Review of DC & AC with Simultaneous Outputs

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Abstract— Now-a-days with inadequacy in electrical energy & continuously enlarging fuel cost, leads to investigation on the Non-Conventional energy sources. This paper presents a stand-alone hybrid Solar-Wind energy system for applications in isolated areas. The wind & solar system are connected to the common load through Boost Derived Hybrid Converter. The modeling and simulation of hybrid system are done using MATLAB /SIMULINK. The performance of the hybrid system is evaluated under different speeds & different irradiation levels. Simulation results show that the proposed hybrid system has the potential to meet the demand of an isolated area such as Islands.

Keywords: Non-Conventional Energy, Hybrid Energy System, Boost-Derived Hybrid Converters, Microgrid

I. INTRODUCTION

In this paper, wind and solar plant is design to make a Micro-grid. For the local use for remote area Micro-grid is a good solution. As the need of energy is increasing drastically day by day, Micro grid is good solution to meet the energy demand. Micro grid is a small scale grid which can operate separately or with other small power grid. Micro-grid is used to generate, distribute and control power in small section. Micro-grids are design to provide continuous power and balance customer local demand.

In the year 2012, 44.8 GW of new wind energy conversion systems were installed worldwide. The trends has been towards increasingly larger turbine sizes, culminating in the installation of off-shore wind parks that are not located to far from load centres . The energy system proposed in the paper seeks to address both issues related to electricity and transportation sectors. One potential solution to this is hybrid, Micro-grids that can be either vertically integrated with high-rise building as frequently encountered in urban areas [1].

In this paper, Hybrid Converter is also designed. Hybrid Converter work as both Inverter & Chopper. Working of Hybrid Converter depends on the switching of MOSFET. Input of Hybrid Converter is DC and it gives AC & DC as output with the help of Inverter and Chopper and then it is supplied to the loads.

II. METHODS & MATERIAL

A. Block Diagram Explanation

1) Solar Power Plant

Solar energy is one of the cleanest and greenest technologies. Although solar energy is led by thermal power plant. It is expected that solar energy in World will prove to be the single largest source of power. Therefore solar energy plays a dominant role in Indian Power Scenario due to various benefits it offers over other non-conventional sources.

On an average Country has 300 sunny days a year & received an annual radiation of 1600-2200 kWh/m2 translating into an annual estimated potential of 6 billion GWh [1].

To harvest the solar energy, most common way is to use photo-voltaic panels which will receive photon energy from sun & convert to electrical energy. Solar technologies are broadly classified as passive and active. Solar depending on way they detain, convert & distribute solar energy. Solar energy is one of the cleanest and greenest technologies. Although Solar Energy in India is led by solar thermal power plant, it is expected that Solar PV in India will prove to be the single largest source of power in the times to come. It is thus no surprise that Solar Energy is & will continue to play a dominant role in Indian power scenario due to various benefits it offers over than renewable sources.

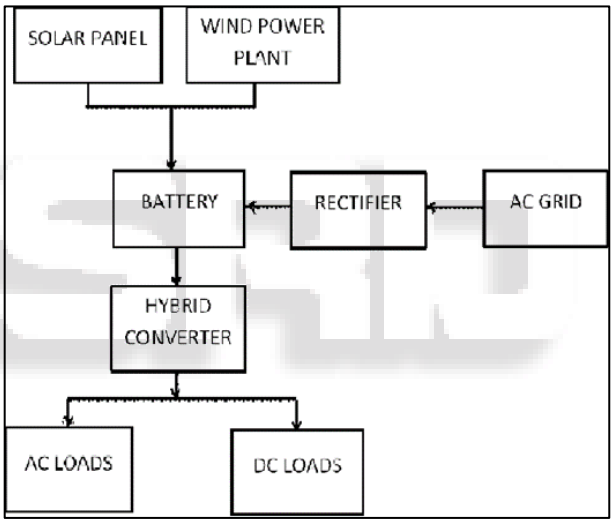

Fig. 1: Block Diagram of Micro-Grid with Simultaneous AC-DC Outputs

2) Wind Power Plant

A wind turbine is also called as a wind energy converter; it converts kinetic energy to the electrical energy. Manufacturing of wind turbines are in wide range. Wind turbines are manufactured in two types for vertical axis and horizontal axis. For battery charging or for power traffic warnings signs smallest turbines are used. For making contribution to domestic power supply larger turbines are used. Array of large turbines, is called as wind farms. This becoming an important source of renewable energy and this is used by many countries to reduce the use of fossil fuel which are limited. Wind turbines can rotate either in vertical direction of horizontal direction as per their construction

3) Battery Storage

Battery storage stored energy which generate at one time for use later whenever there is need of energy. A device which stored energy is known as battery or accumulator. Battery storage power stations use for low levelling storing electrical energy at times of low demand for use during peak periods. It is design for the purpose of discharging to a

lower capacity between 50%-80% than conventional battery. Deep cycle of our battery is C10.

Lithium-Ion solar batteries are the ideal match for solar energy storage needs. We have a solar energy system with energy storage, the power generated when the sun is out. If the existing energy storage system for our solar system is inefficient. Typical Lead Acid Batteries used for solar energy storage have many problems including: they are almost never adequate to handle generated energy storage needs, do not efficiently and effectively store generated power, do not last long, are they are very heavy and made of a toxic material.

Energy is of various types, which include radiation, chemical, electrical potential, gravitational potential, latent heat, elevated temperature and kinetic energy. There are some examples of energy storage are rechargeable battery which is used to operate mobile phones, fossil fuel for example coal and gasoline which stored ancient energy, food stored chemical form of energy. There are some applications of battery storage; they are mills, homes, grid electricity and power stations, air conditioning, transport, electronics.

4) Boost Derived Hybrid Converter (BDHC)

The foregoing system has various types of loads i.e. DC and AC loads, which are capable of being interfaced with different conventional and non-conventional energy sources. This interfacing is achieved by means of different electronic converters. With this in mind, to drive DC and AC loads concurrently from single DC input in a single step, a new technology of Boost Derived Hybrid Converter provides simultaneous DC and AC to loads from a "Single Switch Controlled Boost Converter". Hybrid converter requires lesser number of switches to provide AC and DC output with an increased reliability.

Voltage source inverter (VSI) in hybrid converter would involve the case of deadline circuitry to prevent shoot through. In addition, due to electromagnetic interference or other spurious noise, miss gating turn on-off of inverter switches may takes place, resulting in damage of switches. Impedance Source Inverter (ZSI) reduces the problem of shoot through interference.

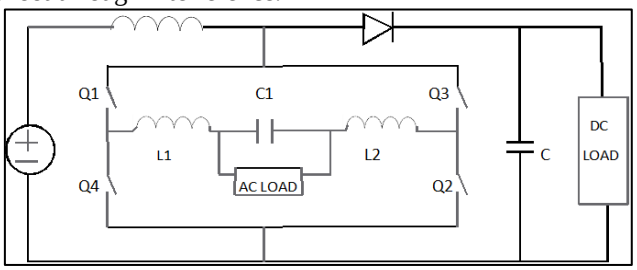

Fig. 2: Hybrid Converter

The Switched Boost Inverter (SBI), is Hybrid Converter topology, which can achieve similar advantages as ZSI with lesser number of passive components and supply simultaneously AC as well as DC loads.

a) Operation of BDHC

The operation of BDHC undergoes following interrogation:

1) Boost operation is controlled by DUTY CYCLE (D_{st}).
2) Inverter operation is done by MODULATION INDEX (M_a).

b) Operating Principle

The schematic diagram of BDHC is as shown in figure. If current through starting inductor (L) is maintained greater than zero, then the circuit will operate in mode of continuous conduction.

In this new BDHC technology, the controlling of AC output has been achieved by employing a modified scheme of Sinusoidal Pulse Width Modulation (SPWM)

BDHC can be operated in three modes:

(1) Shoot-through Interval (STI)

This interval is as shown in Figure (i). This interval has been achieved by Gating ON each switch of a particular leg (either Q1-Q4 or Q2-Q3). And the duty cycle (D_{st}) of BDHC is decided on the basis of duration of shoot-through interval [4]. The diode D is reverse bias during this period. The inverter output current circulates within the bridge network switches. Thus, BDHC allows additional switching states [4].

(2) Power Transfer Interval (PTI)

This interval is as shown in Figure (ii). During this interval the current is flowing through the opposite leg (Q1-Q2 or Q3-Q4) of BDHC via AC load in the converter circuit, the interval of power transfer in attained. During this, the diode D starts conducting and the DC output voltage is obtained [4].

(3) Zero Interval (ZI)

This interval is as shown in Figure (iii). This interval occurs when the inverter current circulates among the bridge network switches in not sourced. The diode D conducts during this interval.

During STI we get only DC output only when the capacitor is initially charged. In PTI we get both the outputs simultaneously. And during ZI we get only DC as output.

5) Power from AC Grid

An electrical grid is also known as power grid. It is an interconnected network which starts from generating station called as producers and ends at consumer. It consist of generating station that generate electric power, electrical substation for the purpose of step up and step down of voltage, high voltage transmission lines which carry power from sources to demand centre, distribution lines which gives the power to the individual consumer.

6) AC & DC Loads

An AC load is any device which receives alternating current electrical power from a source in an electrical system. And DC load is any device which receives direct current electrical power from source in an electrical system.

III. Results & Discussion

The solar power plant is modelled and simulated using MatlabR2018Ra/Simulink. The integration of solar panel & wind plant, as a dc input sources has been implemented and verified in MATLAB R2018a/Simulink to drive DC as well as AC loads. The analysis of different types of load is done in MatlabR2018a/Simulink.

IV. Conclusion

Micro-grid is an extension of main grid providing on-site generation capable of fulfilling its local load demand. It is concluded that micro-grid is to be added to the main grid to

increase the reliability, improve power quality, avoid the use of depleting fossil fuels, and reduce greenhouse emissions. The micro-grid is connected to islanded or isolated and grid connected modes. Depending upon the requirement these renewable energy sources are connected to the main grid or operate separately. As renewable energy sources are intermitted in nature, energy storage schemes are required to store the energy. It is desirable to develop reliable micro-grid operation and effective energy storage algorithms which would enhance the performance of hybrid power systems.

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