ANALYSIS OF VARIOUS FACTORS AFFECTING THE RELIABLE WORKING OF ONE MEGA WATT SOLAR SYSTEM

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ABSTRACT:

The main objective of this project is to simulate, analyze and compare the performance impact of various factors on efficient and reliable working of Solar system module with the real time module present in solar grid at N.P.Kunta. The output efficiency of any solar system is effected /reduced by various factors like module quality-LID (Light induced degradation)-mismatch ohmic losses, soiling losses, IAM (Incident angle modifier), ageing, Inverter efficiency. The project began with a board data base of meteorological data including global daily horizontal solar at NTPC-TATA-100MW grid connected solar Photo Voltaic power plant established at N.P.Kunta, Anantapur. Using PV System software(6.4.6) is taken for analysis. One mega watt unit at N.P.Kunta in real time is taken for analyze and comparison with the simulation. The effect of various losses on percentage efficiency and generation (Mwh/yr) of power per whole year is analyzed. In addition losses, soiling loss, IAM (Incident angle modifier), ageing , inverter efficiency. Day to day outputs of real time solar system using MATLAB\Simulink the same exiting real time solar system module of One Mega watt is defined the theoretical power generation of MATLAB simulated system compared with real time solar power plant generation. This experiment is carried for 7 days atmospheric conditions. By comparing the result in MATLAB the efficiency of theoretical is almost same compared to the grid analysis.

Keywords: Photovoltaic array, MATLAB /Simulink, PV System

1. INTRODUCTION: Interlinking of Photo voltaic (PV) power to grid one of the major interests. Design, study and analysis of key components in a PV power system staring from generation of power to interlinking to main grid are very crucial, this paper defines to find out percentages of efficiency and various loss factors with respect to changes on environmental parameter of temperature and irradiance solar PV system efficiency. Loss factors defining in PV system software, MATLAB/Simulink model has been verified based the manufacture data of the 252Wp solar PV panel. And compared the exiting real time solar system module of One Mega watt. Also the performance of the module under irradiance and temperature are analyzed. Model evaluation is presented using a TS252MBZ.

Factors Should be Consider While Designing the System

1. The efficient sunshine hours in the location.
2. The proportion of the rainy/cloudy days in the location.
3. How many rainy-cloud days for the system to work normally.
4. The Installation location should be wide, and make sure that there is no high building or other things to over the solar panel and the sunshine.

II.SITE AND TECHNICAL DETAILS OF REAL TIME SYSTEM

A.SITE LOCATION [NTPC-TATA-100MW]

The power grid 100MW solar power plant is a ground mounted and is located at N.P.Kunta Village, Anantapur (Di), Andhra Pradesh at a latitude of 78.41190E longitude of 14.05580N and at an altitude of 1426m. The site is selected based on its merit for producing maximum output throughout the year, availability of ground water for cleaning of panel proximity to grid for evacuating the power.

B.PLANT LAYOUT FOR ONE MEGA WATT:

The One Mega watt limit of the plant is spread more than 7 sections of land of land. Each exhibit has 8 string combiner boxes. Each combiner string box has 22 strings has associated with it in parallel . Each string has 24 PV modules associated in arrangement. In this manner each cluster has 164 strings with an aggregate number of 3936 PV modules of limit of 252Wp each. The clusters are associated independently to one MW inverter. The yield of every inverter is associated with 0.380/33KV stage up transformer. The power created from this plant is emptied to a closest 33KV lattice substation situated around one Km (feeder) from the plant. The plant takes energy for its interior utilization, for lighting and support exercises, through helper transformer from its own age amid the day time and from lattice amid evening. Ethernet is associated for recording net energy imported to the network for charging.

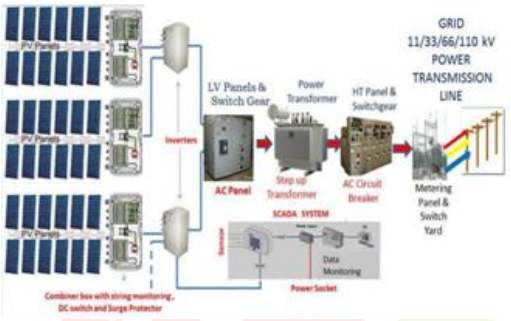

Fig 1: Schematic diagram of PV grid connected plant

C. SOLAR PV TECHNOLOGY

Solar PV technology changes over sun normal energy to valuable electrical energy. PV modules are made of Poly Crystalline/Mono Crystalline solar cells associated in arrangement and parallel modes. Sort of solar board utilized as a part of this venture is Poly crystalline. Poly Crystalline boards are most productive sort of solar boards but on the other hand are the more affordable. Their execution, to some degree is better in low light conditions over all proficiency by and large is around 18% justified of this write boards around 20-25 years. Solar board determinations are Poly TS252MBZ Wp 60 cells with Voc-37.6v; Isc-8.92A working module temperature different from 15 to 45 Degree centigrade with a tilt edge of module 3Degree (summer) 27 degree winter. Measurements of single module (mm) are 1670(L)*1000(w)*4(T) mm add up to territory of single board is 6573mm.

D.INVERTER

GEC (Grid Export Condition) inverters are used here for suppressing the harmonic produced after DC to AC conversion. In an inverter room one PVS800-57-1000KW are installed. The PVS800-57 is a central inverter for inverting, adjusting and conveying power generated by the solar module to the electrical power grid. The efficiency of inverter is 98.8%.

The same specifications mentioned above are taken for modeling in MATLAB.

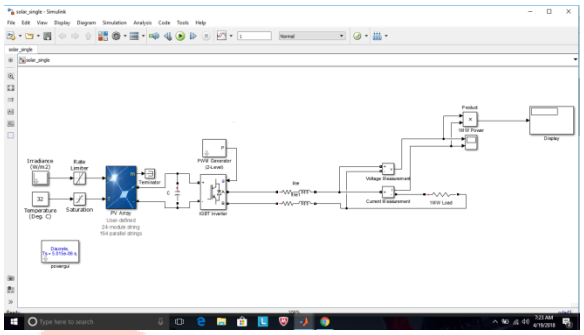

Fig: 2 Simulation diagram in MATLAB

III.RESULT AND DISCUSSION

The work is partitioned into two sections

1.First to consider and examine then information gathered for the year 2017 at N.P.Kunta Solar power lattice (PV Syst).

2.Second demonstrating of a solar framework through Simulink with an indistinguishable particulars from ongoing framework at N.P.Kunta for One Mega watt and contrasting the productivity for various atmospheric conditions. Here 7 days are considered with the conditions arranged.

PART: 1

The total system performance and efficiency of each system of plant are evaluated by entering the specification of a particular design. Design the system according to the specifications of all components.

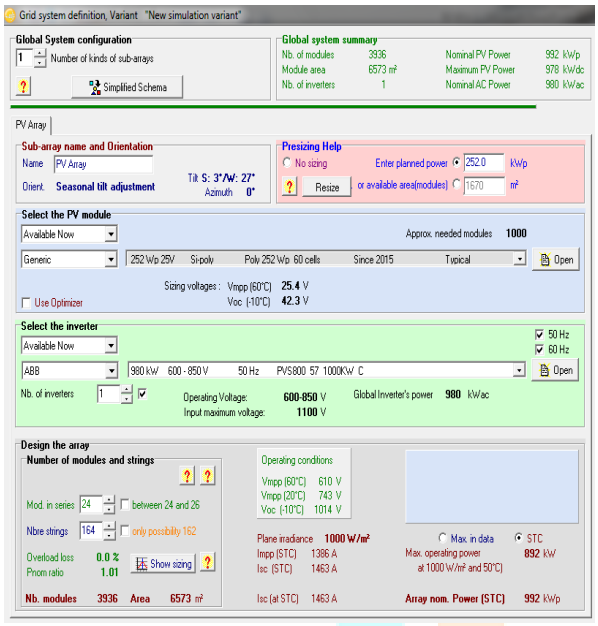

Fig:3 Solar design(Solar module, inverter, array design)

Mainly PV system depends on analysis of various loss factors and percentage efficiency loss during given period with respect to irradiance for the size of module taken. Taking into account irradiance conditions (orientation, site location, metrological conditions).

Those factors are

i.PV array loss factors

ii.Inverter losses

Loss diagram over the whole 2017 year for One Mega watt

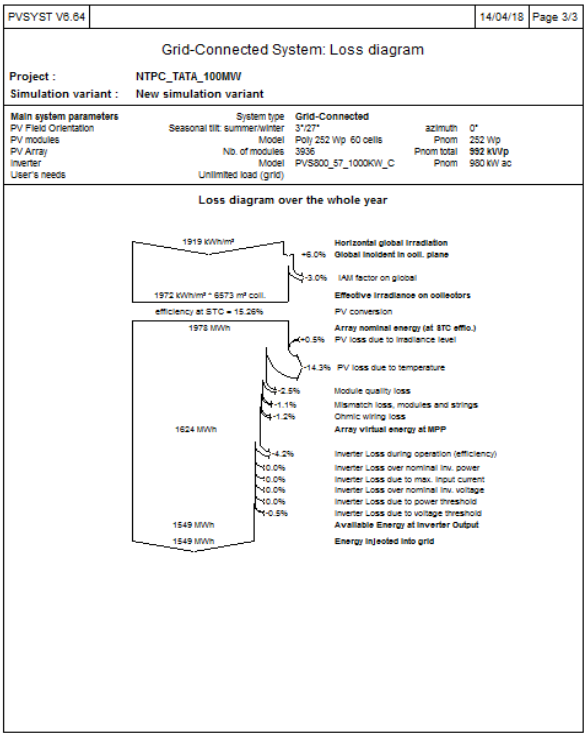

Fig: 4 Loss diagram of 2017 for One Mega watt

Solar system is effected/reduced by various factors module quality – LID (Light induced degradation) – mismatch, ohmic losses, IAM (Incident angle modifier), ageing, inverter efficiency. Most of the loss effects due to the irradiance. Loss percentage is 1919Mwh/yr. Produced energy is 1549Mwh/yr with performance ratio (PR) 76.81% during the year 2017 for One Mega watt. Using Simulink the same exiting real time solar system module of One Mega watt at N.P.Kunta in the year 2017 is defined for 7 days with different atmospheric conditions and comparing with the grid analysis.

TABLE:1

Comparison of simulated output power to the real time grid output power.

DATE	T(oC)	I(W/m2)	L(Wp)	Grid(Wp)
22.9.17	30	190	520	513
3.10.17	36	277	510	496
4.10.17	29	140	516	503
14.10.17	28	277	548	531
30.11.17	25	184	556	534
1.12.18	25	140	534	521
22.1.18	32	216	520	511

T(oC)-Temperature in Centigrade.

I(W/m2)-Irradiance in Watt per meter sq.

L(Wp)-Simulation of load power in MATLAB

Grid(Wp)-Real time grid output power.

- By comparing the result in MATLAB the theoretical power is almost equal to the grid power.
- If the irradiance of the module increases, the conversion efficiency will be increases.
- The difference between the MATLAB simulated output is depends on irradiance.

IV.CONCLUSION

In One Mega watt solar power plant we observed real time efficiency reaches to the maximum value because of proper cleaning of panels, reducing the copper losses by placing the inverters and transformers nearer to the solar panels, there is no shading effects on the panels. Also module matching is doing properly (tilting of panels). With the above maintenance \factors the losses effect is minute on the output power. So, the efficiency of the grid is depends majorly on irradiance.

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