Power flow regulation for Integration of Electric Vehicles to PV based micro grid using fuzzy controller

POLU VEERA RAGHAVA REDDY, *Assistant Professor EEE , TKR College of Engineering & Technology (Autonomous)*

ADERLA ANJAIAH, *Assistant Professor EEE , TKR College of Engineering & Technology (Autonomous)*

T.VIJAY KUMAR *UG Student ,EEE , TKR College of Engineering & Technology (Autonomous)*

M.CHANDRA SHEKAR SAI KUMAR, *UG Student ,EEE,TKR College of Engineering & Technology (Autonomous)*

S. KAVYA SRI, *UG Student ,EEE , TKR College of Engineering & Technology (Autonomous)*

SHAIK ABEED, *UG Student ,EEE , TKR College of Engineering & Technology (Autonomous)*

***Abstract*— Utilization of Electric Vehicle as an assistant control source to a DC micro-grid for dynamic control is inspected here. This paper center on advancement of a Fuzzy based controller competent of controlling the bi-directional dynamic control stream between a DC Micro-grid and an Electric Vehicle. The framework empowers to adjust the stack on network by performing crest shaving amid crest hours and valley filling amid off-peak hours.The DC network was outlined for a PV based micro-grid. The coordinates DC micro-grid was reenacted on MATLAB/Simulink stage and the gotten characteristics illustrate that the control stream from framework to vehicle and vehicle to framework amid the crest and off-peak periods separately.**

***Keywords*— Active power flow control, Solar Panel,Fuzzy Logic, G2V, Micro-grid, V2G**

1. INTRODUCTION

There is a gradual transition taking place in the Indian electricity grid from its traditional structure to a clever one. The network execution is being advanced by taking into account Conveyed Vitality Assets and integrating them with the traditional lattice through medium-voltage dissemination frameworks. The Power Act 2003, which was mostly focused on communicated era hinting at rustic jolt, was the first step made by the Government of India (GOI) towards a decentralized structure. The act in question advances frameworks for independent renewable vitality. This study was followed by the National Power Approach 2005, which focused on using decentralized DER to coordinate with the regular network in order to create a strong national zap framework. Two GOI plans, the Farther Town Charge Plot and the Rajiv Gandhi Grameen Vidyutikaran Yojna, are intended to provide up to 90% of funds to national zap projects that use decentralized DER.

A paradigm shift from electromechanical frameworks to control hardware based framework interfacing would be enabled by the development of a DER based framework. This would result in a very powerful and effective lattice interface. However, the control electronic converters used are more concerned with limitations like overvoltage capability and limited overcurrent adaptability than with the conventional electromechanical frameworks. A network architecture that is heavily impacted by DER would also have less inertial reaction and a higher penetration level from renewable energy sources. However, this needs to be carefully examined to prevent significant temporal associated network mishaps.

The tall beginning taken a toll included in creating a Battery Vitality Capacity Frameworks is the major bar in the advancement of renewable based charging offices. Until the battery capacity costs are radically decreased, the capacity and utility suppliers have to look for inventive strategies to work the DER frameworks financially. The short-term instability of the control framework is the area where Battery Vitality Capacity Frameworks in DER might play a significant role in today's networks.

This gives you the ability to actually control the control quality. Short-term charging and releasing appear to be used to control the voltage direction and recurrence in the framework. With the development of electric vehicle (EV) based portability considerations, the idea of improving a virtual distributed energy resource (DER) has emerged. Exploring the possibility of drawing power from an EV or hybrid electric vehicle (HEV)'s battery bank is an exciting unexplored avenue.

2. PV INTEGRATED DC MICRO-GRID

A PV (photovoltaic) integrated DC micro-grid refers to a small-scale power distribution network that utilizes direct current(DC) electricity generated from photovoltaic panels (solar panels) as its primary energy source. Photovoltaic Panels are the primary energy source in the micro-grid, converting sunlight directly into electricity. PV panels generate DC electricity, which is the same type of electricity stored in batteries and used in many electronic devices. The micro-grid is designed to power DC loads directly. These can include LED lighting, DC appliances, electronics, and other devices that operate on DC power. By using DC loads directly, the need for DC to AC (alternating current) conversion and vice versa is minimized, reducing energy losses and improving overall efficiency. Batteries are often included in DC micro-grids to store excess energy generated by the PV panels for use during periods of low sunlight or high demand. The stored energy can be utilized to power loads when the sun isn't shining or during peak demand times. DC-DC converters are used to regulate and control the flow of electricity within the micro-grid. These devices convert the voltage levels of the DC electricity as needed to match the requirements of different loads or to efficiently charge/discharge batteries.

3.BLOCK DIAGRAM

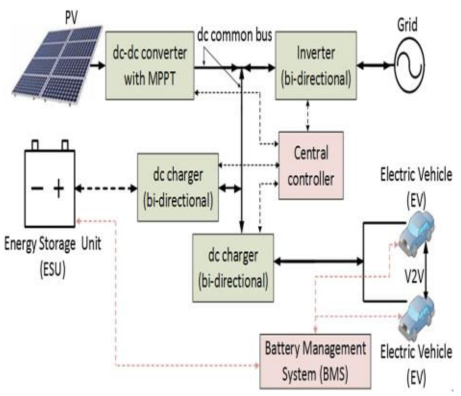

Fig 1: PV Based Mirco-grid

The PV system has been designed to generate an output voltage of 72 V. A Maximum Power Point Tracking (MPPT) algorithm is implemented in the system to extract the maximum available power from the grid. The variation in the incidence is negated by the algorithm enabling maximum power extraction from the system. The power output could be seen to track the maximum power point based on the algorithm and settles. The power is generated by the PV system and is given to the grid based on the load requirement. The voltage from the PV system is then fed to a Boost converter which steps up the voltage to 300V to match the DC Link voltage.

4. FUZZY CONTROLLER

The coordination of power flow in DC micro grids enables to improve the energy management of the multiple generation sources as well as the performance of the grid as a whole. However, the battery based sources used for storage has the limitations in their charging and discharging capacity as measures should be taken to avoid quick discharge of battery and to preserve the State of Charge (SoC).

The fuzzy logic based controller is used to control the bidirectional power flow. A reference of 4000 MW ,scaled down,. This activates the power flow from the EV to the grid to reduce the load. Any power demand below 4000MW is considered as Valley filling during which the power is fed to the EV for charging them. The measurement involves comparison on the bidirectional power flow which generates an error which the PI then translate in to a duty cycle. The determined duty cycle is used to control the switches of the Buck and Boost converters which are used to enable G2V and V2G operations respectively symbols must be defined in a clear and understandable way.

5. SIMULATION MODEL

Fig .2 shows the DC micro-grid model implemented using MATLAB/Simulink. The model shows the DC micro-grid where the DC power source represents the auxiliary battery bank. The power flow from the PV system is coupled through the Boost Converter while the integration of the EV Battery pack is done through a bi directional Buck- Boost Converter.

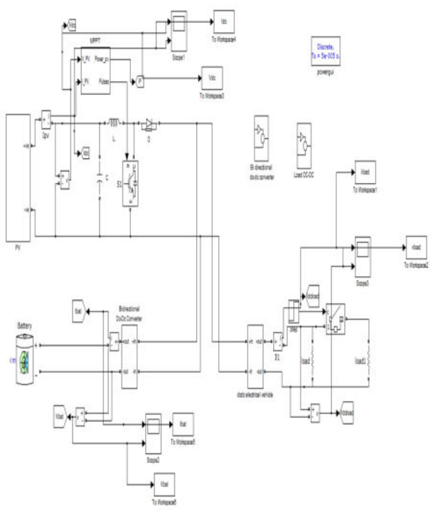

Fig:2. MATLAB/Simulink model of the DC Micro Grid.

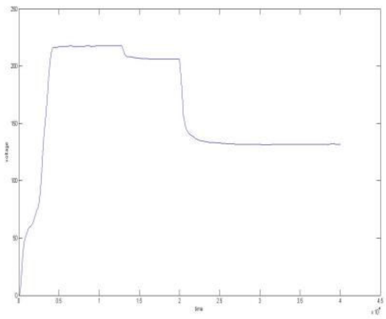

Fig:3. Output scope of the MPPT Voltage

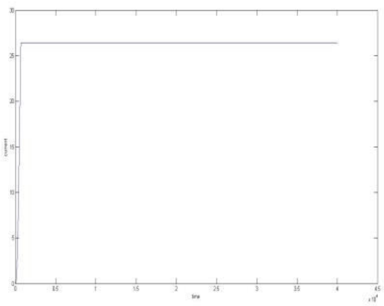

Fig:4.Output scope of the MPPT Current

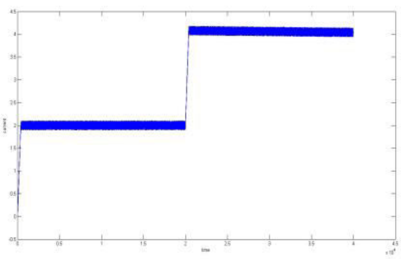

Fig:5.Output scope of the LOAD Current

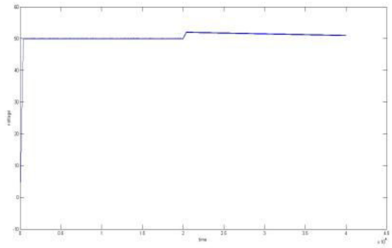

Fig:6. Output scope of the LOAD Voltage

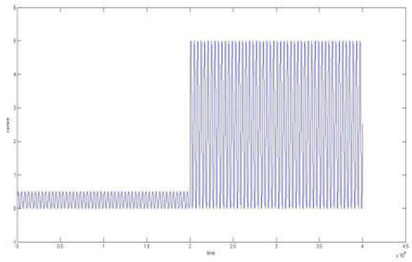

Fig:7.Output scope of the Charging/Discharging Battery Current

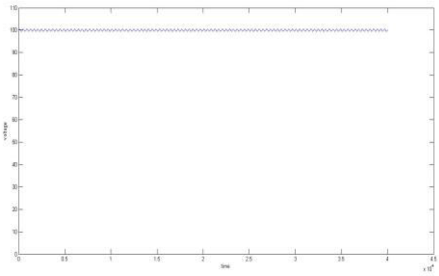

Fig:8. Output scope of the Charging/Discharging Battery Voltage

6.CONCLUSION

Due to technological improvements and growing public support for electric vehicles, there will soon be a greater number of EVs on the road. The conventional grid system in place in India would be impacted by this abrupt surge in load. Thus, it is essential to facilitate the EVs' seamless integration with the grid. This would imply that rather than acting as a load on the grid, EVs should operate as an auxiliary source. A solar-powered DC micro grid is created and conducted. The seamless integration of EVs with the grid would be made possible by this micro grid. This makes it possible to provide both valley filling and peak shaving. Therefore lessening the micro grid's load.

One possible way to increase the penetration of renewable energy sources in the grid is to feed the utility with the power generated by the PV system. With the help of an additional battery bank, the PV system was successfully linked into the DC micro grid. In accordance with the reference load profile, the EV battery pack was also successfully charged and discharged. Only real power flow is taken into account at the moment, but the same system may eventually be the subject of a reactive power flow analysis**.**

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