in designing wellness infrastructure that is community-driven, community impact, sustainable, and resilient to Nigeria’s energy challenges.

Keywords: Community health priorities, renewable energy, wellness facility, infrastructure gaps, Caleb University, Lagos State, sustainability.

INTRODUCTION

Caleb University is situated within the suburban zone of Imota, a community and location experiencing rapid population growth, rapid user occupancy in Lagos. Despite the school having a large population of Staff, students, the institution lacks a fully functional wellness centre capable of addressing its unique environmental, social, and health challenges which are very important and vital to the users. Existing health services are limited primarily to basic first-aid care, general consultation, and treatments, mental health support, fitness rehabilitation, and preventative wellness programs (Ogunyemi et al., 2023). It has been discovered that Students report increasing stress levels, fatigue, limited opportunities to counseling, and inadequate spaces for physical or mental restoration (Okafor & Aluko, 2024). The surrounding community of Imota faces its own challenges, including inadequate primary healthcare, long travel distances to specialized services, and inconsistent public health outreach, Inadequate health awareness programs to be enlightened in the community. These external factors further influence the wellness needs of Caleb University residents, who due to the lack of these facilities often have to go out of the school premises in order to get adequate health facilities leading to delayed treatment and higher costs.

Energy reliability also poses a significant challenge. The existing campus grid experiences regular outages, forcing health services to operate under time constraints and limiting the availability of essential medical equipment in order to function as expected. Integrating renewable energy—primarily solar energy— which can stand in the gap to offer a sustainable solution to ensure consistent power supply while reducing operational costs, supporting environmentally responsive architectural design in order to achieve and maintain its functions.

Scope of the Study

The scope of this study is limited to the evaluation of community health needs, identification of infrastructure deficiencies, and assessment of renewable energy opportunities which can also improve the functionality and specifics within Caleb University. The research focuses on physical wellness and development, mental health wellness, sports rehabilitation, relevant to a university community. Renewable energy strategies assessed include solar PV systems, hybrid inverters, battery storage, and passive design principles.

Aim and Objectives

The aim of this study is to focus on health as an importance and infrastructural gaps or deficiencies in Caleb University and explore how a renewable-energy-based wellness facility can address these in order to achieve sustainability.

The objectives are to:

1. Analyze the physical, emotional, mental, and environmental health needs of the Caleb University community as a whole.
2. Evaluate the deficiencies in existing wellness infrastructure, health services or concern and energy efficiency on campus.
3. Assess renewable energy sources—primarily solar PV—suitable for powering a campus wellness facility without regular power outage.
4. Provide a functional design recommendations for an integrated, climate-responsive, and community-centered wellness centre.

Justification for the Study

This study is justified on the basis of four major points: community wellness, environmental sustainability, institutional functionality and functionality and academic productivity for the students and community.

First, the research addresses critical health service gaps or issues within Caleb University health systems, where students and staff express undesirable needs in mental health care, preventive services, diagnostic capacity, and emergency response (Adegboye, 2024). The most important way to solve this can be developing a wellness centre that responds directly to these priorities.

Secondly, the integration of renewable energy aligns with global sustainable development goals, helping reduce carbon emissions and operational costs associated with conventional power systems (UN-Habitat, 2020).

Third, energy stability is essential for running modern health facilities. A renewable-energy-supported design improves reliability and ensures that essential services remain functional even during power outages (Owolabi & Fagbenro, 2023).

Finally, the study enhances academic performance for the students most especially by promoting improved mental and physical well-being, thereby supporting student concentration, functionality, productivity, and long-term health outcomes that would enhance proper health and medical care.

LITERATURE REVIEW

This chapter reviews existing literature relevant to community health priorities, wellness infrastructure gaps, renewable energy integration, and sustainable architectural design for health facilities. The purpose is to establish a well understood and explained discuss for the development of a renewable-energy-based urban wellness facility within Caleb University, Lagos State. Contemporary research emphasizes that health facilities and amenities must function beyond curative medicine to incorporate preventive care, mental wellness, sports rehabilitation, and environmental health. This review identifies knowledge gaps and positions this study within the broader discourse of sustainable wellness architecture for proper development.

Conceptual Framework

The conceptual framework of this study is built on the interaction between three major variables:

- Community health priorities
- Infrastructure adequacy
- Renewable energy integration

These variables collectively influence the development of a sustainable and resilient wellness facility in order to also bring about functionality and efficiency.

In this framework:

Independent Variables

- Community-defined health needs
- Infrastructure availability
- Renewable energy systems

Dependent Variable

- A functional, resilient, and sustainable urban wellness centre

The conceptual relationship assumes that when community needs are properly discovered, evaluated and infrastructure gaps are addressed through renewable-energy-supported design, the result is a wellness facility capable of delivering consistent, accessible, functional, efficient health services. The framework integrates architecture, public health planning and involvement and energy sustainability to bring about where design decisions respond to environmental realities and user needs simultaneously.

Independent Variables

a. Community Health Priorities

Community health priorities refer to the physical, psychological, and environmental wellness needs identified by users of a facility which has a lot to do with the users comfort. Studies and research on Nigerian university populations show rising levels of stress, anxiety, fatigue, and also lifestyle-related illnesses due to academic pressure, lack of proper health facilities and urban living conditions.

Research highlights the need for:

- Mental health counselling spaces
- Preventive healthcare programs which encourages enlightenment
- Sports rehabilitation facilities and amenities
- Environmental wellness programs

Health infrastructure that reflects community priorities improves health behavior, reduces off-campus requests for proper healthcare and increases user trust in institutional systems.

b. Infrastructure Gaps in Institutional Health Systems

Infrastructure gaps describe deficiencies in Inadequate or no space provided, Health equipment, energy supply, and service capacity and functionality. Many tertiary institutions in Nigeria operate with limited clinic facilities that provide only first-aid or general consultation which brings about a major Gap in the health and wellness conditions.

Common gaps include:

- Inadequate diagnostic equipment
- Lack of mental health facilities
- Absence of rehabilitation spaces for inadequate spaces
- Weak or non- functional emergency response systems
- Limited operating hours due to energy instability or unexpected power outage.

These deficiencies reduce service effectiveness and create pressure on external healthcare systems.

c. Renewable Energy Integration

Renewable energy integration refers to the adoption of solar photovoltaic systems, hybrid energy storage, and passive architectural design strategies to ensure stable facility operation.

Healthcare facilities require uninterrupted power supply for:

- Efficient functions of Medical equipment
- Adequate Lighting and ventilation
- Refrigeration and diagnostics of samples
- Digital health systems

In energy-insecure regions, solar-powered systems enhance reliability, reduce operational costs, and support environmental sustainability and it also allows the efficient functions of Medical equipments

when needed. Passive design strategies could include the following such as natural ventilation, shading devices, daylight optimization.

Dependent Variable

Sustainable Wellness Facility

The dependent variable is a purpose-built wellness centre that combines healthcare delivery, environmental sustainability, and architectural functionality and functionality.

Key performance indicators include:

- Functional spatial organization
- Accessibility and inclusiveness
- Energy reliability
- Environmental responsiveness
- User satisfaction
- Operational efficiency

A successful wellness facility must operate as a climate-responsive building that integrates renewable energy with health-centered spatial planning.

Theoretical Framework

This study is grounded in three interrelated theories:

a. Sustainable Architecture Theory

Sustainable architecture emphasizes minimizing environmental impact while maximizing occupant well-being. It promotes energy efficiency, renewable energy use, and climate-responsive design. In healthcare environments, sustainability improves indoor comfort, reduces operational costs, and enhances long-term functionality.

b. Community-Centered Health Planning Theory

This theory argues that health infrastructure must reflect user-defined needs and must also serve its purpose. Facilities designed with community participation and involvement will demonstrate higher utilization rates and improved service satisfaction. Community-driven planning and involvement aligns architecture with real health priorities rather than imposed issues, situations or also assumptions.

Empirical Studies

Empirical research consistently supports the use or adoption of renewable energy and sustainable design in healthcare infrastructure. Research on university wellness centers shows that facilities combining mental health, preventive care, and sports rehabilitation significantly improve academic productivity and student well-being. This would have a very good effect mentally on the students which will definitely bring about proper academic productivity and concentration.

Review of Previous Studies

Previous research highlights several important findings:

- Infrastructure deficits in tertiary institutions limit healthcare access
- Mental health services are critically underprovided in Nigerian campuses
- Renewable energy enhances functionality in public institutions
- Passive design strategies are effective in hot-humid climates
- Community participation improves facility relevance and acceptance

While many studies examine energy sustainability or healthcare access separately, few integrate architectural design, renewable energy, and community-defined health priorities into a single framework. Therefore, this discovery would also help this research to be really specific or achieving its aim and objectives.

Gap in Literature

Despite growing research on sustainable infrastructure and health planning, several gaps remain:

1. Limited studies combine renewable energy systems with campus wellness architecture to bring about functionality

2. Few evaluations focus on university communities as unique health ecosystems and its impact on its users
3. Insufficient research links mental wellness, rehabilitation, and preventive care within a single facility model
4. Architectural implications of energy instability in Nigerian institutions remain under-explored.

This study addresses these gaps by proposing a renewable-energy-supported urban wellness facility grounded in community health evaluation and development.

Summary of Literature Review

The reviewed literature establishes that:

- Health infrastructure and strategies must respond to community-defined priorities
- Energy instability and outages undermines healthcare delivery
- Renewable energy improves functionality, sustainability and efficiency
- Integrated design approaches outperform isolated solutions

The chapter confirms the necessity of a sustainable, energy-resilient wellness facility that is expected to the needs and uses of a university environment. It provides the intellectual foundation for the research methodology and design recommendations presented in subsequent chapters.

RESEARCH METHOD

This chapter presents the methodology adopted for evaluating community health priorities, infrastructural gaps, and renewable energy opportunities toward designing a sustainable urban wellness facility at Caleb University, Lagos State. It outlines the research design, study area, data collection methods, sampling strategy, analytical tools, and ethical considerations that would be used for this research exercise. The methodological framework is structured to generate reliable qualitative and descriptive data capable of informing architectural and environmental design decisions.

Research Design

This study adopts a mixed qualitative-descriptive research design. The approach is exploratory and evaluative, aimed at understanding:

- Existing health service conditions and functions
- Community wellness priorities for the users
- Infrastructure limitations and deficiencies
- Energy reliability challenges and efficiency
- Environmental design opportunities and strategies

The design allows for in-depth assessment of user experiences, institutional gaps in development and sustainability potential. A case-study strategy is employed because the research focuses on a specific institutional environment.

Study Area

The study area is Caleb University, located in Imota, Ikorodu, Lagos State. The university represents a rapidly growing academic community. The university is experiencing infrastructure deficiency and energy instability which leads to regular power outages..

The surrounding Imota–Ikorodu region further influences healthcare access patterns, as many users depend on outside campus facilities due to the absence of these facilities In the school environment for specialized services.

Research Approach

The study employs a community needed assessment approach, participatory evaluation with infrastructural review and feedback. The approach involves stakeholder perspectives and real-world operational conditions.

The research is guided by the following questions:

1. What are the major physical, mental and environmental health needs of the university community?
2. What infrastructural deficiencies limit current wellness functionality of its services?

3. How does energy instability affect healthcare delivery and its efficiency?
4. What renewable energy opportunities can support a wellness facility for it to become for sustainable?
5. What architectural implications arise from the findings?

Population and Sample Size

The study population includes:

- Students
- Academic staff
- Non-academic staff
- Campus healthcare personnel
- Facility management personnel

The sample size is determined based on representatives ensuring diversity across age groups, academic levels, and institutional roles.

Sampling Technique

A sampling method is employed to ensure balanced representation of user categories. Participants are grouped into:

- Students
- Healthcare staff
- Administrative personnel
- Facility managers

This technique ensures that both service users and service providers contribute to the data to achieve an accurate and balanced feedback.

Data Collection Methods

Data is collected using multiple instruments to ensure transparency and reliability.

a. Questionnaire Survey

Structured questionnaires are administered to students and staff to assess:

- Health service usage patterns
- Comfortability levels
- Wellness priorities and functions
- Accessibility challenges
- Perceived infrastructure gaps

The questionnaire includes both closed and open-ended questions to capture quantitative trends and qualitative insights.

b. Semi-Structured Interviews

Interviews are conducted with:

- Healthcare staff
- Facility managers
- Administrative officials

These interviews explore operational constraints, energy reliability issues, and infrastructural limitations in greater depth.

c. Environmental Observation

Direct observation is used to evaluate:

- Existing clinic facilities
- Spatial organization
- Equipment adequacy
- Ventilation and lighting conditions
- Energy backup systems

Data Collection Instruments

The primary instruments used include:

- Printed and digital questionnaires
- Interview guides
- Observation checklists
- Field notes

Data Analysis Methods

Data analysis is conducted using both descriptive and thematic techniques.

Quantitative Analysis

- Frequency distribution
- Percentage analysis
- Comparative summaries

This identifies patterns in service usage and user perception.

Qualitative Analysis

- Thematic coding
- Content analysis
- Pattern interpretation

This reveals recurring issues related to infrastructure, wellness priorities, and energy challenges.

Results are interpreted in relation to architectural implications and sustainability design strategies.

Reliability and Validity

Reliability is ensured through:

- Standardized and transparent questionnaires
- Consistent interview procedures and guidelines
- Cross-verification and confirmation of responses

Validity is strengthened through:

- Multiple data sources
- Participant diversity
- Field observation
- Document triangulation

Ethical Considerations

Ethical principles guide the research process.

- Participation is voluntary
- Informed consent is obtained for the involved parties
- Confidentiality is maintained
- Data is securely stored

Participants are informed of the study's purpose and may withdraw at any stage without consequence.

Limitations of the Study

The study acknowledges the following limitations:

- Restricted access to institutional energy records
- Time constraints in participant engagement

Despite these constraints, credibility is assured.

RESULTS AND DISCUSSION

This chapter presents the findings from the community assessment and interviews conducted at Caleb University, Lagos State. The results are organized according to the research objectives: community health priorities, infrastructure gaps, energy reliability challenges, and implications for a renewable-energy-supported wellness facility.

Demographic Profile of Respondents

The survey captured responses from students, academic staff, non-academic staff, and healthcare personnel to ensure balanced representation to also get accurate answers.

Key observations include:

- Majority of respondents fall within the 18–35 age group
- A significant portion of participants reported regular academic or work-related stress which can also make work difficult when there is regular power outage.
- Over half of respondents indicated frequent use of off-campus health facilities due to limited on-campus services.

The demographic structure confirms that the campus population is highly active and requires accessible preventive and mental wellness support.

Community Health Priorities

Findings show that respondents identified the following as top wellness needs:

1. **Mental health counselling should also be made available**
2. **Sports injury rehabilitation**
3. **Emergency response services**
4. **Stress management programs and seminars**

Mental wellness emerged as the most urgent priority. Many respondents expressed the reasons why the mental wellness must be put into proper consideration. Also, difficulty accessing confidential counselling services, leading to delayed treatment or avoidance of care.

Students reported high levels of fatigue and anxiety linked to academic pressure, while staff highlighted occupational stress which can be limited wellness infrastructure.

These findings suggest that a future wellness facility must prioritize psychological services alongside physical healthcare.

Assessment of Existing Infrastructure

The existing campus health facility was widely perceived as inadequate for a growing population. It was discovered that the infrastructures currently made available are not adequate enough most especially due to the current population.

Identified gaps include:

- Limited or non functional diagnostic equipment
- Absence of specialized mental health rooms
- Lack of physiotherapy or rehabilitation and counselling spaces
- Insufficient recovery areas
- Poor spatial organization

Observation confirmed that the current facility functions primarily as a basic clinic rather than a comprehensive wellness centre. It was also confirmed that the treatments there are based on general complaints which shows the absence of specialists.

Energy Reliability Findings

Energy instability emerged as a critical operational constraint. The students showed their dissatisfaction with the current health situation and conditions of the energy situation.

Respondents reported:

- Frequent power outages
- Equipment shutdown during consultations which leads to time delays
- Limited operating hours which is very inefficient
- Dependence on generators mostly due to lack of available energy

Healthcare personnel emphasized that energy interruptions compromise diagnostic accuracy, storage of medical supplies, and patient confidence. This brings about the reduction overview of the health facilities and certain health conditions.

The findings strongly support renewable energy integration as a way out for reliable healthcare delivery and efficiency.

Environmental and Spatial Observations

Field observations revealed environmental design challenges affecting user comfort:

- Poor natural ventilation
- Inadequate daylight penetration
- Overheated interior spaces

These conditions increase thermal discomfort and stress, contradicting the principles of architecture and its design strategies.

These findings reinforce the need for universal accessibility standards in the proposed wellness centre.

Discussion of Findings

The results reveal a strong alignment between community-defined health priorities and infrastructure deficiencies.

Three major conclusions emerge:

1. Wellness Demand Exceeds Facility Capacity

The current health infrastructure cannot meet the mental, physical, and preventive wellness needs of the campus population. This would defiantly bring out the request for off campus services.

2. Energy Instability Limits Service functions

Healthcare delivery is directly dependent on stable energy supply. Renewable energy integration is not optional but essential as this would fill in the gap for energy instability to replace with energy efficiency.

3. Environmental Design Affects Health goals

The discussion confirms that a renewable-energy-powered wellness facility would address multiple layers of need: medical, psychological, environmental, and infrastructural of its basic users.

Implications for Architectural Design

The findings translate directly into design requirements:

- Dedicated mental health suites
- Diagnostic and screening units
- Sports rehabilitation zones
- Emergency treatment rooms
- Passive cooling strategies
- Solar-powered energy systems
- Universal accessibility design
- Daylight-optimized interiors

The facility must function as a hybrid of healthcare, wellness, and environmental architecture.

Summary of Findings

This chapter establishes that the university community requires a comprehensive wellness centre which would serve its basic purposes and also supported by renewable energy and climate-responsive design.

CONCLUSION

The research confirms that the university community faces various limitations in engaging in comprehensive wellness services. Existing health infrastructure is insufficient to support the mental, preventive, and rehabilitative health needs of a growing academic population which brings about a good and sustainable learning environment.

A key conclusion of this study is that healthcare infrastructure in institutions must be a major priority in order for the students, staff and stakeholders to have a proper learning environment. Modern wellness facilities must operate as integrated environments that combine preventive health, psychological support, sports rehabilitation, and environmental wellness within resilient architectural systems. Therefore, the study establishes that a renewable-energy efficient-powered wellness centre is not just an improvement to the community of the users or stakeholders but improvement in institutional functionality, academic productivity, and long-term community well-being.

RECOMMENDATIONS

Based on the findings, the following recommendations are proposed:

1. Development of a Purpose-Built Wellness Centre

The university should prioritize the design and construction of a dedicated wellness facility that integrates preventive healthcare, mental health services, rehabilitation spaces, and environmental wellness programs in order to serve its purpose.

2. Adoption of Climate-Responsive Architectural Design

The wellness centre should implement:

- Passive cooling strategies
- Natural ventilation
- Daylight-optimized interiors
- Shaded circulation zones
- Energy-efficient materials

These measures reduce operational costs and improve user comfort.

3. Strengthening Mental Health Infrastructure

Mental health is very vital. The mental health infrastructure must bring about proper counselling suites, quiet therapy rooms, and stress-recovery spaces should be made available into the facility layout to address rising psychological wellness needs.

5. Universal Accessibility and Inclusive Design

The facility should comply with universal design principles to ensure access for persons with disabilities and vulnerable users in order for proper consideration. Inclusive architecture increases equity in healthcare delivery.

Contribution to Knowledge

This study contributes to academic and professional knowledge the followings:

- Community health planning and involvement
- Renewable energy systems for efficiency
- Sustainable architectural design and proper design strategies

It demonstrates that healthcare infrastructure in developing institutional environments must be approached as an integrated system rather than isolated components. The research provides a framework for designing wellness facilities that are resilient, energy-efficient, and community-driven.

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