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Simulation study on installation of Solar Photovoltaic panels on roof top of Vagdevi Junior College, Newtown, Mahabubnagar by using Helioscope web-based software

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Abstract - *This paper illustrates about the importance of helioscope software which is basically a web-oriented cloud computing based software application. By using this software, one can analyze the pattern of solar irradiation; assessing the number of solar panels that can be installed in series or parallel configuration, how much energy could be generated and more importantly how much quantity of energy is being wasted in the form of losses. There are many options in this software like checking wiring connections, checking panel name plate details and their ratings, analyzing the battery specifications and also one can test the real time shading effects also. A case study has been conducted on installation of solar panels on roof top of vagdevi junior college, Mahabubnagar and presented in this paper.*

Key Words: Helioscope, solar panel, Vagdevi Junior college.

1. INTRODUCTION

This paper explained about the installation of Roof top based photovoltaic (PV) systems which are very commodious for installation in commercial buildings and also for installations in residential areas so that one can save huge ground area space. There are many types of software available [1-10] in order to analyze the solar PV installations, but helioscope has some special features like embedding the googlemap locations directly and anyone can study the dimensions of PV arrays which are to be installed. It is user-friendly software. Helioscope software shows exactly the location where the panels to be installed. Visualization of installation area of solar PV panels becomes very clear and feasible. This software application also yields us the simulation reports of the various parameters like performance ratio, energy rendered and statistical based data pertaining to the solar radiation both day wise or monthly wise depending on the user requirement.

2. HELIOSCOPE SOFTWARE

While using this web-based software application, the following steps need to be considered.

- An account should be created and login is required. After login, the software asks for creating a new project.
- After creating new project, we should specify the location where we are interested to install the solar PV array. The location name need to be specified in software and location name is given as Vagdevi Junior college, Mahabubnagar, Telangana, India in this context. The simulation case study has been performed for this location area respectively.

Fig -1: Location of Vagdevi Junior college, Mahabubnagar traced by helioscope software

- The software asks for the building area in order to install PV panels. After selecting the required area, the software shows the layout as shown in Fig. 2.
- The specialty of this software is that, after mentioning the name of location, the software clearly shows the Google-map based satellite location. The Fig. 2 clearly depicts the arrangement of solar PV panels on the top of the Institution. The software itself counts the number of PV panels

required for the given space area. In this case study, it suggested '7' panels for installation.

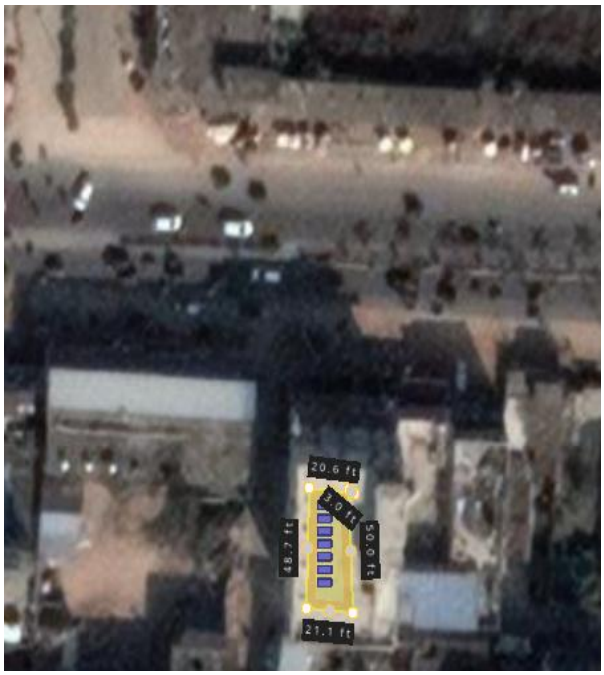

Fig -2: Solar PV panels area selected on top of Vagdevi junior college building shown by helioscope

- There are few steps to be implemented in this software for the purpose of installation. Firstly, it is required to design the Mechanical field segments. It tells about how many panels are necessary to install.

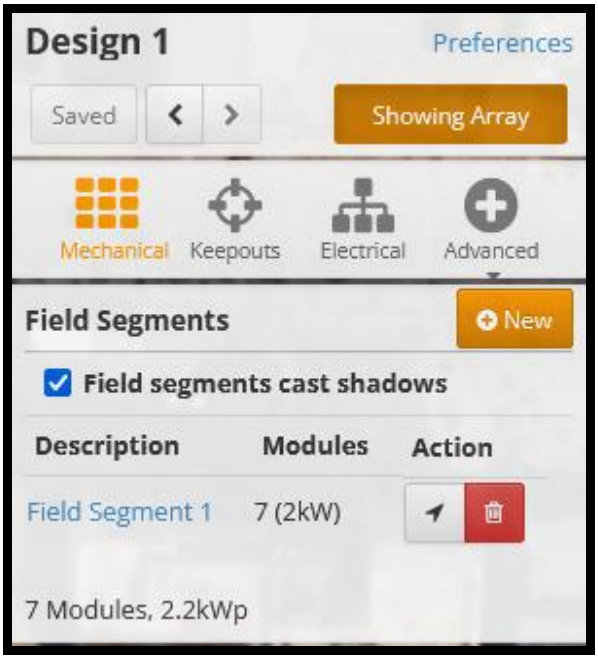

Fig -3: Solar PV design specifications

- Secondly, electrical based connections to be specified by selecting the type of PV panel needs to be installed. We need to check the manufacturing company name of PV panel and the type of inverter used for DC to AC conversion.
- The software has also many options like; we can check the tilting angle of PV panels. It specified tilting angle of panels as '10' in this particular simulation study.
- The wiring connections and name plate details of inverter also been represented by software which is shown below in Fig. 4.

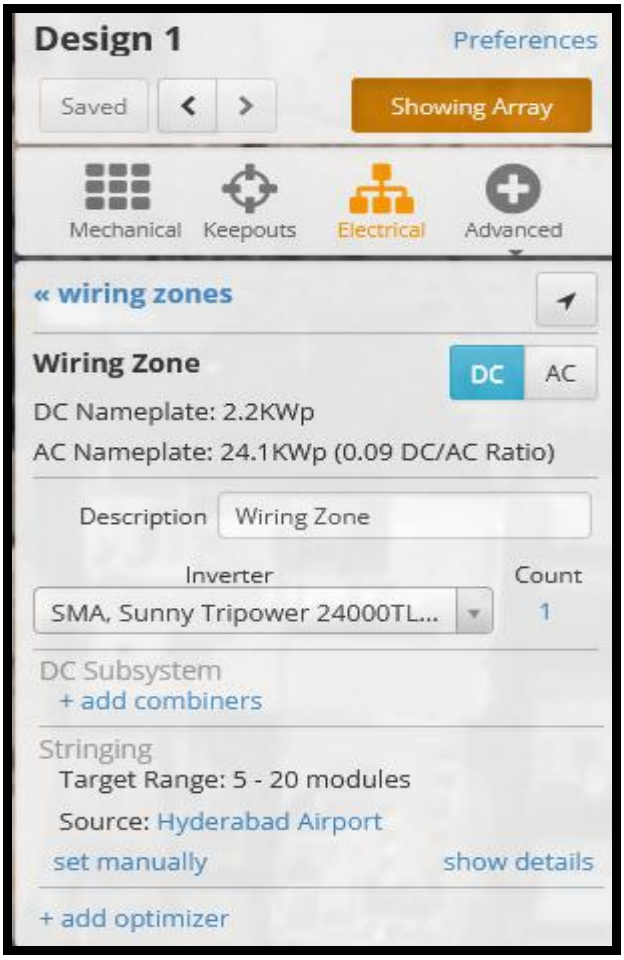

Fig. 4 Wiring and Inverter specifications

3. SIMULATION RESULTS:

The simulation has been carried out by the software. The various simulation output reports have been represented in this paper. The results basically illustrates about the performance ratio parameter, the rating of the PV panels and inverter, annual production (in kWh) energy by the panels, weather conditions and many more.

These results are shown in figures given below respectively:

Design	Design 1
Module DC Nameplate	2.24 kW
Inverter AC Nameplate	24.1 kW Load Ratio: 0.09
Annual Production	3.639 MWh
Performance Ratio	79.0%
kWh/kWp	1,624.6
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	65abda0128-d0531e05fa-88d9e374c3-10904ea752

Fig. 5 Simulation reports of panel and inverter

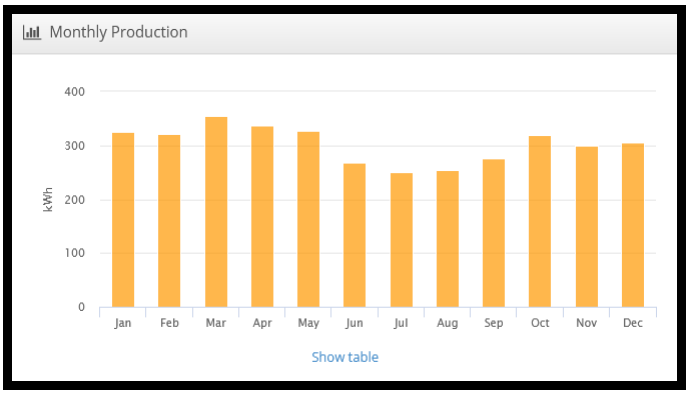

Fig. 6 Monthly energy production

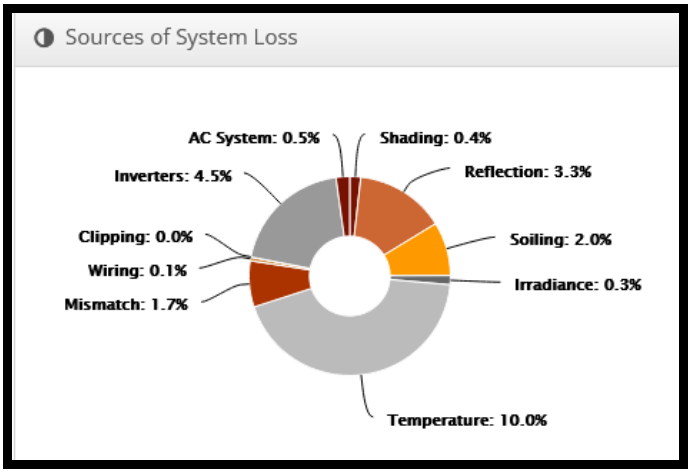

Fig. 7 Sankey diagram depicting losses

Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,976.5	
	POA Irradiance	2,056.4	4.0%
	Shaded Irradiance	2,048.1	-0.4%
	Irradiance after Reflection	1,980.5	-3.3%
	Irradiance after Soiling	1,940.8	-2.0%
	Total Collector Irradiance	**1,940.9**	**0.0%**
Energy (kWh)	Nameplate	4,349.2	
	Output at Irradiance Levels	4,334.5	-0.3%
	Output at Cell Temperature Derate	3,902.5	-10.0%
	Output After Mismatch	3,835.6	-1.7%
	Optimal DC Output	3,830.3	-0.1%
	Constrained DC Output	3,830.2	0.0%
	Inverter Output	3,657.3	-4.5%
	Energy to Grid	**3,639.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		29.5 °C
	Avg. Operating Cell Temp		40.9 °C
Simulation Metrics			
	Operating Hours		4625
	Solved Hours		4625

Fig. 8 Energy generation details

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	5-20	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	10°	180°	2.0 ft	1x1	7	7	2.24 kW

Fig. 9 Wiring and field segment details

4. CONCLUSIONS

This simulation work is carried out mainly in order to check the feasibility of installing the solar PV panels on roof top area of vagdevi junior college. The installing of PV array analysis has been attained with the help of helioscope which is web-technology related application and user-friendly software. This paper explained regarding the process of PV panel configuration design in detailed version. The conclusions pertaining to the kWh energy afforded, performance ratio parametric quantity and the energy actually being estimated.

REFERENCES

[1] Anshul Chouhan, Dr. Rajeev Arya and Dr. Nilesh Diwakar, "Performance evaluation of a 21 kW Solar Power Plant in Central India & Analysis by using BlueSol PV & Helioscope Software program", International Journal of Engineering development and research (IJEDR), Vol-7, issue – 4, 2019.

[2] D J Damiri, S Legino and S Amboro, "Engineering design development of 52.5 KiloWatt peak solar photovoltaic system for industrial Rooftop building", Journal of Physics: Conference Series, 1402 (2019).

[3] Najibhamisu Umar, Birinchi Bora, Chandan Banerjee and B. S. Panwar, "Comparison of different PV power simulation softwares: case study on performance analysis of 1 MW grid-connected PV solar power plant", International Journal of Engineering Science Invention (IJESI), Volume-7, Issue-7, Ver II, PP 11-24, July 2018

[4] B.Kailash Krishna Prasad, K. Prahlada Reddy, K.Rajesh and P.Viswanath Reddy, "Design and simulation analysis of 12.4 kWp Grid connected Photovoltaic system by using PVSYST Software", International Journal of Recent Technology and Engineering (IJRTE), ISSN:2277-3878, Volume-8, Issue-5, January 2020.

[5] Vikas Sharma and Anand Mohan, "Planning, structure and preparation of cost effective sun oriented vitality based electrical power framework system at Alakh Prakash Goyal shimla university, Himachal Pradesh", International Journal of Recent Technology and engineering (IJRTE) vol. 8,issue -2, July 2019, pp. 2643-2649.

[6] C. P. Kandasamy, P. Prabu and K. Niruba, "Solar potential assessment using PVSYST software", International Conference on Green Computing, Communication and Conservation of Energy (ICGCE) 2013, pp. 667-672.

[7] Nallapaneni Manoj Kumar, M. Rohit Kumar, P. Ruth Rejoice and Mobi Mathew, "Performance analysis of 100kWp grid connected Si-poly grid connected photovoltaic system using PVsyst Simulation tool", Energy Procedia 117 (2017), pp. 180-189.

[8] P. Karki, B. Adhikary and K. Sherpa, "Comparative study of grid-tied photovoltaic (PV) system in Kathmandu and Berlin using PVsyst", Proceedings of IEEE Third International Conference on Sustainable Energy Technologies (ICSET), Kathmandu; 2012. p. 196-199.

[9] Rachit Srivastava and Vinod Kumar Giri, "Design of grid connected PV system using Pvsyst", African Journal of Basic & Applied Sciences, 2017, 9(2), pp. 92-96.

[10] Surabhi Sharma, Ciji Pearl Kurian and Lakshmanrao S Paragond, "Solar PV system design using PVsyst: A case study of an academic institute", International Conference on Control, Power, Communication and Computing Technologies (ICCPCCT), 2018, pp.123-128.

BIOGRAPHIES

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