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Performance Evaluation of selected Solar Energy Parameters in the Rainy and Dry Seasons for Ten Months period

Chikwudo Ogonna Nwoye*
Department of Physics and Industrial Physics, Solar Energy Physics, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.

Anthony Osita Chibuike Nwokoye
Department of Physics and Industrial Physics, Solar Energy Physics, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.

Corresponding Author's E-mail: con.nwoye@unizik.edu.ng

Abstract
This study evaluated the performance of selected solar energy parameters in the rainy and dry seasons for ten months period. Specifically, the study determined if the relationship between the performances of daily Light Intensity and Maximum Power Point in the rainy and dry season is statistically significant. Conducting the field study in Uruana area of Nibo Community in Awka South Local Government Area of Anambra State, Nigeria between 1st May, 2025 – 28th February 2026 (a ten months period), real time performance data of the selected four (4) solar performance parameters such as Light intensity (lux), Output Current (I), Output Voltage (V), and Maximum Power (Pmax) were collated on hourly basis from 0600hours – 1800hours daily across the Rainy season (1st May, 2025 – 30th September, 2025) and Dry season (1st October, 2025 – 28th February, 2026). These data were further analysed using graphs with the aid of Microsoft excel 2016 package and IBM SPSS version 26 utilizing Pearson correlation analysis statistical tool. Results showed that the level of relationship between the daily performances of Light Intensity and Maximum Power Point was very weak but positive in the Rainy and Dry seasons, though such observed daily performances was statistically significant in the Rainy season but non-statistically significant in the Dry season (p-values 0.000 and 0.138; r 0.389 and 0.033 for Rainy and Dry seasons). The study therefore recommends that there is need to take actionable steps during solar energy system installation to ensure that the solar panels are installed on a height that is easily accessible. This will promote regular removal of soiling during the Dry season and equally upgrade the solar energy system with high efficiency solar cells such as monocrystalline.
Keywords: Dry season, Performances Evaluation, Rainy season, Solar Energy Parameters.

1. Introduction

Despite the abundance of rich renewable energy resources such as rivers/ ocean bodies, sunlight, wind among others which inhabits and surrounds the Nigeria territorial landscape, the country has found it almost completely difficult to harness the essentialities of these important sources of energy in providing sufficient, adequate and reliable electricity to homes, industries, organisations and its citizens. This, as a result, has presented Nigerians with solar renewable energy sources which is void of noise pollution and other emissions that usually poison the air, tree and water consumed by human beings. According to Hector *et al.* (2022), this alternative renewable energy is also referred to as solar energy; a non-conventional energy sources and has several benefits among which are its unlimited availability and accessibility that will not run out amidst extensive exploitation. This unique energy involves the conversion of sunlight into electricity such that sunlight is collected either directly by using photovoltaic or indirectly using concentrations of solar energy (Nwokoye, 2006; Shravan *et al.*, 2020).

Taking advantage of this rising renewable energy concept in Nigeria, Onifade (2015) stressed that Nigeria's geographical location around the equator lies within a high sunshine belt that exposes the country to enormous radiation from the sun. Thus, the comprehensive and large scale deployment and application of solar energy electrification system in rural areas and villages that are rich in solid minerals, agricultural produce and raw material production, are evident promising grounds for industrialization which Nigeria dreams so intently towards regaining its lost economic glory in the international market space. Despite these benefits, the efficiency and performance of solar panels and solar energy system as a whole appear to still maintain the position of mere narratives among many potential but prospective solar energy Users, most especially in developing countries like Nigeria. This is more as many households and industries in developing countries like Nigeria have continued to express fears to the reliability of this form of renewable energy source to achieve maximal and very sufficient industrial based electricity generation particularly during the rainy season when the daily visibility of the sunlight, that is the sole source of the solar energy system, is not guaranteed as obtainable in the dry season.

Indeed, measuring solar energy radiation is considered very crucial in the effective maximization of this energy concept especially in the face of climatic and seasonal changes because most times, energy from the sunlight that are consumed for illumination is more than necessary, thus the need for effective measurement of light intensity of the environment across different seasons and the adequate control of the same to boost energy usage, savings and storage (Ghassan, 2015; and Juan, 2016 cited in Ozcelik, 2017) is hereby brought to the fore in this study. This is more as the amount of solar radiation received at any geographical location depends on the time of the day and season of the year.

Aside the fact that most prior related studies such as Ndiaye *et al.* (2025), Bamisile *et al.* (2025), Diallo *et al.* (2025), Pepa *et al.* (2025), Ajub *et al.* (2025), Niang *et al.* (2024), Kurniawan *et al.* (2024), Bendaas *et al.* (2023), Bahanni *et al.* (2022), Tasie *et al.* (2022), Irawan *et al.* (2022), Gopi *et al.* (2021a), Mejias *et al.* (2021), Jed *et al.* (2021), Ach-heb *et al.* (2021), Gopi *et al.* (2021b), Zhe Li *et al.* (2021), Kazem and Chaichan (2015) et cetera, were all carried out in other countries such as Senegal, Guinea, Morocco, Algeria, Indonesia, Oman, South India, France, , the few that were conducted in Nigeria such as Madu *et al.* (2025), Ibrahim *et al.* (2024), Omoriare *et al.* (2024), Eze *et al.* (2024), Asime and Lawson (2022), Osanyinpeju *et al.* (2018), Owajubohn et al. (2018), Uko *et al.* (2016), Okonkwo and Nwokoye (2014), Ettah *et al.* (2010) were actually carried out in Asaba Delta State, Calabar Cross River State, Akure, and Port Harcourt, and not in Anambra State, Nigeria. Besides the dearth of related studies in the present research discourse, many of the above studies were not carried out across different seasons. Some were conducted within a few months of the rainy season, while others were executed during a few months of the dry season. Some others were conducted from January – December without any intent of observing seasonal comparison of the data to the parameters measured during the year. The study therefore envisages to evaluates the performance of selected solar energy parameters in the rainy and dry seasons for ten months period. Specifically, it intends to:

1. determine if the relationship between the performances of daily Light Intensity and Maximum Power Point in the rainy and dry season is statistically significant.

The study therefore conducts analysis on:

Ho: The level of relationship between the performances of daily Light Intensity and Maximum Power Point in the rainy and dry season is not ascertained to be statistically significant.

However, further studies showed:

Ndiaye, Aidara, Sene, Drame, and Ndiaye (2025) conducted a study to evaluate the performance of the 23 MWp Diass power plant in Senegal over a one-year period, in accordance with the IEC 61724 standard. The daily DC and AC energy Ed produced by the Diass power plant is calculated respectively on the basis of the hourly energy Eh produced by the modules and on the output of the inverters obtained by the SCADA. The study adopted performance parameters such as reference yield, final system yield, PV Array, performance ratio, losses, capacity utilization factor, the performance parameters examined indicate annual average reference, PV array, and final yields of 5.83 h/d, 4.17 h/d, and 3.95 h/d, respectively. The performance ratio varies between 64.65 % and 75.82 %, while the capacity utilization factor ranges from 13.80 % to 20.49 %. The results demonstrate better performance during the dry season, along with accurate energy production predictions using the PVWatts and PVUSA models during the rainy season.

Madu, Nosegbe, Orhorhoro and Igbagbon (2025) assess the performance of photovoltaic system for homes in Asaba, Nigeria between 0600hours and 1800hours. Solar PV systems, their parts and components, and their working principle were all designed. The study developed a 5,000-watt inverter, the study test results showed that the month of January 2024 (dry season) had the highest daily power output, while the month of September 2024 (rainy season) produced the lowest daily power output. The study equally observed that the average daily power output was reached: 8440.3 watts in January 2024 (dry season) > 8440 watts in November 2023 (dry season) > 7913.5 watts in December 2023 (dry season) > 6453.59 watts in June 2024 (rainy season) > 6208.74 watts in July 2024 (rainy season) > 5242.5 watts in September 2024 (rainy season). Most significantly, each of these months' daily power output was more than the roughly 5000 watts needed to operate a contemporary three-bedroom apartment in Asaba without experiencing power outages.

Bamisile *et al.* (2025) in their study examined six key influences namely solar irradiance, ambient temperature, atmospheric conditions, terrain effects, extreme weather events, and long-term irradiance changes. The study noted that solar irradiance has strong geographic and temporal variability, making it the most significant factor. Second, raising module temperature reduces efficiency by 0.4–0.5 % per degree Celsius, limiting productivity in hotter climates. Third, atmospheric conditions (clouds, aerosols, pollutants, and dust) can reduce electricity output by up to 60 %, especially in desert regions. Fourth, terrain factors like albedo and snow present mixed effects, with increased reflection boosting output but snow obstructing panels. Fifth, extreme weather like wildfires and hailstorms cause substantial damage, while solar eclipses lead to large but short-lived output losses. The study noted that long-term changes in solar irradiance, driven by climate change and air pollutants, present future challenges for maintaining PV efficiency. Optimizing PV systems for diverse climates and mitigating environmental impacts on productivity is important to the continued success of solar photovoltaics.

El-Shaer *et al.* (2014), in their work discussed the effect of light intensity and temperature on performance parameters of mono-crystalline and poly-crystalline silicon solar module. The study carried out the experiments under a solar simulator for various intensity levels in the range 0.2 1.0 Sun and 10–50°C, respectively. The results of the two modules indicated that light intensity has a dominant effect on current parameters. It was found that photocurrent; short circuit current and maximum current have been increased linearly with increasing light intensity. So, he concluded that concentrating system could be regarded as a best choice to enhance the power output of solar system. Furthermore, he observed that the power density of the mono-crystalline and poly-crystalline silicon solar module increased from 8.96 and 7.72 mW/cm^2 to 46.72 and 40.4 mW/cm^2 for light intensity 0.2 and 1 Sun respectively. On the other hand, he noticed that the module temperature had a dramatic effect on voltage parameters. Open circuit voltage and maximum voltage were decreased with increasing module temperature. So, the maximum power density of the mono-crystalline and poly-crystalline silicon solar module decreased from 43.4 and 48.76/cm^2 to 36.32 and 41.88mW/cm^2 for temperature 10°C and 50°C respectively.

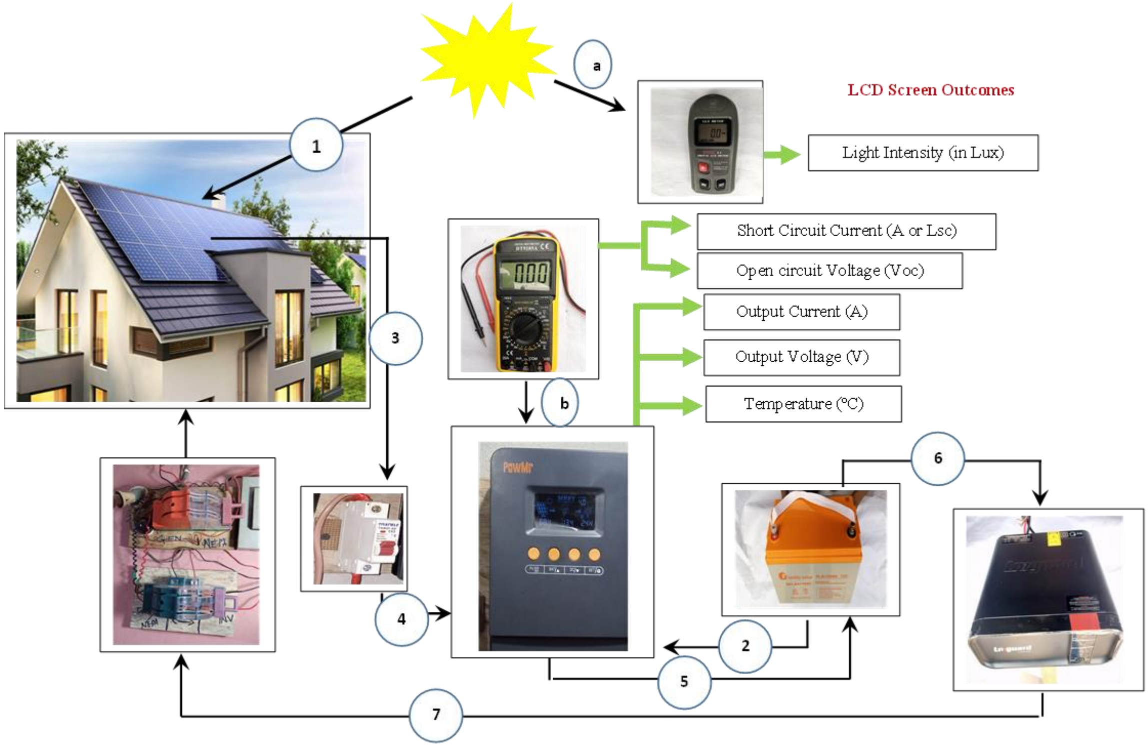
Okonkwo and Nwokoye (2014) conducted a study to analyse the Solar Energy Parameters in Bida, Nigeria over a period of thirteen years (2000 – 2012). They however focused on Gunn-Bellani solar radiation, sunshine hour duration, relative humidity, rainfall, wind speed, maximum and minimum temperatures which data were analysed using both single-variable and multi-variable regression techniques of the Angstrom type to generate several regression equations (models). The study observed that the highest and lowest air temperatures are obtained in the months of March and December respectively. It also discovered that the highest and lowest values of the fraction of sunshine occurred in the month of November and August respectively.

Using a mono crystalline silicon solar panel with an area of 1.9m^2, Ettah, Ushie and Opara (2010) adopted modern digital instrument such as BK precision model 615 digital light meter and Alda AVD890C digital multimeter to measure solar radiation, current and voltage under varying conditions of temperature. The study found that the best solar panel operating temperature was 45°C, noting that between solar panel temperatures of 26°C and 32°C, output voltage remained relatively stable varying between 8.0V and 8.10V. It further observed that an average Solar panel temperature of 26.2°C was recorded in the morning hours but increased to 45°C during the noon, Current was also noted to have increased from 0.0 to 20.0 x 10-1A during the noon. This implies that solar panel temperatures between 26°C and 45°C appear to favour increase in output current as output current was observed to begin to drop above 45°C despite further increase in solar panel temperature.

2.0 Materials and methods

2.1 Experimental Procedures and Materials

This study adopted experimental research design. This design was considered appropriate because it allowed the Researchers to set up the relevant solar energy system infrastructure, collate the hourly performance readings of the selected solar energy parameters from 0600hours to 1800hours (a total of thirteen hours daily), and record the real time performance readings of the solar energy parameters as observed. The study was conducted in Uruanna area of Nibo Community, Awka South local government area of Anambra State, Nigeria, under daily real time condition. To achieve the purpose of this study under daily real time sunlight situation, a robust and functional solar energy system was set up using materials such as Digital Lux Meter (range up to 200,000 or 1580W/m^2 equivalent), two (2) Photovoltaic Panels (250W) which were installed southward, POWMi MPPT Solar Charge Controller, Fidelity Solar 12V Battery for Power, Digital Multi-meter (DMM) , Inverter (i-verter, LGS1100I-EX), Circuit Breaker (63 Amps), two (2) Electrical Change-Over Switch (OPEC, 200 Amps) and Twain and Single Cables.. Thus, the study involved manual collation of target parameters' data on hourly basis, and this lasted for a period of ten (10) months which equitably cut across two notable seasons in Nigeria namely the Rainy season (1st May 2025 – 30th September, 2025) and Dry season (1st October 2025 – 28th February, 2026). A total of 304 days was covered (that is, 153 rainy season days and 151 dry season days respectively). The solar energy system was connected to active load that ensured that the battery was duly controlled to avoid full charge. This measure ensured that the hourly real time performance readings obtained were very much reliable. The set up used was readily captured in Figure 1.



Source: Researcher's Concept, 2025/2026.
Figure 1 Blockchain diagram showing the set up.

The daily hourly performance data of the five (5) solar energy parameters studied which were collated through the LCD screen of the Solar Charger, the Lux Meter, and the Digital MultiMeter, were analysed, first, by means of tables and thereafter graphs using the Microsoft Excel version 16 package. This was to allow for a concise appreciation of the trends and performance levels of the solar energy system in the Rainy and Dry seasons respectively.

These were further evaluated by way of statistical analyses using the Pearson Correlation statistical tools to test the various hypotheses formulated in the study. The choice of the Pearson Correlation was to concisely evaluate the level of relationship between the scores or readings of a given solar parameter across two different seasons, namely the rainy and the dry seasons. Likewise, the Correlation statistical played significant role in enabling the study to understand the quality (positive or negative relationship), strength (strong or weak relationship) and direction (significant or insignificant) of relationship between the readings of different solar parameters during a given season. This is where due emphasis on the p-value of analysis output obtained cannot be ignored.

Accordingly, a p-value is viewed as a statistical measurement used to validate a hypothesis against observed data. In other words, a p-value measures the probability of obtaining the observed results, assuming that the null hypothesis is true. The implication of the p-value output obtained is such that the lower the p-value, then the greater the statistical significance of the observed difference.

2.2 Performance of Some Solar Parameters
For the purpose of the successful completion of this study, the daily performance of the Maximum Power (Pmax) of the installed solar energy system, was determined by means of computations using obtained relevant data readings of appropriate solar parameters that constitute its formula as stated below:
Maximum Power (Pmax) = Output Voltage (V) x Output Current (I).

2.3 Decision Rule
In this, we take up general rule on level of significance, and interpretation of Correlation.

2.3.1 General Rule on Level of Significance

a. Accept the Alternate hypothesis if p-value is equal to or less than 0.05, indicating that there is a statistically significant difference between performances of the selected solar energy parameters in the Rainy and Dry seasons.
b. Accept the null hypothesis if p-value is greater than 0.05, indicating that there is no statistically significant difference between performances of the selected solar energy parameters in the Rainy and Dry seasons.

2.3.2 Interpreting Correlation (r) Coefficient Outcome, Direction and Strength

i. 0.0 to 0.3 = Very weak but positive relationship.
ii. -0.0 to -0.3 = Very weak and negative relationship.
iii. 0.3 to 0.5 = Moderate and positive relationship.
iv. -0.3 to -0.5 = Moderate but negative relationship.
v. 0.5 to 0.8 = Strong and positive relationship.
vi. -0.5 to -0.8 = Strong but negative relationship.
vii. > 0.8 = Very strong and positive relationship.
viii. > - 0.8 = Very strong but negative relationship.
ix. $\underline{+}$ = A perfect positive or negative Linear relationship

3.0 Result and Discussion

3.1 Data Analysis and Hypothesis Testing

This section clearly presents the output of the relevant analysis carried out in testing the hypothesis formulated for the study. We now determine:

H_o: The level of relationship between the daily Light Intensity and Maximum Power Point in the Rainy and Dry season is not statistically significant.

H_i: The level of relationship between the daily Light Intensity and Maximum Power Point in the Rainy and Dry season is statistically significant.

Using the performance data readings of the relevant solar parameter as measured on daily basis from 0600hours – 1800hours over a ten months period (May 1, 2025 – February 28, 2026), the hypothesis was tested for scientific proof of concept and statistical evidence. The analysis output is as presented in Table 1.

Table 1
Correlations

		MaxPowRAINY	MaxPow DRY	LightInt RAINY	LightInt DRY
MaxPowRAINY	Pearson Correlation	1	.177**	.389**	.076**
	Sig. (2-tailed)		.000	.000	.001
	N	1989	1961	1989	1963
MaxPow DRY	Pearson Correlation	.177**	1	.184**	.033
	Sig. (2-tailed)	.000		.000	.138
	N	1963	1961	1961	1961
LightInt RAINY	Pearson Correlation	.389**	.184**	1	.034
	Sig. (2-tailed)	.000	.000		.127
	N	1989	1961	1989	1963
LightInt DRY	Pearson Correlation	.076**	.033	.034	1
	Sig. (2-tailed)	.001	.138	.127	
	N	1963	1961	1963	1963

**. Correlation is significant at the 0.01 level (2-tailed).

- *Note: MaxPow RAINY denotes Maximum Power Rainy Season*
- *MaxPow DRY denotes Maximum Power Dry Season*
- *LiightInt RAINY denotes Light Intensity Rainy Season*
- *LiightInt DRY denotes Light Intensity Dry Season*

Source: IBM SPSS ver 26

Inferring from Table 1, it can be seen that the correlation coefficient (r) which is used to determine the strength and direction of the relationship between the daily Light intensity (lux) performance and Maximum Power (Pmax) in the Rainy was 0.389, indicating a weak but positive linear relationship between the daily performances of Light Intensity (LightInt RAINY) and the Maximum Power (MaxPowRAINY) from May 1, 2025 – September 30, 2025 exist. This was further complemented on by the p-value (Sig) of the test that peaked at 0.000 (less than 0.05), thus attributing the observed weak but positive linear relationship between LightInt RAINY and MaxPowRAINY to be statistically significant.

During the Dry season, though the relationship between LightInt DRY and MaxPowDRY was positive but statistically insignificant, as the correlation coefficient (r) and the p-value (which was greater than 0.05) recorded 0.033 and 0.138 respectively, the extent of such positive relationship was deemed very weak. This, once again, lend support to the implication of the finding made during the Rainy season that despite the lengthy or hotter sunlight during the Dry season, not so much impact of it was felt during the peak of energy generation (Maximum Power) by the installed solar energy system.

The linear relationship between the LightInt RAINY and LightInt DRY revealed a non-significant positive relationship between the quality of daily Light intensity (lux) performances in the Rainy and Dry seasons (p-value 0.127 which was greater than 0.05, while the r stood at 0.034). Yet, the relationship between the daily Maximum Power (Pmax) performances in the Rainy and Dry season (MaxPowRAINY and MaxPowDRY) maintained a positive and statistically significant position, implying that despite the non-significant relationship between the observed daily sunlight in the Rainy and Dry seasons which readily attest to a possible difference in the quality of daily irradiance observed between the two seasons, the relationship between the observed daily Maximum Power (Pmax), which points to highest amount of energy generated by the installed solar energy system, during the Rainy and Dry season was statistically significant as the p-value (0.000) was less than 0.05 or 5% level of significance. The implication was that despite the difference in the daily Light intensity (lux) performances during the Rainy and Dry seasons, similar daily Maximum Power (Pmax) performances was recorded during the two different seasons.

Looking at the relationship between the daily performances of Light Intensity (lux) in the Dry season (LightInt DRY) and the Maximum Power (Pmax) in the Dry season (MaxPowDRY) from October 1, 2025 – February 28, 2026, it was observed that the correlation coefficient (r) peaked at 0.033, indicating a state of very weak but positive relationship. Further consideration of the p-value (Sig) of the test showed an output of 0.138 which is greater than 0.05, thus indicating that the observed positive linear relationship between daily performances of LightInt DRY and MaxPowDRY was statistically insignificant.

Decision: Since the p-values (0.000 and 0.138) are less and greater than 0.05 respectively, the study concludes that the level of relationship between the daily Light Intensity and Maximum Power Point was very weak but positive in the Rainy and Dry seasons, though their daily performances was statistically significant in the Rainy season but non-statistically significant in the Dry season (p-values 0.000 and 0.138; r 0.389 and 0.033 respectively).

Further Discussion of the Experimental Result

The linear relationship between the LightInt RAINY and LightInt DRY revealed a non-significant positive relationship between the quality of daily Light intensity (lux) performances in the Rainy and Dry seasons (p-value 0.127 which was greater than 0.05, while the r stood at 0.034), thus aligning with the studies of Ajuh *et al.* (2025) who reported that high rainfall and humidity leads to reduction of sunlight. Yet, the relationship between the daily Maximum Power (Pmax) performances in the Rainy and Dry season (MaxPowRAINY and MaxPowDRY) maintained a positive and statistically significant position, implying that despite the non-significant relationship between the observed daily sunlight in the Rainy and Dry seasons which readily attest to a possible difference in the quality of daily irradiance observed between the two seasons, the relationship between the observed daily Maximum Power (Pmax), which points to highest amount of energy generated by the installed solar energy system, during the Rainy and Dry season was statistically significant as the p-value (0.000) was less than 0.05 or 5% level of significance. The implication was that despite the difference in the daily Light intensity (lux) performances during the Rainy and Dry seasons, similar daily Maximum Power (Pmax) performances was recorded during the two different seasons. This finding was supported by Tasie *et al.* (2022) who argued that solar Panels perform efficiently and better in all seasons. This is quite impressive and a good news for prospective solar energy Users and consumers.

Looking at the relationship between the daily performances of Light Intensity (lux) in the Dry season (LightInt DRY) and the Maximum Power (Pmax) in the Dry season (MaxPowDRY) from October 1, 2025 – February 28, 2026, it was observed that the correlation coefficient (r) peaked at 0.033, indicating a state of very weak but positive relationship. Further consideration of the p-value (Sig) of the test showed an output of 0.138 which is greater than 0.05, thus indicating that the observed positive linear relationship between daily performances of LightInt DRY and MaxPowDRY was statistically insignificant. This perhaps may align with the assumption that during intense heat, a Panel could experience a 10% to 25% reduction in its overall electricity generation compared to cooler, clear spring days. This assumption also describes the temperature coefficient of photovoltaic cells which states that the electrical output of a solar panel decreases as its operating temperature rises. This readily attest to the reliability and most suitability of the Rainy season for solar energy generation.

Arithmetic evidence from the average daily performance of Light Intensity (lux) in the Rainy season, showed that irradiance was at its highest at exactly 1500hours in the month of May 2025 recording 130061.0 lux (equivalent of 1027.48W/m^2) and in the Dry at 1400hours in the month of January 2026 recording 194687.1 lux (equivalent of 1538.03W/m^2). Further observations revealed that more irradiance (sunlight) was observed in the Dry season between the months of November 2025 and February 2026 from 1200hours – 1400hours, recording impressive higher lux performance values that fall within the range of 170000 lux – 190000 lux (equivalent of 1343W/m^2 – 1501W/m^2), than was obtained during the other hourly time frame and months of the Dry season.

Comparing the irradiance performance during the Rainy season between the time frame of 1200hours – 1400hours from the months of May 2025 to September 2025, the average daily light intensity values fell within the range of 40000 lux – 120000 lux (equivalent of 316W/m^2 – 948W/m^2), indicating that the intensity of the sunlight observed in the Rainy season cannot be compared with those of the Dry season. However, the result of the average daily performance of Maximum Power (Pmax) in the Rainy and Dry seasons showed that average Pmax range of 400.0 – 480.0 was recorded between 1200hours and 1500hours from the months of May 2025 – September 2025 (Rainy season) to the months of October 2025 – February 2026 (Dry season), thus indicating a trend of similarity in the performance of Maximum Power (Pmax) in the Rainy and Dry seasons.

The implication of this is that the overall quality of light (lux) accessed by the two Panels during the five months of the Rainy season, was not statistically strong yet positive and significant to harnessing the highest amount of power (Pmax) that was generated by the installed solar energy system during the 5 months period of the Rainy season on a daily basis measurement pattern from 0600 hours to 1800 hours. This also overrides existing fears on the reliability of the solar energy system during the Rainy season, seeing that despite the attributed weak nature of the light accessed during the Rainy season period, such quality of light made remarkable positive and significant contribution to the maximum power of the installed solar energy system, thereby recording commendable energy generation performance at its peak performance level. These findings aligns with the research outcomes of Kurniawan *et al.* (2024) who reported that solar cell efficiency is greatly influenced by light intensity. Eze *et al.* (2024) and Omoriare *et al.* (2024) equally support the finding reporting that there is a positive correlation between solar irradiance and power output from January – April 2024.

4.0. Conclusion

This study has successfully extended the frontiers of periodical evaluation of the performances of the solar energy system, viewing it from the seasonal perspective, specifically in the Rainy and Dry seasons. The level of relationship between the daily Light Intensity and Maximum Power Point was very weak but positive in the Rainy and Dry seasons, though their daily performances was statistically significant in the Rainy season but non-statistically significant in the Dry season

From Table 1, it was observed that the correlation coefficient (r) which is used to determine the strength and direction of the relationship between the daily Light intensity (lux) performance and Maximum Power (Pmax) in the Rainy, was 0.389, indicating a weak but positive linear relationship between the daily performances of Light Intensity (LightInt RAINY) and the Maximum Power (MaxPowRAINY) from May 1, 2025 – September 30, 2025 exist. This was further complemented on by the p-value (Sig) of the test that peaked at 0.000 (less than 0.05), thus attributing the observed weak but positive linear relationship between LightInt RAINY and MaxPowRAINY to be statistically significant. This finding agrees with the research outcomes of Curbe (2025) and Lynta (2025) who reported that the low direct sunlight during the Rainy season due to cloudy or foggy weather can still generate usable electricity when it reaches the Panels.

During the Dry season, the relationship between LightInt DRY and MaxPowDRY was positive but statistically insignificant as the correlation coefficient (r) and the p-value (which was greater than 0.05) recorded 0.033 and 0.138 respectively. The extent of such positive relationship was deemed very weak. This, once again, lend support to the implication of the finding made during the Rainy season that despite the lengthy or hotter sunlight during the Dry season, not so much impact of it was felt during the peak of energy generation (Maximum Power) by the installed solar energy system. This finding was completely supported by Andrew and Andrew (2025) and Richard (2025) who found out that when solar Panels are exposed to too high irradiance and temperature, the flow of electricity within each solar cell is slowed, thereby reducing efficiency or power outputs.

This study therefore concludes that while seasonal variations in the performances of the solar energy system in the Rainy and Dry seasons persist, observations made proved that the extent of such variations or differences in its performances is not statistically significant to undermine the efficiency and reliability of the solar energy system in the Rainy season.

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