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Hybrid DC Micro grid for Smart Energy Delivery

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ABSTRACT : The novel Hybrid system consist different sources such as PV system, t AC source, The battery are used as the main energy storage sources all together, form DC micro grid for smart energy delivery in off grid and on grid mode. Therefore, grid provide good quality of power to three different load namely 110V AC single-phase output and 48V DC output, The grid is at 230Vrms with 50Hz connected to a isolator in connection with the DC bus. The Three phase output of the grid is converted to rippled DC by the use of DBR (Diode bridge rectifier) The converted DC voltage is fed to ZETA converter which is a DC-DC converter, making the rippled DC to constant DC with the use of a buck inductor. Proposed system using Zeta converter to stabilize the DC voltage. Proposed system analyse in MATLAB Simulink environment.

KEYWORDS: DC Microgrid, PV System, Battery, EV.

I.INTRODUCTION

Micro grids are to be one of the most important factors for future power systems. These various renewable energy sources are generally connected parallel in Micro grid system. In order to get better performance from Micro grid, the existing system has to be modified or rectified. Micro grid concept integrates large amounts of micro energy sources without disrupting the operation of main utility grid. Hybrid Micro grid consists of PV/AC source energy sources for DC and AC networks respectively. Total energy storage systems may be connected to either AC or DC Micro grids. • Renewable energy source is one of the most searched topics in the field of electrical and electronics engineering. When fossil fuels such as coal, oil and natural gas are burned, the emission gases such as carbon dioxide and methane are released in atmosphere. And this causes climate change. The fossil fuels cannot be found constantly, which leads us to the use of renewable energy sources. Due to reasons such as the availability of renewable energy source such as solar, wind, hydropower, hydrogen, biomass, geothermal energy, reliable and clean energy resources and high efficiency, it has been widely studied today. One of the advantages of renewable energy source is the coexistence of several renewable energy source. There are some advantages of these hybrid models where renewable energy source is used together. In this project, a new Hybrid charging Station system is proposed for the smart energy delivery. The proposed system is connected with the 230V AC power source, and integrates the renewable energy sources of photovoltaic (PV) power and the battery. Hence, the proposed DC micro-grid system can not only provide the high quality power for two types of DC and AC loads, but also achieve many special features and characteristics for smart energy delivery.

II.RESEARCH OBJECTIVES

The objectives of this project are as follows:

The primary objectives of this study can be summarized as follows:

- 1) To study various power generating sources and how it makes highly flexible and efficient.
- 2) To enhance the share of renewable energy in the total energy generated.
- 3) To design Smart DC micro grid

III.PROPOSED METHODOLOGY

The grid is at 230Vrms with 50Hz connected to a isolator in connection with the DC bus. The Three phase output of the grid is converted to rippled DC by the use of DBR (Diode bridge rectifier) The converted DC voltage is fed to ZETA converter which is a DC-DC converter, making the rippled DC to constant DC with the use of a buck inductor. The MOSFET switch provide in the ZETA converter switches according to the duty ratio given by the PI controller for which the input is given from the error value of the reference and measured output DC value of the ZETA converter. It a closed loop control system with feedback PI controller circuit and the switching frequency of the ZETA converter is 45kHz.

The converted DC voltage form the ZETA converter is fed to the DC bus where all the other modules are connected. On the load side we have three loads, one AC load which has to be 110Vrms and 50Hz. Second 100V DC load, and third is 48V DC load.

The AC load consists of a PWM inverter employing Simple sinusoidal PWM technique converting DC to PWM AC with 110Vrms 50Hz output in turn connected to a AC load.

The 100V DC load is connected to a DC-DC buck boost converter with two MOSFET switches each operating with NOT operation. The switching frequency is 20kHz and the duty ratio is 0.2

The 48V DC load is connected to another DC-DC buck-boost converter with two MOSFET switches each operating with NOT operation. The switching frequency is 20kHz and the duty ratio is 0.1In both the DC-DC buck boost converters when the MOSFET Q1 is OFF Q2 is ON charging the inductor. After a cycle of time period 50usec the MOSFET Q1 is ON and Q2 is OFF and the charge present in the inductor discharges through the MOSFET Q1

Considering the fig.1 test system the modelling of the Hybrid system with PVA, and AC source with Zeta converter is designed in MATLAB Simulink environment. The modelling of the proposed system is shown below.

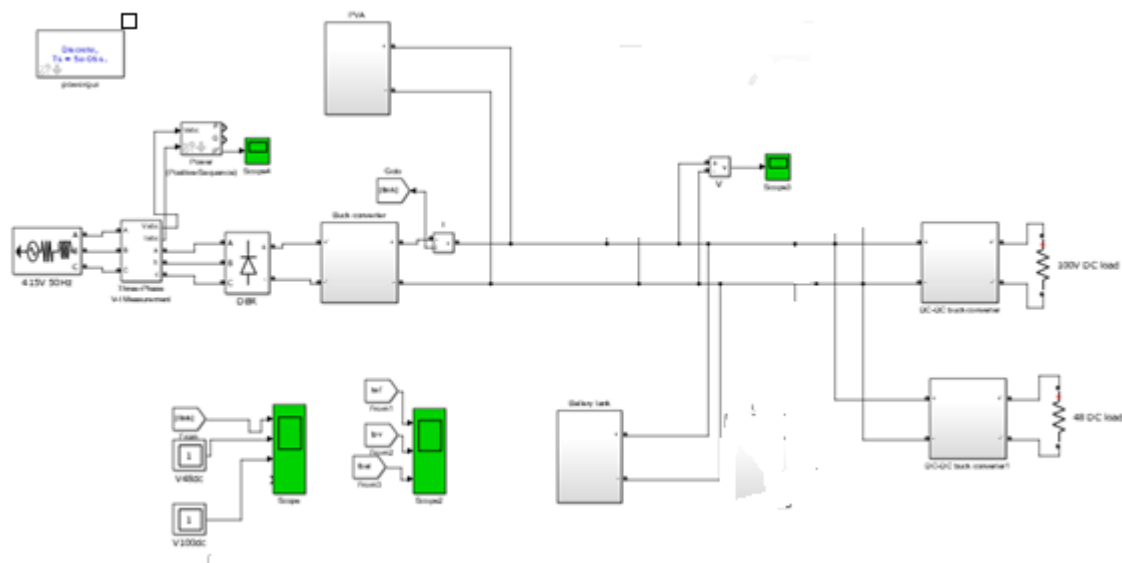


Fig. 1: Simulink modelling of proposed test system

IV.RESULT

Fig. 1 Simulink modelling of proposed test system of the DC micro grid system with PVA, wind farm, loads ,Boost converter and Zeta converter is designed in MATLAB Simulink environment

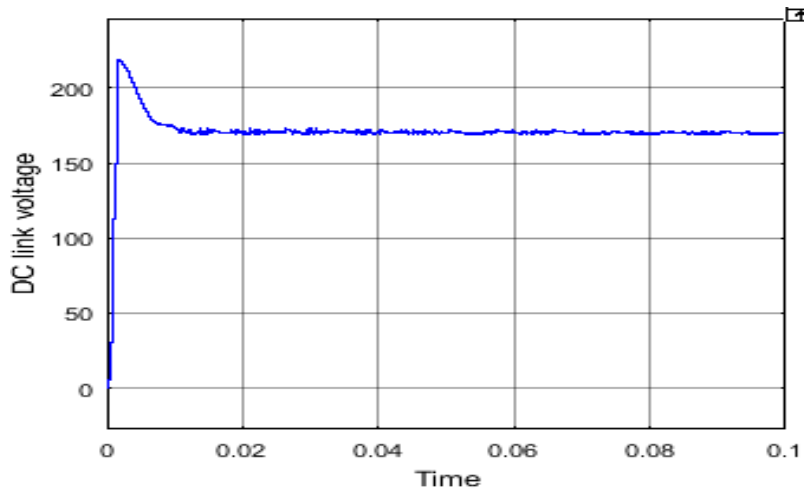


Fig. 2: DC link voltage

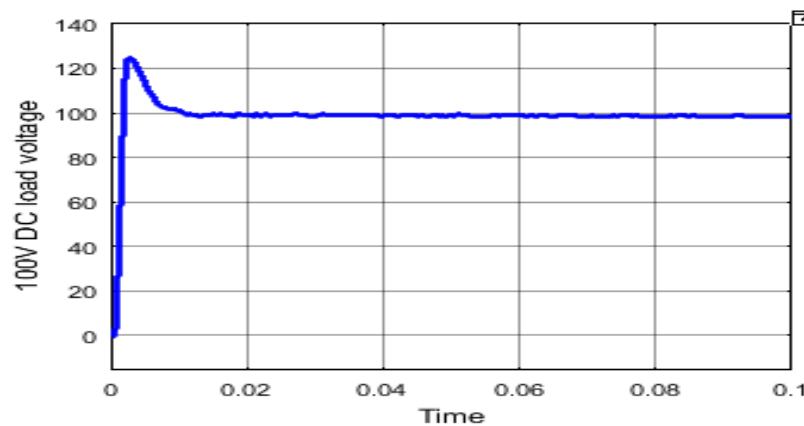


Fig. 3: 100V DC load voltage measured after buck converter

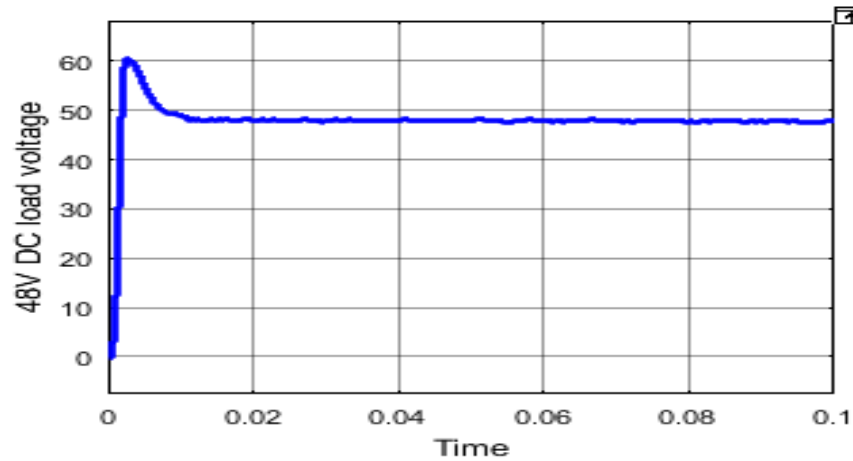


Fig. :4. 48 V DC load voltage measured after buck converter

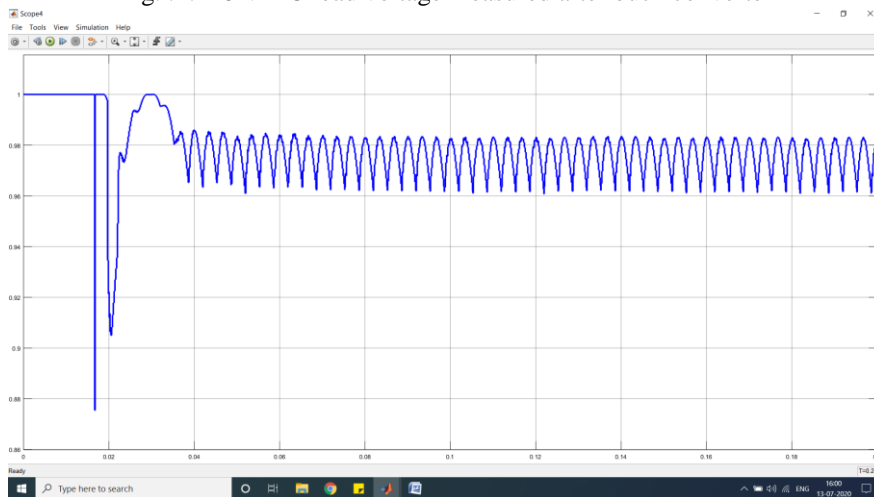


Fig.5 : Power factor of three phase source with Zeta converter



Fig. 6: DC link voltage at PCC with Zeta converter



V.CONCLUSION

In Proposed Hybrid system As seen in the given graphs and, it is clear that the test system with Zeta converter has better performance as compared to conventional Buck converter. The ripple in the DC link voltage at PCC is less in Zeta converter in the range of below 1% along with improved power factor of the three phase source maintained above 0.96. All the graphs are represented with time defined analysis using powergui block available in MATLAB Simulink environment.

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