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DISTRIBUTED ENERGY GENERATION WITH RENEWABLE RESOURCES FOR MICRO GRID APPLICATIONS

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Abstract: In this project Operational controls are designed to support the integration of wind and solar power within micro grids. An aggregated model of renewable wind and solar power generation forecast is proposed to support the quantification of the operational reserve for day-ahead and real-time scheduling. The use of a single power processing stage to interface multiple power inputs integrates power conversion for a hybrid power source. This structure removes redundant power stages that would exist in the conventional approach that uses multiple converters. The controls are implemented for the special case of a dc micro-grid that is vertically integrated within a high-rise host building of an urban area and load share control method of droop control is employed.

Keywords— DC-AC Inverter, Micro grid ,Multi Port DC-DC Converter, Dump load ,MATLAB/SIMULINK Software.

I. INTRODUCTION

A. WIND ENERGY CONVERSION SYSTEM:

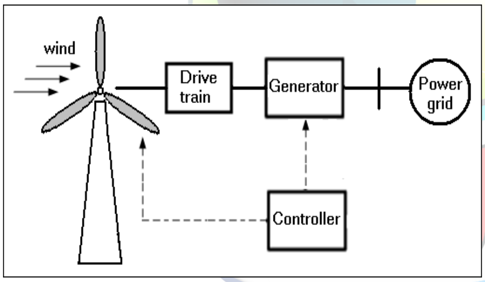

Fig. 1 Wind Energy Conversion System

Wind Energy Conversion System (WECS) Wind energy can be harnessed by a wind energy conversion system, composed of wind turbine blades, an electric generator, a power electronic converter and the corresponding control system. There are different WECS configurations based on using synchronous or asynchronous machines, and stall-regulated or pitch regulated systems. However, the functional objective of these systems is the same: converting the wind kinetic energy into electric power and injecting this electric power into a utility grid. As mentioned in the previous section, in the last 25 years, four or five generations of wind turbine systems have been developed. These different generations are distinguished based on the use of different types of wind turbine rotors, generators, Control methods and power electronic converters. Wind power plants can make a significant contribution to the regional electricity supply and to power supply diversification. A very short lead time for planning and construction is required as compared to conventional power projects. Wind energy projects are flexible with regard to an increasing energy demand - single turbines can easily be added to an existing park.

Fig. 2 Basic Diagram For Wind System

Many African countries expect to see electricity demand expand rapidly in coming decades. At the same time, finite natural resources are becoming depleted, and the environmental impact of energy use and energy conversion have been generally accepted as a threat to our natural habitat. Indeed these have become major issues for international policy. In the scenario of alternatives, more and more developing countries and emerging economies

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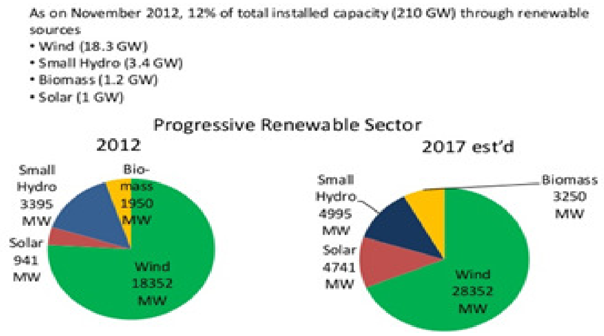
are placing their faith in greater use of renewable energy and are formulating specific expansion



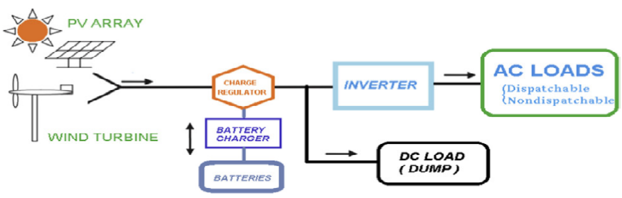
targets for a 'green

Fig. 3 India's Renewable Scenario

energy mix'. In many locations excellent wind conditions promise inexpensive power generation when compared with costly imported energy sources such as diesel. Despite political will and considerable potential, however, market development in these countries has been relatively slow to take off. There is a shortage of qualified personnel Exploitation of wind energy and to develop projects on their own initiative. The absence of reliable data on wind potential combined with unattractive energy policy framework conditions deters experienced international investors, who instead focus their attention on the expanding markets in Western countries.

II. EXISTING SYSTEM

This system comprised of the Renewable hybrid power generation system consist of solar and wind, then the multilevel energy storage system, which is comprised of the Battery Energy Storage system(BESS) and the super/ultra capacitor. Power produced from hybrid source is transferred based on load demand to load as well as energy storage system through converter and inverter. The solar pv power is connected to the DC bus through the DC-DC converter, likewise the multilevel energy storage is also connected to the DC bus through the DC-DC converter. Excessive power generated from



wind generator during high wind speed is transferred to dump load.

A. BLOCK DIAGRAM

Fig. 4 Block Diagram of Existing System

B. DUMP LOAD:

Solar panels are unique in that they can be short circuited (positive and negative connected) or disconnected (positive and negative open circuited) without any issue. If your batteries are full and the solar modules are still making power, you can simply short circuit (not so common) or disconnect the solar modules from your batteries with a charge controller. Wind turbines and water turbines generate electricity by rotating and need to have a load on them at all time. Without a load (such as a battery or a dump load) they will over-speed and possibly be damaged. Water turbines will generally turn 3 to 4 times as fast without a load while it can vary greatly with wind turbines as the wind speed changes.

C. CHARGE REGULATOR**:**

In the system, the output electrical power is provided to the loads with the highest priority. If the output electrical power is excessive for the demands of the loads, the surplus is used to charge the battery. Provided that the loads can't use up the whole output power, and the battery is fully charged, the superfluous power is then sent to the local distribution. The output electrical power is provided to the loads with the highest priority. If the output electrical power is excessive for the demands of the loads, the surplus is used to charge the battery. Provided that the loads can't use up the whole output power, and the battery is fully charged, the superfluous power is then sent to the local distribution Network.

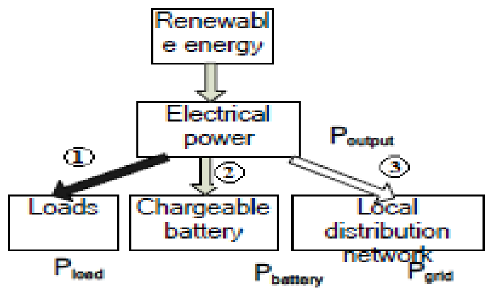


Fig. 5 Energy Transformation Mode

III.PROPOSED SYSYTEM

In our proposed model of The proposed DC Micro grid consists of PV module, wind generator, BESS, Ultra Capacitor, Multi-port DC-DC Converter, DC Load, DC-AC Converter and Grid .Brushless DC wind generator is used to produce DC power directly on wind conversion which would avoid losses during

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rectification. Battery Energy Storage System (BESS) and Ultra Capacitor is used as Multilevel Energy Storage System (MESS) to store the energy produced by the renewable sources. The energy stored in the MESS can be utilized for future use during demand in DC bus through Multiport DC-DC Converter.

A. BLOCK DIAGRAMOF PROPOSED SYSYTEM:

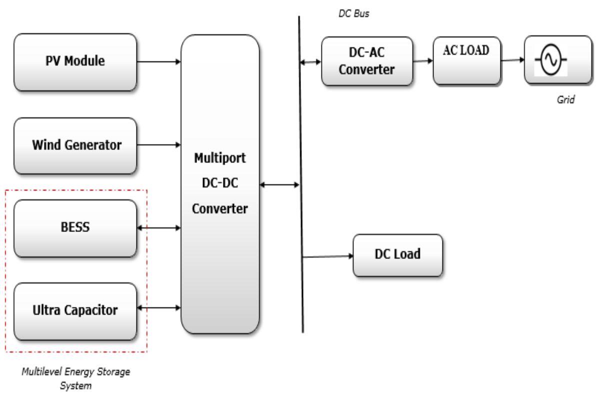
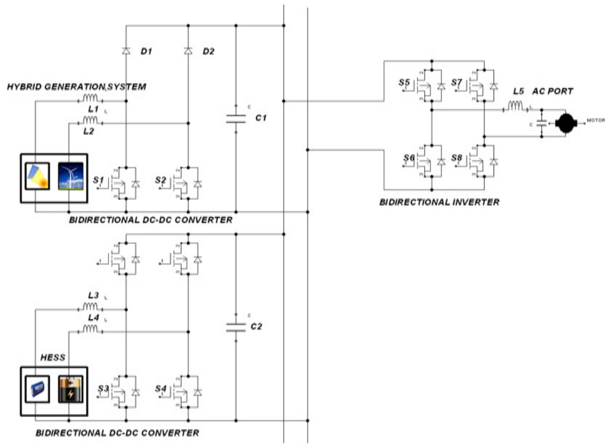


Fig. 6 Block Diagram of Proposed System



B. CIRCUIT DIAGRAM:

Fig 7 Circuit Diagram of Proposed System

C. HYBRID ENERGY STORAGE SYSTEM:

i. Solar Panel:

A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. A photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 320 watts.

ii. Wind Power:

Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electricity, wind mills for mechanical power, wind pumps for pumping water or drainage, or sails to propel ships.

At the end of 2009, worldwide nameplate capacity of wind-powered generators was 159.2 Giga watts (GW). Large-scale wind farms are connected to the electric power transmission network; smaller facilities are used to provide electricity to isolated locations. Utility companies increasingly buy back surplus electricity produced by small domestic turbines. Wind energy, as an alternative to fossil fuels, is plentiful, renewable, widely distributed, clean, and produces no greenhouse gas emissions during operation. However, the construction of wind farms is not universally welcomed because of their visual impact but any effects on the environment are generally among the least problematic o any power source.

The intermittency of wind seldom creates problems when using wind power to supply a low proportion of total demand, but as the proportion rises, increased costs, a need to upgrade the grid, and a lowered ability to supplant conventional production may occur. Power management techniques such as exporting and importing power to neighbouring areas or reducing demand when wind production is low, can mitigate these problems.

D. MULTILEVEL ENERGY STORAGE SYSTEM:

The current design practice is to build and support a power network designed the meet the highest peak load of the year. By doing this a large portion of the system sits idle most of the year. Smart Grid aim is to reduce this gap by having the system idle the minimum time. The need to efficiently use the electricity For utilities this means lowering the generation cost and maximize the assets of the network such as transformers. The battery is charged, the charging current Ic, the charging voltage (port voltage) Uc, the potential difference Eb between the positive plate and the negative plate of the battery and the internal resistor $Rb$of the battery has the following relationship:

E. MULTI PORT DC-DC CONVERTER

DC-DC converter, which connects the renewable energy source to the DC bus. Also, there are more conversion steps. The power is transformed from DC to DC, then from DC to AC if the load is AC load. The

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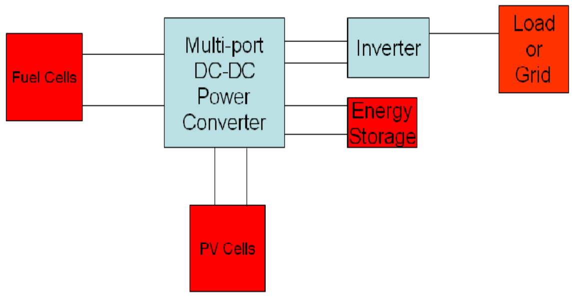
efficiency is lower because of more conversion steps. the conversion steps are minimized, resulting in higher efficiency. Due to the presence of the transformer in some circuits electric isolation is available, which is important for safety.

With the turn ratio of the transformer in certain topologies, it will be more efficient to integrate different renewable energy sources of different voltage levels.

The multiport power converter will connect all renewable energy sources and energy storage Some ports are bi-directional if they are connected with energy storage, while some are uni-directional if they are connected with energy source. one of the applications of the multi-port DC-DC power converter. This converter



integrates fuel cell, photovoltaic cells, energy storage and the load. If the load is AC, an extra inverter is needed to convert the DC power into the AC power.

IV.SIMULATION

Sim Power Systems and other products of the Physical Modeling product family work together with Simulink to model electrical, mechanical, and control systems. Sim Power Systems operates in the Simulink environment. Therefore, before starting this user's guide, you should be familiar with Simulink.

A. OVER ALL SIMULATION DIAGRAM

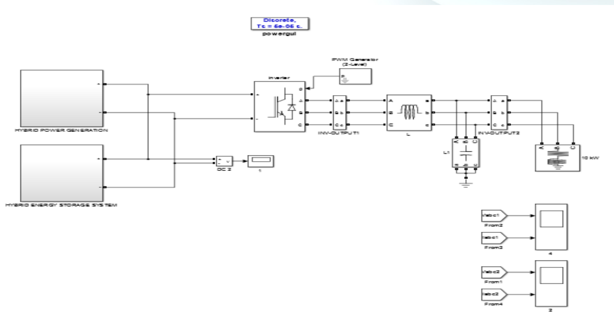


Fig. 8 Simulation Diagram

B. SIMULATION RESULT

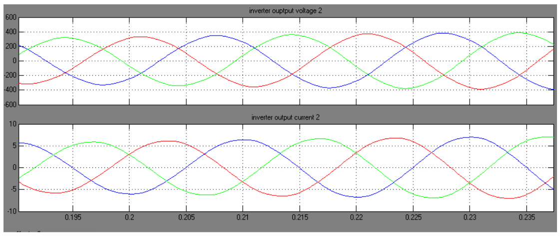


Fig. 9 without Filter of Inverter Output Voltage and Current

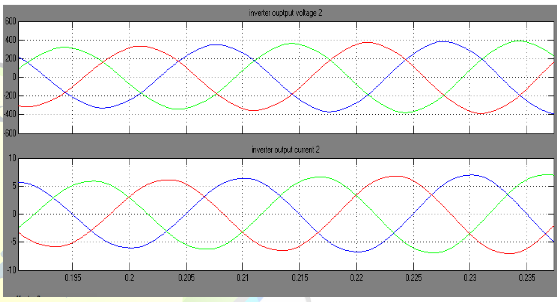


Fig.10 With Filter of Inverter Output Voltage and Current

V. CONCLUSION

In this project Operational controls are designed to support the integration of wind and solar power within micro grids. An aggregated model of renewable wind and solar power generation forecast is proposed to support the quantification of the operational reserve for day-ahead and real-time scheduling. discusses converter structures for hybrid power sources. A multiport system structure has been described. Compared with the conventional structure using multiple converters, a multiport converter promises integrated power conversion by utilizing only a single power processing stage. Based on the basic bidirectional switching cells and a combination of dc-link and magnetic coupling methods, several multiport bidirectional dc-dc converter topologies have been presented. The presented three-port topologies provide a method to integrate a main source and energy storage. Furthermore, based on the interleaving technology the proposed basic bidirectional switching cells and three-port topologies have been extended to their poly phase interleaved versions.

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