ABSTRACT

Realization of an Open-Source Software of Computation for the Optimization of Hybrid Renewable Energy Systems: Application in the Caribbean Region

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The optimization of hybrid solar wind energy systems constitutes an understanding of the generation components, climatological conditions, electricity usage and the techno-economic indicators used to assess their operations. This research presents an open-source tool (Photurgen) for the analysis of hybrid solar wind energy systems. The tool has three main modules; Photurgen Analysis (PTGA); Photurgen Optimization (PTGO) and Photurgen Geographic Information System (PTGGIS). Notwithstanding, modules can be modified to the user's desired application. Investigation on the forecasting of climatological (i.e. solar radiation, wind speed and temperature) and load consumption (i.e. electricity usage) time-series obtained in Jamaica finds that suitable prediction models are attainable using the univariate Auto-Regressive Integrated Moving Average (ARIMA) technique. This is of significance due to its validation of previous work done involving hourly averaged wind speed sequences in Jamaica (Daniel and Chen, 1991). Results of the study show Photurgen as a suitable alternative for the assessment of solar wind energy systems; one solution aimed towards increasing the penetration of these technologies within the Caribbean.

Keywords: Daren Antonio Watson; Auto-Regressive Integrated Moving Average (ARIMA); Caribbean Area; Green Technology; Photurgen; Renewable Energy Sources; Machine Learning; Optimization; Energy Systems; Energy Consumption.