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A Review on BESS of Solar PV Based on MMC by using Power Quality Algorithm

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Abstract: ***A complete renewable energy system uses one charge controller with by grouping all batteries connected into parallel strings. Uncertainty of renewable energy systems, notably the physical phenomenon (PV) and electric cell systems, and constraint of battery power charging and discharging area unit fundamental issues for developing with and managing battery storage systems of complete renewable energy systems. Within the previous analysis localized management mechanism is planned and is a sensible limitation even though we tend to implement a tiny scale model. So in this paper proposes an alternative optimization method called constant current control method to provide system stable performance to optimize the reliability of system to the maximum extent total circuitry is modeled and simulation under graphical user interfacing environment and MATLAB based simulation results are provided. The total proposed circuit configuration will provide optimal performance than a typical decentralized technique.***

Keywords: Fuel cell system, PV system, Battery system, Decentralized Battery Energy Storage System, Modular Multilevel converter

1. Introduction

The implementation of non standard energy system place a amplifier appear developing the agricultural electrification which ends up of households unit of measurement a great deal of wide scattered and tract like mountains and islands. Generally stand alone renewable energy system uses charging batteries among the parallel strings. This lands up within the diminution of battery life time. to boot, battery charging phenomena of battery is forbidden by all-time low and highest charging densities power, but power that charging batteries varies, relying the power lasting from feed load demand. Division the PV-Fuel Cell and Batteries which can be referred to as to be the localized battery storage system methodology [DBESS], which is able to supply higher performance, long lifespan storage and minor maintenance value of battery storage systems.

This paper proposes the Decentralized battery energy storage system [DBESS] method with by using the charging controller of battery group ratings. The objective of the BESS method is to reduced loss generated by the source.. The flow chart for power quality has been developed for the system and It makes the proposed modular multi level converter is the highly efficient optimum technique to give the better expected results. proposed by, this paper applied the MPPT power algorithm of PV and Battery modules, by PV - Fuel cell – battery system using DBESS method.

2. Battery system

The most common batteries used in the market today are Li-Ion, lead acid, Nickel-based and sodium based batteries. We focused on Lithium-ion batteries since they are most far and wide used ones in built-up applications [1][2][3]. The Li-Ion batteries can store up to ten times more energy than that of other batteries comparatively as shown in Table 1. In progress Li-ion battery technology under test in grid connected systems the system efficiency 95% while comparing the other technologies as shown in Figure 1.

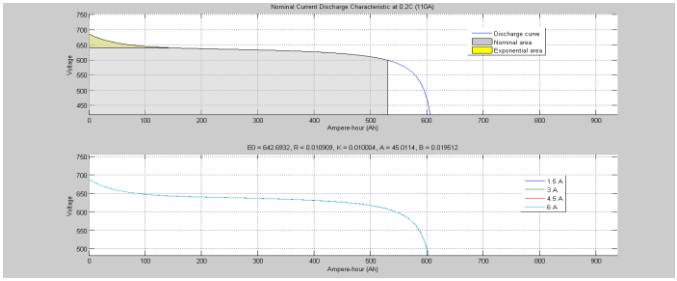

Figure 1: Lithium Ion Battery Characteristics

Comparison of Three groups of Batteries on Table 1

Parameter	lithiumion	Lead acid	Nickel
life time	long	Long	Medium
Efficiency	95%	93%	91%
SOC	100%	98%	98%
DOC	68%	64%	63%
Max Efficiency	95%	91%	90%
Losses	3-5%	6%	10%

3. Decentralized battery storage system of the group

This paper intend the DBESS method for Fuel cell, PV and Battery group system to improve the efficiency by using the charging controller. The fuel cell and PV operating and the battery group is charging and discharging process as shown in Figure 2 [2].The operation of the system using DBESS method based on battery, Fuel cell, PV and load based on operating the system.

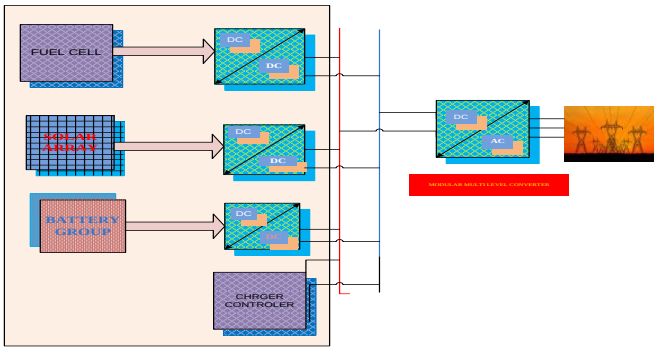

Figure 2: Block Diagram

4. Planned Work

A. Photo voltaic system

In the photograph voltaic (PV) system, electric cell plays a serious role in generating the voltage by mistreatment photograph voltaic result. PV array is that the arrangement of star cells connected asynchronous or parallel for generating the desired current, voltage and high power [4][5]. each cell is analogous to a diode with a contact intentional by semiconductor material. It produces the present once sun light-weight impacts on the junction, thanks to physical phenomenon impact. The equivalent circuit of pictured PV cell is shown in Figure 3 and the present equation is shown below

$$I = I_{ph} - I_D - I_{sh}$$

$$I = Iph - I_o [\exp (q V_D / nKT)] - (v_D / R_S)$$

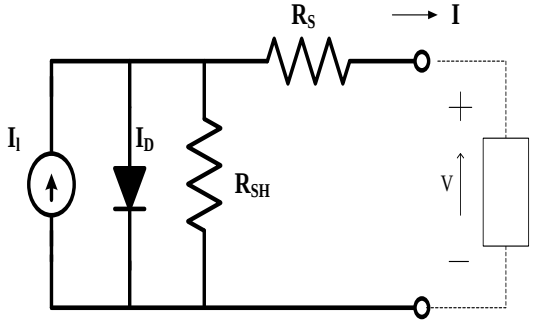

Figure 3: Solar PV equalint Circuit

B. Maximum power point Tracking

This fragment covers the conception of MPPT and is employed in star charge controllers. By exploitation this system DC to DC conversion are often enforced that optimizes the match between the solar battery (PV panels), and therefore the battery bank or utility grid. during this technique the controller mechanically controls the voltage by bit in accordance with the measuring of power the array. This technique of mechanically adjustment is termed perturb and observe technique that the ofttimes accustomed improve the potency. this is often commonest, though this technique will consequence in oscillations of power output. P & O technique is that the most universally used MPPT technique because of its easiness of accomplishment. Perturb and observe technique might lead to higher potency, only if a correct analytical and adaptation hill climb approach is adopted [6][7][8].

C. Modular Multilevel Converter

The standard structure convertor (MMC) is that the lead space beneath discussion of accelerating importance for medium/high-power energy conversion systems. A range of pulse-width modulation (PWM) technique and power quality rule supported employing a single reference wave, that are developed for the MMC [9][10]. The ability quality rule is to boost the entire harmonic distortion, problems, issues, effective power are dominant of the MMC as shown in Figure 4. Its modularity and measurability alter it to conceptually meet any voltage level necessities with superior harmonic performance reduced rating values of the convertor parts and improved potency of power quality as shown in Figures 5 and 6.

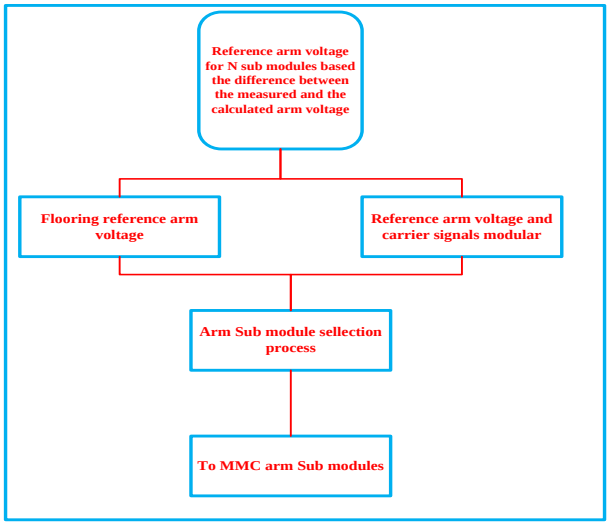

Figure 4: Power Quality Algorithm Flow chart

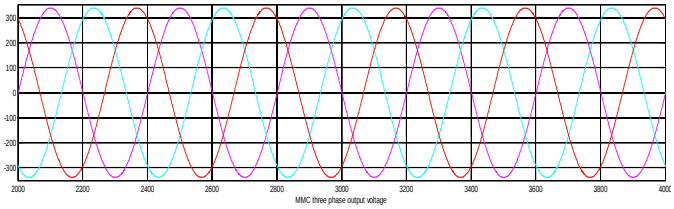

Figure 5: MMC Voltage Output

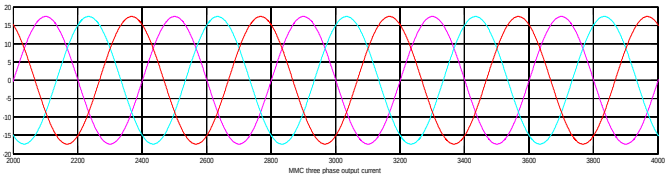

Figure 6: MMC Current Output

5. Results Discussion

This paper simulates the DBESS method to improve the efficiency of fuel cell, PV, Battery system using one battery group for which results are shown in Figure 7and Figure 8. The DBESS method can get better the consistency of Fuel cell – PV - Battery system. Then the system designed one group. the project of the power quality of services for uses and The levelized of the power quality of the system .

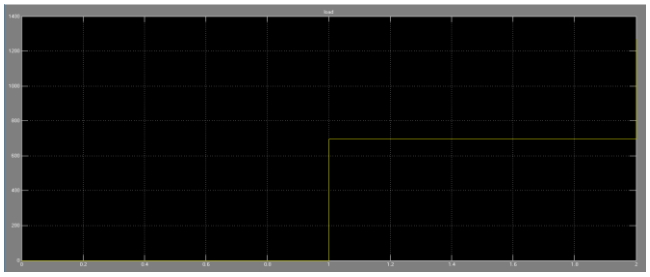

Figure 7: Battery Voltage Charge

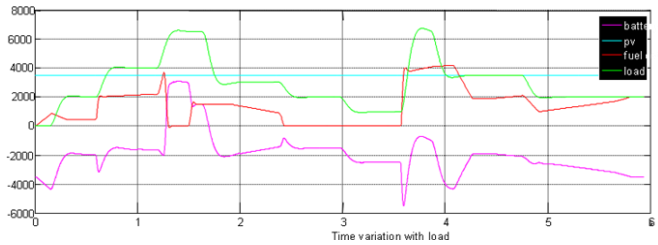

Figure 8: PV, Battery, Fuel Cell and Battery System

Fuel cell Calculation:

Power - 50 KW
DC Voltage - 625 V_{dc}
Open circuit voltage - 200 v
Nominal Stack Power - 50000 w
Maximum Stack power - 120400 w
Nominal Utilization
[Hydrogen][H_2] - 99.25%
[Oxygen] [O_2] - 58.67%
Fuel cell output Voltage - 600 v

SOLAR CALCULATIONS:

Irradiation of solar - 700 w/m^2
Temperature - 300 ^{0}F
Open circuit voltage- 200 V
PV output Power rating
Before boost converter - 15.4*200 =3080 W
PV output Power rating
After boost converter - 15.4*600 = 9240 W
PV rating - 700 w * 12 h
PV rating - 8400 Wh/m^2

$$Solar\ efficency\ \eta = \frac{3080\ w}{8400\ w} * 100$$
$$Solar\ efficency\ \eta = 36.66\ \%$$

The results of charging and discharging process are shown in Figure 7. The battrey group and load both operated with charging and discharging, In the load operation the power will tequired for the load suddenly icrease the tha battery discharge. the load is operating low level of the rating the battery can be charging process by using the charger controller. As ahown in Figure 8 the voltage charging process.

6. Conclusion

The application of large scale BESS Decentralized battery energy storage system technology in Solar PV system Modeling of load demand connected DBES is one of the important issues in power Quality system simulation analysis of MMC. It was concluded that the system using DBES method has more reliability and more efficiency than the system using one lithium ion battery group, while decreasing the number of PV and battery modules leading to lower levelized cost of energy and waste energy. In terms of BESS by using with MMC operating with power quality algorithm the efficiency system is improving of the renewable energy systems.

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