International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 09 | September - 2022 Impact Factor: 7.185 ISSN: 2582-3930

Paper on Solar PV based Scalable DC Microgrid Design and simulation for Rural Electrification

[1] *Mr. Gajanan S.Deotale Electrical Dept.VIT,College*
[2]*Dr.Nilesh Bodne Electronic Dept.VIT,College,*
[3]*Prof.Saurab Lawate*

Abstract: In this paper We present the analysis and design of the e dc micro grid system for electrification. The micro grid configuration has been driven by field information gathered from India. The important parameter of such system depends on the Micro grid capacity of the transmission network which overflows the value of the voltage and the current from the main grid, which power the cost matrix analysis of the overall system which has to be equal. In this paper, we compute that the excessive cost of power (COE) for the proposed dc micro grid framework will be under minimal charges as put forth by the electrification governing agency according to the per kW-hr. We additionally present test results from a privately introduced dc micro grid model that exhibit the consistent state conduct, the bother reaction, and the general efficiency of the framework. The results show the reasonableness of the introduced dc micro grid design has totally inflicts with the main grid feasibly and found out to be very easy to implement without any extra cost to the system as far as the rising districts and the number of population in such districts are concerns.

1.INTRODUCTION

Power machine harmonic distortion has existed for the reason By 2035, the population of the world is supposed to increase by almost 1.5 billion which will make the population reach 8.8 billion people. This increase in the population will cause two things. The first one is an increase of the demand on energies. The demand on energies will cause the decrease of fossil fuels resources and the increase of CO2 emissions to reach approximately 39 billion tones by 2035. The second one is creating issues related to power grids which can be resumed to;

- Congestion : The components of the power grids are old and cannot satisfy the demand for a growingpopulation
- Security, protection, transmission losses and losses due to the gap between production andconsumption.
- Problems emerge when the power grids are far from where the power isneeded.

2.BACKGROUND

The energy that is collected from renewable resources is called renewable energy, which are naturally replenished on a human timescale, such as sunlight,wind,rain,tides,waves,and other mal heat.

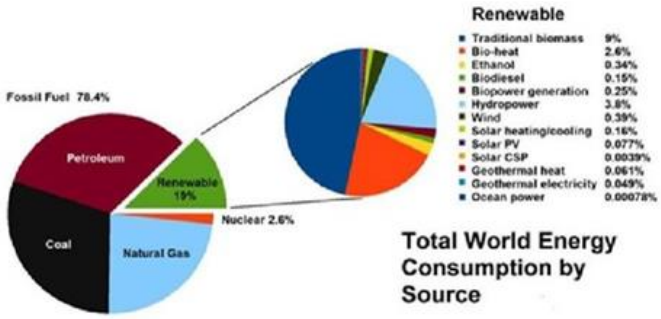

Figure 1 World energy consumption by renewable sources

3. SMARTGRID

A smart grid refers to a new and innovative system of electrical distribution that has the ability to manage and control information and power generation. It is capable of using different power sources to get the energy needed. The smart grid is also capable to store the produced energy that was not used by the consumer [2].What makes the smart grid really innovative is the shift that one can notice between the old grid and the new one. A smart grid relies more on a two-way communication system between the power supplier and the power consumer. Here the power supplier will produce energy using different energy sources (solar, windpower) based on the information got from the power consumer[3]. One can notice the difference compared to the old grid where a hierarchical system was followed, i.e. the power producers continue to produce energy even if the demand wasmet

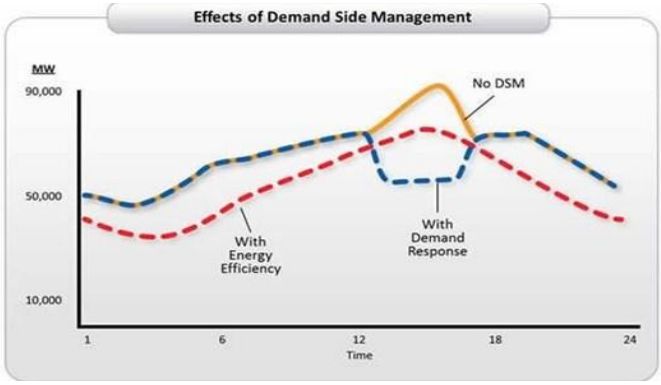

Figure 2: Effects of demand side management

2. LITERATURE SURVEY

1. Mírez Jorge, "A Modeling and Simulation of Optimized Interconnection between DC Microgrids with novel strategies of voltage, power and control" 978 - 1 - 5090 - 4479 - 5/17/$31.00 ©2017IEEE.

This paper interconnected MGs have been analyzed using mathematical modeling, numerical simulations and taking into account technical criteria of operation and management possible to implement. It is observed that electrical loads must be regulated in the sense that they ensure an almost constant consumption power during a period of system operation (which may take several minutes), this may be possible if the load element - MG can do the following: (a) prediction of the consumption trend, (b) heating on/off, (c) air conditioning on/off, (d) water pump on/off, (e) any other requirements energy that can be programmed for use (for example: washing machine, irrigation, etc.). With the condition that once in operation it does until it finishes its process. The customer could only put the electric loads in "on-off" condition and the load microcontroller and MG can program the operation and decide the moment of start.

2. F ulongLi, Zhengyu Lin "Active DC Bus Signaling Control Method for Coordinating Multiple Energy Storage Devices in DC Microgrid" 978-1-5090-4479-5/17/$31.00©2017IEEE.

This paper proposed an active DC bus signaling (ADBS) method to coordinate multiple battery banks in a DC microgrid. It has the advantages of accurate current sharing. Using the proposed ADBS method, the master controller can collect State of charge (SoC) of each slave battery bank by actively varying the DC bus voltage levels and monitoring the current change. The master module then sets a working voltage level after decision-making. The proposed method was experimentally evaluated, and the experimental results show that all the possible working voltage levels can be reached and the accuracy of current sharing isguaranteed.

3. K. Tazi, F. M. Abbou, A. Bannour Chaka, and F. Abdi "Modeling and simulation of a residential microgrid supplied with PV/batteries in connected/disconnected modes—Case of Morocco" Received 10 December 2016; accepted 14 March 2017; published online 28March2017.

Modeling and simulation of a residential microgrid supplied with PV/batteries in connected/disconnected modes—Case of Morocco co-published by Dr. Tazi,Dr. Abbou, Dr. Bannour and Dr. Abdi reviews the different components of a micro- grid with their respective mathematical equations. The model introduced was built in Matlab/Simulink and the scenarios tested in the system validation were described in detailed. This modelwasbuiltaccordingtotherulesofdistributionofaMoroccan grid code. The sample was selected in a way that would allow a representation of power consumption of an average household in the region of Ifrane. The scenarios previously mentioned were used to test the micro-grid in normal operation as well as in faulty operation that need disconnection from the utilitygrid.

4. Prajot Prabhakaran "Mitigation of Voltage Unbalance in a Low Voltage Bipolar DC Microgrid Using a Boost-SEPIC typeInterleavedDC-DCCompensator"978-1-5090-1546

-7/16/$31.00 ©2016IEEE.

In the proposed method, apart from the converter losses, the compensator doesn't consume or supply power. Hence, no active source is required in mitigating the unbalance. The proposed method reduces the current in the neutral line,thereby reducing the overall line losses in the bipolar dc microgrid. Simulation and experimental results are presented to validate the efficacy and feasibility of the proposed technique.

5. Lehn Luis E. Zubieta and Peter W. "A High Efficiency Unidirectional DC/DC Converter For Integrating Distributed Resources Into DC Microgrids" 978-1-4799-9880-7/15/$31.00 © 2015IEEE.

This paper presents a novel unidirectional DC/DC converter that can be used to transfer power from distributed resources such as Solar PV or Fuel Cells into a DC microgrid.Theconverter is based on the LLC topology but designed tooperate in a specific region of the gain curve that provides several benefits to integration of renewable energy sources into a constant DC bus. The isolated converter shows veryhigh efficiency, full range of zero current switching, and simple control. The novel topology also has the inherent attribute of balancing the voltage on a bipolar DC bus by automatically shifting the processed power to the pole with the lower voltage.

6. Ngoc An Luu "Control and management strategies for a microgrid." Electric power. Université deGrenoble,2014.

This publication about Control and management strategies for a microgrid first addressed environmental restrictions and the increase in fuel prices and considered them as an opportunity to better exploit renewable sources of energy in power systems. He states that in order to integrate the renewable sources in anelectrical grid, a microgrid is required. This concept encompasses a low voltage system with DERs which stands for distributed energy resources as well as flexible load and storage devices. As the integration of renewable energy resources into a microgrid may be very challenging and may have impacts on the operation of the microgrid, Ngoc An Luu's thesis suggests strategies that promote optimal sizing and security, reliability and efficiency such as battery energy storage systems (BESS) and photovoltaic productions (PV). A method is also proposed to manage optimally the energy that goes in microgridoperation.

7. D. Habumugisha S. Chowdhury S.P Chowdhury "A DC-DC Interleaved Forward converter to step-up DC voltage for DC Microgrid Applications" 978-1-4799-1303-9/13/$31.00 © 2013IEEE

This paper presents models of DC-DC Forward converters leading to the suitable topologies. Precisely, the combination related to cascaded, paralleled, bridged and interleaved technologies of classical DC-DC Forward converters have been experienced for being applied to DC Microgrid.Interleaved DC-DC Forward converter with double three windings transformer is analyzed under PSPICE simulation for validating the high conversion issue and clamped regenerative techniques.

8. R. Zamora and A. K. Srivastava, "Controls for microgrids with storage: Review, challenges, and research needs," Renewable and Sustainable Energy Reviews, vol. 14, issue 7, pp. 2009–2018,Sep.2010.

Ramon Zamora and Anurag K. Srivastava, in their work, assert that the the drastic increase in demand for secure, reliable, efficient and sustainable electricity has generated significant interest in microgrids. Their paper translates their effort to improve that technology and focuses of controls of microgrid in association with energy storage. An overview of the current control mechanism is provided along with the challenges it faces or mayface.

3 PHOTO-VOLTAIC CELL

A PV system or a solar panel is one of the most used sources of renewable energies. It relies on sun rays to generate electricity and is made up of several solar cells made from silicon and protected by layers of glass. PV systems contain invertors that transform the DC obtained from solar power to AC ready to be used.

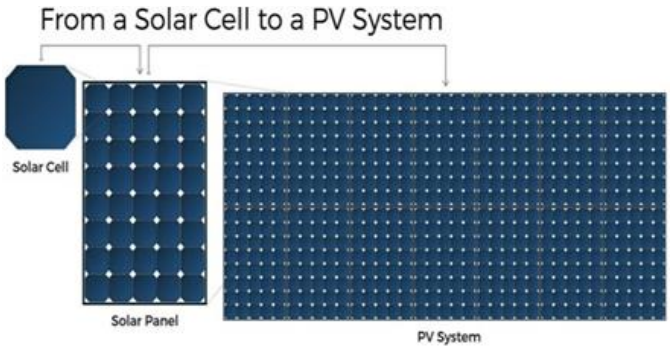

Figure 3: Solar cell, solar panel and PV system

Different types of solar panels exist such as crystalline silicon, thin-film, mono crystalline and poly-crystalline. Those types differ in their structure, efficiency, cost,production,and maintenance. For instance, mono-crystalline, which is made of of silicon ingots, has high efficiency rates reaching up to 20% because of the purity of the silicon used, a high cost and a low maintenance. Mono crystalline produces high power and generates electricity four times more than thin-film solar panels. Whereas poly-crystalline solar panel, which is made of square silicon ingots, has a lower cost but also a lower efficiency (up to 16%) compared to mono crystalline solar panels. Bellow is an illustration that shows both a mono crystalline and poly-crystalline solarpanel

4. DC BOOSTCONVERTER

Boost converters are high efficiency step-up converters that are characterized by having an output voltage higher than their input voltage. They are composed of two semiconductor switches and a storage element

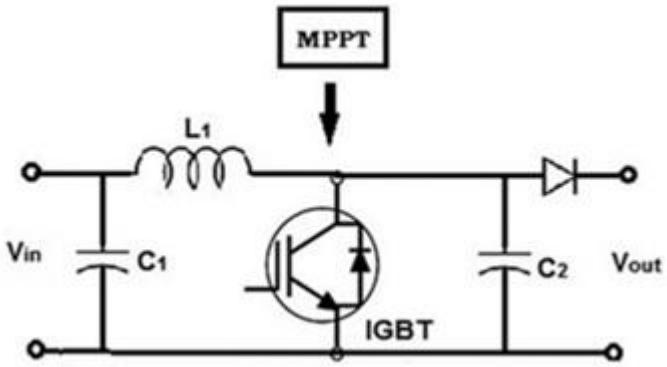

Figure 4: Boost Converter

CONCLUSION

DC Microgrid is preferred if more components are directly DC compatible. For that particular system, it is possible to reduce the dump load size and also improved efficiency by removing all types of converters. Examples of DC compatible components are LED lights, TV, laptop, mobile charger etc. DC micro grids are cheaper in cost. AC Microgrid is preferred when Microgrid directly connected to the grid here no dump load is required. Microgrids are expensive due to inverters. The main advantage with AC Microgrids is expandable and efficient.

This master thesis helps to encourage further study of individuals in the renewable energy system. The worldwide prospect is to reduce fossil energy supply. It is one of the important issues in present days. By using renewable energy sources; if the energy produced locally it would result in a build of the Microgrid in the region as well as reduced transmission losses i.e. energy produced and used locally. Local pollution can also be lowered and in a wider perspective, since the electric power-grid is connected throughout many countries with a common trade system, it can also help to reduce the pollution globally .It is also the prospect for

REFERENCES:

[1]G. Mamatha "Assessment of different MPPT Techniques for PV system", IJERT, ISSN 2278-864,VOL.4,15MAY2010.

[2] Rajesh K.S.& Ragam Rajagopal, "Implementation of an adaptive control strategy for solar Photovoltaic generator in microgridwith MPPT and energy storage", ICRERA, 978-1-5090-3388-1, 23Nov2016.

[3] Hengyu Li, Chongyamg Zhao, Hao Wang ,SharorangXie and Jan Lao "An Improved PV system based on Dual Axis solar tracking and MPPT", IEEE, 978 - 1- 4799 - 3979 - 4/14Aug2014.

[4] Hui Zhang, Hong Ji ,Jing Ren, Lin Shan, Yongjun Gao "Research on MPPT control and implementation method for photovoltaic generationsystemanditsstimulation",IEEE,978-1-4244-3557
-9/09.

[5] Osamede Asowata, "Stimulation and analysis of MPPT in a stand alonePv system:a case study using regression analysis and pulse width modulation" IEEE, April2017.

[6] Yuncong Jiang, Ahmed Hassan, "Load current based analog MPPT controller for PV solar system", IEEE, 978-1-4577-1216-6, March2012.