ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 2, February 2018

A Hybrid Power Flow Control Systems in Low Voltage AC Grids

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ABSTRACT: Due to development in renewable energy technologies and the continued rise in the cost of oil products hybrid renewable energy systems are gaining additional importance for supplying the power to fulfill the today's increasing energy demands either as a standalone system or as a grid connected system. The aim of this thesis is to presents a replacement changed Perturb & Observe (P&O) algorithm for maximum power point tracking (MPPT) in wind-solar energy systems. MPPT techniques are employed in photovoltaic systems to maximize the PV array O\P power by tracking unceasingly the maximum power that depends on temperature and irradiance conditions. This paper describes the energy storage utilization in low voltage grid, that is very penetrated with photovoltaic, so as to avoid the assembly of unwanted effects like the flow and future excessive voltage fluctuation, whereas additionally different useful services like reduction of peak demand are used. Additionally easy approach a way to utilize energy storage to handle these issues is planned and easy charge\discharge strategy was designed for energy time shifting and capability firming. It deals with the generation of electricity by using two sources mix that results in generating electricity with cheap price while not damaging the natural balance.

KEYWORDS*:* Solar - Wind generation, Bidirectional converter, Maximum power point tracking (MPPT), Changed P&O management, Boost Converter, Rectifier, Three Phase Inverter.

I. INTRODUCTION

Electricity is most required for our day to day life. There are two ways in which of electricity generation either by typical energy resources or by non-conventional energy resources. Voltage demand will increase in word therefore to meet demand we've to come up with voltage. The traditional energy resources are depleting day by day. The non-conventional energy resources like solar, wind will be smart various supply. Energy is indispensable to human life. Energy isn't solely a measuring for economic and social improvement however additionally a basic human necessity. To resolve energy issues like energy importation, a decrease of environmental pollution, heating, increasing price of energy, and energy inefficiency is that the vital crisis in our day to day life. Photovoltaic (PV) system has gained wide quality within the past decade together of the renewable energy sources because of the chance of depletion of typical energy sources and its high price furthermore as its negative effects on the atmosphere. Despite the high cost of solar modules, PV power generation systems, in particular, the grid-connected type, have been commercialized in many countries because of its potential long-term benefits. And in good weather condition, we can use both sources combined.

II. HYBRID ENERGY SYSTEM

The hybrid energy system is one of the combinations of two energy sources for giving the power to the load. In other words, it can be outlined as "Energy system which is fabricated to extract the power by using two energy sources is known as the hybrid energy system''. Hybrid energy system has smart dependableness, efficiency, less emission, and lower cost. In this proposed system wind and solar power is employed for generating power. Solar and wind have smart benefits than aside from the other non-conventional energy sources. Each the energy sources have bigger availableness altogether areas. It desires lower price. There's no got to realize special location to put in this technique.

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A.Solar Energy

Solar power is the energy that gets by the radiation of the sun. Solar energy is present on the earth unceasingly and in a plentiful manner. Solar energy is freely obtainable. It doesn't manufacture any gases that mean it's pollution free. It's affordable in price. It has low maintenance price. The only issue with the solar system it cannot manufacture energy in bad weather conditions. However, it's higher efficiency than different energy sources. It only required an initial investment. It's long life and has a lower emission.

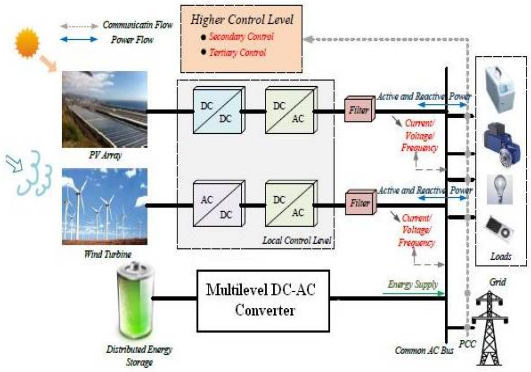

FIG.1. Grid-connected hybrid system

B. Wind Energy

Wind energy is the energy that is extracted from the wind. For extraction, we have a tendency to use a windmill. It is renewable energy sources. The wind energy desires less price for generation of electricity. Maintenance price is additionally less for wind energy system. Wind energy is present nearly 24 hours of the day. It's less emission. Initial price is additionally less of the system. Generation of electricity from wind relies upon the speed of wind flowing.

The main disadvantages of using freelance renewable energy resources are that inconvenience of power for all time. For overcoming this we have a tendency to use solar and wind energy together. This will result in continuity of generation. This may build system reliable. The planned method is based on the subsequent principles:

- High energy supply reliability.
- Full utilization of the complementary characteristics of solar and wind.
- Tiny fluctuation of power injected into the grid.
- Optimisation of the battery's charge and discharge state.
- Minimization of the total price of a system.

II. BOOST CONVERTER

Step up - A Converter that outputs a voltage over the input voltage (like a Boost Converter). A boost converter (step-up converter) could be a power converter with an output DC voltage higher than in its input DC voltage. It's a category of switching-mode power supply (SMPS) containing a minimum of two semiconductor switches (a diode and a transistor) and a minimum of one energy storage component. Filters fabricated from capacitors (sometimes together with inductors) are ordinarily additional to the output of the converter to cut back output voltage ripple.

Continuous Current Mode - Current and therefore the field of force within the inductive energy storage never reach zero.

Discontinuous Current Mode - Current and therefore the field of force within the inductive energy storage might reach or cross zero.

Noise - Since all properly designed DC-to-DC converters are completely infrasonic, "noise" in discussing them continually refers to unwanted electrical and magnetic attraction signal noise.

RF noise - Switching converters should be inherently emit radio waves at the switching frequency and in its harmonics. Switching converters that manufacture triangular switching current, like

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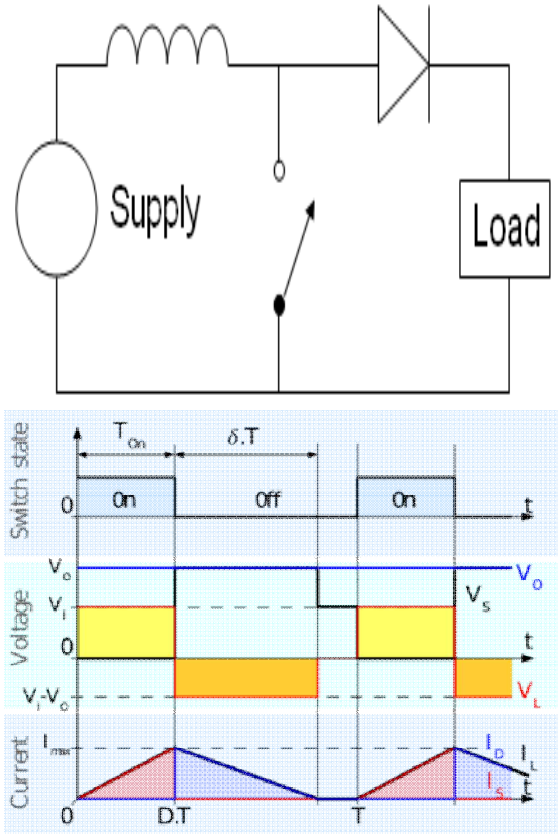

FIG.2. Boost Converter

the Split-Pi or Ćuk converter in continuous current mode, manufacture less harmonic noise than different switching converters. Linear converters manufacture much no RF noise. An excessive amount of RF noise causes electromagnetic interference (EMI).

Input noise - The converter loads the input with sharp load edges. Electrical noise will be emitted from the active power lines as RF noise. That ought to be prevented with correct filtering within the input stage of the converter.

Output noise - The output of a DC-to-DC converter is intended to have a flat, constant output voltage. Regrettably, all real DC-to-DC converters manufacture an output that perpetually varies up and down from the nominal intended output voltage. This varied voltage on the output is that the output noise. All DC-to-DC converters, as well as linear regulators, have some thermal output noise. Switching converters have, additionally, with switching noise at the switching frequency and its harmonics. Some sensitive radio frequency and analog circuits need a power supply with therefore very little noise that it will solely be provided by a linear regulator. Several analog circuits need a power supply with comparatively low noise, however, will tolerate a number of the less-noisy switching converters.

IV. MAXIMUM POWER POINT TRACKING

Maximum power point tracking (MPPT or typically simply PPT) could be a technique used usually with wind turbines and photovoltaic (PV) solar systems to maximize power extraction beneath all conditions.

PV solar systems exist in many various configurations with reference to their relationship to electrical inverter systems, external grids, battery banks, or different electrical loads. In spite of the ultimate destination of the solar power, though, the central issues self- addressed by MPPT is that the efficiency of power transfer from the cell depends on each the quantity of sunlight falling on the solar panels and therefore the electrical characteristics of the load. Because the

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amount of sunlight varies, the load characteristic that provides the very best power transfer efficiency changes, in order that the efficiency of the system is optimized once the load characteristic changes to stay the ability transfer at highest efficiency. This load characteristic is termed the Maximum power point (MPP).
Solar cells have a complicated relationship between temperature and total resistance that manufactures a non-linear output efficiency which may be analyzed supported the I-V curve.

IV- Curve :
It is the aim of the MPPT system to sample the output of the PV cells and apply the correct resistance (load) to get maximum power for any given environmental conditions.

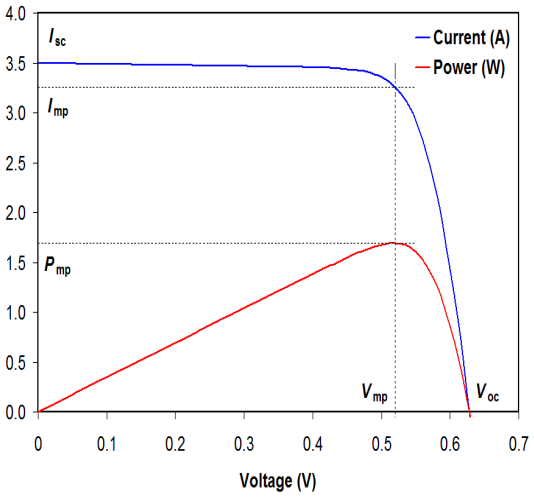

FIG.3. IV-Curve

MPPT devices are generally unsegregated into an electrical power converter system that has voltage or current conversion, filtering, and regulation for driving varied loads, as well as power grids, batteries, or motors.

PERTURB AND OBSERVE :
In this technique, the controller adjusts the voltage by a little quantity from the array and measures power. If the ability will increase, any changes therein direction are tried till power not will increase. This is referred to as the Perturb and Observe technique and is most common, although this technique may end up in oscillations of power output. It is said as a hill climbing technique, because of it depends on the increase of the curve of power against voltage below the maximum power point, and the fall on top of that point. Perturb and observe is the most typically used MPPT technique because of its simple implementation. Perturb and observe technique might end in high-level efficiency, provided that a correct predictive and adaptive hill climbing strategy is adopted. The perturb and observe technique needs oscillating power output around the maximum power point even beneath steady state irradiance.

V.ENERGY STORAGE SYSTEMS

Energy storage systems include varied suggests that of storing and recovering energy. Electrical energy storage systems settle for and come back the hold on energy as electric power, although they'll store the energy in another kind. Non-electric energy storage units store the energy in another kind. Despite this, they'll be of interest to electrical utilities and power engineers since they will materially have an effect on the form of daily demand curves. Among different benefits and options, energy storage of either type permits peak shaving in electrical usage: power will be consumed at just the once (off-peak or slowly over a long period to time) and therefore the energy truly used at once more and may be at a higher rate than once place into storage.

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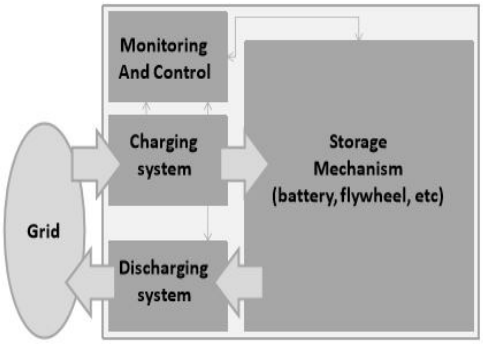

FIG.4.Basic Components of an Energy Storage Systems

Capabilities Provided by Electric Energy Storage :

Electrical energy storage units will be used to provide a variety of benefits to an influence system. Energy storage is commonly used to store power throughout times of low usage and to output that power to fulfill power desires once demand is high. Figure 4 shows the daily usage of a little community within the western US with hour, 7.5 MW storage units to flatten daily load cycle. Peak demand that has to be equipped by generation and T&D delivery to the city is reduced by 10%.Creating renewable energy sources like wind and solar generation into dispatchable sources of power. Each wind and solar generation are somewhat erratic in their expected output depending on the weather. Solar generation undoubtedly won't give any power in the dead of night. Without electrical energy storage, the ability they generate should

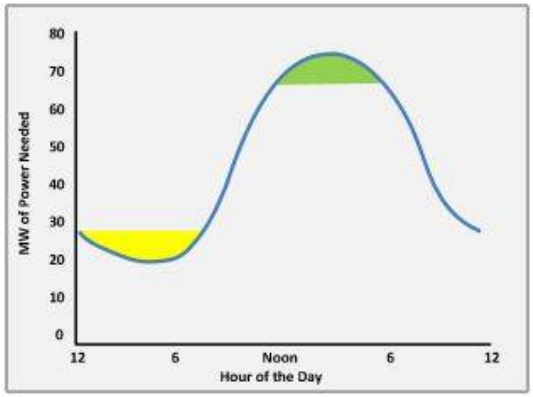

FIG.5.The daily demand curve of the substation feeding a little city (blue line). Peak Demand is 75MW. A 15MW-hour electrical energy storage system Charges between midnight and 8 AM (yellow) and unharness power between Noon a 6 PM, reducing system peak by 10%.

consumed at the moment generated. Otherwise, it's lost their non-dispatchable sources of power. A properly sized and the designed electrical energy storage system can accept power from the solar and wind generation when they manufacture it, put it aside for later use, so unharness it upon command (dispatch it as requested) once required, creating the energy created by the renewable energy generation dispatchable power.

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Improved Potency of generation :

Most generators are best for an exact style purpose, an exact quantity of outputted power. Some generators are simply rather more economical than others. A power system is generally operated with solely the foremost economical generators obtainable in operation at any time. Which means that in daily cycles like that shown in Figure 5, the least economical generators are left till last (peak time) to be run. A curve like that shown additionally means they need to be run to "follow load" – they're throttled up or back so don't continually run at their best level. For these reasons, the maximum of generators and therefore the approach they're operated is far additional economical once there's energy storage as compared to once there's not.

VI. GRID CONNECTED SYSTEMS

An electrical grid is an interconnected network for releasing electricity from producers to shoppers. It made up of generating stations that manufacture electrical power, high voltage transmission lines that carry power from distant sources to demand centers, and distribution lines that connect unique customers. When renewable energy systems are capable of the powering houses and small businesses among any connection to the electricity grid, many people prefer the merits that grid-connection offers.

A grid-connected system that can allow you to power your home or any other small business with renewable energy during those periods (daily as well as seasonally) when the sun is shining, the water is running, or the wind is blowing. Any excess electricity you produce is fed back into the grid. When renewable resources are unavailable, electricity from the grid supplies your needs, eliminating the expense of electricity storage devices like batteries. Some of the things you require to know when thinking about connecting your home energy system to the electric grid include:

- Equipment needed to connect your system to the grid.
- Grid-connection needs from your power provider.
- State and Community requirements andcodes.

VII.MATLAB/SIMULATION RESULTS

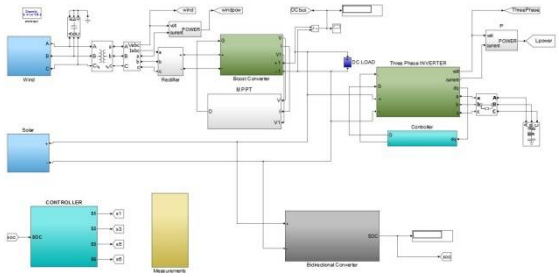

FIG.6.Matlab/Simulation of Hybrid power flow control systems in low voltage AC grids.

VIII.RESULT ANALYSIS

Simulation output

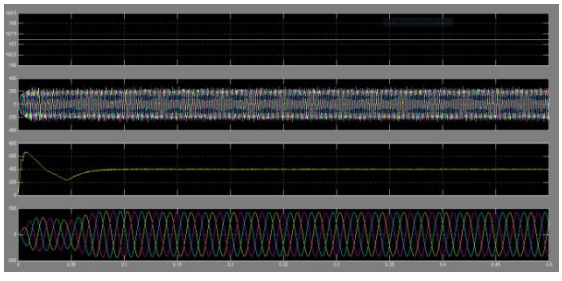

FIG.7.Simulation waveform of Solar, Wind, DC-DC Voltages, Output Voltages.

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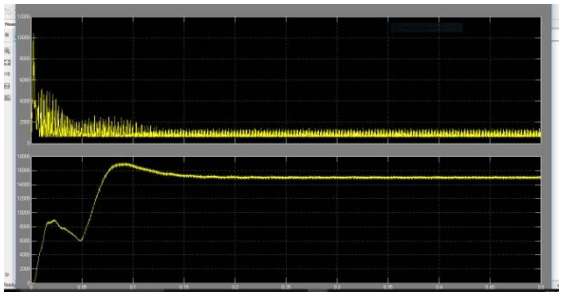

FIG.8.Simulation waveform of Source Power and Load Power.

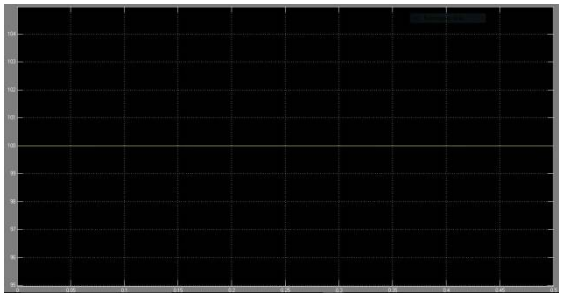

FIG.9.Simulation waveform of Storage Capacity.

IX.CONCLUSION

Hybrid power generation system is best and effective answer for power generation than typical energy resources. It has bigger potency. It will give to distant places wherever government is unable to succeed in. In order that the ability will be utilized wherever it generated in order that it will cut back the transmission losses and value. The price reduction will be done by increasing the manufacture of the equipment. People should inspire to use the nontypical energy resources. It is extremely safe for the atmosphere because it does not manufacture any emission and a harmful wasteful product like typical energy resources. It is price effective solution for a generation. It only requires initial investment. It has additionally long lifetime. Overall it smart, reliable and affordable solution for electricity generation.

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