Innovative Journal for Opportunities and Development in Science & Technology,
Volume 1,Issue 9, May 2021
Paper Id: – IJ2021V1I9 -15A-E,
ISSN 2582-6026

WIND-SOLAR MICROGRID

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ABSTRACT :- A wind-solar microgrid (MG) is investigated to work in isolated and remote areas where abundance of renewable sources i.e. wind, solar, hydro etc. are available. The consistent speed wind age is accomplished with lasting magnet simultaneous generator (PMSG) and sunlight based boards are utilized to create DC power from the daylight. A lift converter is used to get this sunlight based capacity to loads and the battery bank utilizing gradual conductance (INC) approach. This battery bank is resembled at the DC transport of the VSI (Voltage Source Inverter). The normalized sign least mean fourth (NSLMF) control is applied to provide power quality solutions like harmonic suppression, voltage regulation, the reactive power compensation and power balance etc. This investigation targets auditing the advances made towards the usage of microgrid control frameworks fusing PV-Wind age units with accentuation on the pertinent microgrid control strategies and principles. Based on the review conducted, it was noted that every control strategy has its merits, demerits, level of efficiency and cost. Further, to address the control challenges of the PV-Wind hybrid generation system, A MATLAB-Simulink model is developed to demonstrate the performance of the microgrid.

Keywords :- Wind- Solar MG, PMSG, Solar Panel, NSLMF, Power Quality.

1. INTRODUCTION

An increased demand of electrical energy and shrinkage of conventional resources (coal, natural gas & oils etc.) have given new dimensions to renewable energy research and their utilization in urban and rural areas. The remote areas where the grid is not accessible but the renewable sources like hydro, wind, solar are in abundance can be exploited to generate electricity in the form of distributed generation systems and microgrids [1, 2]. Renewable energy conversion into the electrical energy has become possible with the development and advancement in area of power electronics [3]. Price rate of the conventional sources are increasing day by day and to get relief from such expensive energy consumption [4], the

renewable based microgrids can be a good replacement, as now the renewable energy has become affordable due to the reduction in cost. The wind and solar powers can be the good choices as they are in their advance stage of development and Governments are also promoting them under various schemes. The constant speed wind turbines are used to extract electrical power, which deliver power to the loads at constant frequency. Their control becomes simple and number of converters is reduced as MPPT and speed control are not required which are the common for variable speed wind turbines [5, 6]. Therefore, such system becomes cost effective and their installation cost is also reduced. For constant speed wind generation, PMSGs are used as they are maintenance free and have good thermal capacity as slip rings are absent. In absence of the rotor windings the field losses are reduced and the weight and size of the generator are also reduced. Therefore, the overall efficiency is improved [7]. The solar systems individually [8] or in hybrid combinations with other renewables [9-10] can function in grid tied mode or in isolated generation. Solar systems are used with or without MPPT. The wind-solar MG (Microgrid) for rural electrification can be a good choice. Because during low wind seasons (winters) the solar power generation with battery bank can support the load demand and in rainy season when the wind is available however, sun light availability is poor the wind power with battery bank meets the demand. Therefore, this report contributes the wind-solar MG, the constant wind generation with PMSG and the solar power generation using two-stage boost converter control for maximum power extraction. By INC [11, 12] MPPT technique, extracted power is fed to the consumer loads and an excess power is fed in the battery. The battery bank is connected at the DC bus of the VSI (Voltage Source Inverter) to support the DC bus voltage. This VSI is connected at PCC between PMSG and the load.

1.1 Rural Electrification

Power access to remote areas by electric connection is a process of rural electrification. A village would be declared as electrified according to vide letter No. 42/1/2001-D (RE) Issued by Ministry of power (MOP), if Basic infrastructure such as Distribution Transformer and Distribution lines are provided in the inhabited locality as well as the Dalit Basti hamlet where it exists. Electricity is provided to public places like Schools, Panchayat Office, Health Centers, Dispensaries, Community focuses and so on The quantity of families energized ought to be in any event 10% of the all out number of families in the town. Power is utilized for lighting and family exercises, for automation of many cultivating activities, like sifting, draining, in processing plants. The Rural Electrification Corporation Limited (RECL) was framed explicitly to figure out the issues come in giving power in every one of the towns the nation over. There are different plans dispatched by government every once in a while like Rajiv Gandhi Garmin Vidyutikaran Yojana (RGGVY),Remote Village Electrification Programme, Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Pradhan Mantri Gram Vidyut Yojna to expedite the electrification and diversify the procedure. Work has been done for wastage reduction, providing

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better equipment and improving the overall infrastructure for electrical transmissions in villages etc. but Poverty, lack of resources, lack of political will, poor planning, and electricity theft which is a severe loss of power of one kind and keep away rural area without access to electricity.

II. WHAT IS A MICROGRID SYSTEM

A micro grid (MG) can be defined as a group of renewable energy sources and energy storage devices controlled by a monitoring system to provide power to the loads for which it is designed (Bouzid et al., 2015). The fuel source might possibly incorporate the neighborhood utility network. A microgrid can be viewed as a more modest adaptation of the customary force matrices. The consortium of Electric Reliability Technology Solutions (CERT) portrays the idea of a microgrid as a collection of burdens and miniature sources working as a solitary framework giving both force and warmth. A microgrid comprises of force generators, circulation and control frameworks for voltage guideline actually like a customary network. However, the main difference between the conventional grid and the microgrid is the close proximity between the power generation and the end users. In recent years microgrids have gained a lot of attention due to the advancements in renewable energy technologies. The figure 1 describes one of the many concepts of microgrids. The figure contains power sources such as solar PV arrays, wind turbines, utility grid and energy storage devices. The diesel generators can be used as a backup power supply or as a regular power source running parallel to the renewable energy sources (RES).

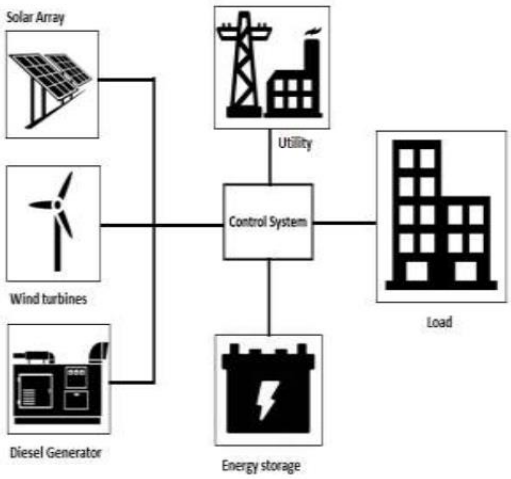

Fig.No -1 Concept of a microgrid

2.1 Key Issues Of Microgrid

Technical benefits of the microgrid are an islanding implementation of distributed generation to improve the distribution system service quality and increased the power system reliability [8]. Microgrid can be implemented to meet the increasing growth in demand and distributed generation is used to perform special task for microgrid operation such as reactive and active power control, ability to correct voltage sags and system imbalances [9-10]. This section is a review of three technical challenges on micro grid with respect to voltage and frequency control, islanding and protection of micro grids.

2.2 Advantages of Microgrid

The microgrids advantages are as follows Provide good solution to supply power in case of an¬ emergency and power shortage during power interruption in the main grid Plug and play functionality is the features for¬ switching to suitable mode of operation either grid connected or islanded operation, provide voltage and frequency protection during islanded operation and capability to resynchronize safely connect microgrid to the grid Can independently operate without connecting to¬ the main distribution grid during islanding mode, all loads have to be supplied and shared by distributed generations.

2.3 DC Microgrid

A micro grid can be defined as a group of renewable energy sources and energy storage devices controlled by a monitoring system to provide power to the loads for which it is designed. The energy source may or may not include the local utility grid. An electricity network consists of two primary systems, which are transmission system and the distribution system. A conventional network comprises a central power station from where the power is being transferred to the distribution centers and then to the customers. The problems associated with this are that it is not totally reliable and as the power generation is far from the load it will be difficult to cope with the disturbances occurring at the load end. A micro grid, on the other hand, consisting of distributed generation will be more suitable for these needs. Currently the AC network is predominant in most parts of the world but the DC micro gird network is gaining importance these days due to the higher efficiency when coupled with renewable energy sources and storage systems. A micro grid system for residential purpose will consist of components such as an isolation transformer, a rectifier.

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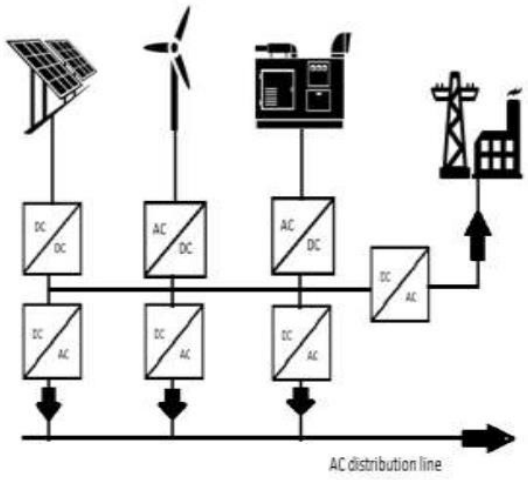

Fig.No 2: Components involved in a microgrid

III. DISTRIBUTION SYSTEM

Planning a distribution system plays an important role in constructing a microgrid. An efficient distribution system not only assures reliable power but also proves to be economically justifiable on the investment side. There are three types of distribution that are available for general utility connection as well as microgrids. They are Radial¬ Loop¬ Network.¬ The most commonly used distribution systems in microgrids are radial and loop type distribution. These two types are considered due to the ease in their implementation and the cost involved in constructing them. Both these types of distribution will be discussed in detail.

3.1 Radial

Radial distribution is the most sought out system for power distribution. It is employed in majority of the power distributions around the world. It accounts for 90% of all distribution in North America. Most of the microgrids that are deployed and that are being constructed opt for radial distribution system as they are cheap, simple to design and easy to plan and operate. Radial distribution has only one path between the generation and the houses connected to it.

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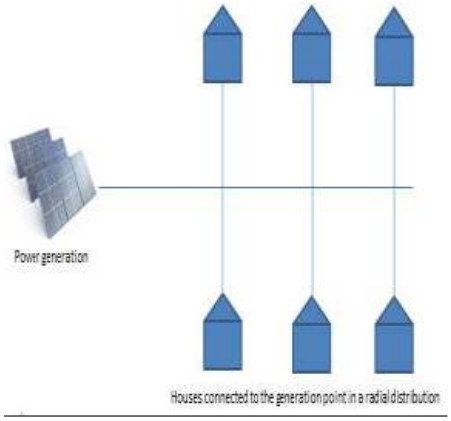

Fig No 3 A Typical Radial Distribution.

IV. OPERATION & CONTROL OF MICROGRID

The microgrid, an integrated form of DERs, is normally interfaced with load and utility grid by power electronic inverters. It can operate in grid-connected mode or in islanded mode. In grid-connected mode, the microgrid either draws or supplies power from or to the main grid, depending on the generation and load with suitable market policies. The microgrid can separate itself from the main grid whenever a power quality event in the main grid occurs. Autonomous control of micro sources suggests that the microgrid should follow a peer-topeer and plug-and-play model avoiding the installation of a single point of failure like microgrid control centre (MGCC) and dedicated storage units, so the micro sources should have integrated storage unit (Battery bank in the dc bus of the inverter). The microgrid should disconnect itself from main grid on occurrence of abnormal condition and to be shifted to islanded mode. The variation in voltage and frequency becomes more prominent when microgrid is switched over to islanded mode. Under grid connected situation of microgrid, the voltage and frequency are determined by the grid. When the microgrid islands, one or more primary or intermediate energy sources should be controlled by adjusting its voltage and frequency. If the frequency reaches to a very low value, the load may be temporarily shaded.

V. CONCLUSION

This paper presents, a brief review on microgrids with HRES based distributed generation. There are many commercially viable projects on HRES being operational around the world. Some of the cases considering unmistakable blends of RE sources and its effect have been investigated in this paper. Part of ESS on HRES based microgrid framework has been

featured and a short conversation on different ESS has been introduced. Additionally the Microgrid designs, its demonstrating and control have been talked about and brief outline has been introduced in organized structure. Current status and future scope of EPG with HRES to elevate energy poverty and rural electrification has also been discussed. A wide ranging list of references has been included to provide ready references to the researchers pursuing research in this field.

REFERENCES

[1] Bhim Singh, B. K. Panigrahi, Geeta Pathak, "Control of Wind-Solar Microgrid for Rural Electrification", 978-1- 4673-8962-4/16/$31.00 ©2016 IEEE

[2] Mr. Rahul Kumar, Dr. Tarlochan Kaur, "Designing of Micro-grid for Rural Electrification Case Study", International Research Journal of Engineering and Technology Volume: 04 Issue: 06 | June -2017 Page no. 2076-2081.

[3] Rumman R Islam,Mingyu liao,Thai hau vo, Jayashree Ravishankar "Expremental set of microgrid with wind & solar with power Emulators." 978-1-4799-3739- 4/14/$31.00c 2014 IEEE.

[4] Linus A. Alwal, Peter K. Kihato and Stanley I. Kamau "A Review of Control Strategies for Microgrid with PV-Wind Hybrid Generation Systems" Proceedings of the Sustainable Research and Innovation Conference, JKUAT Main Campus, Kenya. Page no. 243-250 ©2011 IEEE

[5] A. Rashid, N. Hasan, K. T. Parvez and M. N. I. Maruf, "Study and analysis of a small scale micro-grid using renewable energy resources," Proceedings of International Conference on Electrical Engineering and