Abstract

With the gradual increase in the demand for power because of increased economic productivity and population, coupled with the aim of attaining the Sustainable Development Goals, there has been an increase in the uptake of renewable energy resources like solar power. This project assessed the suitability of setting up large-scale Photovoltaic (PV) solar power plants in Laikipia County. PV solar plants that generate more than 500 kilowatts (kW) are considered to be largescale photovoltaic systems. Geographic Information System (GIS) and the Analytic Hierarchy Process (AHP) were combined during analysis and a GIS database built using layers obtained from national and international organizations. The factors considered included: the amount of Global Horizontal Irradiance (GHI) received, proximity to rivers, roads, transmission lines and substations and the slope of the terrain. Land uses were categorized as viable areas (bare ground, scattered vegetation and grasslands) and restricted areas (urban areas, agricultural land and forests). Since one of the main benefits of solar energy is conservation of the environment, protected areas like national parks, game reserves and conservancies were excluded from the analysis as they safeguard the natural habitats of wildlife from destruction. Buffers were placed around the restricted areas and they were amalgamated to form a restriction mask. The factors were reclassified, with the new values ranging from 0 (representing non-viable areas) to 5 (most suitable areas), and weighted using AHP. The weighted datasets were then overlaid and restricted areas were excluded to obtain the suitable areas for the installation of large-scale PV power plants. Results showed that the Laikipia County can be considered as a very good location for installing large-scale PV power plants with a total area of 125 km2 classified as highly suitable, translating to 6,250 MW (double the current electrical capacity of Kenya, 2651 MW). A PV plant receiving the minimum solar irradiance of 1300 kWh/m2 ·year has a capacity of 0.05 kW/m2 . 1193 km2 was classified as moderately suitable (59,650 MW) and 3234 km2 as areas of low suitability (161,700 MW); to be considered after utilizing the highly suitable areas due to higher initial capital cost. A superior alternative to GHI is Photovoltaic Power Potential (PVOUT); estimated photovoltaic (PV) power generation potential based on solar resource data and PV modeling software provided by Solargis. However, it could not be used in this project since the data currently available has a low spatial resolution of 1 kilometer, which was considered too low for the intended analysis.