Simulation Performance of Proposed 200KWp Grid Connected Rooftop Solar Power Plant At MVJ College of Engineering Bangalore using PV Watts India

P.Sunil Kumar[1], Dr.Jayanna Kanchikere[2], Puvada Praveena [3]

[1]Assistant Professor, Department of Electrical and Electronics Engineering,MVJ College of Engineering,Bangalore-560 067, India

[2]Professor, Department of Electrical and Electronics Engineering, St.Peter's Engineering College, Hydearabad-500100, India

[3]Assistant Professor, Department of Electrical and Electronics Engineering,MVJ College of Engineering,Bangalore-560 067, India

***Abstract*— In grid connected rooftop solar PV system, available rooftop area on buildings is used for setting up solar power plant and DC power generated from solar photovoltaic (SPV) cells is converted to AC power by solar grid inverter and is fed to the grid during day time. In night when solar power is not sufficient, loads are served by drawing power from grid. In this paper, the Proposed Simulation analysis of 200KWp solar photovoltaic roof top grid connected power plant at MVJ College of Engineering, Bangalore city is carried out using PV Watts India simulation software. The simulation results of DC energy output of PV module and AC energy output of inverter are presented. The annual average solar radiation at MVJ College of Engineering is 4.25 kWh/m^2/day. The system losses are 15.85% and capacity factor is 12.2% using PV Watts India software. The DC energy output of PV array is 223464.8 KWh/annum and AC energy output of inverter is 223464.8 KWh/Annum.**

***Keywords*— Capacity factor; DC demand; AC Output; solar radiation; System losses.**

I. INTRODUCTION

MVJ College of Engineering, Bangalore city is located at latitude of 30.35 ^{0}N and longitude of 76.45 ^{0}E [1]. Electric utilities are finding it difficult to meet rise in peak demand and as a result, most of cities and towns are facing severe electricity shortages [2].

II. ON - GRID SOLAR ROOF TOP POWER PLANTS

Solar Photovoltaic cells convert sunlight energy to DC current through a photovoltaic process [9]. The solar PV systems may be: off-grid and on-grid. Batteries are needed in off-grid plants [3]. Batteries require replacement once in every 3-5 years in off-grid [7].

In Grid connected solar rooftop power plant, the DC power generated from solar photovoltaic (SPV) panel is converted to AC power using solar grid inverter and is fed to the grid either of 11KV lines or of 400/230V, three / single phase lines and if any shortfall of solar energy is imported from grid[4]. A schematic diagram of a grid connected solar rooftop photovoltaic power plant is shown in Fig.1 [5].

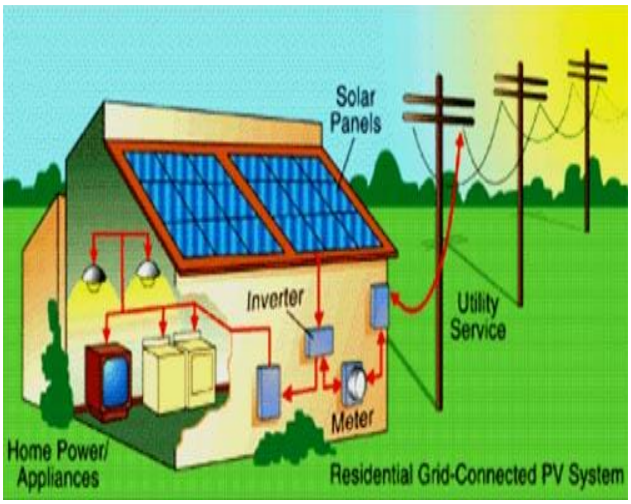


Fig1. A Schematic diagram of a Grid connected Solar Roof Top Photo Voltaic Power Plant.

III SIMULATION ANALYSIS RESULTS USING PV WATTS INDIA

PV Watts India software is one of the simulation software developed by NREL to estimate the performance of the solar power plant [6].

A. Resource Data and System info

The resource data and system info for inputs considered for 200KWp roof top solar power plant are shown in Fig.2 & 3[8].

Fig.2 Resource data of 200KWp solar rooftop plant

MVJ College of Engineering, Bangalore city is located at latitude of 30.35^0N and longitude of $76.45\ ^0$E.

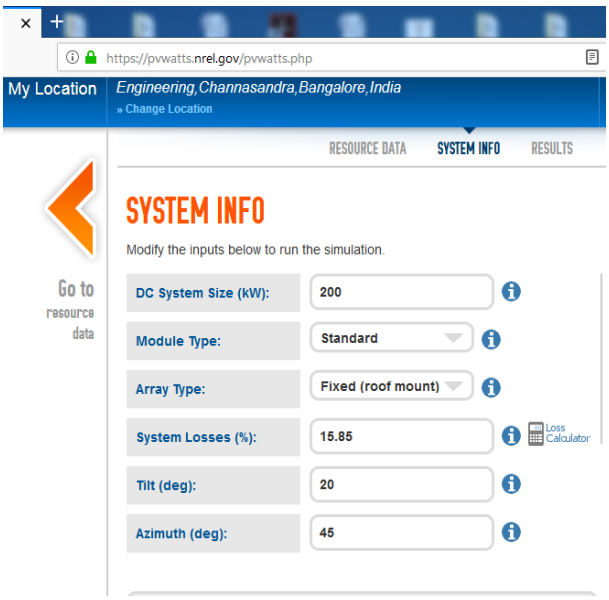
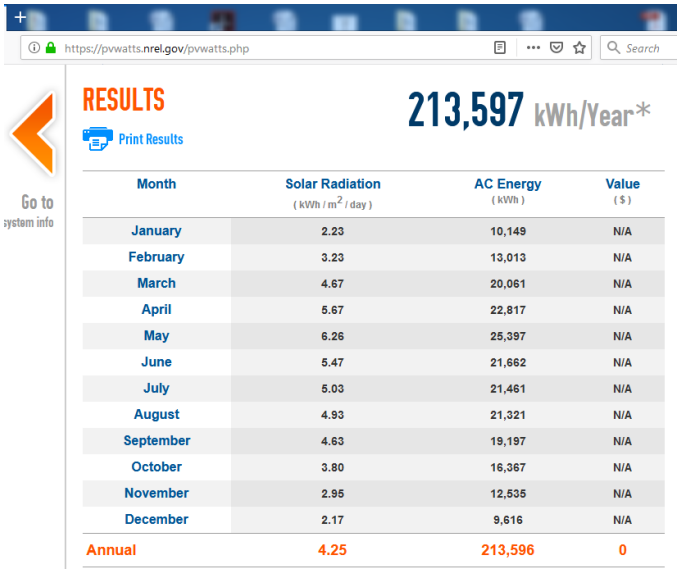


Fig.3 System info of 200KWp solar rooftop plant

The system considered is DC system size 200KW, module type is standard, and array type is Fixed (Roof Mount) with tilt angle 20^0 and Azimuth angle 45^0. The system losses are calculated as 15.85%.

B. Results of 200KWp rooftop solar plant

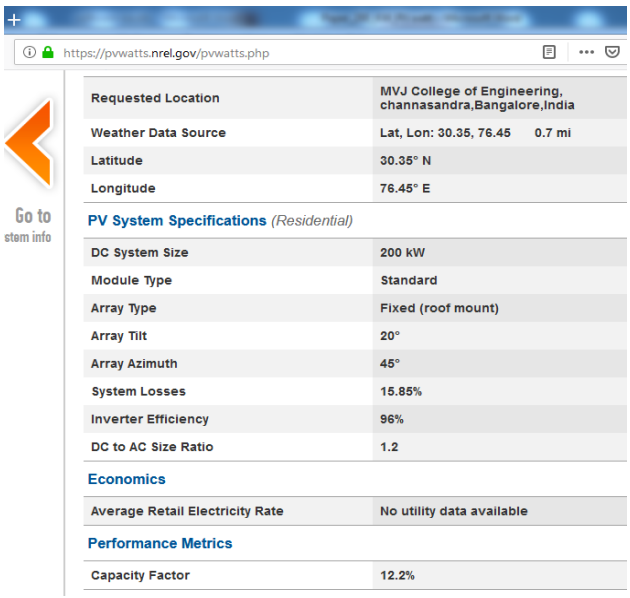
The maximum energy is generated in the month of May is 25397 KWh and minimum energy generated in the month of December is 9616 KWh. The total amount of energy generated from 200KWp plant for the entire year is 213596.8 KWh is shown in Fig.4.



Month	Solar Radiation (kWh / m² / day)	AC Energy (kWh)	Value ($)
January	2.23	10,149	N/A
February	3.23	13,013	N/A
March	4.67	20,061	N/A
April	5.67	22,817	N/A
May	6.26	25,397	N/A
June	5.47	21,662	N/A
July	5.03	21,461	N/A
August	4.93	21,321	N/A
September	4.63	19,197	N/A
October	3.80	16,367	N/A
November	2.95	12,535	N/A
December	2.17	9,616	N/A
Annual	4.25	213,596	0

Fig.4 Simulation results

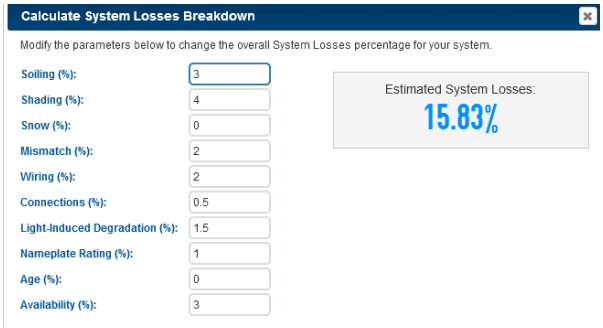
The location and PV system specifications are given in Fig.5



Requested Location	MVJ College of Engineering, channasandra,Bangalore,India
Weather Data Source	Lat, Lon: 30.35, 76.45 0.7 mi
Latitude	30.35° N
Longitude	76.45° E
PV System Specifications *(Residential)*	
DC System Size	200 kW
Module Type	Standard
Array Type	Fixed (roof mount)
Array Tilt	20°
Array Azimuth	45°
System Losses	15.85%
Inverter Efficiency	96%
DC to AC Size Ratio	1.2
Economics	
Average Retail Electricity Rate	No utility data available
Performance Metrics	
Capacity Factor	12.2%

Fig.5. The location and PV system specifications

The system losses breakdown is shown in Fig.6



The Simulated results of DC array output and Inverter output of 200KWp rooftop solar plant are shown in Table 1.

Table 1. Simulated results of DC array output and Inverter output of 200KWp rooftop solar PV plant

Month	Solar radiation KWh/m^2/day	AC output of Inverter(KWh)	DC Output of PV array(KWh)
Jan	2.227464	10149.1	10696.76
Feb	3.228683	13013.5	13651.54
March	4.672992	20060.59	20943.9
April	5.669619	22816.96	23825.38
May	6.264345	25397.31	26498.73
June	5.474364	21662.49	22632.02
July	5.032106	21461.16	22436.88
Aug	4.933654	21320.57	22294.43
Sep	4.627256	19197.21	20071.1
Oct	3.800112	16366.7	17119.42
Nov	2.94652	12535.16	13146.29
Dec	2.172725	9616.02	10148.32
Annual	4.254154	213596.8	223464.8

The solar radiation is 4.25 kWh/m^2/day. The solar energy incident on the solar panels will convert into electrical energy. The capacity factor PV array is 12.2% and system losses are 15.85%. After the inverter losses the available energy obtained at the inverter output is 213596.8 KWh /year and the DC output of array is 223464.8 KWh/year as observed from Table 1.

IV. CONCLUSIONS

The Proposed Simulation analysis of 200KWp solar photovoltaic roof top grid connected power plant at MVJ College of Engineering, Bangalore city is carried out using PV Watts India simulation software. The following conclusions are drawn from the study

.

- The maximum energy is generated in the month of May is 25397 KWh and minimum energy generated in the month of December is 9616 KWh.

- From the simulation, the solar radiation is 4.25 kWh/m^2/day. The solar energy incident on the solar panels will convert into electrical energy. After the inverter losses the available energy obtained at the inverter output is 213596.8 KWh /year and the DC output of array is 223464.8 KWh/year.
- From the simulation, the system losses are 15.85% and the capacity factor is 12.2%.

References

[1] https://eosweb.larc.nasa.gov/sse
[2] Jayanna Kanchikere, K. Kalyan kumar, "Proposal for 1 kW Roof-Top Solar PV Plant", International Research Journal of Engineering and Technology (IRJET), Vol. 4, Issue 7, July 2017
[3] Manu Kumar D. M., Ganesha T., Mallikarjunayya C. Math, "Performance and Evolution of Grid Connected to 5MW Solar Photovoltaic Plant in Shivanasamudra", International Journal of Research in Advent Technology, Vol. 3, No. 1, June 2015
[4]Jayanna Kanchikere, Dr.A.K.Ghosh, Dr. Kalyan Kumar, "Performance And Simulation Analysis Of 80KW Grid Connected Rooftop Solar Power Plant At St.Peter's Engineering College,Hyderabad using PV Watts India" Journal of Applied Science and Computations(JASC), ISSN NO: 0076-5131, Volume 5, Issue 6, PP. 43-56, June-2018
[5] http://www.omansolar.com/grid.htm
[6]Jayanna Kanchikere, Kalyan Kumar, Sudhakumari Jha, " A Review of 100KW rooftop Solar PV Plant", International Journal of Engineering, Technology, Science and Research (IJETSR), ISSN 2394-3386 , Volume 5, Issue 1, PP.221-226, January 2018
[7]Jayanna Kanchikere, Dr.A.K.Ghosh, Dr. Kalyan Kumar, "Analysis of 80KW grid connected rooftop solar power plant using SISIFO" International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)-Scopus Indexed ISSN: 2249-8001, Volume 8, Issue 6, pp. 33-46 , Dec 2018
[8] Jayanna Kanchikere, Dr.A.K.Ghosh, Dr. Kalyan Kumar, "Online Monitoring And Simulation Of 30KW Grid Connected Rooftop Solar Power Plant At St.Peter's International School, Hyderabadusing PV Syst" Internation Journal Of Advance Research And Innovative Ideas In Education (IJARIIE),ISSN(O)-2395-4396, Volume 4, Issue 3, PP. 1890-1906, June 2018
[9] Dr.Jayanna Kanchikere , Kalyan Kumar, Sudhakumari Jha, S.Maneendra "An Analysis of 80KW Grid Connected Rooftop Solar Power Plant at St.Peter's Engineering College", International Journal of Electronics, Electrical and Computational System (IJEECS), ISSN 2348-117X , Volume 7, Issue 4, PP.415-423, April 2018