

# Analysis and monitoring of the performance of different solar photovoltaic technologies in an arid zone for the optimization of instantaneous production and the preservation of performance over time

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## Introduction – thesis –

The main objective of this thesis project is to develop a research and development platform for monitoring the performance of different solar photovoltaic technologies in an arid zone for the optimization of instantaneous production and preservation of performance over time.

This objective can be achieved by an accurate evaluation of the performance of photovoltaic technologies without underestimating the impact of climatic and environmental factors (temperature, solar irradiation, dusting).

This is followed by an analysis of performance degradation over time and the development of a decision support tool.

## SPECIFIC OBJECTIVES – thesis –

The main objectives during the different stages of this project are summarized as follows:

- To inventory and analyze the existing PV technologies used throughout the Islamic Republic of Mauritania;
- Develop an instrumentation and monitoring platform for PV modules of different technologies;
- Present the environmental conditions of the site such as ambient temperature, amount of irradiation received, wind speed and direction. This will allow us to better interpret the performance of these solar technologies;
- Evaluate the impact of climatic factors on the performance to extract losses due to dusting;
- Set up a computerized tool to analyze the performances over a long period of time.

Based on the monitoring data, the work consists first of all in analyzing the impact of environmental factors: climate (temperature, humidity) and dust deposits on the performance of PV technologies. This step must lead to the realization of an adapted instrumentation allowing to inform in particular: the electrical characteristics (Intensity, tension, energy output) the quality of the radiation, the influence of the wind and the influence of the level of dust on the various technologies of PV modules.

## LOCATION OF THE STUDY SITE

A 50 MWp solar power plant was inaugurated Thursday, November 23, in Toujounine, Nouakchott North, the realization of this plant is part of the objectives set by the government in the field of energy to generalize access to electrical energy of the population, to improve the quality of electrical services and to integrate renewable energy to diversify the energy mix.

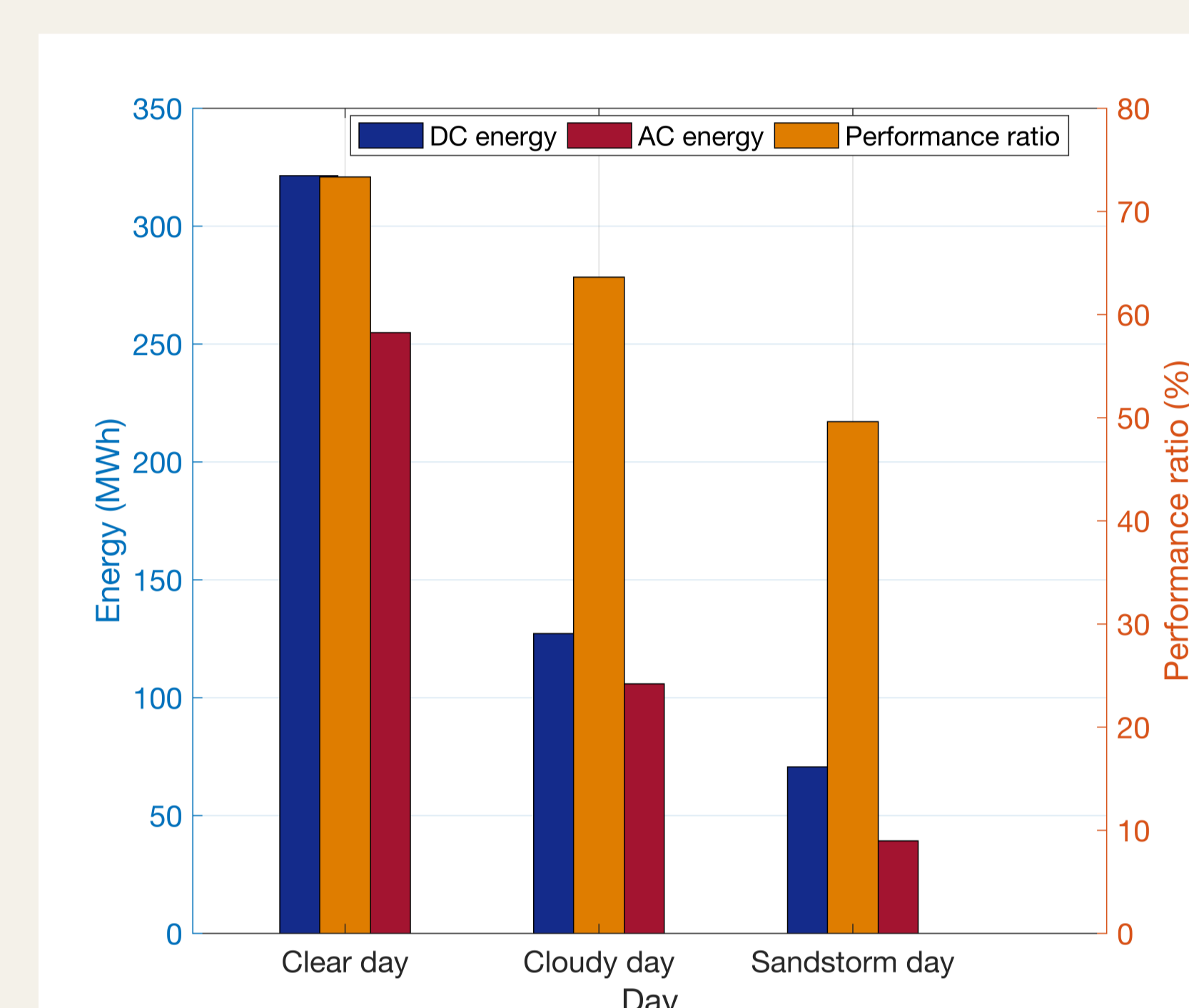
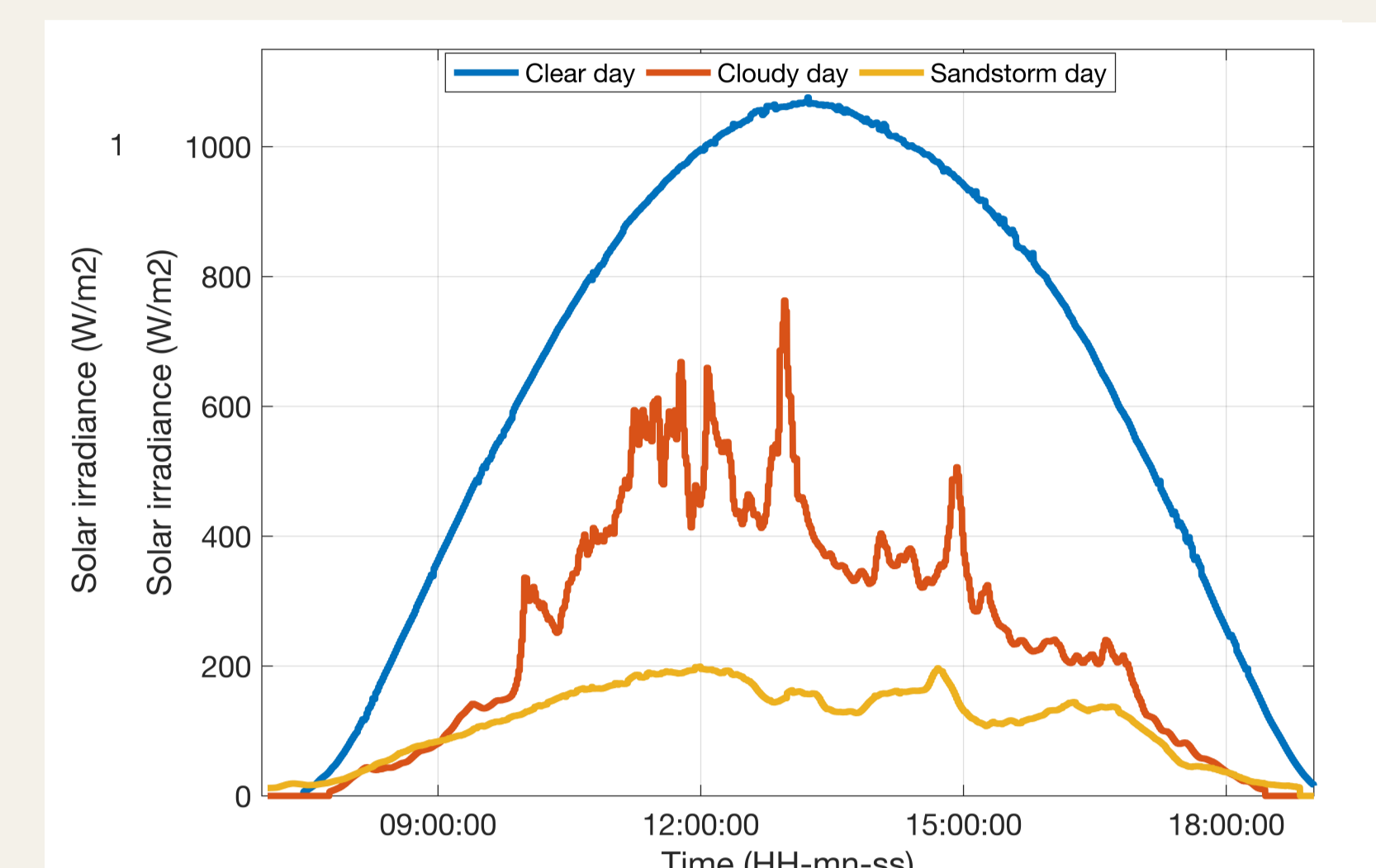
## Title paper for publication

Performance Evaluation of 50 MWp Solar Photovoltaic Power Plant Under Different Climatic Conditions in Nouakchott, Mauritania

## Abstract

The aim of this study was to evaluate a performance analysis of a 50 MWp solar photovoltaic power plant connected to the SOMELC medium voltage electrical grid installed in the Saharan environment of Nouakchott, Mauritania (18° 4'24.532" North, 15° 52'47.101" West). This study is done in two seasons characterizing the climate of Nouakchott (dry and wet), then in three typical days (clear, cloudy, and sandstorm) based on the measurement data that are obtained from the site of the installation. The measurements were collected daily, to improve the performance evaluation, real-time measurements with a step of 10 seconds for the different climatic parameters (solar irradiation, ambient temperature, module temperature, wind speed), and electrical parameters. The performance evaluation was done based on the IEC 61724 standard to study the comportment of the power plant during different weather conditions. The total energy produced by the plant in May 2020 dry season (hot heat and harmattan) is 10,559 GWh, of which 6,973 GWh was injected into the power grid of Nouakchott. However, the total energy produced in November 2019 wet season (rainy and cool) was 8,132 GWh, of which 6,937 GWh was injected into the power grid of Nouakchott. Besides, the energy injected by the plant into the grid was for a clear day 263.87 MWh, while for a cloudy day was 118.41 MWh, while it was 39.81 MWh for a sandstorm day. The results showed that temperature and irradiation play an important role in the performance of the system. The performance ratio and efficiency of the system strongly depend on temperature and increase from 73.343%, 11.03% respectively on a clear day, to 63.627%, 11.74% for a cloudy day, however for a sandstorm day is 54.02%, 8.91%.

## Graphs



## Biography

**Mohamed Saleck HEYINE** (IEEE Student Member S'18, EPS AND ) was born in Nouakchott, Mauritania. He received the B.Sc. degree in Electronics Electrotechnical Automation from the Faculty of Science and Technology, Nouakchott, Mauritania, in 2014, and the M.Sc. degree in electrical engineering (Control of Electrical Systems) from the Higher Institute of Industrial Systems, University of Gabes, Tunisia, in 2016. He is currently working toward a Ph.D. degree at the University of Nouakchott Al Aasriya.

His research interests include photovoltaics and power electronics, the performance evaluation and analysis of PV systems, and photovoltaic power plant grid-connected. He is affiliated with IEEE as student member and he is involved in NGOs, student associations, and managing non-profit organisations.

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