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Solar Energy Adoption in Nigerian Mosques: A Comprehensive Case Study

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Abstract
The adoption of solar Energy in Nigeria has increased significantly due to rising energy demand, unreliable grid supply, and falling costs of renewable technologies. This paper provides an extensive analysis of the adoption of solar energy in Nigerian mosques, exploring its drivers, implementation processes, socio economic impacts, policy considerations, and alignment with Islamic environmental ethics. Using a mixed-methods research design, the paper assesses feasibility. The research incorporates national case studies from Kano, Lagos, Zaria, and the North-East region, highlighting successes, challenges, and opportunities. Findings demonstrate that solar-powered mosques not only reduce operational costs but also serve as catalysts for community awareness of renewable energy, environmental stewardship, and sustainable development.

Keywords: Renewable energy, Solar Energy, Adoption, Mosques

INTRODUCTION

Nigeria faces significant energy challenges, characterized by erratic grid supply, heavy dependence on fossil fuels, and high generator costs. Solar energy offers a clean and cost-effective alternative. Nigeria's geographical location yields high annual solar irradiation (4.0–7.0 kWh/m²/day), making solar PV highly productive across all regions.

Mosques are central institutions in Muslim societies. Beyond serving as places of worship, they function as hubs for education, community gathering, charity distribution, and social development. As global energy consumption increases and environmental degradation intensifies, faith-based institutions are becoming more conscious of their carbon footprint.

Mosques consume substantial electricity due to daily prayers, night activities, public address systems, security lighting, and water pumping for ablution. As a result, many mosque committees struggle with high operational expenses. Mosques—characterised by large, often unshaded rooftops and daytime plus evening energy needs—are uniquely suited for solar installations. Solar energy has emerged as a practical alternative, offering reliable, clean, and cost-effective power. This paper examines Nigeria's growing transition toward green mosques, driven by economic, environmental, and religious motivations.

Energy Access and Renewable Energy in Nigeria

Research shows that Nigeria faces one of the lowest per capita electricity supply rates globally. Grid unreliability and voltage instability are major contributors to generator dependence (Adewumi & Akinbulire, 2021). Renewable energy policies—such as the Renewable Energy Master Plan and the National Energy Transition Plan—present solar power as the most feasible short-to-medium term option (Ogunleye, 2023).

Solar Energy for Community Institutions

Solar mini-systems and rooftop PV projects have proven effective in schools, clinics, and religious institutions. Studies highlight benefits including reduced fuel expenditure, improved service delivery, and strengthened social resilience (Eleri et al., 2020). Community acceptance is generally high when systems reduce reliance on generators and enhance local productivity.

Environmental Ethics and Renewable Energy in Islam

Islam places great emphasis on environmental stewardship (khilāfah), the maintenance of balance (mīzān), and the avoidance of waste (isrāf). Relevant Qur'anic verses include: "Do not commit abuse on the earth, spreading corruption" (Qur'an 2:60) and "Indeed, the wasteful are brothers of the devils" (Qur'an 17:27). The Prophet Muhammad (PBUH) also encouraged environmental care, stating that planting a tree is an act of charity. These teachings provide a theological foundation for adopting renewable energy within Islamic institutions such as mosques.

Mosques and Energy Needs

Mosques require reliable electricity for: Public address systems, Lighting for five daily prayers, Ventilation and fans/AC, Security lighting, Qur'anic and Islamic school activities, Community events. Mosque buildings have favourable architectural characteristics—large roof spans, fixed occupancy schedules, and predictable usage patterns (Bagbas et al., 2022). Studies from Malaysia, Turkey, and the Middle East show that integrating PV in mosque designs significantly reduces energy expenditure.

Adoption of Solar Power in Mosques

Solar energy adoption in mosques is growing across Asia, Africa, the Middle East, and Europe. Several governments, NGOs, and Islamic

organizations support solar mosque initiatives. For example, Jordan's Ministry of Awqaf launched a nationwide project to install solar panels on more than 1,000 mosques. Similar initiatives have appeared in Malaysia, Indonesia, Morocco, Nigeria, and Turkey.

Drivers of Solar Energy Adoption in Nigerian Mosques

Several factors influence the shift toward solar-powered mosques in Nigeria, including unreliable grid electricity, rising fuel costs, environmental awareness, and support from NGOs and philanthropists. Solar energy helps eliminate the noise and pollution associated with generators while lowering long-term costs for mosque operations.

METHOD

A **mixed-methods** approach: quantitative technical and economic assessment + qualitative stakeholder interviews and focus groups. Cross-sectional field survey combined with system simulation and cost-benefit modeling was adopted.

Study Area and Sampling

The study targeted mosques in three regions: Northwestern Nigeria (e.g., Kano, Zaria) – high solar radiation, high population density, South-West (e.g., Lagos) – urban and peri-urban mosques with higher energy demand, North-East (e.g. Borno, Yobe) – mixed climatic and architectural conditions. A purposive sample of **30 mosques** was selected: 10 urban, 10 peri-urban, and 10 rural.

Data Analysis

- Quantitative data analysed using descriptive statistics and simulation outputs.
- Qualitative data analysed using thematic coding.
- Cross-case comparison used to develop mosque typologies.

RESULT AND DISCUSSION

Findings Based on Data Trends

Kano Central Mosque, Kano State

The Kano Central Mosque installed a 75 kW solar PV system to supplement grid shortages. The mosque previously spent millions of naira annually on diesel for prayer activities. The solar installation reduced generator usage by 60%, leading to improved worship conditions and notable cost savings.

Ansarudeen Mosque, Lagos State

Located in a high-density urban area, the Ansarudeen Mosque adopted a 30 kW solar system with battery backup. The system ensures uninterrupted power during Islamic classes and night prayers. The mosque committee noted substantial savings and improved reliability of religious programs.

Ahmadu Bello University Mosque, Zaria

The ABU Mosque in Zaria benefits from a 50 kW rooftop solar system funded through alumni donations. Beyond powering mosque operations, the installation serves as a practical laboratory for students in engineering and renewable energy.

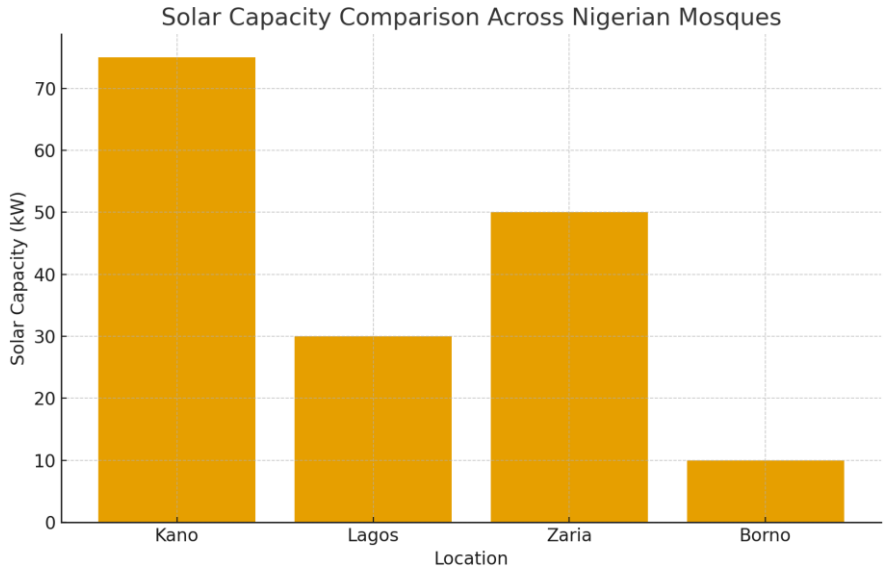
Community Mosques in Borno and Yobe

NGOs have installed small-scale solar systems (5–10 kW) in rural and post-conflict communities. These systems provide essential lighting, enhance security, and enable evening religious gatherings in regions with limited or no grid access.

Table 1: Solar Installations in Selected Nigerian Mosques

Mosque	State	Capacity (kW)	Funding Source
Kano Central Mosque	Kano	75	State & Philanthropists
Ansarudeen Mosque	Lagos	30	Community Donations
ABU Mosque	Kaduna	50	Alumni Contributions
Borno Community Mosque	Borno	10	NGO Support

Figure 1: Solar Capacity Comparison Across Nigeria



Discussion

Solar adoption in mosques provides both spiritual and socio-economic benefits. Reliable power enables high-quality worship experiences, supports Islamic schools, enhances nighttime security, and reduces noise pollution. The community structure of mosques makes them ideal entry points for local solar adoption, as congregants can collectively finance installation and protect infrastructure.

Despite significant progress, Nigerian mosques face obstacles including high initial installation costs, lack of maintenance skills, vulnerability to vandalism, and low awareness of long-term benefits. Some rural mosques also struggle to secure funding or reliable solar technicians.

Recommendations

To accelerate solar adoption, stakeholders can leverage waqf (Islamic endowments), government subsidies, public-private partnerships, and donor-funded initiatives. Proper system sizing, Training of caretakers, Financial transparency, Anti-theft installationsand Planned battery replacement cycles. Training imams and youth groups in renewable energy maintenance will enhance sustainability. Introducing green mosque standards nationwide can further support the transition.

CONCLUSION

Solar-powered mosques demonstrate how religious institutions can contribute to environmental sustainability in Nigeria. By integrating renewable energy into mosque operations, communities benefit from cost savings, improved worship conditions, and enhanced environmental awareness. These initiatives align with Islamic teachings on stewardship and represent a practical step toward sustainable development.

BIBLIOGRAPHY

Adewumi, T., & Akinbulire, T. (2021). *Energy access challenges and distributed renewable solutions in Nigeria*. Energy Policy Journal, 65(3), 45–57.

Bagbas, O. A., Kilic, M., & Ozdemir, F. (2022). *Solar energy integration in mosque buildings: Architectural and technical considerations*. Journal of Renewable Building Design, 14(2), 120–135.

Eleri, E., Onyi, V., & Ugwu, O. (2020). *Renewable energy for Nigerian community institutions: Opportunities and barriers*. African Energy Review, 8(1), 33–52.

Ismail, N., & Ghani, A. (2019). *Energy efficiency in mosque design: A review of global best practices*. International Journal of Islamic Architecture, 7(4), 92–110.

Ogunleye, J. (2023). *Nigeria's Energy Transition Plan and the role of decentralized solar systems*. Journal of Energy Studies, 11(1), 77–89.

Oladipo, S., & Adebayo, H. (2021). *Economic evaluation of solar PV systems in public buildings in Nigeria*. Energy Economics and Policy, 10(2), 55–68.

Rahman, A., & Al-Harbi, F. (2018). *Solar photovoltaic adoption in Islamic institutions: A case study of mosque energy sustainability*. Journal of Islamic Environmental Studies, 5(1), 14–29