IJASRM

International Journal of Advanced Scientific Research and Management, Volume 4 Issue 6, June 2019

www.ijasrm.com

ISSN 2455-6378

Designing of a grid connected Solar PV System for Street Light of DMRC Housing Complex (Sarita Vihar, New Delhi) Using PVsyst

Md. Ehsan Alam[1] and Muhammad shahid[2]

[1]Department of Electrical and Electronics Engineering, AFU, Faridabad, Haryana, India

[2]Assistant professor, EEE Department, AFU, Faridabad ,Haryana, India

Abstract

Energy crises have increased exponentially in recent years and it has now become a major problem worldwide. Currently, the electrical energy which is produced by non-renewable sources like coal, oil and another fossil fuel. These resources take millions of years to form, are likely to deplete soon. So, it is necessary to adopt renewable sources which produce energy without losing natural resources. In recent few years the trend of using solar PV cell is increasing day by day to generate electrical power for self-use or gives the power to grid. In this paper a grid connected solar PV system is designed for streetlight of DMRC housing complex, Sarita Vihar, New Delhi using PVsyst. PVsyst is a versatile software, which is used to system design and modeling in the field of solar photovoltaic system. Both stand-alone and grid-connected system can be design using this software.

Keywords- solar cell, solar energy, grid connected, PVsyst, photovoltaic, panel.

1. Introduction

The renewable energy has paying attention throughout the world in the recent times due to the increasing energy demand, increased ecological sustainability concerns, and scarcity and increased prices of fossil fuels. The solar energy is now become the most prominent among all the renewable sources, as it is an endless and cleanest resource of energy and its utilization is also ecologically friendly. The current worldwide energy demands are less than the existing potential of solar energy [1].

There are three basic configurations of the solar system. Off-grid system, on-grid system and interactive network system. Currently, photovoltaic energy is widely used in autonomous power systems in remote villages, particularly in hybrid systems with diesel generators. Its main components are the photovoltaic module, the charge controller, the battery and the inverter. In an on-grid system, the electrical device works with solar energy during the day. Any extra electricity generated by the photovoltaic system is fed into the utility grid [2].

Photovoltaic is a technology that reliably converts solar radiation into electricity. There are different types of modules depending on power ratings. Every module has several Solar cells are fabricated by means of semiconductors such as silicon [3].
The photovoltaic cell is used to convert solar energy into electricity through the photovoltaic effect. A photovoltaic cell consists of a thin layer of silicon doped with phosphorus (type N) on a thicker layer of silicon doped with boron (type P). An electric field is generated on the surface of the cell in which these two layers come into contact. When sunlight reaches the surface of a photovoltaic cell, an electric field is generated that supplies impulse and direction to the excited electrons, which generates a flow of current when the solar panel is connected to an electrical load. The power generated by a photovoltaic cell depends on its surface exposed to sunlight [4].
Solar energy offers environmental benefits, low operating costs, and reduced dependence on

IJASRM

International Journal of Advanced Scientific Research and Management, Volume 4 Issue 6, June 2019

www.ijasrm.com

ISSN 2455-6378

imported fuel thus ensuring energy sustainability [5].

Sometime a MPPT algorithm is also connected to the PV array which allow the PV array to produce maximum power. The unidirectional power is obtained from the PV array, change into ac power with the help of three levels inverter and then this ac power is filter through LC filter and fed it to utility grid [6].

Solar installed capacity of India reached 28.18 GW as of 31 March 2019. The Indian government had an initial target of 20 GW capacity for 2022, which was achieved four years ahead of schedule. In 2015 the target was raised to 100 GW of solar capacity (including 40 GW from rooftop solar) by 2022, targeting an investment of US$100 billion [7], (Gopinath, 2015), (Kenning, 2015).

2. Case Study

In this study a grid-connected solar photovoltaic system is designed to compensate the power consumption by the streetlights of DMRC Housing Complex Sarita Vihar, New Delhi, INDIA.

Table 1. PARAMETER OF THE STREAT LIGHT

NO. OF LIGHTS	130
RATING OF EACH LIGHT	35 W
TOTAL LOAD	4.55kW
OPRATING TIME	12 Hrs.
ENERGY CONSUMPTION /DAY	54.6 kWh
YEARLY CONSUMPTION	19.93 MWh

The working process of this solar PV system will be that the whole generated power during the full day is transmitted to the connected grid while at night, the streetlight will consume power from that grid. Data source for solar radiation of this location is taken from meteonorm7.1 station, which is given below in table number 2.

Table 2. METEO AND INCIDENT ENERGY

Months	**Gl Hor kWh/m ^2**	**Di Hor kWh/m ^2**	**T Amb ºC**	**Wind Velo m/s**
January	118.2	37.3	13.23	1.4
February	137.0	36.1	17.24	1.5
March	188.2	50.1	23.29	1.6
April	206.5	66.7	29.22	1.7
May	222.1	88.3	32.61	1.9
June	196.5	96.7	32.14	1.7
July	166.4	93.0	31.42	1.7
August	159.9	93.2	30.36	1.6
September	170.6	71.6	28.58	1.2
October	164.5	46.8	25.49	0.7
November	128.5	33.6	19.32	0.6
December	115.1	29.8	14.85	0.9
Year	**1973.5**	**743.2**	**24.85**	**1.4**

Gl Hor: Horizontal global irradiation

Di Hor: Horizontal diffuse irradiation

T Amb: Ambient Temperature

Wind Velo: Wind velocity

The required data and equipment parameters to complete the design by PVsyst 6.70 is listed in table below.

Table 3. EQUIPMENT PARAMETER

Load	4.55kW
Tilt angle	28.6
Azimuth angle	0 south facing
PV module rating	310W
PV module Isc	6.05A
PV module Impp	5.67A
PV module Vmpp	54.70v
PV module Voc	64.40v
PV module efficiency	21.13%
Inverter maximum efficiency	97.89%
Inverter size	9kW
Inverter maximum input voltage	950v
Cell in a module	96
PV module area	1.631m^2

3. Design by PVsyst V6.70

PVsyst can provide almost everything needed to design a domestic solar system. Shows the number of the photovoltaic module, the battery, the size of the inverter, the loss factor of the PV module, the energy calculation, the time profile, the PV curve, the maximum power point and also the analysis economic. Depending on where it is located, PVsyst can also track the performance ratio, the normalized energy profile, the loss diagram, etc. Its vast geographic database can provide accurate information on solar radiation and the insolation time of a particular area of a country [2,9].

Providing the correct tilt angle, azimuth angle and other necessary data from Table 3, PVsyst provides the following result shown in Table 4.

IJASRM

International Journal of Advanced Scientific Research and Management, Volume 4 Issue 6, June 2019

www.ijasrm.com

ISSN 2455-6378

Table 4. PVsyst OUTPUT RESULT

Parameter	value
No. of PV modules	34
PV modules in series	17
PV modules in parallel	2 strings
Module area	55.4m^2
Wiring ohmic loss	1.5% at STC
Module quality loss	1.0%
Nominal power at STC	10.54kWp
System production	20.4MWh/year
Normalized production	5.30kWh/kWp/day
Performance ratio	86.5%

Normalized energy production per month, daily input output diagram and system loss diagram generated by PVsyst is shown in fig.1 to fig.3 respectively.

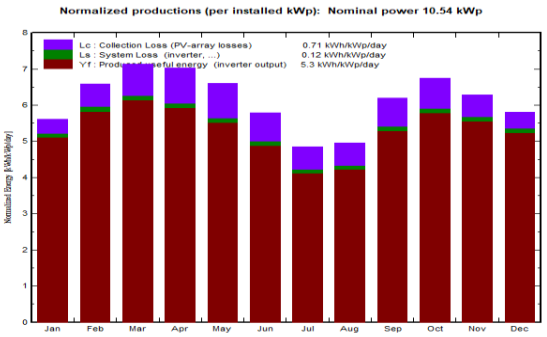
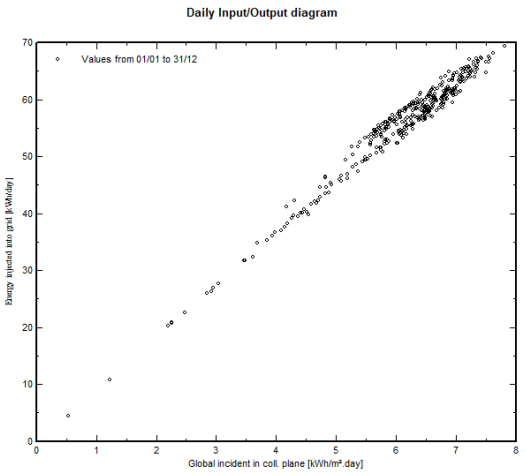


Fig.1. Normalized energy per month



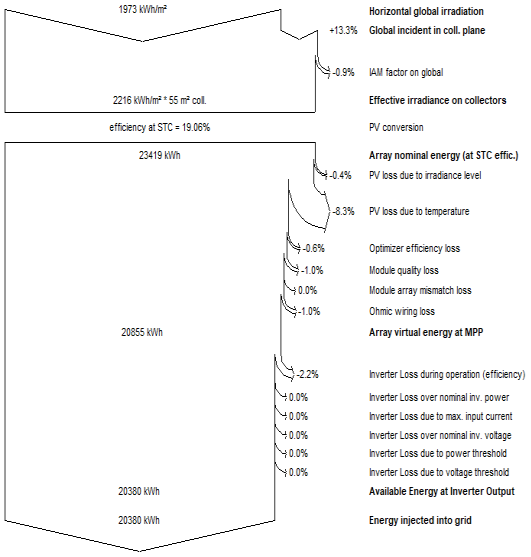


Fig. 3. Loss diagram

4. Conclusions

Solar photovoltaics electrical power system is powered by the sun, provides a reliable, safe, noise-free, emission-free electricity, Friendly to use and does not require refuelling. Also helps to reduce the consumption of fossil fuels in power plants, Pollution and greenhouse gas emissions cause the climate damage. In this paper, design and modelling of a grid connected solar PV system is presented. The working process of this PV system will be that the whole 55.8 kWh generated energy during the day is supplied to the grid. while at night, the complex streetlights will consume power from that grid, and which is approximately 54.6kWh/day. The main advantage of this system is that there is no need to store the generated power. There are a lot of space to make it better in future like economic analysis and implementation on ground.

Acknowledgment

To complete this work, I wish to express sincere gratitude to my supervisor Mr. Mohd. Shahid sir, Department of Electrical and Electronics Engineering, Al-Falah University, Haryana, India for his guidance, inspiration and valuable advice throughout the work.

References

[1] Ali, Farooq, Rehman, Awais, Jamil & Noman, "Design Considerations of Stand-alone Solar Photovoltaic Systems", in International Conference on Computing, Electronic and Electrical Engg. (ICE Cube), Quetta, Pakistan, pp. 1-6, (12-13 Nov. 2018).

[2] Morshed, Ankon, Chowdhury & Rahman, "Designing of a 2kW Stand-alone PV System in Bangladesh Using PVsyst, Homer and SolarMAT", in 3rd International Conference on Green Energy and Technology, Dhaka, Bangladesh, pp. 1-6, (11 Sept.2015).

[3] Ahsan, Javed, Rana & Zeeshan, "Design and cost analysis of 1kW photovoltaic system based on actual performance in Indian scenario", Perspectives in Science, vol. 8, pp. 642-644, (2016).

[4] Niharika & Sudarshan, "Maximum Power Point Tracking Controller for Solar Powered mUAV", in IEEE International Conference on Power, Control, Signals and Instrumentation Engineering, Chennai, India, pp. 1795-1798, (21-22 Sept. 2017).

[5] Singh & Tiwari, "Optimization of a Smart Grid Distributed Generation: Designing of a Hybrid Solar System for a Building", in 1st International Conference on Electronics, Materials Engineering and Nanotechnology, Kolkata, India, pp. 1-6, (28-29 April 2017).

[6] Israr & Pandey, "Modeling and Control of Utility Grid Connected Solar Photovoltaic Array Integrated System Using MATLAB", in International Conference on Computation of Power, Energy Information and Communication, Melmaruvathur, India, pp. 500-505, (22-23 March 2017).

[7] Chandra, Singh, kannojiya & Kesari, "Solar Energy a Path to India's Prosperity", Journal of The Institute of Engineers India, Series C, pp. 1-8, (2018).