POLICY BRIEF

STRENGTHENING URBAN CLIMATE RESILIENCE IN THE SUDAN SAVANNA: UNLOCKING RENEWABLE ENERGY POTENTIAL IN KANO AND BAMAKO

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EXECUTIVE SUMMARY

Urban centres in the Sudan Savanna region of West Africa are increasingly vulnerable to the impacts of climate change, including rising temperatures, land degradation, and energy poverty. Despite growing urban populations, access to sustainable energy remains limited, while reliance on biomass persists. Renewable energy, particularly solar power, presents an opportunity to enhance energy access and resilience in these rapidly growing cities. This study uses the cases of Kano (Nigeria) and Bamako (Mali) to assess urban response to climate change through climate data analysis, land use monitoring, solar suitability modelling, and energy behaviour surveys.

INTRODUCTION

Rapid urban growth and energy poverty heighten climate vulnerability in Kano and Bamako. Despite global renewable progress, West African cities lag due to systemic barriers. This study explores how solar energy deployment can strengthen resilience by integrating climate data, land cover analysis, and local energy use into planning.

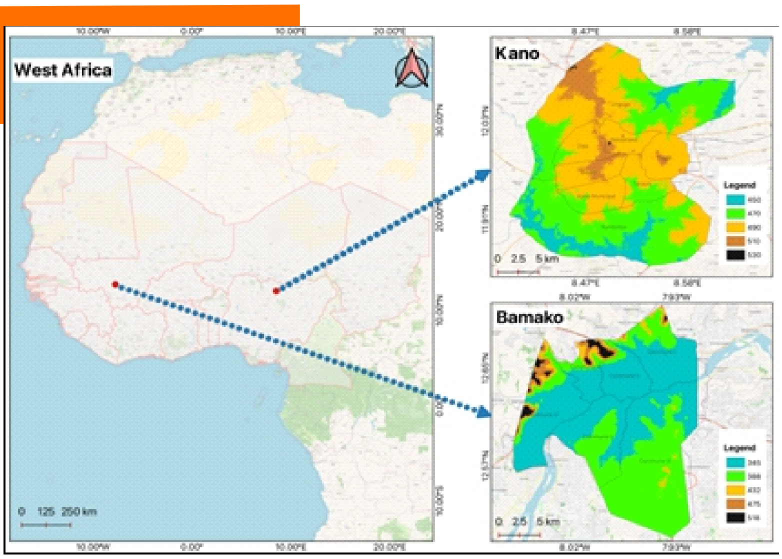

Figure 1: Location of the Study Area

RESEARCH APPROACH

This study applied an integrated, evidence-based research framework combining climate science, geospatial analysis, and social survey methods to assess how renewable energy can support urban climate resilience in Kano and Bamako.

Daily meteorological data (19922022) were analysed to compute Cooling Degree Days (CDD) and Heat Index (HI) for both cities. Landsat satellite imagery was processed using Random Forest classification to map the land use and land cover (LULC) changes across four time points (1991, 2002, 2012, and 2022).To identify the most suitable areas for solar energy development, the Analytical Hierarchy Process (AHP) was applied within a GIS environment, incorporating multiple spatial factors relevant to site suitability.

Complementing the spatial analysis, structured household surveys were conducted in Kano and Bamako to assess access to electricity, cooking energy use, willingness to adopt solar, and perceptions of renewable energy. Finally, Structural Equation Modeling (SEM) was employed to identify the socio-behavioural factors influencing household energy choices.

KEY RESEARCH FINDINGS

1. Climate trends show that Kano experienced a rise in Cooling Degree Days (CDD) from 4,162 in 1992 to 5,280 in 2022 (Figure 2), while Bamako showed a significant decreasing trend (Sen's slope = 3.80 °C-day/year), (Figure 3).

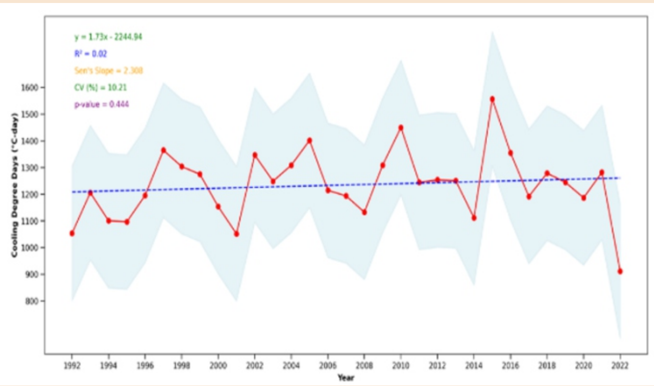

Figure 2: Trends in Cooling Degree Days for Kano

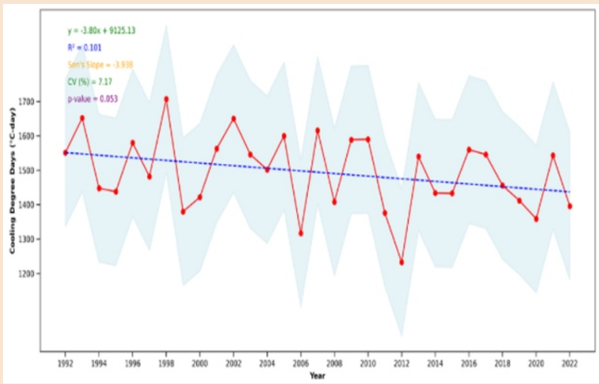

Figure 3: Trends in Cooling Degree Days for Bamako

2. Land use change revealed that built-up areas grew from 66.88 km² to 242.53 km² in Kano with 8.47% annual growth (Figure 4), and from 50.49 km² to 157.88 km² in Bamako (6.86% annual growth), Figure 5, leading to loss of vegetation and barren land.

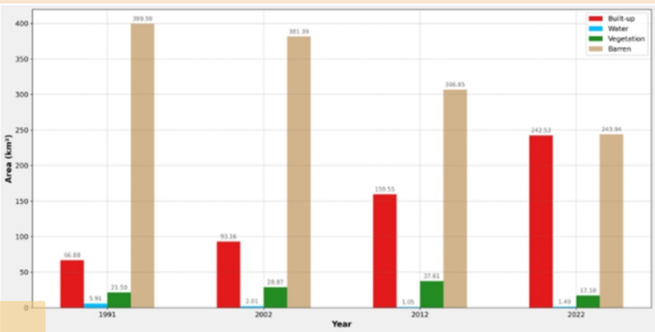

Figure 4: Temporal Evolution of LULC for Kano

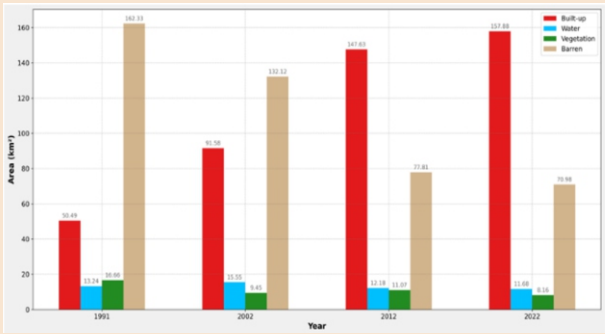

Figure 5: Temporal Evolution of LULC for Bamako

3. Solar suitability analysis identified that only 33.63% (165.5 km²) of Kano's land is suitable for solar farms (Figure 6), concentrated in Kumbotso and Ungogo, whereas 75.85% of Bamako's area is suitable, primarily in Municipality VI (Figure 7).

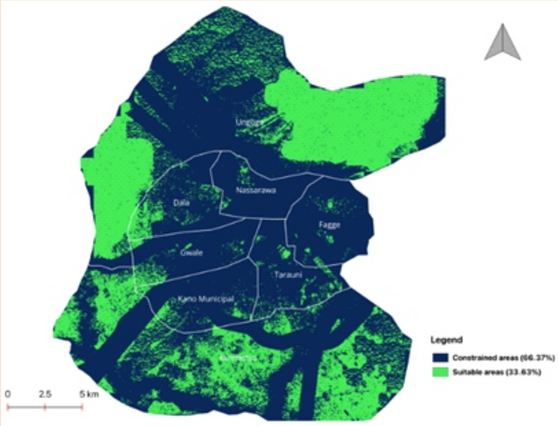

Figure 6: Suitability Map for Solar Plant for Kano

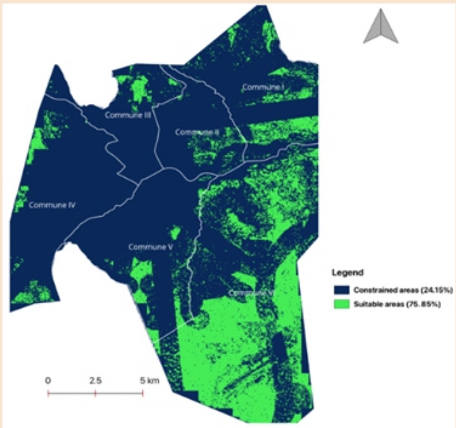

Figure 7: Suitability Map for Solar Plant for Bamako

4. Energy access varies significantly. In Kano, 35.2% of households use solar energy (Figure 8), compared to 8.5% in Bamako (Figure 9). Over 90% of Bamako's households still rely on firewood and charcoal for cooking.

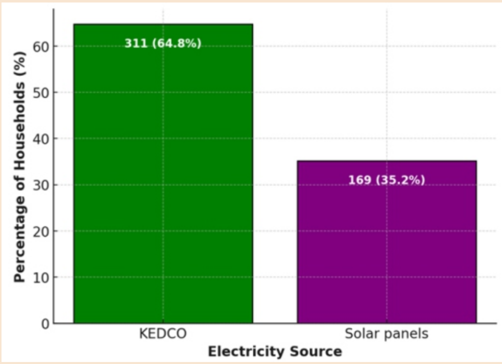

Figure 8: Cooking Energy Choice for Kano

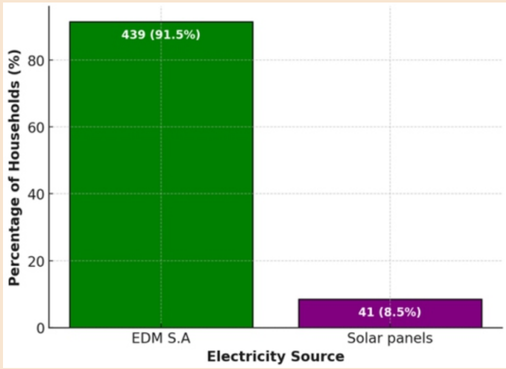

Figure 9: Cooking Energy Choice for Bamako

5. Structural Equation Modeling (SEM) shows that perceived cost negatively influences solar adoption, while social influence and environmental concern are positive drivers (Figure 10).

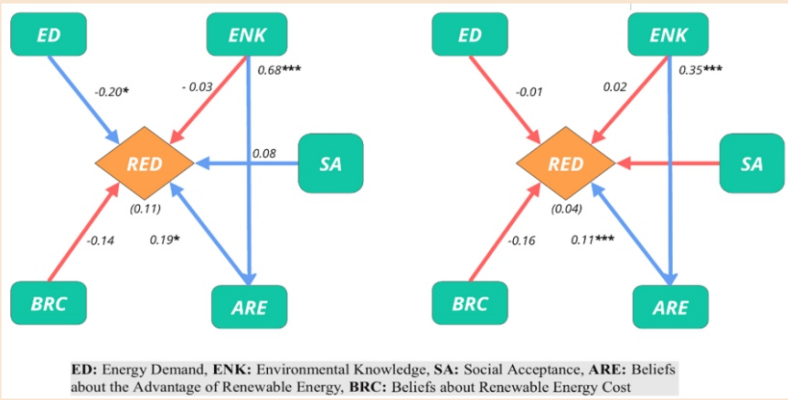

Figure 10: Structural Equation Modelling

IMPLICATION OF FINDINGS

Kano and Bamako face worsening heat stress and energy deficits due to rapid urbanisation and weak infrastructure. This study identifies strong solar potential, especially in Bamako, and calls for integrated spatial planning, public awareness campaigns, and targeted investments to enable equitable, climate-resilient energy transitions across both cities.

POLICY RECOMMENDATION

Policy makers in both cities should adopt a coordinated urban energy strategy that integrates solar targets into land use planning, expands decentralised energy systems, strengthens technical capacity, and embeds climate monitoring. This approach supports inclusive, data-driven decision-making for a resilient and low-carbon urban future.

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