**Webology**, Volume 18, Number 4, 2021
**ISSN:** 1735-188X
**DOI:** 10.29121/WEB/V18I4/134

# ANALYZING THE DIFFERENCES IN IRRADIANCE FOR MONO- AND POLY-CRYSTALLINE PV CELLS

**Niharika Varshney[1],, Parvesh Saini[3], Sandeep Sunori[4]**

[1]Department of Electrical Engineering,Graphic Era Deemed to be University, Dehradun, Uttarakhand India
[2]Department of Electrical Engineering,Graphic Era Hill University, Dehradun, Uttarakhand India
[3]Department of Electronics & Communication Engineering,Graphic Era Deemed to be University, Dehradun, Uttarakhand India

## ABSTRACT
According to the findings of a single blinded randomised controlled experiment, transcutaneous electrical nerve stimulation combined with conventional care can help lessen the presence and severity of unilateral neglect following an acute stroke. When transcutaneous electrical nerve stimulation is utilised after an acute stroke rather than the standard care, daily activities is improved. The Catherine Bergego Scale and the Barthel Index clearly correlate when assessing functional independence in everyday activities in acute stroke patients.

**Keywords:** Matlab, SIMULINK, Photovoltaic Module, standard test condition (STC), mathematical model.

## INTRODUCTION
Traditional energy sources are insufficient to satisfy the world's growing energy demand. As a result, renewable energy sources such as sunlight, wind, and biomass join the picture. Photovoltaic energy is an interesting source of energy in this context; it is renewable, inexhaustible, and non-polluting, and it is used as an energy source in a number of applications [1-6] This paper uses matlab/simulink to model photovoltaic cells of 280 watts. Irradiation, temperature, and load current influence the output quantities (voltage, current, and power). In the model, the results of these three variants are taken into account. For Monocrystalline and Polycrystalline plates, P-V and I-V characteristics are plotted for different irradiations (1000W/m2, 900W/m2, 700W/m2, and 500W/m2)[7-11] at constant temperature 25°C. The results of the simulation are compared to the datasheets of Vikram Solar panels' 60 Cells Mono Somera and Eldora Ultima Silver 1500 V Series. The findings illustrate the model's accuracy. The aim of this paper is to create a MATLAB-Simulation PV model with simple and understandable irradiance levels and constant temperature as key factors.

## 2. *A PHOTOVOLTAIC MODULE AND ITS GOVERNING EQUATIONS*
Solar cells make up a solar module. A solar cell is essentially a tiny semiconductor wafer or sheet

**Webology**, Volume 18, Number 4, 2021
**ISSN:** 1735-188X
**DOI:** 10.29121/WEB/V18I4/134

with a manufactured p-n junction. The photovoltaic modules are made of silicon cells. Silicon solar cells generate roughly 0.7V of output voltage in an open circuit. A solar PV module is made when many of these cells are sequentially joined together. [12-14] The size of each individual cell is used to determine the new module ratings. Solar PV arrays are constructed using a combination of parallel and serial connections between solar PV modules. The greater the cell area, the greater the cell's current production and, thus, the greater the output of power. When photons with energies above the band-gap energy of the semiconductor are absorbed by the PV Cells when they are exposed to sunlight, electron-hole pairs proportional to the incident irradiation are produced. [15] The internal electric forces of the p-n junction push these carriers apart, causing a photo-current that is proportional to solar isolation. PV systems' nonlinear V-I and P-V characteristics vary with irradiance (insolation) under typical test settings (STC). 280 Watt monocrystalline and polycrystalline panel regulation equations.

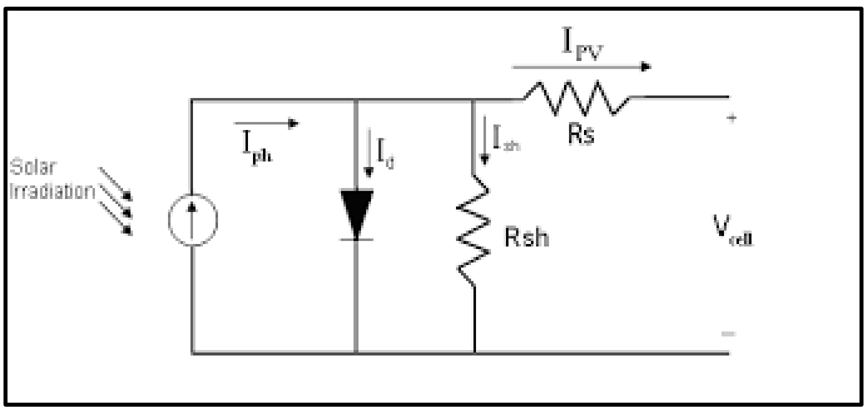


**Fig.1: Equivalent circuit of PV cell.**

$Iph$=[$ISC$+ $Ki\ Tc$−$Tr$ ∗ $S$100 (1)
$Irs$=$ISC$/[exp $qVocNSkATc$ − (2)
$IS$=[ $TcTr$ ]3exp $qEgkA$( 1$Tr$−1$Tc$) (3)
$Ipv$=$NP$∗$IPh$− $NP$∗[ exp $qVPv$+$IPv$ $RSNSkATc$ –(4)
Where, Iph=G=photo current, Irs=reverse saturation current, IS=ID=Saturation current, Ipv=output current , NP stands for the number of parallel branches of the cells, A for the diode ideality factor, k for Boltzmann's constant, which is 1.3805 x 1023 JK, Ki for short circuit temperature coefficient, which is measured in mA/oC, NS for number of cells connected in series, q for magnitude of charge on the electron, which is 1.6 x 1019 C, RS for series resistance, RSh for shunt resistance,

### *3. REFERENCE MODEL FOR PHOTOVOLTAIC MODULE*
60 CMS and EUS 1500 V Series by Vikram Solar panels of 280 watts are taken as the reference models for the comparative study of simulation results using above equations [(1) to (4)]. The datasheets of both the PV panels are given below

### *4. A SIMULATED MODEL OF PHOTOVOLTAIC MODULE*
Equations (1) to (3) are used to construct a generalised PV model in Matlab/Simulink (4). For simulation results, a solar module [60 CMS and EUS Silver 1500 V Series by Vikram Solar panels of 280 watts] is used as a reference model. The proposed model is also implemented with P-V and I-

**Webology**, Volume 18, Number 4, 2021
**ISSN:** 1735-188X
**DOI:** 10.29121/WEB/V18I4/134

V characteristics in Matlab/Simulink.

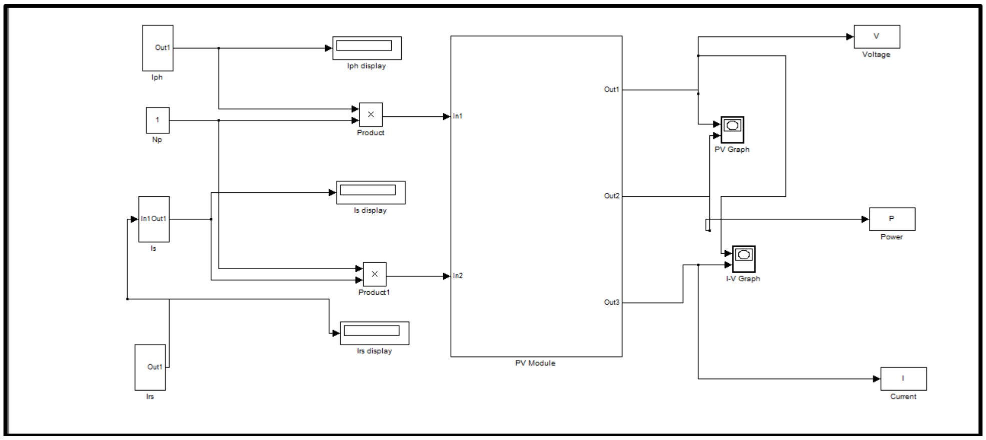


**Fig.2: Simulink Model of PV cell.**

## 5. *SIMULATION RESULTS*

On the basis of comparison, there are simulation results of 60 Cells Mono Somera and Eldora Ultima Silver 1500 V Series by Vikram Solar panels of 280 watts as shown in the figures below. The P-V and I-V characteristics of Vikram Solar panels of 280 watts, 60 CMS and EUS 1500 V Series, are compared. After the simulation results, there is a comparison table.


*Fig.3: PV Graph for Irradiance at G=1000 $W/m^2$ for Mono Crystalline PV Cell*

**Webology**, Volume 18, Number 4, 2021
**ISSN:** 1735-188X
**DOI:** 10.29121/WEB/V18I4/134

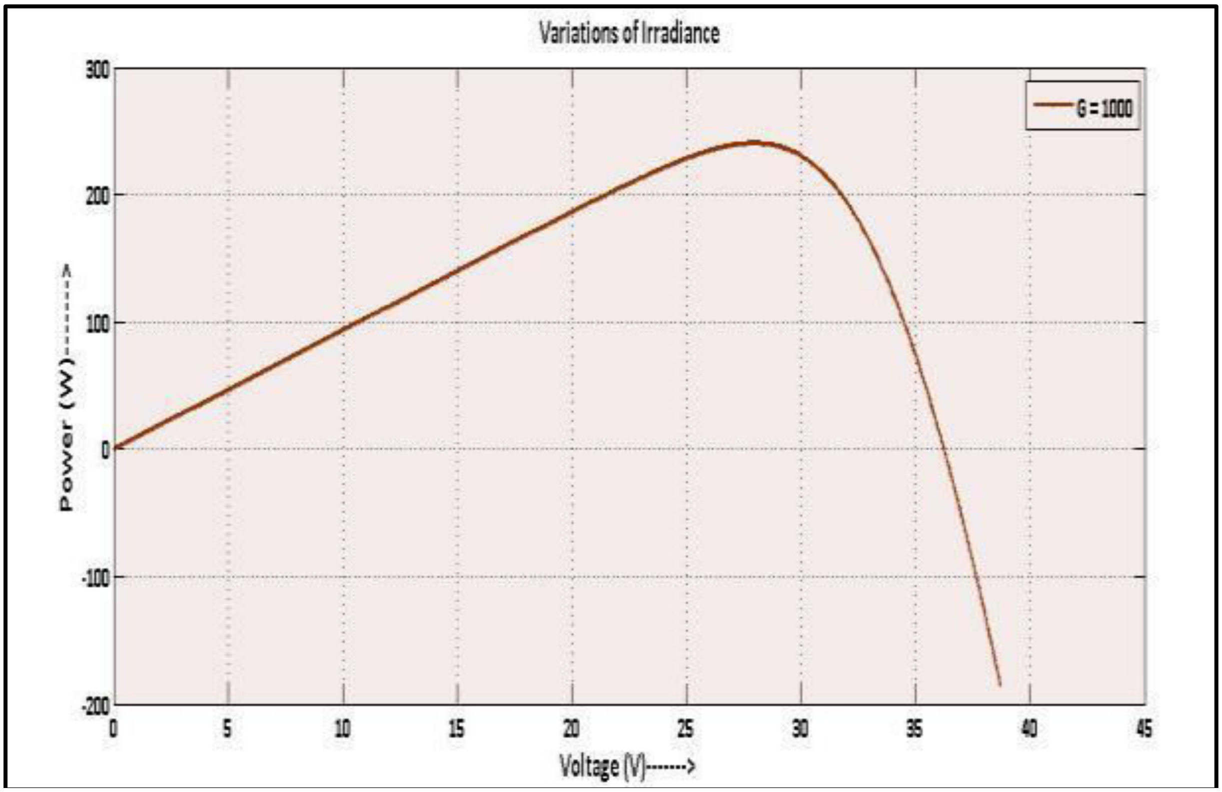


***Fig.4: PV Graph for Irradiance at G=1000 W/m2 for Poly Crystalline PV Cell***

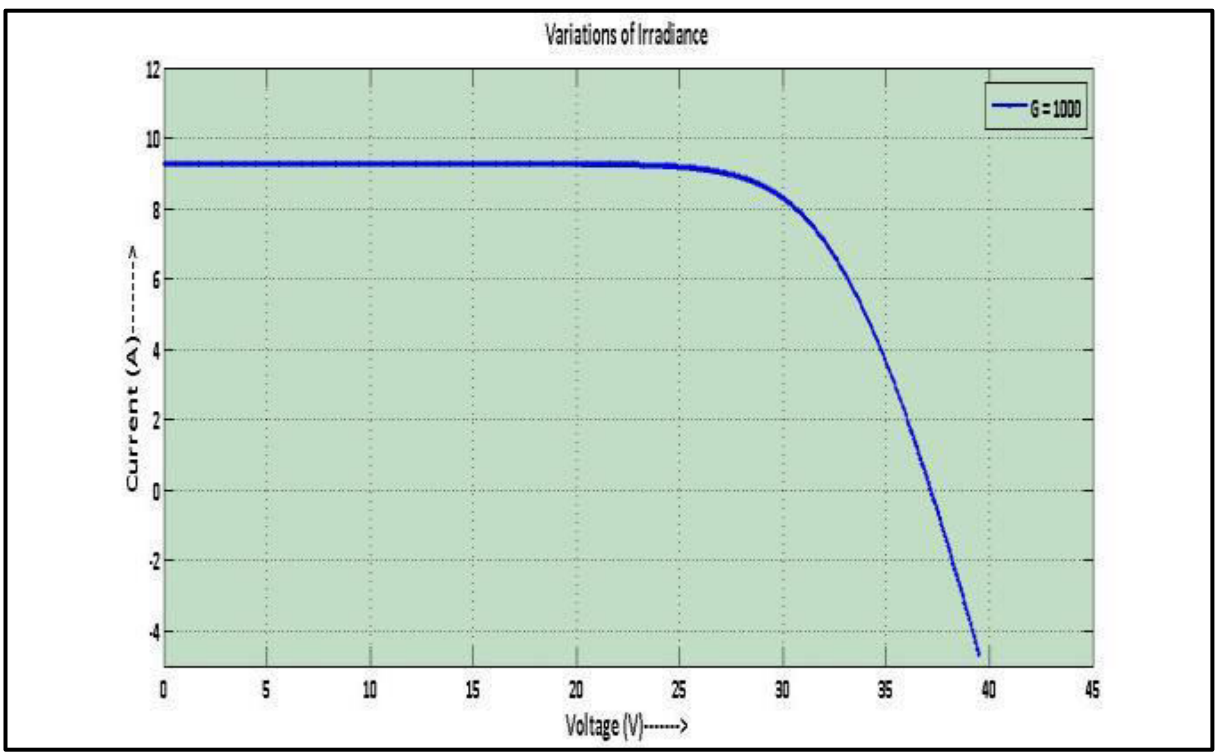


***Fig.5: I-V Graph for Irradiance at G=1000 W/m2 for Mono Crystalline PV Cell***

**Webology**, Volume 18, Number 4, 2021
**ISSN:** 1735-188X
**DOI:** 10.29121/WEB/V18I4/134

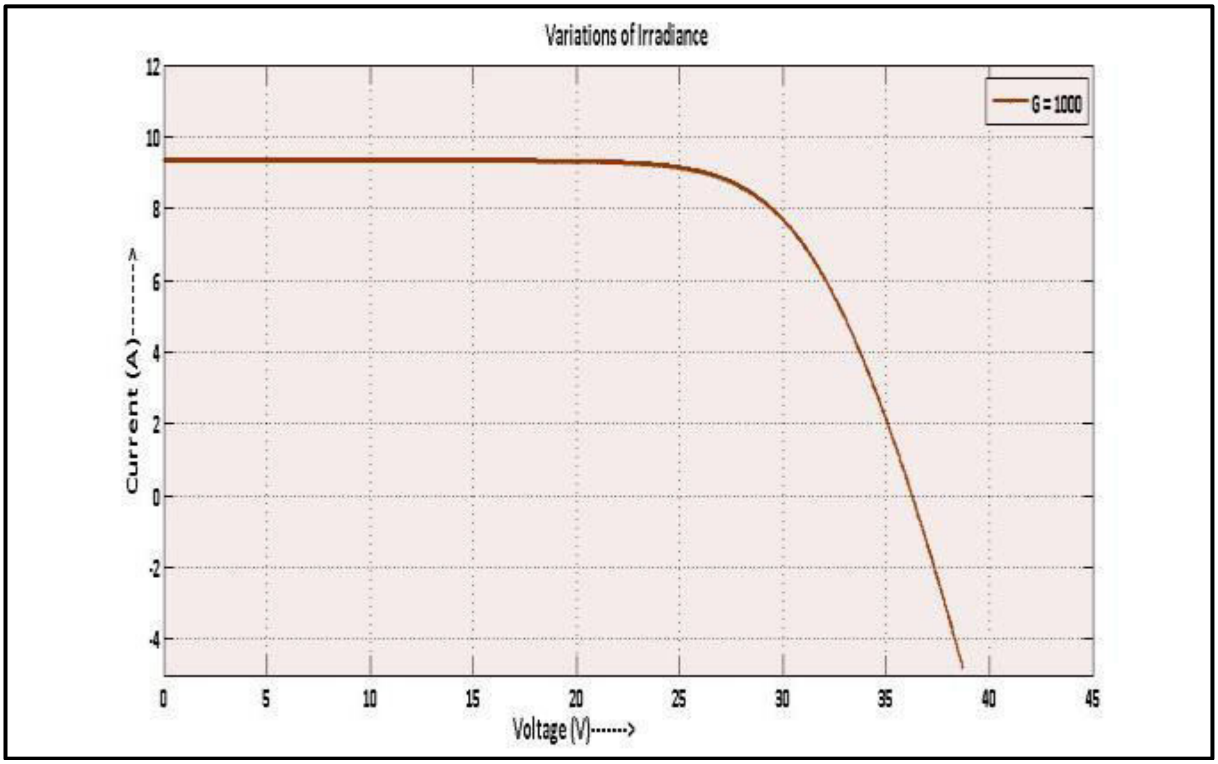


*Fig.6: I-V Graph for Irradiance at G=1000 $W/m^2$ for Poly Crystalline PV Cell*

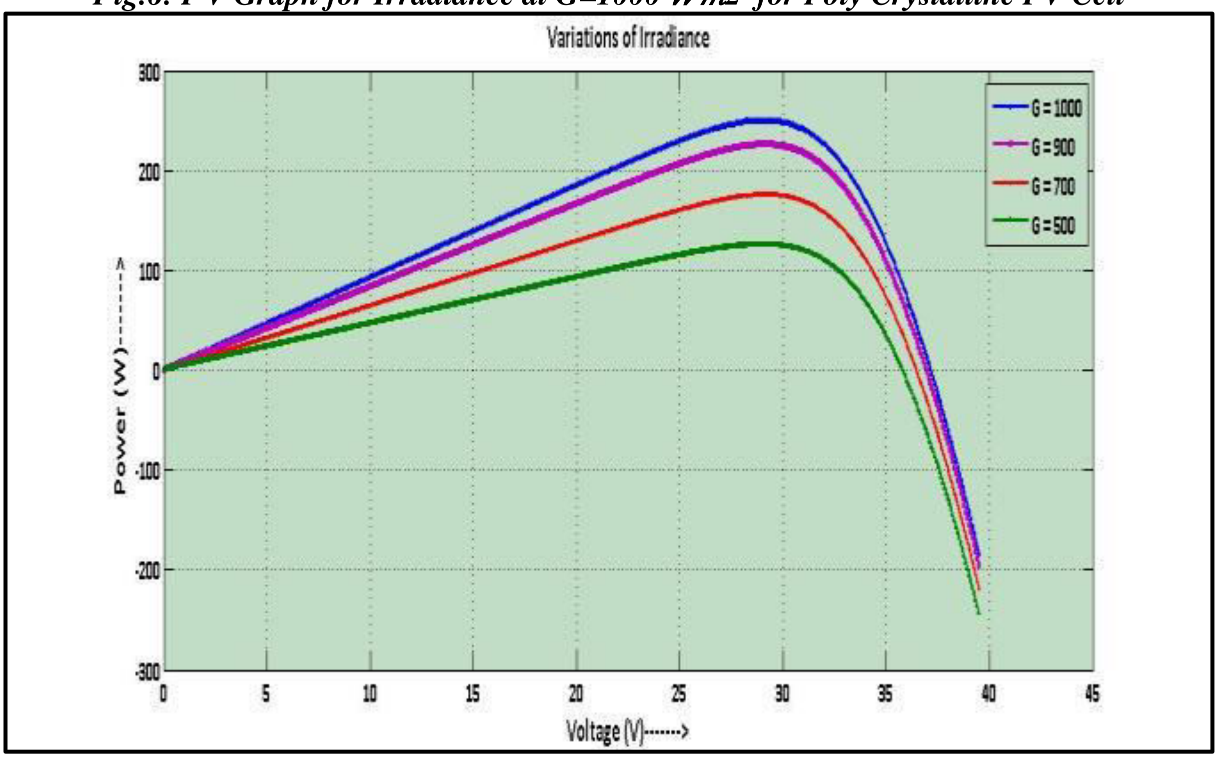


*Fig.7: PV Graph for Irradiance at G=500 $W/m^2$*

**Webology**, Volume 18, Number 4, 2021
**ISSN:** 1735-188X
**DOI:** 10.29121/WEB/V18I4/134

**for Mono Crystalline PV Cell**

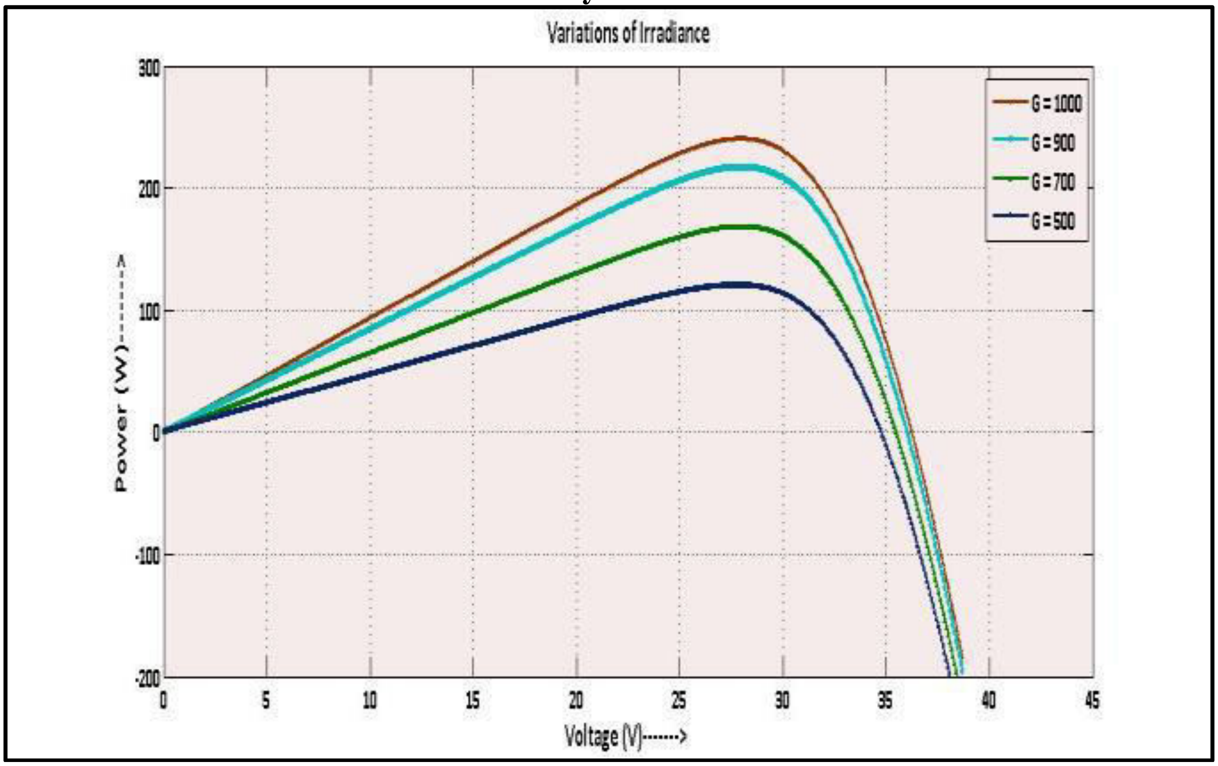


*Fig.8: PV Graph for Irradiance at G=500 $Wm2$ for Poly Crystalline PV Cell*

## CONCLUSION

The figures and tables display the simulation findings for P-V and I-V characteristics for variations in solar irradiation. There are four different irradiance levels: 1000Wm2, 900Wm2, 700Wm2, and 500Wm2. Investigated are the fluctuations in irradiance with a constant module temperature of 25°C. This analysis and research were done for 60 CMS and EUS 1500 V Series by 280 watt Vikram Solar Panels. Solar irradiation levels have a significant impact on the P-V and I-V curves of both monocrystalline and polycrystalline solar panels. It is obvious that the amount of current produced and the maximum output power decrease with falling solar irradiation values. On the basis of comparison, the Mono-Crystalline PV Cell is superior to the Poly-Crystalline PV Cell in this research. The comparison of Mono Somera and Eldora Ultima Silver 1500 V Series solar panels is done with respect to the power and current respectively.

## REFERENCE

1. Vunnam, Sarayu, M. VanithaSri, and A. RamaKoteswaraRao. "Performance analysis of mono crystalline, poly crystalline and thin film material based 6× 6 TCT PV array under different partial shading situations." *Optik* 248 (2021): 168055.
2. Sohani, Ali, et al. "A method for improving the accuracy of numerical simulations of a photovoltaic panel." *Sustainable Energy Technologies and Assessments* 47 (2021): 101433.
3. Sohani, Ali, et al. "Comparative study of temperature distribution impact on prediction accuracy of simulation approaches for poly and mono crystalline solar modules." *Energy Conversion and Management* 239 (2021): 114221.

4. Saeed, Faisal, et al. "A Comparative Study of Grid-Tied PV Systems Employing CIGS and Crystalline Solar Modules." *2021 Mohammad Ali Jinnah University International Conference on Computing (MAJICC)*. IEEE, 2021.
5. Prakash, Saripalli Bhanu, Gagan Singh, and Sonika Singh. "Modeling and Performance Analysis of Simplified Two-Diode Model of Photovoltaic Cells." *Frontiers in Physics* (2021): 236.
6. Hadidi, Abdelkader, Mohamed Blal, and Djamel Saba. "The study of the arid climate effect on the performance of photovoltaic system." *Energy Systems* (2021): 1-20.
7. ALi, K. I. D. A. R., et al. "The Implementation Feasibility of PV Power Plant based on Mono-Crystalline and Poly-Crystalline Technologies for Remote Regions in the Algerian Steppe." *Electrotehnica, Electronica, Automatica* 69.3 (2021).
8. Sharma, Preetika, and Parveen Goyal. "Analysing the effects of solar insolation and temperature on PV cell characteristics." *Materials Today: Proceedings* 45 (2021): 5539-5543.
9. Yilmaz, Saban, et al. "The analysis of different PV power systems for the determination of optimal PV panels and system installation—A case study in Kahramanmaras, Turkey." *Renewable and sustainable energy reviews* 52 (2015): 1015-1024.
10. Raimundo, Ricardo, et al. "Comparative Analysis of Organic and Inorganic Solar Cells." *2021 Telecoms Conference (ConfTELE)*. IEEE, 2021.
11. Ravichandran, Nagananthini, Hady H. Fayek, and Eugen Rusu. "Emerging floating photovoltaic system—Case studies high dam and Aswan reservoir in Egypt." *Processes* 9.6 (2021): 1005.
12. Prakash Saripalli, Bhanu, Gagan Singh, and Sonika Singh. "A Simplified Two Diode Photovoltaic Module: Modeling and Performance Analysis." *International Journal Of Computing and Digital System* (2021).
13. Kranjčić, Nikola, et al. "ANALYSIS OF SOLAR ENERGY POTENTIAL BY REMOTE SENSING TECHNIQUES IN VARAŽDINSKA COUNTY, CROATIA." *International Archives of the Photogrammetry, Remote Sensing & Spatial Information Sciences* 46 (2021).
14. Fakouriyan, Samaneh, Yadollah Saboohi, and Amirhossein Fathi. "Experimental analysis of a cooling system effect on photovoltaic panels' efficiency and its preheating water production." *Renewable Energy* 134 (2019): 1362-1368.
15. Chandra, Subhash, and Arvind Yadav. "An analysis of material technology dependent choice for customers to install PV projects." *Materials Today: Proceedings* 54 (2022): 777-781.