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Design of Renewable Power Plant Using Matlab

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***Abstract*: -- Design and the simulation of a photovoltaic power generation system are using MATLAB and Simulink software. The power plant is composed of photovoltaic panels connected in series and parallel strings, a DC-DC converter and a three-phase inverter which connects to a 0.4 kV three-phase low voltage grid and a 20 KV medium voltage grid by means of a step-up transformer. The DC-DC boost converter uses an MPPT controller and the inverter uses a control method using SPWM.MATLAB is used to investigate the I-V and P-V characteristics of solar photovoltaic cell considering the effect of temperature, solar radiation, ideality factor, series resistance and shunt resistance of the solar cell, number of cells in PV array and reverse saturation current.**

I. INTRODUCTION

The production of electrical energy without polluting actions and on the environment and depletion of its resources is a very topical problem. The solar energy radiation, considered relative to the life on Earth, seems to be inexhaustible. The photovoltaic solar energy relies on the direct generation of electricity by means of silicon cells. Under favorable climate conditions, when shining, the sun provides a power of 1 kW/m2. The photovoltaic panels allow for direct conversion in electricity of 10…15% from the above mentioned energy [1] The efficiency of PV system is a permanent concern . [2] The irradiance energy of the sun to electrical energy can be converted through photovoltaic (PV) power generation systems. If the power generation system does not include batteries to store the DC energy, instead including a common capacitor between the DC-DC and DC-AC converters to store the energy on the side of DC-Link, then a fully non-polluting source is obtained [3] To get an optimization of the power supplied to the network, depending on the irradiance intensity of the sun, it is preferred to select a configuration in which the photo-voltaic power generation system uses an efficient controller such as Maximum Power Point Tracking .

II. LITERATURE SURVEY

[1]I. H. Altas1,* and A.M. Sharaf2 - In this paper, the model given satisfy the DC load as well as AC load with the help of photovoltaic array in different solar irradiations and temperatures. Observing the cell voltage and photovoltaic current at different temperature and irradiation conditions.

[2] J. Ahmad,F.Spertino, A.Ciocia and P.DiLeo- In this paper overcoming some major problems in the Perturb and Observe method of MPPT like oscillations near maximum power point and tracking spped of maximum point. Also suggests, to adjusting the value of perturbation for various conditions of maximum power point.

[3] Dezso Sera, Member,IEEE Laszlo Mathe, Member, Tamas Kerekes, Member- This paper shows the research on Perturb & Observe and Incemental Conductance comparatively. The two methods are thoroughly analyzed both from a mathematical and practical implementation point of view. The results are observed at static and dynamic conditions which shows difference of 0.2% in satic and 0.12% in dynamic conditions

[4] Ioan Viorel BANU,Răzvan BENIUGĂ,Marcel ISTRATE- This paper gives controlling on maximum power point tracking techniques. Here perturb and Observe and Incremental Conductance techniques are compared and improves the perfoemance of both by modification in duty cycle. For higher duty cycle INC method gives better control than P&O. Also seems that P&O technique does not follow faster variation according to variations in temperature and irradiance.

[5] Kancherla. Harini 1, Syama.S2- Author suggesting constant voltage tracking (CVT) technique in Perturb & Observe and Incremental Conductance methods to obtain maximum power point. In CVT method initially voltage makes high and then decreasing slowly upto maximum power point. Concluding that INC technique gives 2% more efficiency than P&O. Also try to increasing the efficiency of solar exceeding 15%.

III. PROBLEM DEFINITION

The low efficiency and high capital cost is major problem in the solar systems. Low efficiency is due to variation in temperature and irradiance of solar. Due to variable irradiance the output power is also variable which is not required. So, by using proper MPPT technique output and efficiency can be increased.

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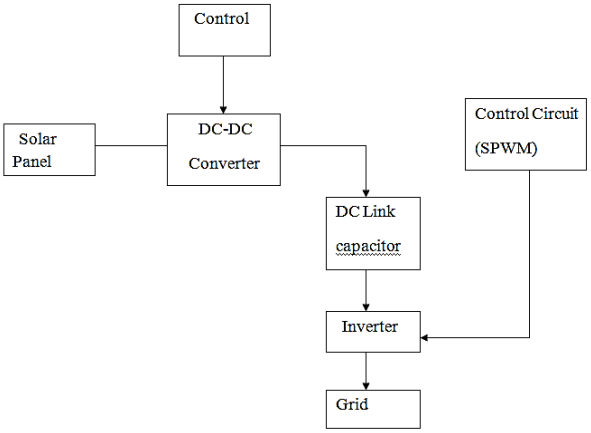
IV. PROPOSED PROJECT SCHEME / METHODOLOGY:-

Proposed system consist of designing of photovoltaic plant with MPPT in matalab simpower system environment.



1.Design of photovoltaic system.
2. Implement MPPT
3. Design of DC-DC converter.
4. Ouput of DC DC converter fed to dc link capacitor and inverter
5. implement system connected grid.
6.Study the P&O and INC techniques.
7.Simulation is done in MATLAB software.

V. DESIGN OF THE PV POWER GENERATION SYSTEM

The electric power supplying by using a PV equipment is made according to the requirement imposed by the electric energy provider who operates at the PV side.
The design of PV Power generation system is composed of following equipment.
1) A PV array of PV Panel grouped in series and/ or parallel string such as to obtained a maximum power.
2) A DC-DC boost converter used as a load regulator and to convert the output voltage of the PV array to a suitable voltage for the inverter.
3) A three –phase DC-AC converter (i.e. inverter) to export the electric energy to the three – phase grid.
4) The PV Power generation system controller, which contains MPPT controller for the DC-DC boost converter & the inverter controller.
The MPPT controller is used to control the duty cycle in order to maintained the operating point as close as possible to the maximum power point of the PV array. The maximum power point is located at the intersection between the voltage-current characteristic curve of the PV array & the equivalent load characteristic.

VI. CONCLUSION

The simulation of the design PV generation system by using Simulink made possible the testing & observation of its stability & efficiency. The PV generation system behaves well in different condition of solar radiance and temperature of PV panel, preserving its stability and succeeding in extracting the maximum power from the PV panels owing to the control algorithm MPPT. The PV generation system is also providing a voltage characterized by a very good quality, the total harmonic distortion in the panels has low value. These conclusion can be deduced based on the obtained the data and waveforms. We conclude that PV generation system was designed properly.

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