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GRID PV INTEGRATED MULTIPLE EV CHARGING CONNECTIONS WITH POWERQUALITY IMPROVEMENT

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Abstract – In *this paper a grid Photovoltaic integrated multiple Electric-Vehicle charging connections with power quality improvement is designed. The proposed system should have constant dc voltage during load fluctuation and change in solar Photo voltaic energy. Also system injecting power from the batteries during high demand times and then charging them in low demand times and the charging time of electric vehicles decreases. The proposed model will be developed using MATLAB/Simulink.*

Key Words: Electric Vehicles (EVs), Energy Storage stage, Battery Energy System(BES), Three-level dc–dc converter.

1.INTRODUCTION

A Smart grid (renewable energy resources) includes smart devices and digital communications and works in a wide range of smart appliances and smart meters in electrical devices. The most recent technologies of Smart grids are the Electric Vehicle (EV) with energy management strategies are shown in figure 1. EVs have revolutionized the motor vehicle industry providing the opportunity for good operation for motor vehicle propulsion systems, the electricity became a suitable type of energy compared to other technologies. Electrical vehicle are classified into different combinations such as hybrid electrical vehicle, Plug-in hybrid electrical vehicle and battery electrical vehicle. The main demerits of Electrical vehicle systems are power quality.

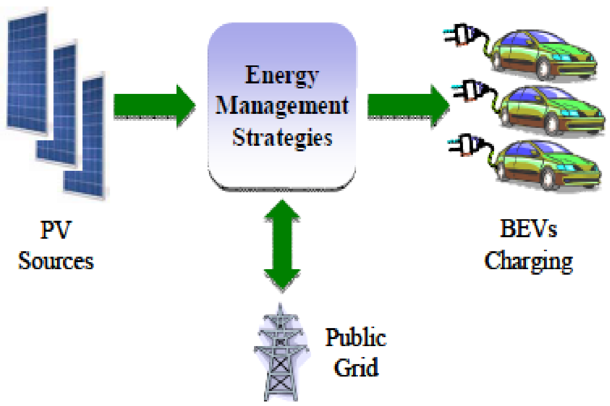

Figure 1 PV grid-connected with EVs charging station.

The reliable and secure operation of smart grids is main factor for Power quality operation. The power quality of a typical power system should able to maintain at rated voltage and frequency. The other factors which affects Power quality problem are imbalance, interruption and harmonics.

2. PROPOSED ELECTRIC VEHICLE CHARGING SYSTEM

Figure 3 shows the proposed system consists of EVs charging system with PV grid-connected configuration and balancing battery energy system. The proposed system allows interaction with a local load and public grid as compared with other grid connected system.

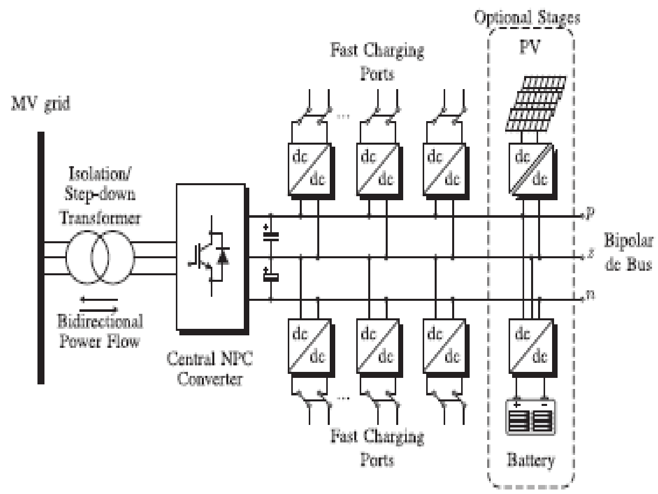

Figure 2 Proposed charging station architecture with balancing BES

Locally generated PV power is combined with public grid using energy management strategies system operating as a backup. The system injects the power from the public grid when the generated PV power is less than the *BEVs* demanded power during low sunshine period. The system sends power back to the grid when the generated PV power is more than the *BEVs* demanded power during high sunshine period. So the energy flow is bidirectional depending on the available needs between load bus and public grid.

A control scheme is developed for balancing the dc voltages which is act like as energy buffer. In order to meet dc voltage balancing, a three-level dc–dc converter is designed to avoid two batteries in the system.

3. SIMULATIONS AND RESULTS

The power flow on the micro grid is investigated by in MATLAB/SIMULINK models a shown in figure 3. The design shown in figure 8 is charging station connected with public grid. Similarly figure 17 show charging station connected with battery system storage.

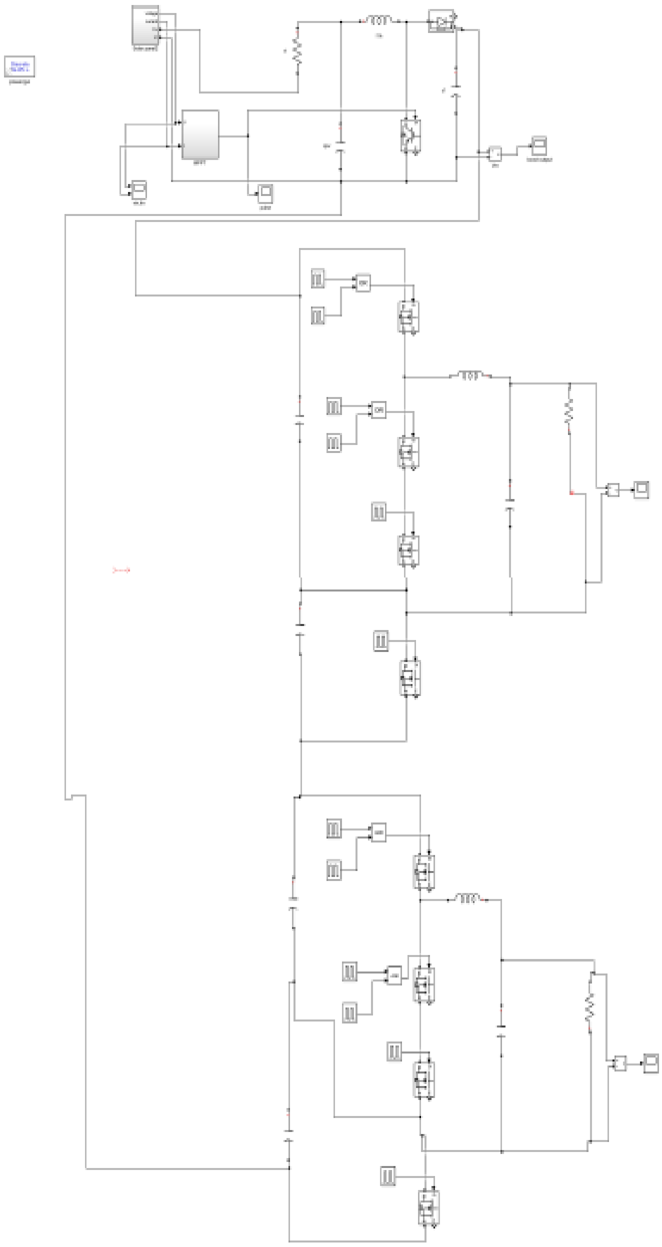

Figure 3 Charging station with PV & MPPT controller

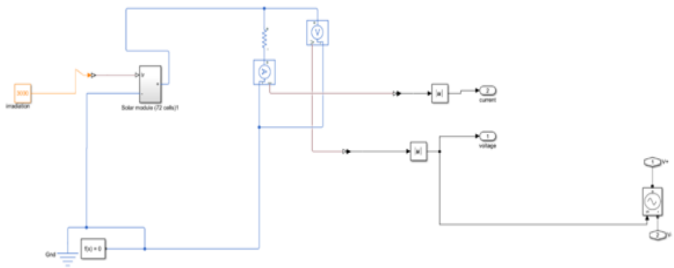

Figure 4 Solar PV Panel

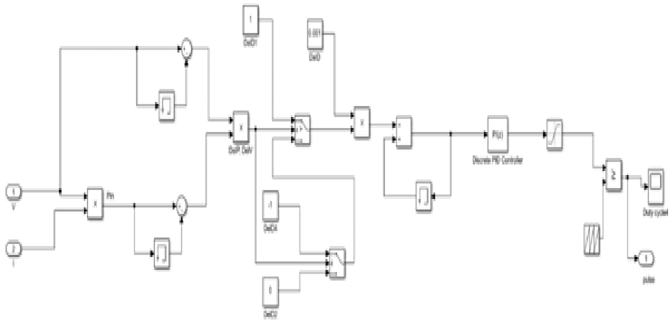

Figure 5 MPPT Controller

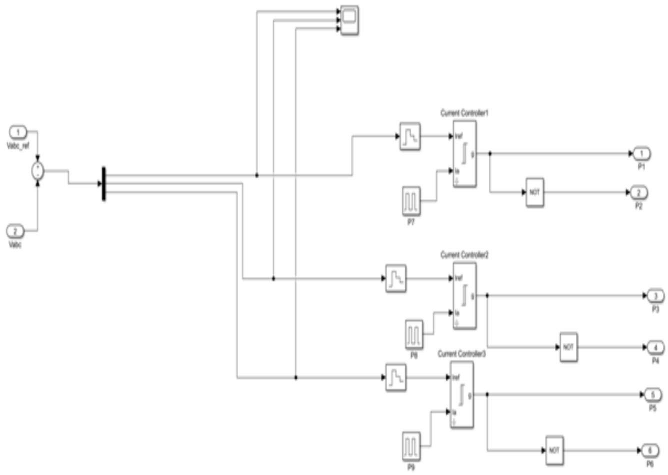

Figure 6 Pulse Generation circuit

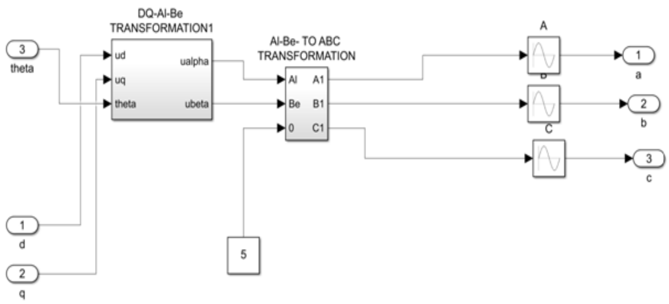

Figure 7 D-Q Transformation

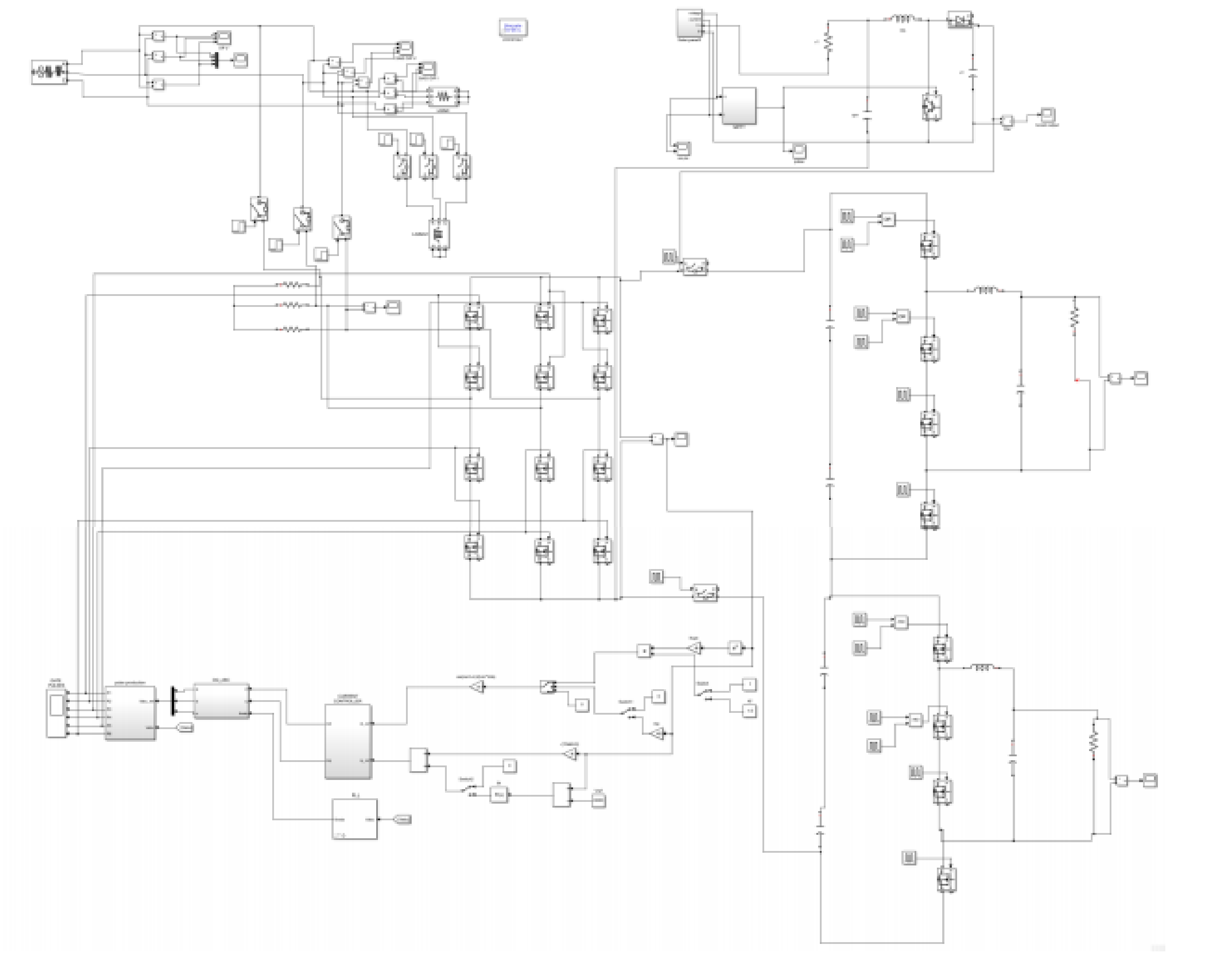

Figure 8 charging station connect to grid

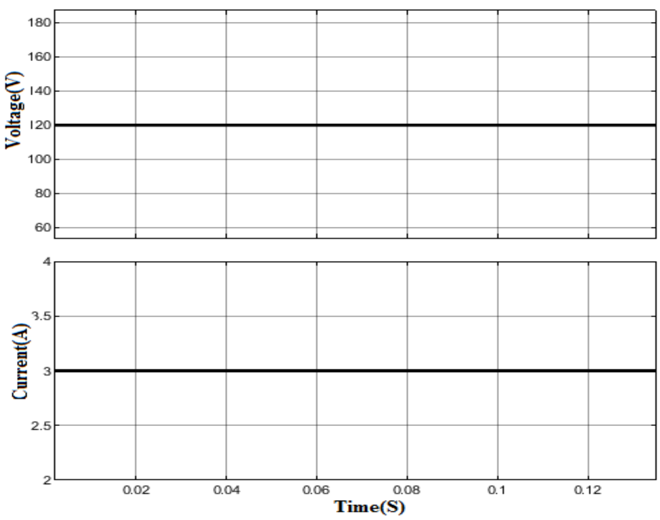

Figure 9 Solar Input Voltage and Current

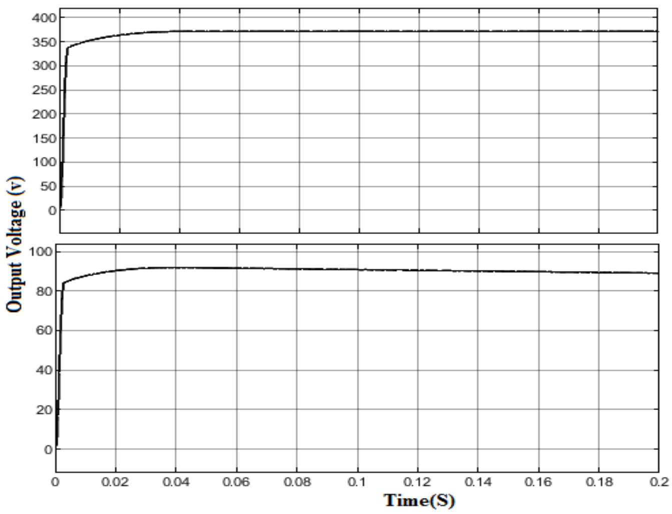

Figure 10 Output Voltage at charging station with solarpanel

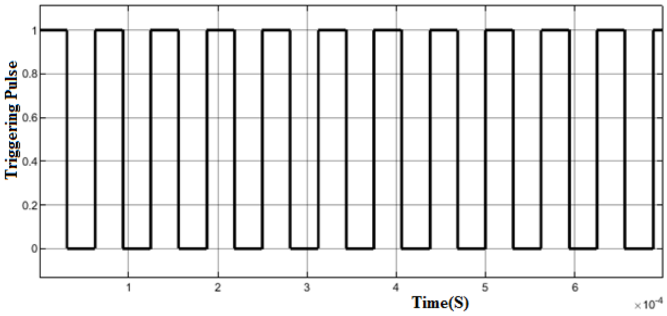

Figure 11 Triggering Pulse

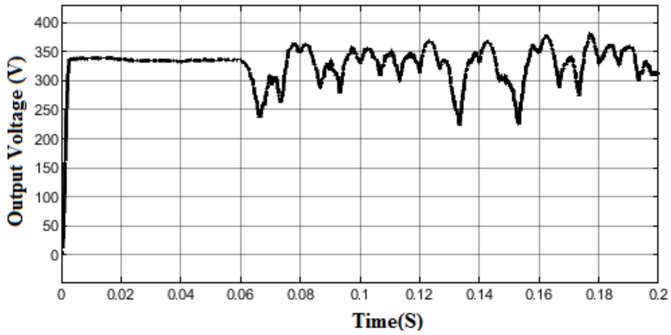

Figure 14 Output Boost Voltages in Grid

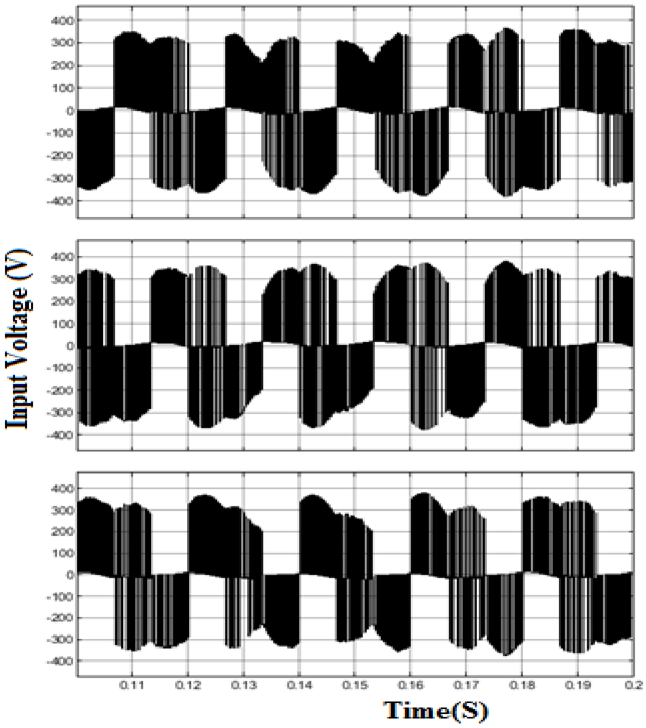

Figure 12 Input Voltage at the Grid

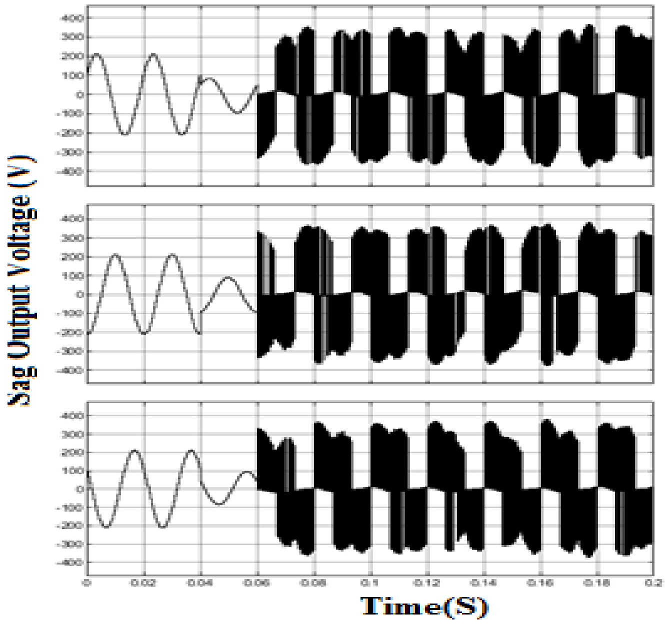

Figure 15 Sag Output Voltage

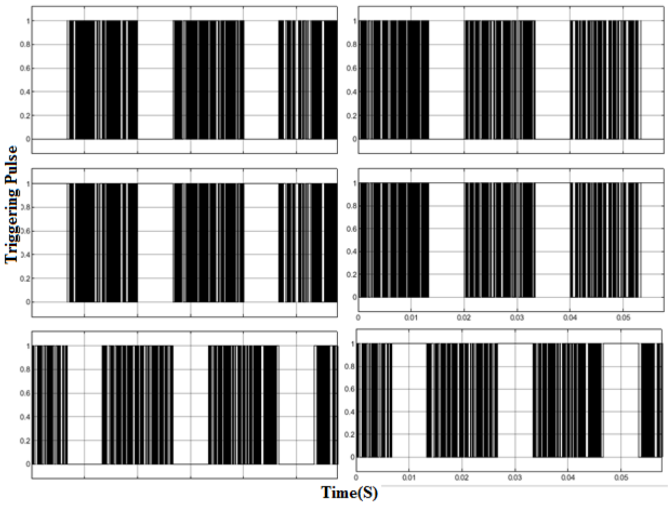

Figure 13 Triggering Pulse at Bridge inverter

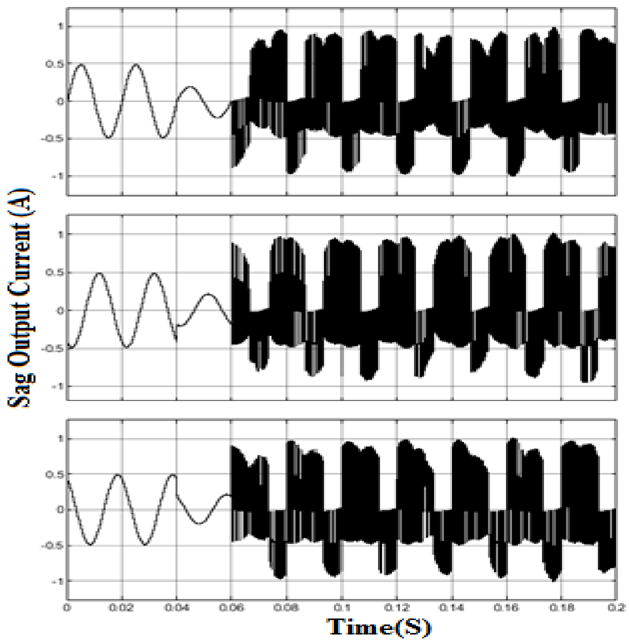

Figure 16 Sag Output Current

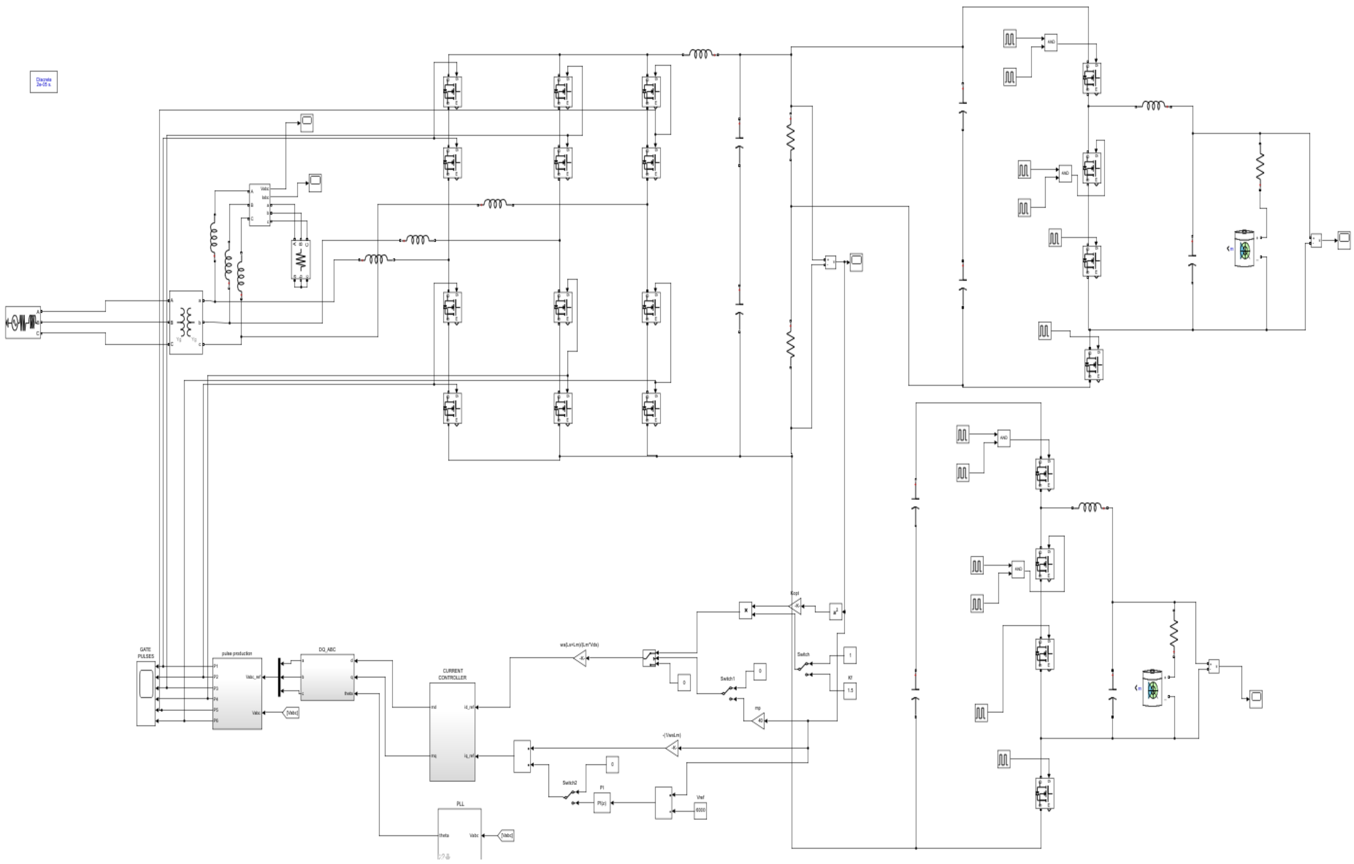

Figure 17 Charging circuit with Battery storage system

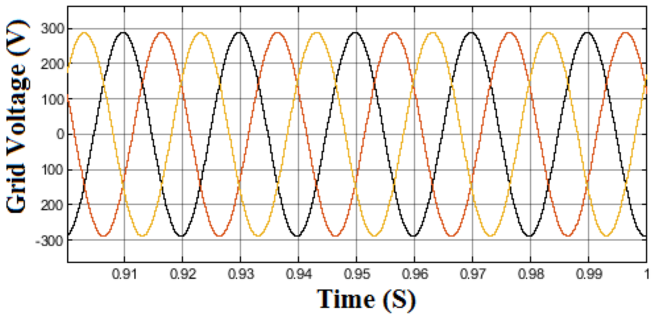

Figure 18 Grid Output Voltage

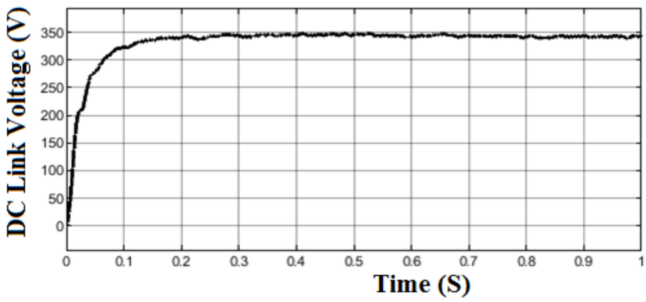

Figure 20 DC Link Voltage

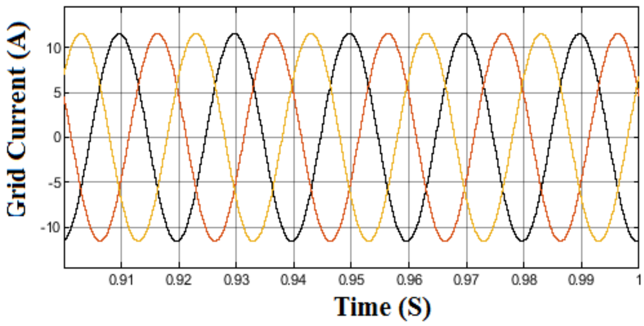

Figure 19 Grid Output Current

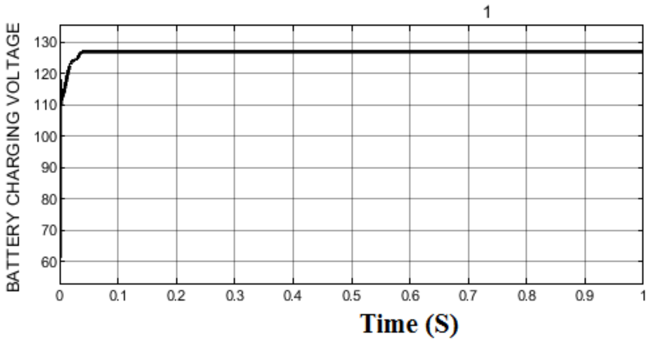

Figure 21 Battery Charging Voltage 1

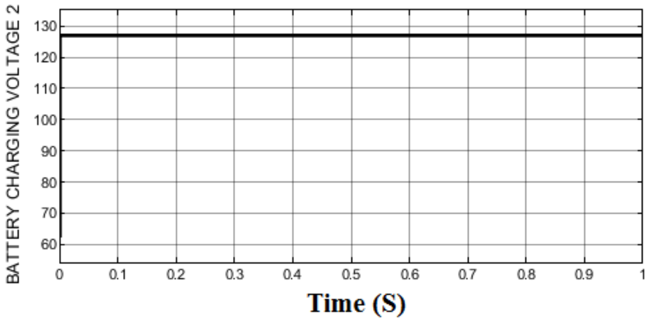

Figure 22 Battery Charging Voltage 2

5. CONCLUSION

In this paper a grid Photovoltaic integrated multiple Electric-Vehicle charging connections with power quality improvement was designed and simulated using MATLAB/Simulink. The proposed system injecting power from the batteries during high demand times and then charging them in low demand times and the charging time of electric vehicles decreases. The proposed system thus compensates the reactive power as well as voltage sag during load fluctuation and changing in solar Photo voltaic system.

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BIOGRAPHIES

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