Review Paper Hybrid Energy Storage System Micro Grid Integration with Four Leg Three Level NPC Inverter

Dhiraj Kashide[1], S.D. Jawale[2]

[1] *Student, M-Tech at EPS MGM'S JNEC AURANGABAD*
[2] *Assistant Professor EPS MGM'S JNEC AURANGABAD*

Abstract— *This paper briefs about Hybrid Energy Storage System Micro-Grids Integration for Power Quality Improvement Using Four Leg Three Level NPC Inverter and Second Order Sliding Mode Control. The use of a 4-Leg 3L-NPC power converter to interface a RES with a HESS (formed by a VRB and a Li-Ion battery) in a micro-grid has been investigated. A new method of the structural that presented and implemented to exploit the entire capability of the 4-Leg 3L-NPC converter to insure a maximum power division between the two ESS. A non-linear scheme has been designed and tuned to control the zero sequence injection in the modulating signals in order to control the power flow of the HESS. Furthermore, the fourth leg of the converter allows the unbalanced load issue to be addressed and thus enable active power filter capabilities. The investigation of the topology showed a power exchange capability among the HESS. Experimental results proved the capacity of the proposed control strategy to manage a HESS in order to improve the power quality and stability as well as to control the renewable energy injected into a micro-grid.*

***Key Words*- Snubber circuit, solar Panel, DC-AC power converters, Energy storage, Micro-grids, Power quality, Sliding mode control.**

1. INTRODUCTION

The increasing penetration Load of DG is changing management of the grid and existing System from centralized to decentralized schemes, For creating several challenges that Can be occurred in order to keep the electrical grid's proper and efficient operation.

The micro-grid concept, which can be mean as a small scale weak electrical grid that is able to operate both in connected and islanded mode, has been extensively studied as a solution for RES integration. The weak nature of a micro-grid implies the use of an Energy Storage System (ESS) to increase RES penetration and insure its stability. A device that stores chemical energy is called battery. Energy comes in multiple ways including radiation, chemical, gravitational potential, electrical potential, electricity, elevated temperature, latent heat, kinetic etc.

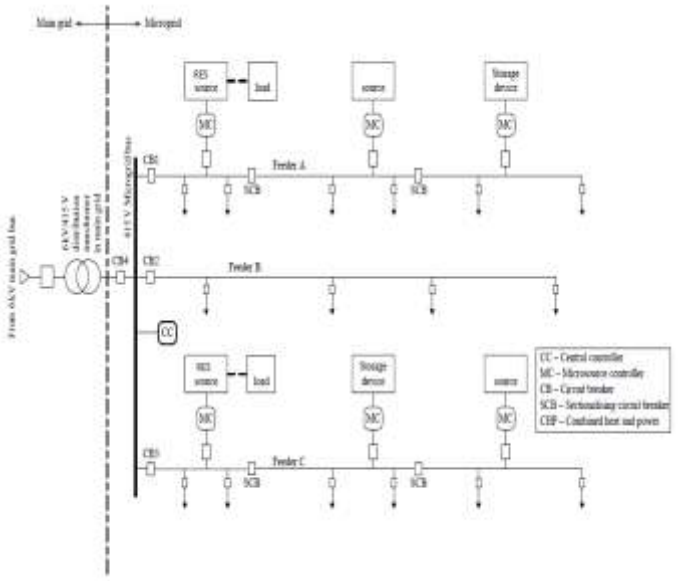

Figure 1.1 A Micro grids Configuration

Energy storage involves converting energy forms which are difficult to store. Bulk energy storage is currently dominated by hydroelectric dams, both conventional as well pumped. Some technologies provide short-term energy storage, while others for much longer. A wind-up clock stores energy in potential form (in this case mechanical, in the spring tension), a rechargeable battery stores readily convertible chemical energy to operate a mobile phone and a hydroelectric dam stores energy in a reservoir as gravitational potential energy .Fossil fuels such as coal and gasoline store ancient energy operates from sunlight by organisms that later died ,became buried and over time were then converted into those fuels .Food (which is made by the same process as fossil fuels) is energy stored in the form of chemical. Ice storage tanks store ice frozen by cheaper energy at night to achieve peak daytime demand for cooling. The energy is not stored directly, but the work product of consuming energy (pumping away heat) is stored, having the equivalent effect on daytime consumption. The largest source and the greatest store of renewable energy is provided by hydroelectric dams. A large reservoir behind a dam can store much water to average the annual flow of a river between dry and wet seasons. Also solar is a type of conventional energy and it is endless because it generates

energy from sun radiation and it works using PV cell and it is require only radiation to generate electricity or energy.

2. HARDWARE DESIGN

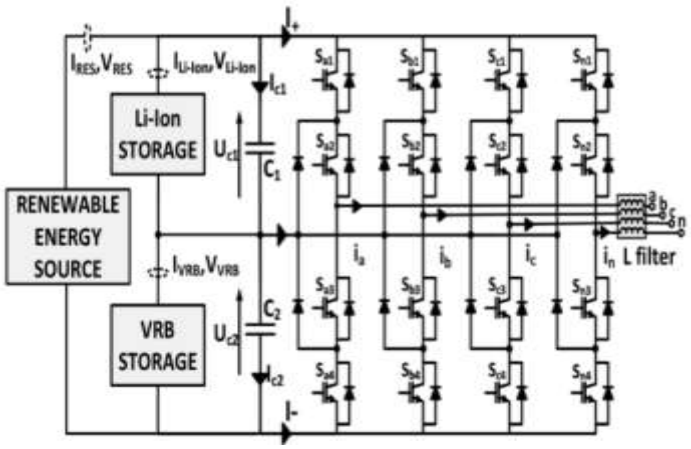

Figure 2.1: 4-Leg 3L-NPC topology Interface

Compared with the single technology ESS, a hybrid ESS (HESS) can combine the advantages of each technology used in ESS and Hybrid, thus being more suitable for large scale renewable energy systems. In this research presented that Micro-grid (MG) is the indispensable infrastructure of HESS topology. Nowadays smart grid is working efficiently, however, fluctuation and intermittence resulted from unstable but micro-sources and nonlinear loads will execute the considerable impacts on operation of the MG. Energy storage technology are presents for a preferable solution to the above issue occurred in smart grid. The paper gives a full scope and review of the principal working of energy storage technologies and also being developed, and the features and benefits of energy are storage systems (ESSs). In [2] the authors represented that going beyond the 2D flows and 3D coupled species/charge/ fluid transport models studying and pore scale felt electrodes can be employed to obtain a better result and understanding of the flow on the pore level. In [4], a unified energy management and scheme is proposed for renewable energy grid integrated systems with battery-capacitor hybrid storage. The intermittent nature of renewable-energy sources (RES), coupled with the unpredictable sudden changes in the load, demands high-power and high, energy, density storage systems to exist in today's micro-grid environment The researchers in present that the battery voltage and current can be rectified with a capacitor. The capacitor having sufficient energy storage to deliver the current pulse for the required time, and its equivalent series resistor (ESR) must be small enough to minimize the voltage droop and spikes. Capacitor meet these requirements. This paper examines performance improve when a capacitor is used with a battery. In the researchers used a dc coupled structure in order to isolate the grid voltages and frequencies from other sources. All sources are connected to a main supply dc bus before being connected to the grid through a main inverter topology. [5]The authors in proposed that Large scale deployment of renewable energy (namely wind energy and solar PV) may entire new challenges in power micro grid systems and more volatility in power prices in utilization of electricity markets. [6] An updated review of the state were presented technology and installations of several energy storage and their various characteristics were analyzed in [8]. In [9] distributed generation of electricity as a new technology for supplying the increasing demand for electricity. Micro grids are attracting a great deal with a system, attention since they integrate, distribute and generation in the main grid reliably and cleanly. In they claimed the significant benefits associated with micro grids have led to the vast efforts to expand their penetration in electric power systems. In this paper a DC-coupled wind/solar/capacitor hybrid power system is studied capacitors have high power density And exceptional durability to store charge as shown in fig(2.1).

[3]. Fig 1 shows the Model of the micro greed. The Li-Ion battery benefits as compare to the lead acid from a high specific power and moderate self- discharge. This technology has also been developed for high power standalone backup applications in recent years.

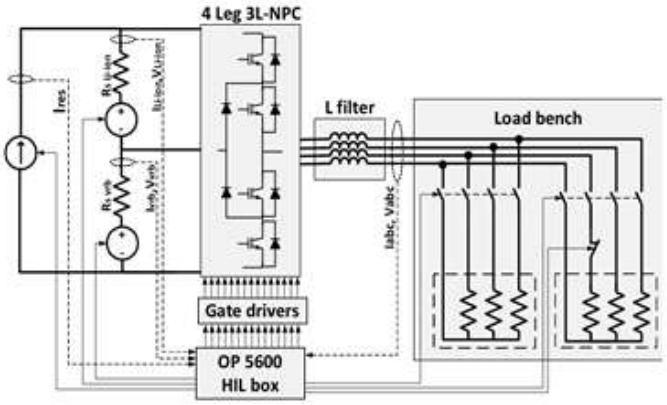

Fig2.2: Experimental schematic (VRB)

Consequently, the use of these two(solar, regular supply) technologies is complementary and realizes a highly specific energy and high specific power in HESS. The proposed control method uses to operate where each phase is controlled by the mosfets (IRFZ44) means for a modulation in input signal it require switching for that we are using CD4047 ic as a mosfet driver and it switches the mosfet at 50Hz frequency and also at variable frequency . A zero-sequence voltage is injected to minimize the switching losses.

3. CONCLUSION

Micro grid is an extension of main grid provides the on-site generation capable to fulfilling its local load demand. Micro grid architecture requires to be added in the main grid to increase the reliability, improve power quality and avoid the fluctuations, improve the technical performance.

Micro grid operating modes and dispatch strategies must be shown in this paper.

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Author's Biography

Dhiraj S. Kashide is currently a M-Tech Student of Electrical Power System (EPS) in Final year, and has been awarded B.E. in Electrical Engineering (EE) Degree in 2017 at MPGI Nanded.

Mr. S.D. Jawale is currently assistant professor at MGM'S Jawaharlal Nehru Engg. College, Aurangabad.