ANALYSIS OF GRID CONNECTED PV SYSTEM WITH INCREMENTAL CONDUCTOR

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***Abstract*—** The Renewable energy resources are widely used due to rapid consumption of fossil fuel and it is leading the world towards energy crisis. To meets the electricity load demands introduction of renewable energy is in generation of electrical power can serve as a great help for the future generation. In the recent years solar energy has one of the safest and pollution less renewable energy resource.[1] The proposed system is also generate the power by using solar energy. In the proposed system we design a P.V module which takes solar energy as input and generate the electrical at its output end. By using MPPT algorithm which is Incremental Conductance Method we get 100kw power from PV module. and also step up the voltage level with help of DC-DC Boost Converter. This boost voltage is further applied to Three Phase Inverter to converts power DC to AC. At the inverter output terminal we get three phase power supply which connected to Grid. Matlab/Simulink used for design the proposed system.

Keywords - Solar Energy , IC-MPPT , Boost -Converter, Matlab, Simulink software.

I. INTRODUCTION

Fossil fuel is not only leading to their rapid depletion but also has adverse impact on environment. This fuel also effect the environment (Growing population) and not sufficient for industrial development which are increased the energy demand to a massive scale. This has lead to insufficiency of resources to meet the global need and also responsible for hike in price range of fossil fuel.[2] Solar renewable resources has proven to be the most effective and promising resource for improving economic activities, generation of electricity and also in controlling emission. Solar energy is easily available as and present at every corner of world and is the most clean and efficient energy resource. It's the ability which can fulfill the electricity demand globally and also maintaining the balance in nature. The solar energy is the most developing area of research field. [4]The researcher are dedicated to discover new techniques which is helping in who to used Renewable energy resources in better manner to achieved maximum output for it future. The main source of this system is solar radiation and it will differ on time but by using MPPT the variation of solar radiation differ but our aim to gives main power by the help incremental conductance with mppt in our system with was connected further in grid for constant demand maintain by control scheme in the grid controlling.

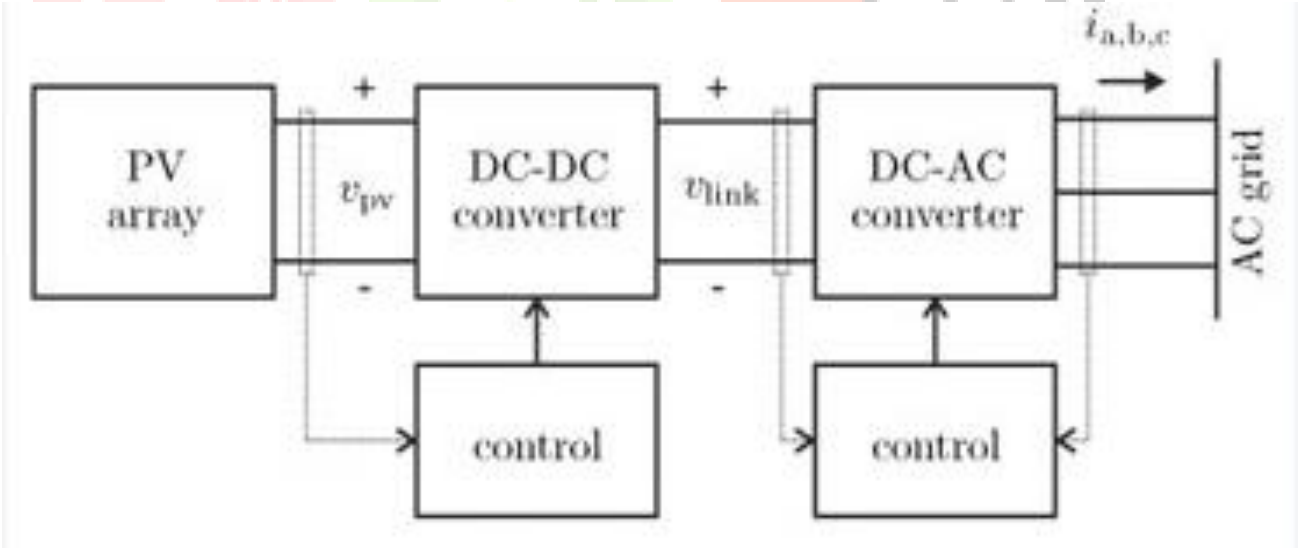


Figure 1 Proposed PV System

In the proposed system we design a PV array which generates electrical power by use the solar irradiation. This generated voltage is too applied for Dc-Dc of the Boost-converter which increases to the voltage and maximum power tracked by [IC] Incremental conductance algo. This algorithm use to generated cycle duty for the boost converter switch to attain the maximum power for PV array. [6-10]The MPPT algorithm used PV array generated the voltage and the current and generate a duty cycle of the converter is switch to archive the step-up voltage. To supply this generated voltage in to grid required an Inverter which was used change to the DC power to the AC power. SPWM (Sinusoidal Pulse Width Modulation) methods were to use the control and switching in the proposed inverter. [3]And also a grid side controller is used to connect this system to grid.

II. SYSTEM DESIGN AND SIMULATION

A. PV System

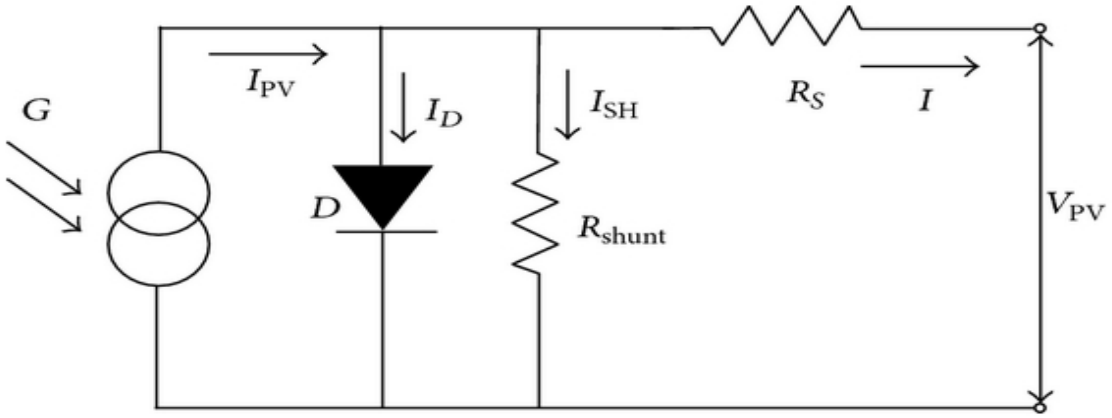


Figure 2. Ckt Diagram of Photovoltaic Cell

The figure 2 show the circuit diagram of the Photovoltaic cell. The input of this system is solar irradiation and output is Electrical energy.

The represented of the PV system by mathematical model equation-1

$$I_{pv} = I_{gc} - I_o\left[exp^{\frac{eV_d}{KFT_c}}\right] - \frac{V_d}{R_p} \quad (1)$$

Where, I_{gc} light generating c/n, I_0 -Saturation current, e-electric charge (1.6×10^{-19} coulombs), K Boltzmann's constant (1.38×10^{-23} J/K), F-Cell idealizing factor, T_C-Absolute Temperature, Vd -Diode voltage, Rp Parallel Resistance.

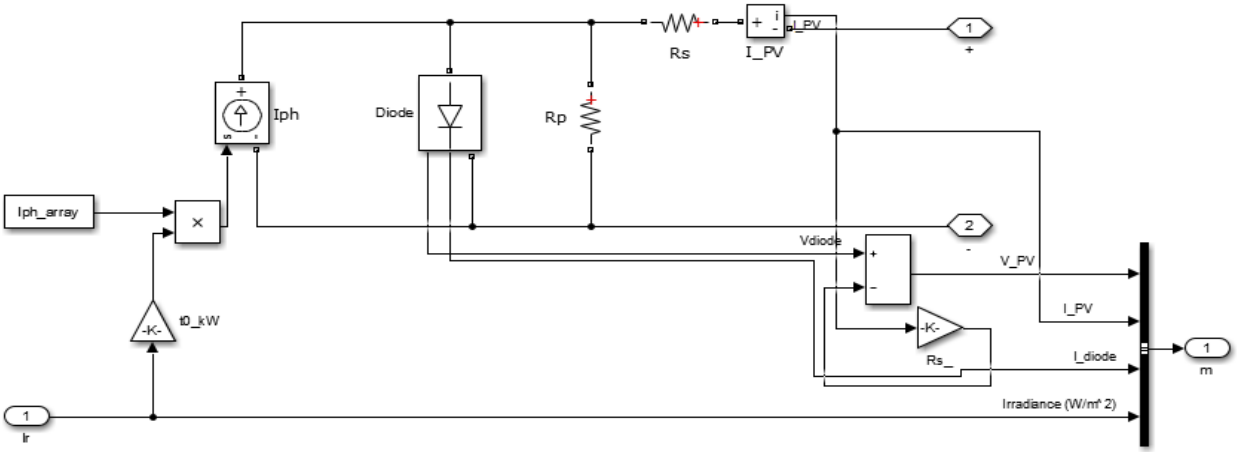


Figure 3. Simulink diagram of PV array

B. IC-MPPT and Boost Converter

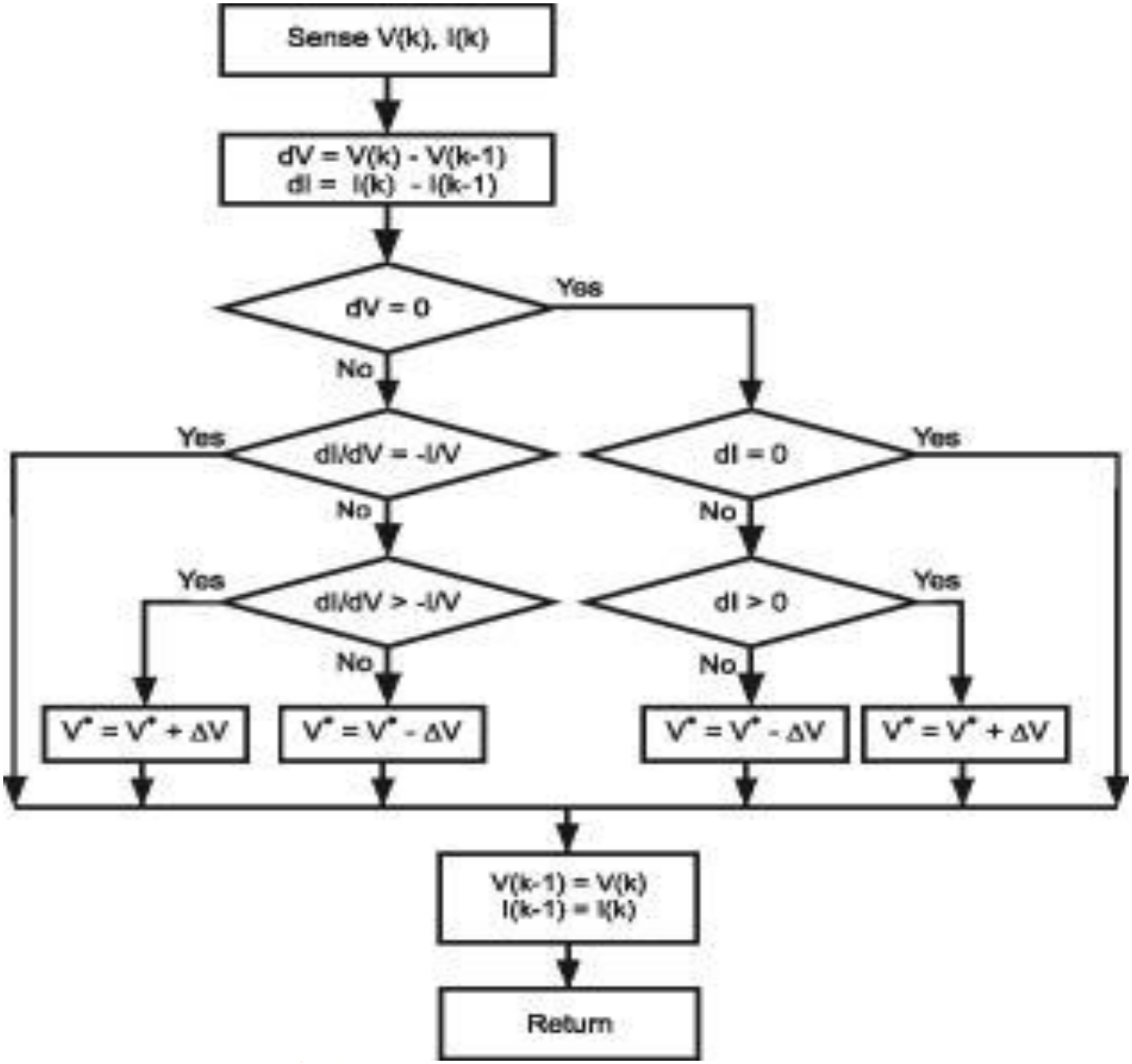


Figure 4.Control flow chart for IC-MPPT

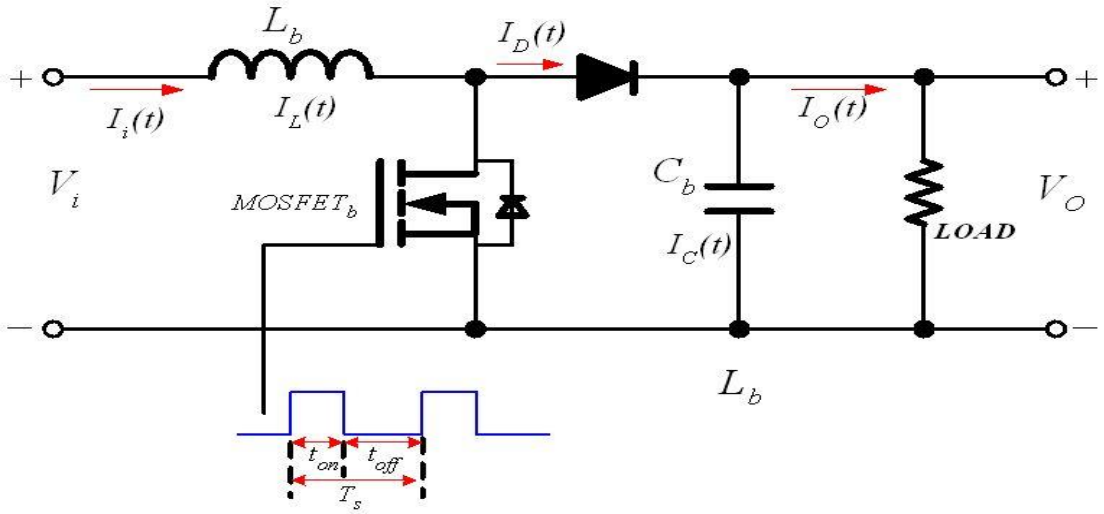


Figure 5. Circuit Diagram of Boost Converter

When MOSFET switch is ON

$$\Delta i = \left(\frac{V_I - V_{Trans}}{L}\right) T_{ON} \qquad (2)$$

When MOSFET switch is OFF

$$\Delta i = \left(\frac{V_{out} - V_{in} + V_D}{L}\right) T_{OFF} \qquad (3)$$

Figure 5 shows the ckt of DC to DC boost-converter. And equation 2 and 3 mathematical equation for ON and OFF condition.[11-12].

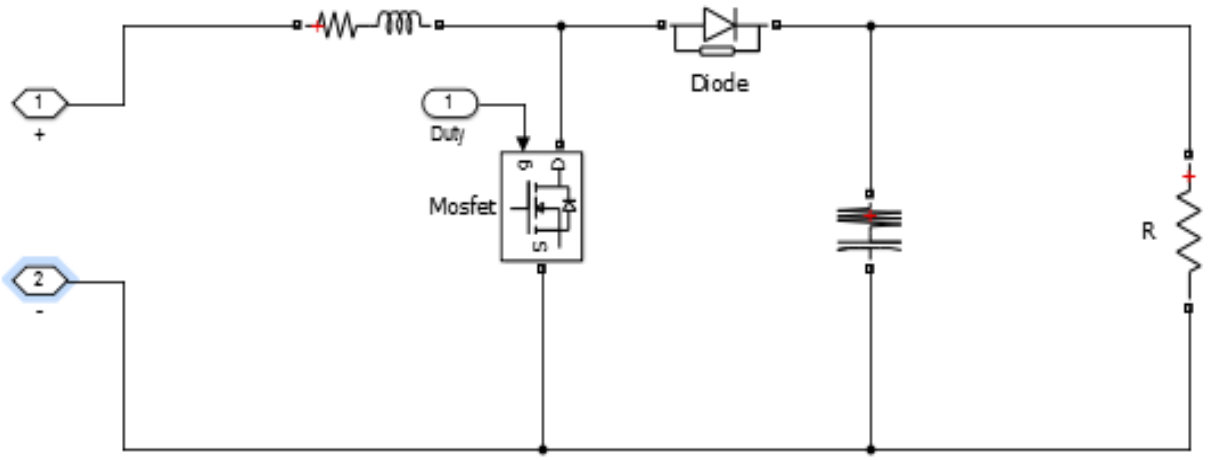


Figure 6.Simulink Model of boost converter

C. THREE PHASE INVERTER

Basically three phase inverter having 1- phase inverter which was connected serially to load terminal. The scheme of control is to operate the 3 switches which was coordinated, so that 1 switches work at the each 60 degree points of the fundamental o/p waveform.[15-18] They gives a line to line o/p wave form for the six steps. The six step of wave form have zero v/g step and +ve and –ve section to square wave form for that harmonics are multiples of three are completely remove. When a carrier based PWM technique are applied to 6-stepped waveforms, the basic over all shape, or covering , of the wave form is continue to have so, the third harmonic and it multiple are will not take place.

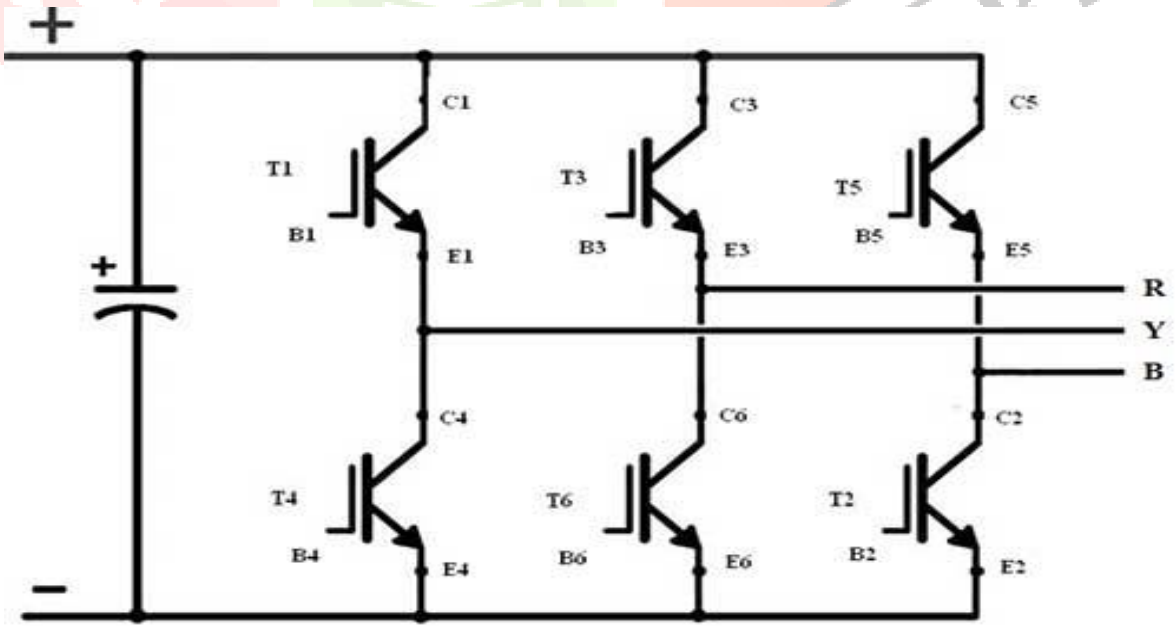
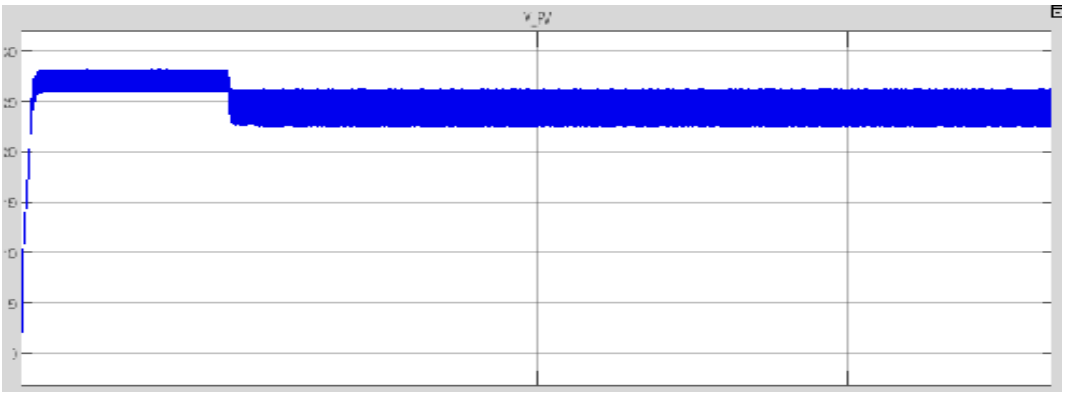


Figure 7. Circuit Diagram of Three Phase Inverter

IV. RESULT



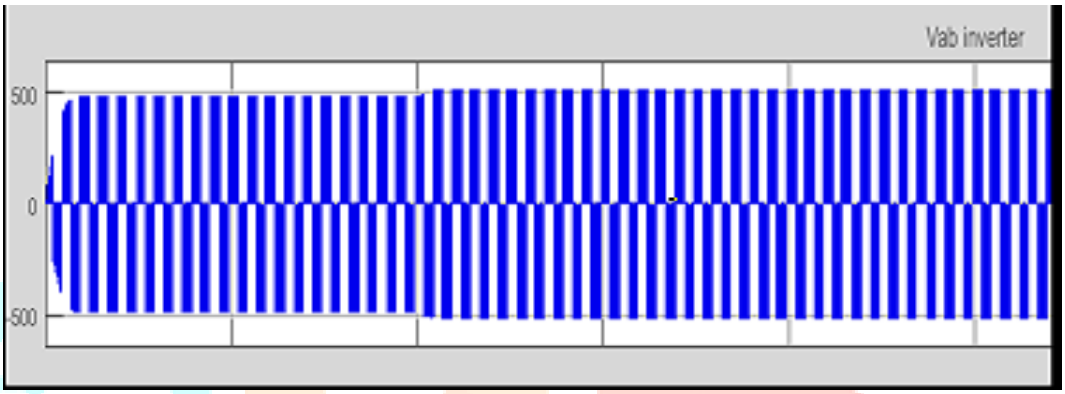


Figure 8.Inverter Output

GRIG OUTPUT VOLTAGE

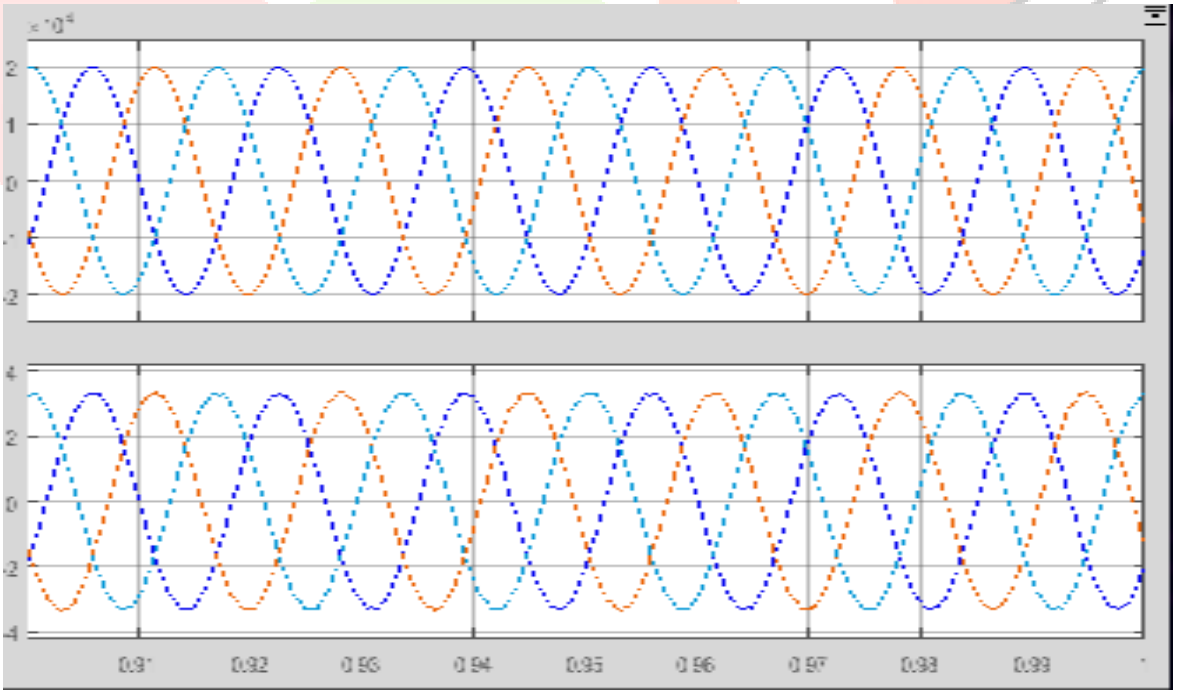


Figure 8- grid connected volatageand current

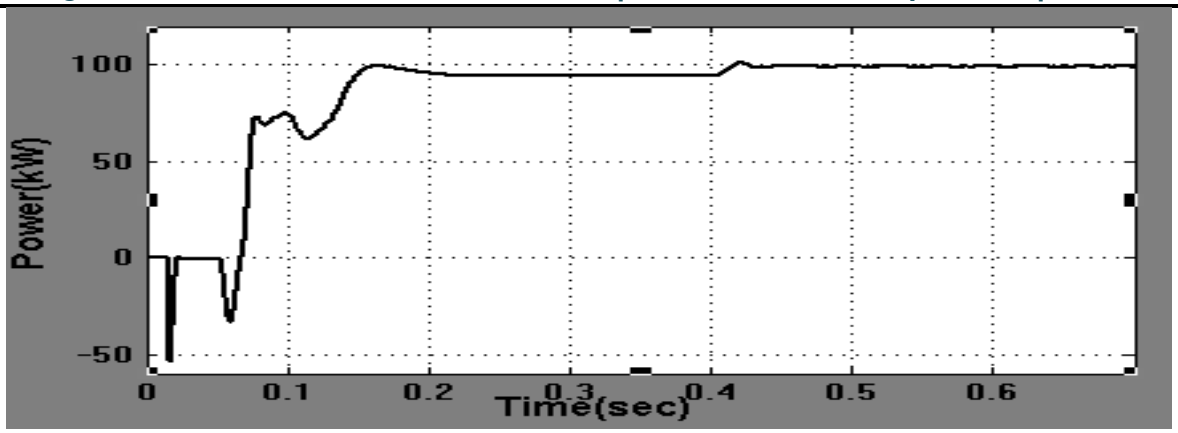


Figure 9 -Grid injected power

III. CONCLUSION

In the proposed system by using incremental conductance MPPT method use and boost converter we step up the generated PV voltage (240 volt to 500 volt) and by the help of three phase inverter which has been convert the boost dc voltage into ac and the 100kw power in supply in to grid whih is connected for inject power. The current and voltage into the grid and control schemes feed into grid for the controlling of load side balancing problem to grid connected so this way to provide a beneficial to grid connected. The above graph will shows both current and voltage and power.

REFRENCES

[1] Natsheh, E.M., and A. Albarba "Grid connected applications/ "Photovoltaic model with MPP tracker for standalone /", IET Conference on Renewable Power Generation (RPG 2011),

[2] Huss ein, K.H., Murta ,I.,-Hoshino Osakad M.," Rapidly changing atmospheric conditions" Maximum pv power tracking: an algorithm", IEEEProceedings of Generation, Transmissionand Distribution, vol. 142, No.1, 1995.

[3] Key hani, Ali, Design of grid renewable energy smart powersystems. John Wiley & Sons, 2016..

[4] Andreas, Matthias A. Bucher, and Göran- Andersson. " Renewable Energy Integration (Second Edition Operational Flexibility of Power Systems."). 2017. 201-216.

[5] http://en.wikipedia.org/wiki/Electricity-ctor_in_India, Accessed on Apr. 2017.

[6] Report on "March 2015 Executive Summary Power Sector", Accessed on Apr. 30,2015.

[7] Ministry of Power, Government of India, "Growth of Electricity Sector in India from 1947-2013", July 2013, Central Electricity Authority, Accessed on 30 AprL2015.

[8] "World Energy Outlook 2014 International Energy Agency: Energy for All", Oct. 2014.

[9] "Balance Report of Load Generation 2014-15", 30 May 2014.

[10] Central Electricity Authority, "Report on 17th Electric Power Survey of India", Ministry of Power, Government of India, 2013.

[11] Cumulative deployment of various Renewable Energy Systems as on 31/12/2012" "New & Renewable Energy:, Ministry of New and Renewable Energy, Government of India. Dec. 2014.

[12] Various Renewable Energy Sources of "Power Generation from", Ministry of New and Renewable Energy, Dec.2013.

[13] "Statistical Review of Solar Energy-2014 workbook", Accessed on Apr. 2015.

[14] "Survey of Energy Resources", World Energy Council, pp. 575–576, 2007.

[15] "White Paper on Implementation Challenges and Opportunities: Power Sector inVIndia", (Klyn veld Main Goerdeler) KPMG, Jan. 2010.

[16] "Kim, I- S., M-B. Kim, and M-J. Youn. "New maximum power point tracker using sliding-mode observer for estimation of solar array current in the grid-connected photovoltaic system." IEEE Transactions on Industrial Electronics 53.4 (2006): 1027-1035.

[17] Alonso, O., et al. "Cascaded H-bridge multilevel converter for grid connected photovoltaic generators with independent maximum power point tracking of each solar array." Power Electronics Specialist Conference, 2003. PESC'03. 2003 IEEE 34th Annual. Vol. 2. IEEE, 2003.

[18] Alonso, O., Sanchis, P., Gubia, E. and Marroyo, L., 2003, June. Cascaded H-bridge multilevel converter for grid connected photovoltaic generators with independent maximum power point tracking of each solar array. In Power Electronics Specialist Conference, 2003. PESC'03. 2003 IEEE 34th Annual (Vol. 2, pp. 731-735). IEEE.

[19] Mellit, Adel, and Alessandro MassiPavan. "A 24-h forecast of solar irradiance using artificial neural network: Application for performance prediction of a grid-connected PV plant at Trieste, Italy." Solar Energy 84.5 (2010): 807-821.

[20] Kjaer, Soeren Bae khoej, John K. Pedersen, and Fre de Blaabjerg. "A review of single-phase grid-connected inverters for photovoltaic modules." IEEE transactions on industry applications 41.5 (2005): 1292-1306.