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Analysis of Various Factors Effecting 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

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I. 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 capacity of the plant is spread over 7 acres of land. Each array has 8 string combiner boxes. Each combiner string box has 22 strings has connected to it in parallel . Each string has 24 PV

modules connected in series. Thus each array has 164 strings with a total number of 3936 PV modules of capacity of 252Wp each. The arrays are connected separately to one MW inverter. The output of each inverter is connected to 0.380/33KV step up transformer. The power generated from this plant is evacuated to a nearest 33KV grid substation located about one Km (feeder) from the plant. The plant takes energy for its internal consumption, for lighting and maintenance activities, through auxiliary transformer from its own generation during the day time and from grid during night time. Ethernet is connected for recording net energy imported to the grid for billing.

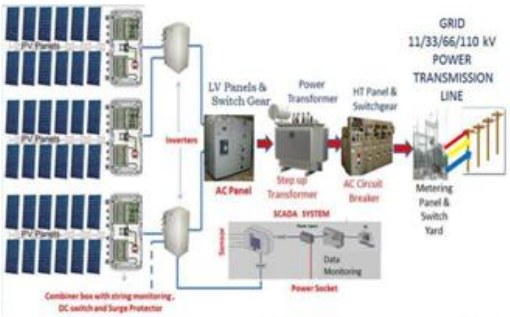

Fig 1: Schematic diagram of PV grid connected plant

C. SOLAR PV TECHNOLOGY

Solar PV technology converts sun natural energy to useful electrical energy. PV modules are made of Poly Crystalline/Mono Crystalline solar cells connected in series and parallel modes. Type of solar panel used in this project is Poly crystalline. Poly Crystalline panels are most efficient type of solar panels but are also the less expensive. Their performance, somewhat is better in low light conditions over all efficiency on average is about 18% warranted of this type panels about 20-25 years. Solar panel specifications are Poly TS252MBZ Wp 60 cells with Voc-37.6v; Isc-8.92A operating module temperature various from 15 to 45 Degree centigrade with a tilt angle of module 3Degree (summer) 27 degree winter. Dimensions of single module (mm) are 1670(L)*1000(w)*4(T) mm total area of single panel 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.

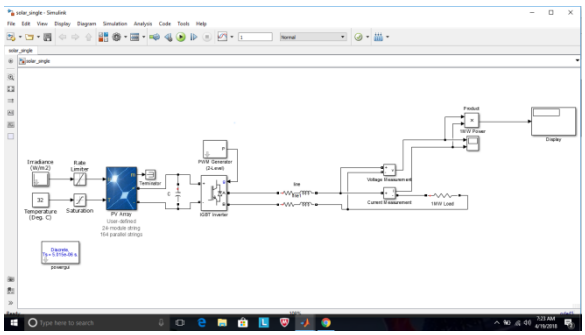

Fig: 2 Simulation diagram in MATLAB

III. RESULT AND DISCUSSION

The work is divided into two parts

1.First to study and analyse then data collected for the year 2017 at N.P.Kunta Solar power grid (PV Syst).

2.Second modelling of a solar system through Simulink with the same specifications as real time system at N.P.Kunta for One Mega watt and comparing the efficiency for different atmospheric conditions. Here 7 days are considered with the conditions tabulated.

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.

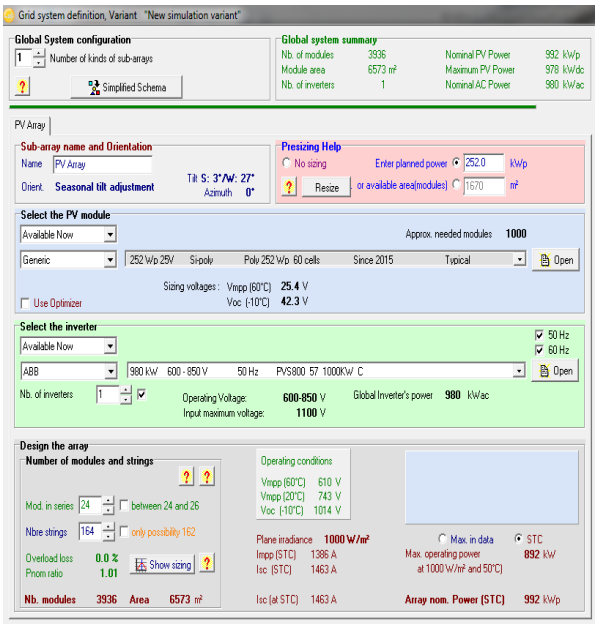

Fig:3 Solar design(Solar module, inverter, array design)

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

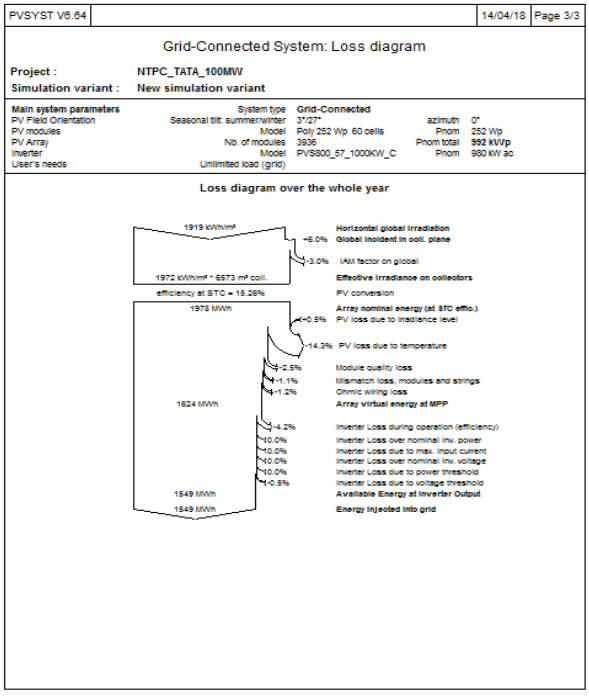

Fig: 4 Loss diagram of 2017 for One Mega watt

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	513	494
3.10.17	36	277	506	498
4.10.17	29	140	503	487
14.10.17	28	277	540	520
30.11.17	25	184	534	510
1.12.18	25	140	521	505
22.1.18	32	216	511	498

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 temperature of the module decreases,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 almost same to the output power. So, the efficiency of the grid is depends majorly on irradiance.

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