Solar Energy Potential in Yola, Adamawa State, Nigeria

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Abstract: - The energy characteristics of the monthly solar radiation data from Yola, a town in Northeastern Nigeria, is examined. A preliminary descriptive analysis show that the data are negatively skewed. Five distributions were fitted to the data and the Weibull distribution provided the best fit for each of the months of the year. The energy output for a standard residential (1.626 m^2) panel with 18.7% efficiency and a standard commercial (1.935 m^2) panel with 23% efficiency, when exposed to solar radiation, are computed for each month using the Weibull distribution. The minimum radiation value was recorded in August. This gives a realizable energy output of 1.514 kWh and 2.216 kWh for standard residential and commercial panels, respectively. These energy outputs are equivalent to lighting 25.2 and 35.4 60-watts lightbulbs, respectively. For a solar cell farm of 1000 standard commercial panels, the realizable energy output is 2.2 MWh. Consequently, there is a good prospect for solar electricity generation in Yola.

Key-words: - Weibull distribution, solar energy, generalized log-likelihood ratio test, electricity generation

1 Introduction

Climate change and its resultant consequences has caused a paradigm shift in energy production and consumption; cars and electrical equipments that use renewable energy are in use. The popular use of fossil fuels is gradually being replaced by renewable energy sources such as geothermal, hydro, wind, solar, tidal, biomass, among many others. These energy sources are non-depletable, pollution-free, side-dependent and self-replenishable. They are almost cost-free, except for the cost of the technology used in harnessing them.

Solar and wind power are the fastest growing energy sources among the large number of renewable energy sources. Solar power, in particular, is the second largest most deployed renewable energy technology in terms of global installed capacity after wind [6]. Solar photovoltaic technologies are more easier to deploy and give direct power for household and commercial uses with the aide of converters and storage batteries.

Nigeria depends largely on fossil fuel for electricity generation whereas there is abundance of sunshine, particularly in the northern part of the country. A study of solar radiation in Nigeria is useful as it can provide the drive for the realization of a clean source of electricity generation.

2 The Problem

Yola, the Adamawa State capital in northesatern Nigeria, is located in the midland climatic zone on the grid coordinates of latitude 9.23°N and longitude 12.47°E, with an altitude of 186.05 m above sea level [13]. Electricity supply to Yola and environs, like many other places in Nigeria, is not sufficient to meet the yearning needs for domestic and industrial uses. Some businesses and households do resort to petrol and diesel powered generators, contributing to global