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Study and Analysis Home Utilization System using Solar Power

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ABSTRACT

The traditional energy sources are speedily exhausting. Also, the cost of energy is growing and that's why photo-voltaic system is a promising alternative. They are ample, pollution free, spread throughout the earth and non-depleting. The difficulty is its high installation cost and low efficiency. Therefore, our aim is to increase the efficiency and power of the system. It is also requires, that steady voltage be provided to the load irrespective of the deviation in solar irradiance and temperature. Photo-voltaic (PV) arrays contain parallel and series combination of Photo-voltaic (PV) cells that are used to produce electricity depending upon the environment (solar irradiation and temperature). So, it is required to link the Photo-voltaic (PV) array with a boost converter. Moreover, our system is programed in such a way that with deviation in load, the change in I/P (voltage and power) fed into the boost converter follows the open circuit characteristics of the Photo-voltaic (PV) array. This system is designed to supply steady stepped-up voltage to variable loads [1]

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INTRODUCTION

Renewable energy is energy that is accumulated from non- depleting resources, which are naturally replenished such as sunlight, wind, tidal waves etc.

Based on REN21's 2016 report, "renewable contributed 19.2% to global energy consumption and 23.7% to their generation of electricity in 2014 and 2015, respectively.

This energy consumption is sub-divided as 8.9% from traditional bio-mass, 4.2% as heat-energy, 3.9% hydro-electricity and 2.2% is electricity from solar energy, wind, geo- thermal, and bio-mass. Globally fund invested in renewable technologies is more than US$286 billion in 2015, with China and the United States diverting funds heavily in wind, hydro, solar and bio-fuels. Universally, about 7.7 million jobs linked with the renewable energy industries, with solar photo-voltaics being the largest employer. As of 2015 globally, about half of all new electricity power capacity installed was renewable".[1]

Renewable energy sources exist over widespread ecological areas, as compare to other energy resources, which are available in a small area. Fast re-accumulation of renewable energy and energy efficiency is resulting in substantial energy security, reduce climatic changes, and commercial benefits. Recent study suggests Greenhouse Gas and their emitters are liable to climate change, thus a higher accountability would provide encouragements for focusing on renewable energy technologies. In surveys World-over it is found in public opinion that, there is strong backing for renewable resources such as solar power and wind power. Renewable energy contribution of at-least 30 countries is now more than 20 percent of energy demand. Norway and Iceland produce all their electric energy demand using renewable energy and large number of countries especially developing countries have set their goal to reach 100% renewable energy in the future. For example, Denmark decided to switch its total energy supply to cent- present renewable energy by 2050.

Different type of renewal energy sources

A. **Wind power:** Air pressure is used to run wind turbines. Modern wind turbines are of 600 kW to 5 MW, however, with rated O/P of 1.5–3 MW are common for industrial use. In 2015,7.5 MW is the largest single installed generator capacity of wind turbine.[1]

B. Hydro power: Hydro-power produce 16.6% of the global total electric energy and 70% of all renewable electric energy till 2015[1]. Since water is 800 times denser than air, even a small moving stream of water, or light sea swell, can produce significant amounts of energy.

C. Solar energy: Solar energy, radiated light and heat from the sun, is harvested using a range of various technologies such as solar heating, photo-voltaic cell, concentrated solar power (CSP), concentrator photo-voltaic (CPV), solar architecture and artificial photo synthesis.

Solar technologies are classified depending on the way they capture, convert and distribute solar energy as either

Passive solar Passive solar technique includes aligning a structure to the sun, picking materials with favorable thermal mass or light dispersing properties, and planning spaces that circulate air. Passive solar systems function without the support of peripheral devices such as greenhouses, sun-rooms. Solar energy captures sun-rays through transparent glass windows that retain heat.

Active solar Active solar technique include solar thermal energy, using solar collectors for heating, and solar power , converting sunlight into electricity either directly using photo-voltaic (PV), or indirectly using **Concentrated Solar Power** (CSP). A photo-voltaic system converts light into direct current (DC) by taking benefit of the photoelectric effect. An active solar system depends on outer energy sources or backup systems such as radiators, heat pumps to convert solar energy into electricity.

D. Geothermal energy: Earth's geothermal energy comes from the primitive development of the planet and from radioactive decay of mineral deposits. This geothermal energy is from thermal energy generated and deposited in the earth. Thermal energy is the energy that determines the temperature of matter.

E. Bio energy: Bio-mass is biological material derived from alive or recently dead organisms. As source of energy, bio-mass is used straight via burning to produce heat, or indirectly by converting it to bio fuel.

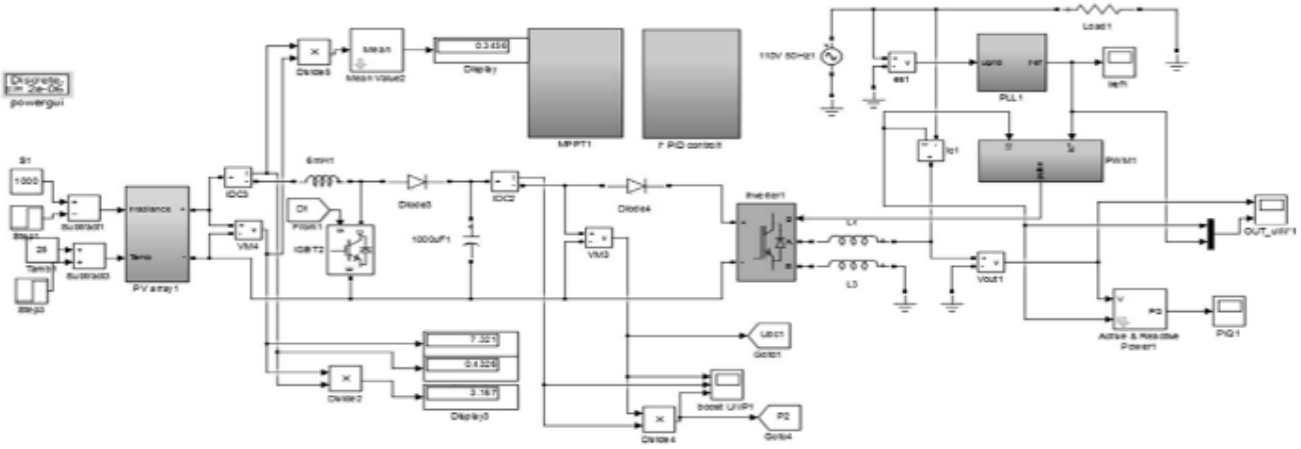
Proposed Methodology:-
MPPT

Figure 1.1 comparison Power generation in different source.

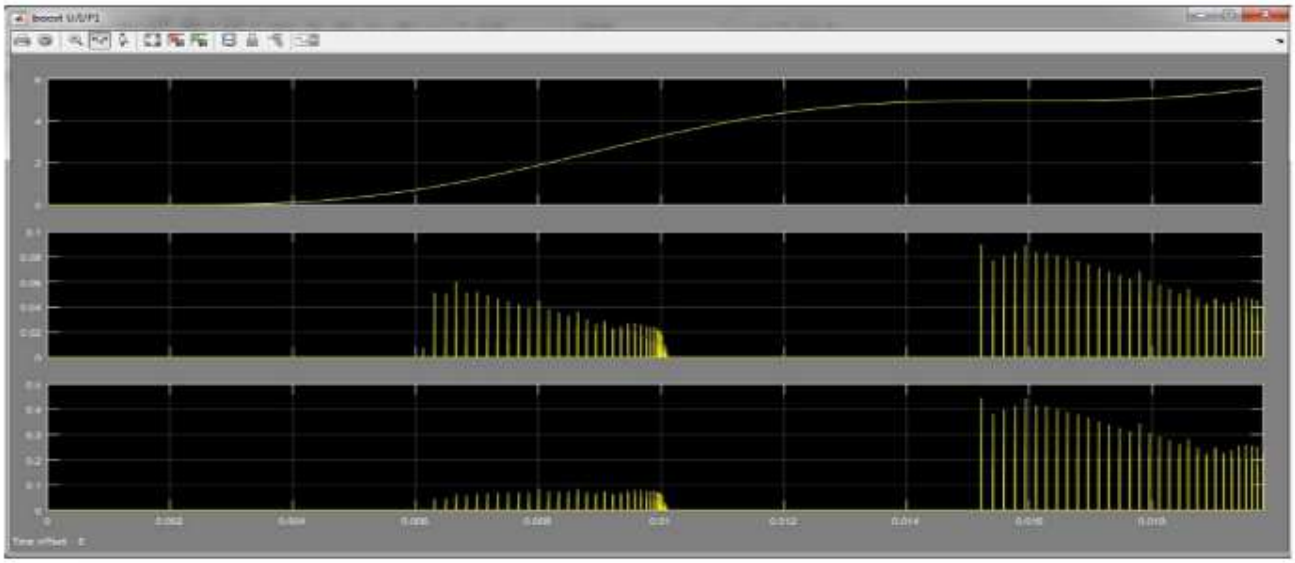
Sr. No.	MPPT Algorithm	Features
1	Perturb and Observe(P&O)	• Easy to implement and having low computational demand. • Applicable for most of the systems. • Doesn't require any information about the photo-voltaic (PV) panel, but only the measured voltage and current.
2	Incremental Conductance (INC)	• Tracking maximum power point without oscillations around the MPP in steady state condition. • Maximum tracking accuracy and faster speed.
3	Modified INC	variation in the photo-voltaic (PV) panel O/P power with voltage instead of a nonlinear relationship between photo-voltaic (PV) voltage and and variation in photo-voltaic (PV) panel.
4	Constant Voltage (CV)	Rapidly detect the current maximum power point by measuring the open circuit voltage.
5	dP-P&O	• Overcomes the drawback of traditional hill climbing method by preventing itself from being track in the undesirable direction. • An additional power measurement in between two different sampling Instances.
6	Open circuit and Slope detection tracking	• Avoid unnecessary power loss as disconnection between solar panel and power stage occur only once and hence power efficiency is maintained • High tracking speed and accuracy.

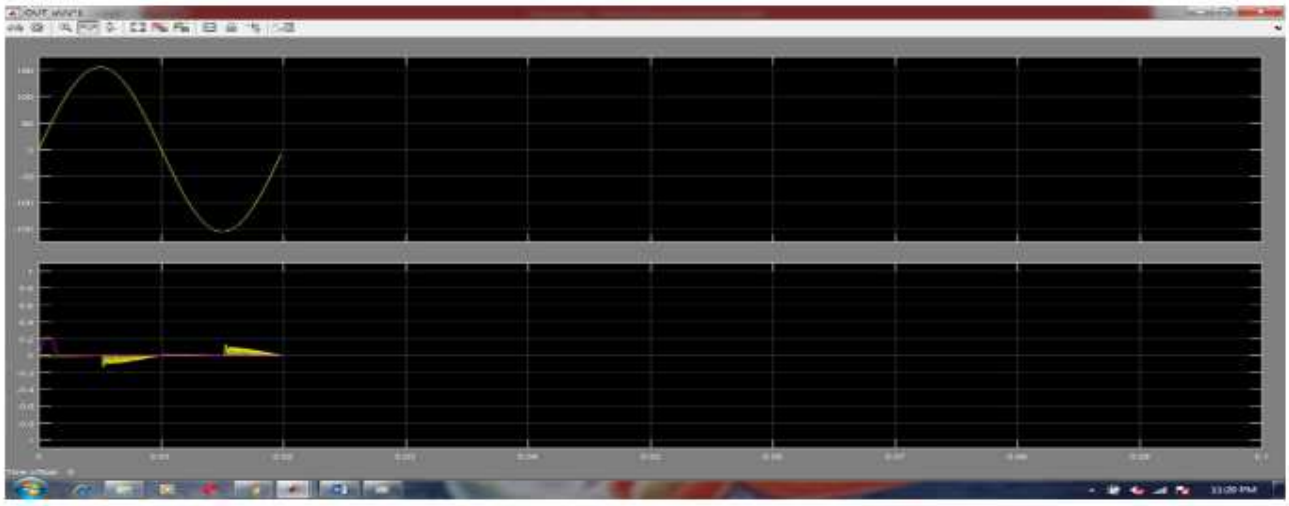
Proposed Simulation Work

A diagram of a proposed photo-voltaic system is illustrated model in MATLAB/Simulink. A boost converter interfaced with photo-voltaic (PV) array to a resistive load. both P & O and IC algorithms have been implemented with all consideration of the optimization techniques. The simulation has been for both algorithms under correctly the same conditions. Here, the main point is to consider the speed at which the system converges on maximum power point, and the ripple in the power due to oscillations around the maximum power point at steady state conditions.



Result & Conclusion: -





Conclusions

- The Performance of the developed model is tested under different Load conditions.
- Our Proposed photo-voltaic (PV) model controlling a motor and battery with control architecture.
- Rapid Time is reduced from 10-20 second to 0.05 second.
- Using PID controller along with MPPT algorithm produce stable power with less transient time and also improve quality of supply for sensitive industries.
- Results of Perturb and observe algorithm produce good result mean to say able to obtain maximum power point in comparison with other algorithms.
- Our model using FACTS devices and PLL system improve voltage stability and minimizes Harmonics.
- Our model present best controlling Techniques for small to high load systems.

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