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ABSTRACT

Climate change stands as a stark testament to the dramatic consequences of human actions on the planet. To better counter and mitigate its impact, several studies have been conducted worldwide. However, the contribution of such efforts is neither less nor more and is continuing to be made regardless of their results, as climate change is a matter of past, present, and future. This study is one of a number of such studies exploring how West African cities could respond to the effects of climate change by relying on renewable energy sources, using Kano and Bamako as case studies. For this purpose, it was necessary to account for the impact that climate change wrought on the two cities through the degree days method, using three decades of daily meteorological data. The findings revealed different trends, with Kano experiencing a positive variation in cooling degree days (Sen's slope = 2.308) and an increasing trend of 1.73 °C-day yr^{-1}, whilst in Bamako, a significant decreasing trend ($p = 0.05$) of -3.80 °C-day yr^{-1} was observed. Furthermore, Landsat data were used with Random Forest machine learning to evaluate spatiotemporal evolution in Kano and Bamako. The results of the land use maps showed the same pattern of rapid urban expansion, with built-up areas increasing from 66.88 to 242.53 km^2 representing 8.47% in annual growth rate in Kano and from 50.49 to 157.88 km^2 with an annual growth rate of 6.86% in Bamako. Meanwhile, other land use and land cover (LULC) classes, such as vegetation and bare land, decreased considerably over time in both cities. In the global context linking climate change and renewable energy as one of the solutions to its impacts, identifying suitable locations for solar power facilities is of paramount importance. This study has also addressed this concern by using the Analytic Hierarchy Process (AHP) in combination with Geographic Information Systems (GIS) to shed light on areas potentially suitable for the installation of solar power plants in the cities of Kano and Bamako. The findings revealed that Ungogo and Kumbotso in Kano, and Communes I and VI in Bamako, are the most suitable areas for solar energy development. An assessment of solar farm capacity revealed a notable gap between the two cities. In Kano, Bayero University (7.1 MW) and Ado Bayero Mall (1 MW) contributed to a total installed solar capacity of 8.1 MW, highlighting significant investment from both the academic and private sectors. Conversely, Bamako recorded only a single installation at the Institute of Applied Science, with a capacity of 0.1 MW, underscoring limited solar energy projects. The study also explored electricity access and cooking energy choices. The findings showed that approximately 64.8% of households in Kano are supplied with electricity by the Kano Electricity Distribution Company (KEDCO), compared to 35.2% who use solar panels. In Bamako, 91.5% of households receive electricity from Energy of Mali (EDM), while only 8.5% rely on solar panels as their source of electricity. Cooking energy choices further demonstrated disparities. In Kano, 42.9% of households used firewood and charcoal, while 31% relied on liquefied petroleum gas (LPG), 25.2% relied on electric stoves and only 0.6% used kerosene. In Bamako, biomass dominated, with 90.6% of households depending on firewood and charcoal, while only 9.2% relied on LPG. Moreover, the study explored the factors influencing renewable energy adoption through structural equation modeling and identified cost

as a significant barrier to deployment. However, perceptions toward renewable energy varied by city. In Bamako, belief in its benefits promoted development, whereas in Kano, energy demand, social acceptance, and perceived advantages were the main drivers. The findings suggest the need to implement targeted policies to reduce costs, promote clean cooking energy solutions, and improve public awareness. Simultaneously, efforts should prioritise the development of solar energy infrastructure in areas identified as most suitable to enhance energy access and climate resilience in both cities.