

# Spatial Mapping of Solar Potential of Ghana using Geographic Information Systems

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**Key words:** Cartography; Geoinformation/GI; Remote sensing; Spatial planning

## SUMMARY

Ghana is endowed with significant amounts of renewable energy resources, that when fully exploited, can contribute to mitigating the power crisis facing the country as well as reducing the rates of forest depletion and CO<sub>2</sub> emissions. Even though solar energy potential in Ghana is estimated at 35 EJ (Exajoules), Ghana has not taken full advantage of this free and available renewable energy yet. (Mensah, Boahen and Amoabeng, 2017) For the utilization of a solar energy potential and system, knowledge about the solar irradiation potential in every location is required. In addition, a solar energy map is practicable for further evaluation of the renewable energy option and strategic planning, such as for site location (Joshi, 2013). This research therefore, aimed at developing solar energy potential map for the exploitation of solar energy to support other power sources to meet the growing demand of electricity in Ghana. The solar potential map was developed using Google Earth Engine (GEE). The Landsat 8 OLI/TIRS satellite data was used to generate the Global Horizontal Irradiance (GHI) over the various regions. The Dark Object Subtraction method was used in computing the solar radiation from Landsat 8 and had a minimum and maximum of about 1.5 kWh/m<sup>2</sup> and 7 kWh/m<sup>2</sup> respectively from 2014 to 2018. A Time series analysis was performed on the solar radiation monthly data for each year from 2014 to 2018. This was to find out the trend of increase and decrease in solar radiation over the months in the various years. The Surface Albedo was also calculated for the regions to know the general reflectivity of solar radiations over the areas. The mean of the solar radiation was computed from 2014 to 2018 as well as that of the Land Surface Temperature (LST) and Surface Albedo. The derived solar potential showed that the upper part of Ghana had a higher potential for solar radiation than that of the lower regions. The Northern region had a very high solar potential, followed by the Upper East and Upper West region. Volta region showed a fairly minimum solar potential values.

Key words: Land Surface Temperature, Google Earth Engine, Global Horizontal Irradiance, Surface Albedo, solar potential, Landsat 8 OLI/TIRS.

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