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A Review of Performance Analysis of Microgrid

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Abstract:.
In most decades the demand is increases more than generations.so utility grid are more burden then resolave the burden introduce the Microgrid.Microgrid has drawn more and more attention because of the enormous benefits it can bring to traditional power system and local communities. Microgrids are essentially modern, small-scale (electrical) power distribution systems. They can afford benefits, such as enhancing system reliability, reducing capital investment and carbon footprint, and diversifying energy sources. Microgrids contain several generators, whose size may range from several tens of kilowatts to a few megawatts.. They are different from traditional cen-tralized electricity networks, which transmit vast amounts of electrical energy across long distances at very high voltages. However, microgrid are similar to utility scale power distri-bution grids, which generate, transmit and regulate electricity to the consumer locally. In this review pepar performance Analysis of Microgrid research how to increase power quality, BESS(battery energy storage system), voltage and frequency, wind energy for blackstart in microgrid or isolated island mode improve the performance of Microgrid.

Keywords: Hybrid design of Microgrid, isolated island, power quality,BESS system,wind energy system, Renewal energy systems (RES)PV systems.

1.Introduction

The electric power system, a vast and complex system, is managed through power system community. The network has been, is, and will be characterized by sharing varying renewable sources.The sharing in electricity generation at global scale is accomplished through an increase in renewable sources.The industrial advances and environmental concerns make the interconnection of renewable energy sources tendency toward the distribution network.Microgrids are local power systems of different size, operating inside the distribution systems.Due to their ability to:(a) reduce environmental impact, reduce investment in power plant construction, equipment and cost, (b) increasingenergy stable efficiency, (c) ride-through capability provided by energy storage, and (d) alleviate consequences of sud-den grid outages microgrids are becoming popular[1]

2.Literature survey:

2.1 Hybrid design of Microgrid

The day by day increase the dimand of power more than generation This grid outage.There are number of drives to build synergistic and integrated microgrids to reduce burden on utility grid.Hybrid power systems are becoming a popular way in the design of microgrids by using locally available RES such as Photovoltaics (PV), Fuelcells (FC), and Windpower (WP) to compensate the depletion of fossil fuel resources. Proper selection of architecture with respect to specific location is a major challenge.steady evolution of the regulatory and functional changes of electric utilities have led to a new trend of micro power plants at distribution called microgrids. Green Microgrids Development in India Microgrids deployment has unique opportunity in Indian context due to issues in rural electrification, increasing needs, fossil fuel depletion, peak loads, quality and reliability. Recent energy missions, attractive subsidies from government, and regulations on fossil fuel usage are the key catalysts for microgrid installation across India [2].

2.2 Small Microgrid performance of isolated island

A generalized model of a Microgrid in an island mode is proposed for assessing the system power and frequency performances. This Microgrid (MG) includes a diesel backup generator along with a number of Distributed Energy Resources (DES): Wind Turbine Generator (WTG), Photovoltaic System (PV), Fly- Wheel Energy Storage system (FESS), and Battery Energy Storage System (BESS).The Microgrid can work both in grid- connected mode and stand-alone mode. Controlling the frequency deviation is posing a great challenge in stand-alone mode due to the mismatch between load demand and generation and it comprises Low Voltage (LV) distribution networks with distributed generation (DG) units, renewable energy resources (RES), controllable loads, and often storage devices,. The benefits of Microrids are energy efficiency improvement, decreasing of overall energy consumption, network operational benefits and a cost efficient electricity infrastructure replacement. The power generation subsystems of the single Microgrid area is equipped with energy storage units which could have crucial role with the providing energy within a very short period in order to stabilize the Microgrid.Microgrid can also cause several technical challenges including frequency regulation which might be considered as one of the most fundamental drawbacks in its operation[3].

2.3 Laboratory-scale Microgrid

To achieve the reliable MG operation, economic and generation scheduling should be done using both optimization and control methods. Energy scheduling utilization is strongly required for the daily short term operation planning (daily and hourly). Managing of energy and control actions are required to establish common concerns The generation scheduling can be categorized as: static and dynamic. Uncertainty is normally classified as short-term energy management. The real time price of electricity and fuel cost are important terms to be considered. Before applying practical experiments for MG, simulation and modeling are mandatory MG uncertainty is represented and formulated for the generation scheduling problem in.Uncertainties terms as generation and storage resources, stochastic of renewable assets and loads, ac grid readiness and other local distribution systems are considered in Typical LS-MG represents hybrid system and consists of PV arrays, wind generator and batteries integrated to supply distribution system. Different tests are applied to the LS-MGwith various scenarios in stand alone and grid modes to investigate the behavior and performance of this system[4].

2.4 Microgrid vsi under Asymmetric condition

The concept of distributed energy resources (DERs) and Micro-grid has led to the demand for a reliable DC to AC converter or an inverter for grid interfacing that ensures proper power injection into the grid while maintaining rated voltage and frequency. Three phase systems are generally balanced but as we move towards the distribution end, voltage unbalances are very common a severe case of voltage unbalancing can occur in case of single-phasing, where one phase of the supply gets disconnected. Whenever any DER is injecting power to the grid, it must be ensured that the power quality in terms of voltage, frequency, current and voltage harmonics are within IEEE standards. This work investigates the performance of a three-phase voltage source inverter (VSI) during asymmetric conditions in gridtied mode of operation For this study the inverter has been designed and the controller has been implemented in dq - reference frame. Firstly, the controller has been tuned for balanced loading condition with the inverter operating in grid-tied mode. Subsequently, the loading arrangement was changed to implement asymmetric loading conditions mainly unbalancing at the load terminals and grid – side faults[5].

2.5 Synchronous Refrence frame Based Controller for grid interconnected Microgrid

Microgrids and their interconnection with main grid are gaining importance nowadays. Usually inverters acts as power interface between the renewable energy resources and main electrical network. Microgrids are becoming a reality where renewable energy resources, distributed generations (DG), energy storage units etc can be combined together as and when required and also can be integrated with main grid. This concept is gaining more and more importance due to several aspects like environmental, social, economical and political interest.These microgrids operate in such a way that they import or export power to and from the main grid through point of common coupling (PCC). In addition, when there is a grid failure they should be able to work as an autonomous grid. The work in this paper describes a control technique, which is a variation of multi loop approach, to implement the grid parallel and intentional islanding operation of inverter based microgrid. Different algorithms are used for normal operation and for islanding operation. During normal operation, the microgrid appears as constant power source to main grid and in autonomous mode microgrid is able to maintain constant voltage and frequency[6].

2.6.different Types of wind energy systems for Blackstart of Microgrid

Outages and blackouts do occur in the power systems operations. In the case of blackouts, there is no adjacent network available to assist the restoration process. This Paper Analyses the performance of different wind energy systems during black start or restoration of micro grid. Black start of an islanded micro grid was observed connecting three wind generators i.e. asynchronous generators, DFIG and PMSG respectively.Blackouts mention to a total failure of power to a geographic area and is the most extreme form of power outage that occur. It is the largest form of power outage. It is becoming a huge concern all over the world as it is causing much losses. Attempts should be made to develop an efficient way to minimize the losses to a great extent. Recovery after a blackout event is known as black start. After any blackout event the bus voltages tend to go to zero value. Recovering the voltages to previous value is the goal. There are several ways to black start.

2.6.1 Asynchronous Wind Turbine Generator: This type of wind turbine is the most used among abovementioned wind turbines. The main difference between synchronous generator and induction or asynchronous machine is that asynchronous generators do not operate in a fixed speed, for this reason these machines are called asynchronous generator.In a wind turbine generator, the turbine blades spin the rotor a little bit quicker than synchronous speed and thus energy is delivered into its stationary field

2.6.2 Doubly Fed Induction Generator (DFIG) : The doubly Fed Induction Generator is made up of a WRIG where the stator windings directly connected to the constant frequency three phase grid. A bi directional back-to-back IGBT voltage source converter is connected with the three phase rotor windings. Because voltage on the stator is applied from the grid and power converter supplies voltage to the rotor, the term 'doubly fed' is associated with it. This system permits a variable-speed operation over a sizable, but confined span.

2.6.3 Permanent Magnet Synchronous Generator (PMSG): The synchronous generator operates at a constant speed unlike asynchronous generator. Determination of the generators speed is calculated by the number of poles and the frequency needed for the power lines. This constant speed is achieved by giving dc current in rotor. To provide this dc current additional rectifying circuit is needed which is called the exciter and for applying produced dc current onto the rotor slip rings are mounted on the rotor. Creation of magnetic power can be done utilizing permanent magnet or with a conventional field winding.This paper has analyzed permanent magnet synchronous generators for simulation as it is more suitable because of their self-excitation property allowing them to be operate at high power factor and high efficiency.The main intention of this paper is to observe the performance of wind driven generators while attempting black start in a small portion of a power system or micro grid after blackout of a whole power system. As discussed in results section it can be observed that among three generators only the PMSG is capable of starting the micro grid. However, DFIG and Asynchronous wind generator fail to start the micro grid after black out[7].

2.7 Solar PV Besed Microgrid with and without BESS Estimating the expected Battery life.

This paper depicts the performance analysis of the solar photovoltaic (PV) system with and without battery energy storage system (BESS). The superiority of the battery based system has been studied and analyzed and the expected life time of the battery has been calculated. The study has been validated appropriately when the system is subjected to fault conditions. During fault condition, the active power, reactive power, voltage and current at the point of common coupling (PCC) is compared with the solar PV based system with and without BESS system.the world is advancing with the progress in technology, the requirement for energy is increasing at a faster rate due to advancement in Industrialization. As the major portion of the energy requirement is derived from the conventional sources of energy, the stress on fossil fuels is also increasing.The advantage of renewable energy sources of energy are its diverse applications, low maintenance cost, eco-friendly and easy installation at remote area Despite the advantages solar PV also have some disadvantages as well. The energy from solar PV is not reliable due to change in irradiance and climatic functions. Also, PV system faces various challenges such as partial shading while delivering maximum power that requires various mitigation approaches resulting increase in complexity of the systemSolar PV can be referred as useless during night, without the use of battery storage as the requirement would be from a local grid. The voltage output at the PCC terminals at the PV is generally distorted due to variations of irradiance. However with the use of BESS the voltage is improved.Nickel Metal Hydride battery considered for using in solar PV system. The Ni-MH battery has a high cycle count can withstand wide temperature change. The limitations are high self-discharge, heat generation during fast charge and high load discharge. The expected battery life can be calculated by using normal distribution curve. The normal distribution curve can be defined as a symmetrical bell shaped curve which can be extended its tails up to infinite along its both directions. The tails are extended from the mean data set of the observation. The proposed system is compared over integrated with battery and not integrated with battery. The reactive power and active power is compared during line to ground fault conditions. As this idea will be proved appropriate when the system is subjected to faulty condition. The battery connected PV system works superior to the no battery based PV system.Also the expected life time of the battery has also been calculated by using normal distribution[8].

3.Conclusion

In this review pepar I have understood about performance analysis of Microgrid different techniques, design hybrid power system, improve the power quality, frequency, voltage, improve BESS Increases the life of battery, different type wind turbine generator use for black start of microgrid understanding of different problems isolated island ,grid interconnected to Microgrid,Asymmetric condition of Microgrid.

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