Simulation Analysis of low Voltage DC Micro Grid – An Investigation of Load Sharing by Using MATLAB

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Abstract – The DC microgrid consists of PV panel,wind rotary engine, battery, dc loads and a grid connected converter system. Microgrids with important renewable penetration will possible need storage devices to keep up a stable bus voltage thanks to the random behavior of renewable sources and grid loads. In power electronics-based microgrids, the procedure requirements required to implement associate optimized on-line management strategy may be preventative. The DC microgrid consists of PV panel, wind rotary engine, battery, dc hundreds and a grid–connected converter system. Thus on make sure the stableness of a DC microgrid, the flexibility flow at intervals the DC little grid ought to be balanced the smallest amount bit times to require care of a relentless dc bus voltage. Wholly totally different with the centrally management methodology, the droop management supported the dc-bus signaling (DBS) technique is used throughout this paper.

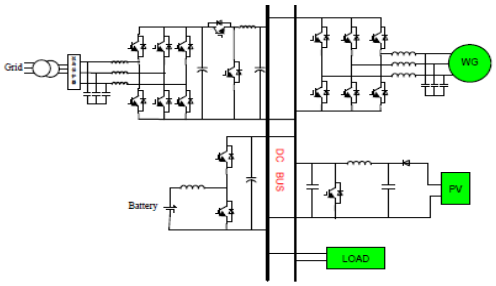
Index Terms – DC micro grid, voltage droop control, power electronics devices, and renewable energy resources.

1. INTRODUCTION

Due to increasing issues on a generic intergrid idea, microgrid has attracted intensive interest. A small grid is generalized into 2 types: AC microgrid and DC microgrid. Compared to the standard ac microgrid design, dc microgrid have several benefits, it would like fewer power converters, higher system efficiency and easier interface of renewable energy sources to dc system, there aren't any would like of frequency, phase, or reactive power management. THE INCREASING range of renewable energy sources and distributed generators needs new methods for the operation and management of the electricity grid so as to take care of or perhaps to enhance the power-supply dependableness and quality. In DC microgrid, the key purpose of power management is to maintain the ability balance between energy sources, utility units, device and dc loads at any time, it means, the voltage stability management is that the vital factor in DC micro grid[3]. DC-BUS is technology for reliable and economical communication over noisy DC or AC Power lines. The DC-BUS was originally developed by Yamar electronics Ltd. in conjunction with the DC-BUS Alliance for. During grid-connected operation, a grid-tied convertor balances the ability of the microgrid by dominant the DC voltage. All masses are connected to the microgrid, and operate ordinarily. throughout islanded operation, distributed generators (DGs), a backup generator, or an energy storage system balances the ability. . Power systems composed of small-scale distributed energy resources, like wind turbines, fuel cells, electrical phenomenon, storage devices, etc. could also be stand alone and grid connected. Several of these generation sources directly prove either dc or variable frequency/voltage ac outputs and, thus, power-electronics technologies became the key a part of the various distributed generation systems. The protection of low-tension dc small grids was studied in where varied protection devices were mentioned and fully totally different fault detection and grounding ways that were investigated. DC voltage management and power sharing terribly} very dc microgrid was investigated considering the dc-side impedance. In , the most focus was placed on the coordination of the dc voltage controllers for varied thus sources so on reduce the present currents. Fully totally different operation modes for dc distribution networks along with ac association fault and islanding are studied. terribly} very dc microgrid, fully totally different| fully different} system components may need different objectives to understand. Also, there's conjointly fully {different| totally different| completely different} |many various| several alternative} transient things happening among the system at different instants. Multiple reverse conversions required in individual ac or dc grids would possibly add additional loss to the system operation and may build the current home and workplace appliances extra tough. The electrical network is that the set of transformers and infrastructures that carry electricity from the centers of production to any or all customers. These networks ar responsible to maneuver and distribute the electricity generated from the supply to the ultimate purpose of consumption. they're designed to work since the center of last century, wherever main production centers were distant from the ultimate costumers, so from the position of customers and also the

characteristics of plants supported renewable energy the particular network is redesigning to become additional appropriate. Since this, a replacement thought of power system is showing considering the aptitude to integrate AN intelligent management.

2. SYSTEM CONFIGURATION



The analysis subject is based on renewable supply and energy storage. Fig.1 shows a planned DC microgrid structure. 12kW PV arrays area unit connected to dc bus. Through a DC/DC boost device.A 5kW turbine generator with double fed induction. Generator (DFIG) is conncted to dc bus through a AC/DC device. Electric battery as energy storage is connected to dc bus through a bi-directional DC/DC device. Variable dc load (20kW-30kW) area unit connected to dc bus. The nominal voltage of dc bus is 400V, however the operative voltage vary of the dc bus is chosen to be between 380V and 420V to permit power sharing and voltage regulation victimization of the loop control.

3. DC BUS SIGNALING

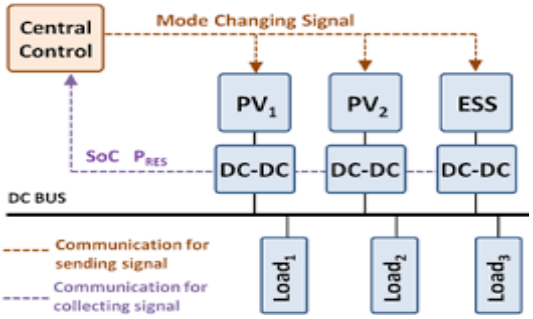


Fig 2 Dc bus signaling

The DC-BUS may be a physical layer that enables transmission of information over the powerline and receiving that signal even though attenuated to the amplitude of the powerline. 2 technologies implement the DC-BUS: computer memory unit orientated and Message orientated. The communication technology is computer memory unit orientated, permitting transfer of one UART information computer memory unit or additional over noisy channel (such because the powerline) at bit-rate up to one hundred fifteen.2 kbit/s; every transmitted computer memory unit is protected against errors caused by noisy surroundings.

4. BI-DIRECTIONAL GRID INVERTER CONTROL STRUCTURE

The electrical converter in standalone operation mode square measure needed to figure in voltage management mode activity effective, potency and quality power to any local load connected to that. de. The electrical converter ought to operate in power issue correction mode once drawing power from the grid. the 2 modes transfer ought to be automatic and thence, sleek and seamless. In power issue correction-rectification mode the system designed filter inductance and therefore the DC aspect capacitance is employed to work out the system dynamics.

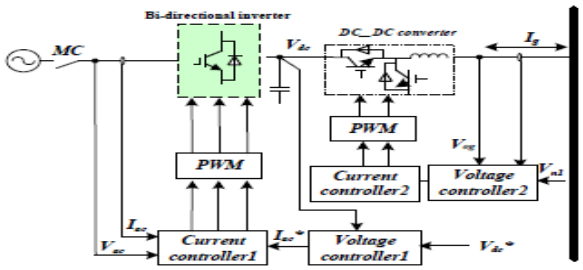


Fig.4Control Structure of Grid Inverter

DC micro grid. energy back to grid, and the inverter current *g I* is negative, while the dc bus voltage between in 390V-400V,the *g I* is positive and it means the system absorb energy from utility grid. The inverters operate in droop control when dc bus voltage between in 390V-410V, and the * *dc V* can be calculated by (1):

$$V_{dc}^{*} = 400 - K_g \times I_{dc} \text{.....(1)}$$

Advantages

- Safety and Protection—The ability of the power system to prevent injury to people and protect equipment from damage.
- Energy Efficiency—measured at the system level, the total input electricity required to serve an end use function.
- Power Quality—The ability of a AC or DC microgrid to stay within its respective Computer Business Equipment Manufacturers Association (CBEMA)/Information Technology Industry Council (ITIC) curve for a given type of disturbance.

Application-

- Solar panels energy management

- Aerospace-

  Saving wires in aerospace applications is obvious. The DC-BUS was used in the European SCARLETT project for harness reduction purposes.

- Home appliances

  Harness of white goods products can be reduced significantly by use of AC/DC-BUS between its modules. The new architecture use only two 24 V DC wires and two 110/220 V AC wires connecting all modules within the white goods products.

5. RESULTS

Model

Model consists of asynchronous generator, PF correction capacitor, and different scope such as reactive power active power. It also consists of LC filter converter.

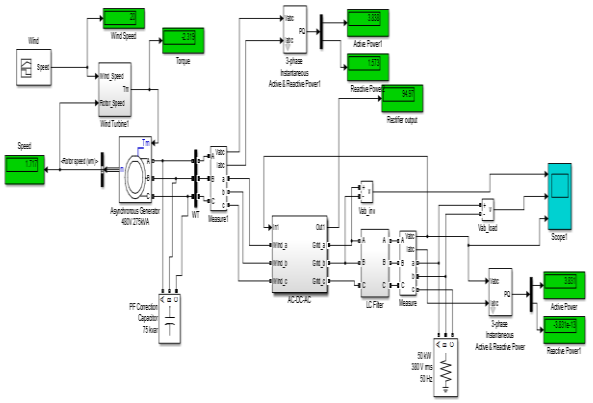


Fig.1 Model

The model is based on the steady state power characteristics of the turbine. Simulink input of the wind speed in m/s. Simulink output of the mechanical power of the wind turbine in pu of the nominal generator torque.

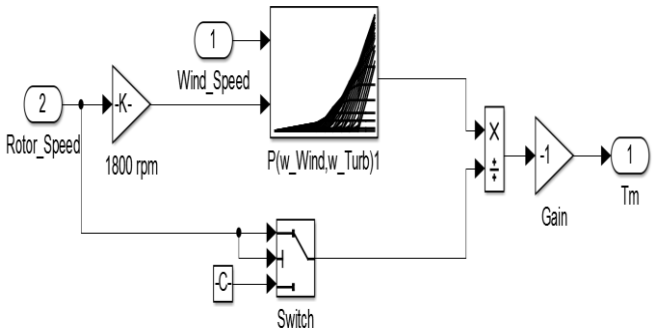


Fig.2 Wind turbine modeling

6. BACK TO BACK CONVERTER

Back to back converter circuit model is a caccade circuit that combination of AC to DC rectifier dc to ac inverter .

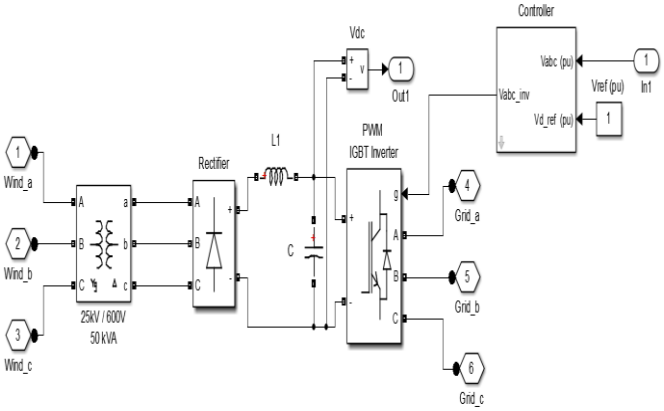


Fig.3 Back to back converter Controller

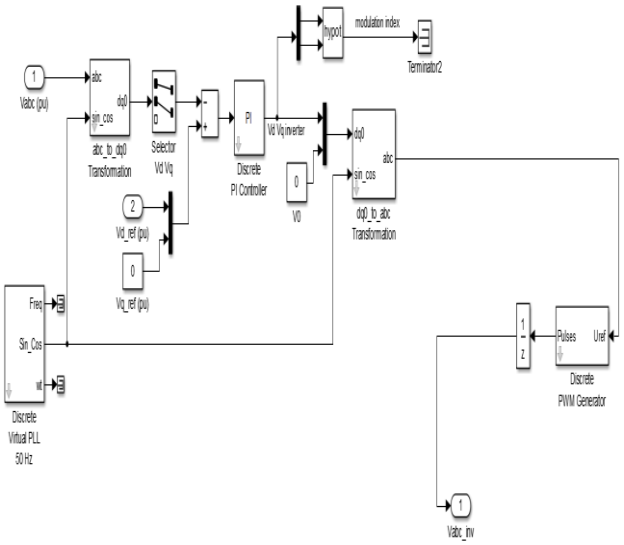


Fig.4 Controller

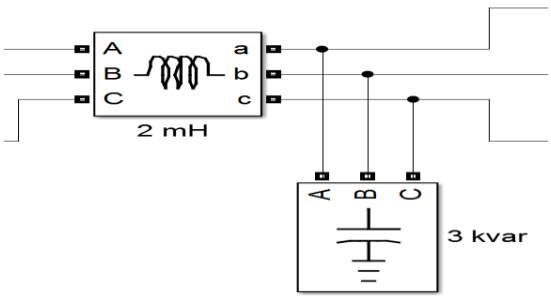


Fig.5 LC filter design

Lc filter are used for generating signals at a particular frequency.

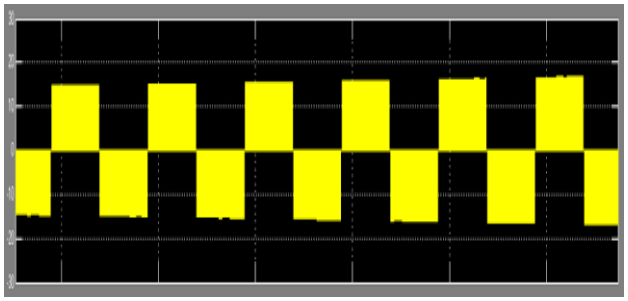


Fig.6 Inverter output (PU) before LC filter

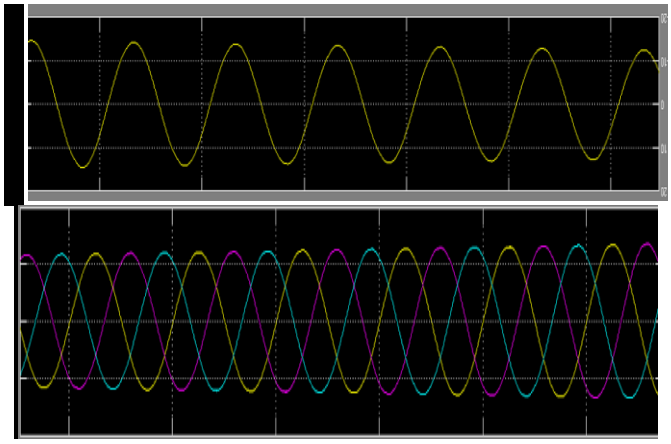


Fig.7 After LC filter

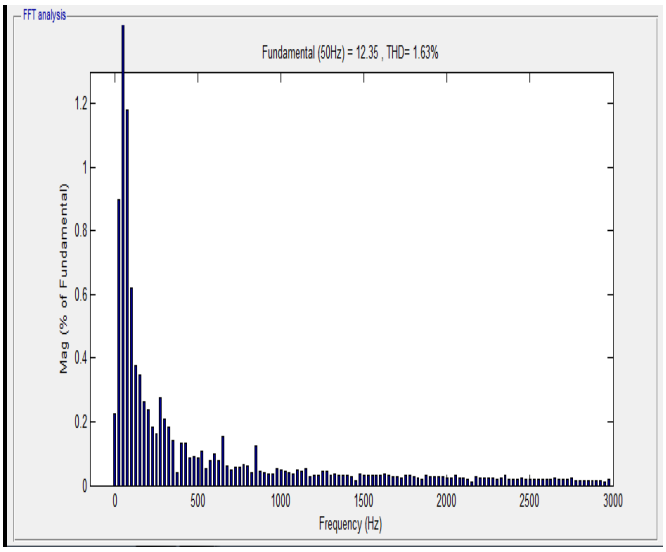


Fig.8 THD (Total harmonic distortion)

7. CONCLUSION

A power management strategy for the DC micro grid is projected, during which the DC bus voltage as AN info carrier completely differentiate to tell apart} different operation state of the micro sources. Management structure of micro sources is developed severally. The ability balance of DC microgrid below changeable load power condition is secure by the projected management technique.

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