# NOCT Characterization of Different Wattage Multi C-Si PV Modules Used in Solar Lighting System

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*Abstract*— NOCT stand for Nominal operating cell Temperature as per IEC 61215 & IS 14286 standard, "NOCT" defined as the cell temperature within an open rack mounted in the following standard reference environment condition :
Tilt angle: 45° ±5 From the horizontal
Total irradiance:800-900 W/m2
Ambient temperature: 20 ±15° C
Wind speed: 1 m/s
Electrical load: open circuit or specified condition.

***Key words:*** NOCT, C-Si PV Modules, Solar Lighting System

## I. INTRODUCTION

This Research deal with NOCT of multi C-Si PV module of different wattage range between 6 watts to 80 watts in composite climate zone (Gurgaon).

This paper introduces the relevant idea of NOCT for different wattage multi C-Si module and its study. NOCT is defined as the equilibrium mean solar cell junction temperature within an open-rack mounted module in the following standard reference environment as per IEC 61215 & IS 14286 standard
Tilt angle: 45°From the horizontal
Total irradiance: 800 W/m$^2$
Ambient temperature: 20°c
Wind speed: 1 m/s
Electrical load: open circuit.

This standard used as qualification testing, guide to the temperature by the user. Recent trends used NOCT calculation for thermal model and energy performance of PV module.

NOCT Measure depends on the following factors:

1) Total irradiance
2) Ambient Temperature
3) Wind speed
4) Difference between cell and junction temperature

Beside these above factors more or less other factor like Module wattage, module size, testing location, weather or atmospheric condition at time of testing, plane of the surface

The primary inspiration to run this study came from following research idea If:

1) Does the different wattage have different NOCT?
2) Why as per IEC standard?

My studies offer to provide practical answers to the above question, with the calculated testing result.

## II. METHODOLOGY

The research utilized four multi C-Si photo voltaic Module range from 6 watt, 12 watt, 75 watt, 80watt, used in solar lighting provided by the National institute of solar energy, photo voltaic testing facility department Gurgaon, Data logger, K –type thermocouple, test Bed as per IEC standard, The test bed setup as per IEC standard and thermocouple attached at the center cell of each module to their output connected to the different channel of data logger as shown in Fig. 1, The module then installs plan of the array as per IEC standard as follows:
Tilt angle: 45°From the horizontal
Total irradiance: 800W/m$^2$
Ambient temperature: 20°C
Wind speed: 1 m/s
Electrical load: open circuit

Each electrical module connected to the data logger as prescribed by IEC standards and result of wind speed, ambient temperature, Junction temperature, total irradiance logged by the data logger. With the logged data filter out all data which are not suited as per IEC standard. As per IEC standard following filter used for NOCT calculation:
Total Irradiance: > 400 W/m$^2$
Ambient temperature: 5°Cto 35°C
Wind speed: 0 .25 to 1.75 M/Sec

## III. RESULT AND DISCUSSION

Effect of module wattage on NOCT as shown in Fig.7 the larger wattage module exhibit higher NOCT value (4°c) as compared to a smaller size module under open circuit condition, this difference due to overheating of module and other electrical parameter such as connection resistance used in PVmodule, Short circuit current, open circuit voltage and heat loss as per thermal model concept.

The graph between different wattage module for Tj-Ta vs Irradiance also plotted as shown in Fig. 3, 4, 5, and 6 and the value for NOCT calculated as per IEC standard.

NOCT Calculation: As per IEC standard NOCT value calculated with the following data get during the one day record of data logger:
Average Ambient = 30.92426128
Average Wind speed= 0.97029687
Correction Factor = 0 as per IEC standard shown in Fig. 2,
NOCT Calculation for :
General Formula uses regression line
NOCT (X Watt) 1day=M×800+C ± (C.F.) …… 1.1
Where, M= slope of a regression equation
C = constant
C.F. = correction factor
NOCT (6 watt) 1 day= 41.227
NOCT (12 watt) 1 day= 42.541
NOCT (75 watt) 1 day= 44.932
NOCT (80watt) 1day=45.128
Where, Ta=20°C
This equation 1.1 is Regression equation at Ta= 20° C ambient reporting condition.

 

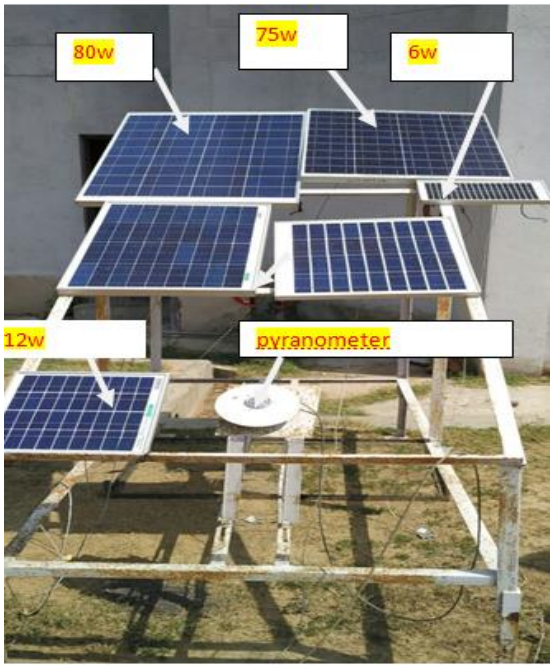


Fig. 1: Experimental setup of Test Bed

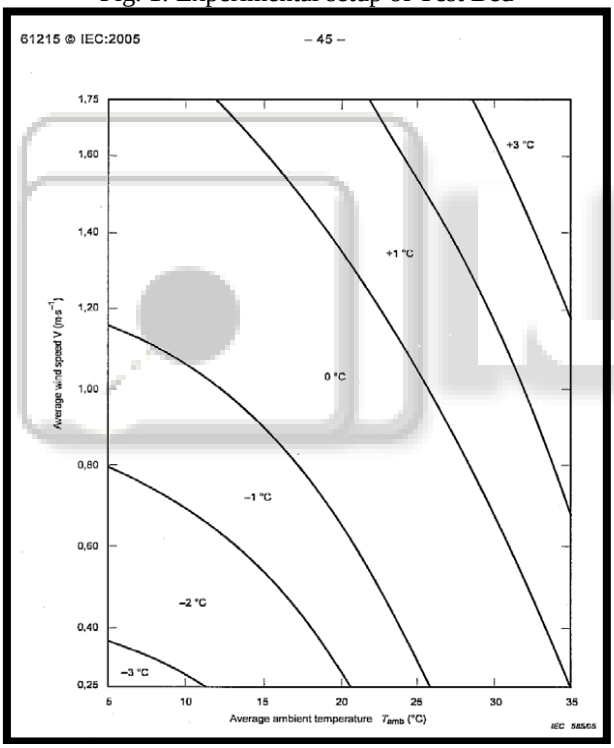


Fig. 2: Avg Ws vs Avg Ta (As per IEC 61215)

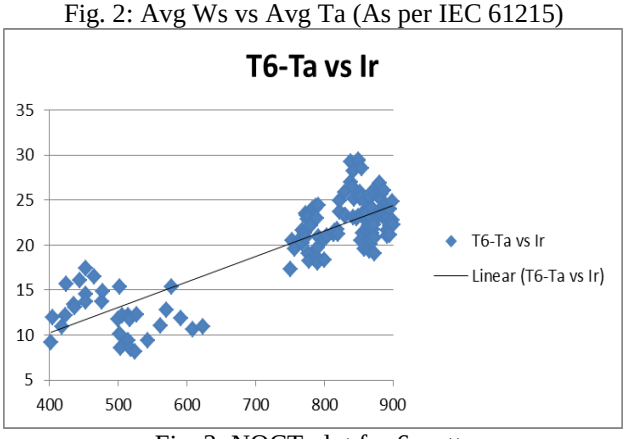


Fig. 3: NOCT plot for 6 watts

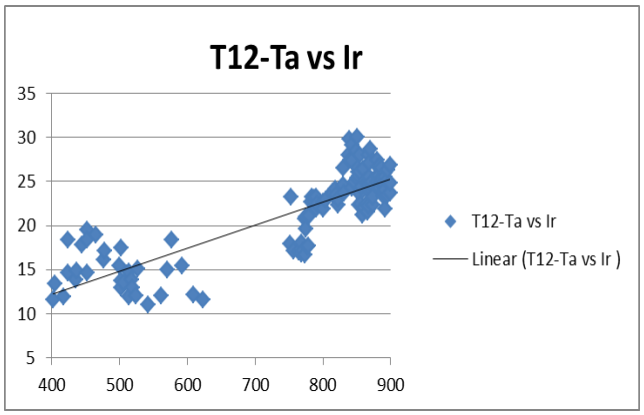


Fig. 4: NOCT plot for 12 watts

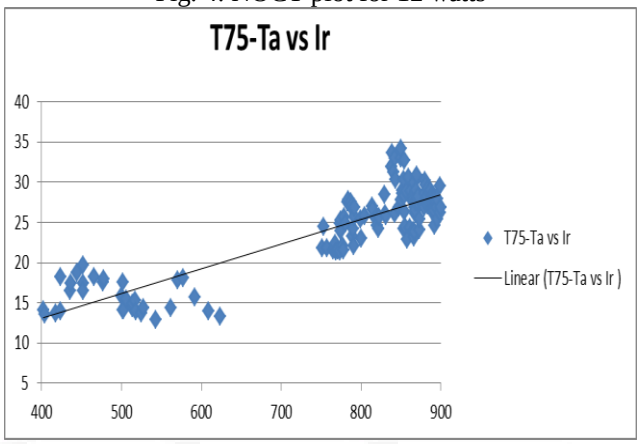


Fig. 5: NOCT plot for 75 watts

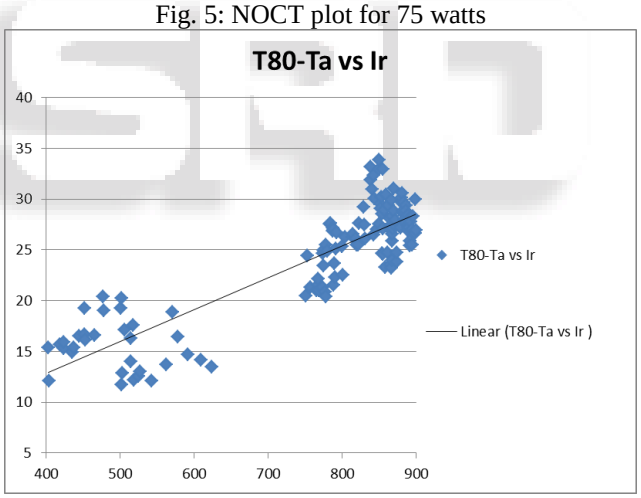


Fig. 6: NOCT plot for 80 watts

## IV. CONCLUSION

From the calculation, it may observe that larger wattage module have higher NOCT value (4°c) when compared to a smaller wattage module under the open circuit condition as per IEC standard, shown in below Fig. 7.

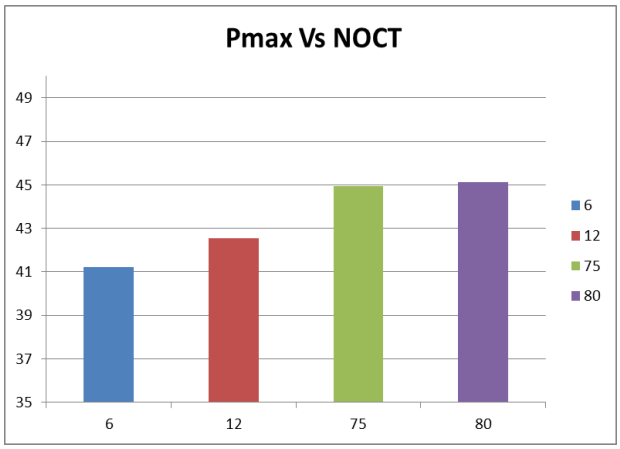

Fig. 7: PMax vs NOCT

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