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Feasibility And Analysis Of Hybrid Energy Based Electric Vehicle Charging Station

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Abstract : The charging station is mainly designed to charge the EV battery using a solar photovoltaic PV array and a BES. However, the charging station intelligently takes power from the grid or diesel generator set in the event of an empty storage battery and inaccessible solar PV array generation. In addition, to obtain ceaseless charging, the PCC (point of common coupling) voltage is synchronized to the grid/generator voltage. In order to improve the operating efficiency of the charging station, the charging station also conducts the vehicle to grid active/reactive power transfer, vehicle to home and vehicle to vehicle power transfer. Using the Matlab/Simulink software, the operation of the charging station is validated.

***Index Terms* - EV Charging Station, Solar PV Generation, Power Quality, DG Set**

Introduction

Electric vehicles (EVs) are viewed as the transportation of the future. The Paris Declaration and Call to Action on Electro mobility and Climate Change states that 100 million electric vehicles must be deployed globally by 2030. EVs emit no tailpipe emissions and use significantly less energy than gasoline and diesel vehicles. They are significantly quieter, require significantly less maintenance, and have a much simpler drive train.

Instead of fossil fuel-based power plants, renewable resources must be used to generate the electricity needed to charge electric vehicles [1-3]. The well-to-wheel green house gas emissions (GHG) of a conventional gasoline car, a hybrid electric vehicle (HEV), a plug-in hybrid electric vehicle (PHEV), and a plug-in electric car are compared to various fuel mix scenarios for electricity generation in Fig.1. Any type of electric vehicle, whether a HEV, PHEV, or PEV, emits less pollution overall than a comparable gasoline vehicle, as is obvious. In addition, the quality of the fuel mix affects an electric vehicle's emissions. [1–3]. Contrary to popular belief, when EVs are charged from a grid that is primarily powered by fossil fuels like coal or natural gas, there are actually significant emissions. But if EVs are charged from a grid that largely relies on renewable energy, net emissions are almost zero. The challenge is to use renewable energy sources to power EVs in the future.

1. Future electric vehicle power will come from a variety of excellent renewable energy sources, including wind, solar, hydropower, geothermal, biogas, and tidal energy. Among these, using solar photovoltaic panels to charge EVs is a desirable option for a number of factors.
2. Over the last few decades, the cost of solar PV has steadily declined, and it now costs less than $1/W [4].
3. PV power is easily accessible to EV users because PV modules, as shown in Fig.1, can be installed on roofs and as solar car parks near EV charging stations.
4. The PV potential of parking lots and rooftops is currently underutilised, but this can be taken advantage of in the future.
5. Because charging power is produced locally in a "green" manner using solar panels, EV charging lowers both energy and power demand on the grid [5-7]. The need for grid reinforcement is lessened or delayed as a result.
6. For managing seasonal and cyclical variations in solar generation, PV systems have traditionally used batteries to store solar energy. The EV battery can act as energy storage for the PV when EVs are being charged from solar power, eliminating the need for a separate battery [8]–[11].
7. Low PV feed-in tariffs are less expensive with solar charging than with grid charging [12], [13].
8. PV systems are low-noise, have no rotating parts, and require little maintenance.

Therefore, using solar energy to charge EVs can both increase their sustainability and lower the overall cost of the infrastructure needed for charging them. This is the thesis's goal and driving force. If PV generation is insufficient, power can still be drawn for EV charging via an alternating current (AC) grid connection. This ensures that if one is insufficient or unavailable, neither PV generation nor EV charging will be hindered.

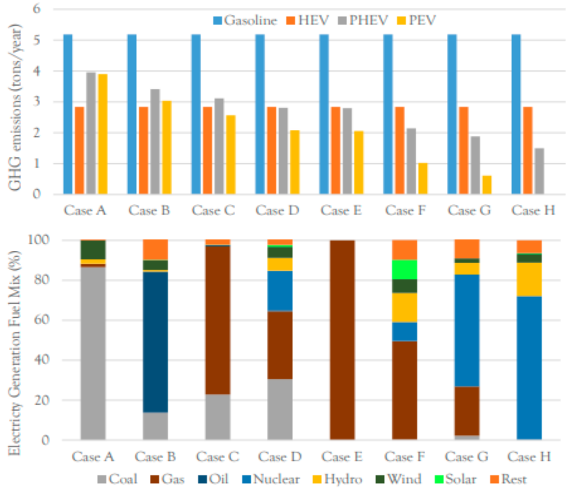

Fig.1 The fuel mix used to generate electricity affects an electric vehicle's well-to-wheel emissions. Biomass, geothermal, and other fossil fuel generation are included in the term "rest".

I. Electrical Bus system

Many different electrical bus system designs, but which one you choose will depend on the voltage of your system, where your substation is located in the electrical power system, how flexible you need the system to be, and how much it will cost.

A conductor or group of conductors known as an electrical bus bar is a device that transfers electricity from incoming distribution lines to outgoing feeders. In other words, it is a type of electric junction where all electrical currents—both incoming and outgoing—converge. The electrical bus bar concentrates electricity in one location as a result.

An isolator and a circuit breaker make up the bus bar system. The circuit breaker trips when a fault occurs, making it simple to remove the problematic section of the busbar from the circuit.

The electrical bus bar can be found in a number of different shapes, including cross-sectional, round, and rectangular. In power systems, the rectangular bus bar is a common sight. Electrical bus bars are manufactured using copper and aluminum.

2.1 Single Bus System

The simplest and most affordable bus system is a single one. According to the diagram, this scheme connects every feeder and transformer bay to a single bus. Such a system can be set up in a very easy and straightforward manner. There is only one bus bar in the system in addition to the switch. The transformer, generator, and feeder are just a few examples of the equipment at the substation that is connected to this bus bar.

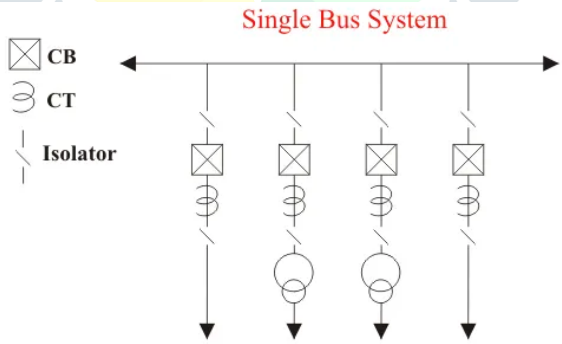

Fig.2 Single Bus System

2.2 Bus System

1. A double bus bar system uses two bus bars that are the same in order to allow any incoming or outgoing feeder to be taken from any of the buses.

2. As depicted in the figure, each feeder is actually connected to both buses in parallel via a separate isolator.

The feeder can be connected to the related bus by shutting any of the isolators. The total feeders are split into two groups, one fed by one bus and the other from other buses, and both buses are powered up. Any feeder, though, is able to switch from one bus to another at any time. Only one bus coupler breaker needs to be closed while buses are being transferred. Before closing the isolator associated with the bus to which the feeder is being transferred and opening the isolator associated with the bus from which it is being transferred, turn off the circuit breaker for the bus coupler first. He or she should then open the bus coupler after the transfer.

The main busbar and the auxiliary bus bar are the two types of busbars used in this configuration. The isolating switches and circuit breaker are connected to the busbar using a bus coupler in the busbar configuration. The bus coupler is also used to transfer the load from one bus to another in the event of an overload. Following are the steps for moving the load from one bus to another.

- By closing the bus coupler, the potential of both bus bars is maintained.
- The load is transferred to a bus bar that is kept close.
- Turn on the main bus bar.

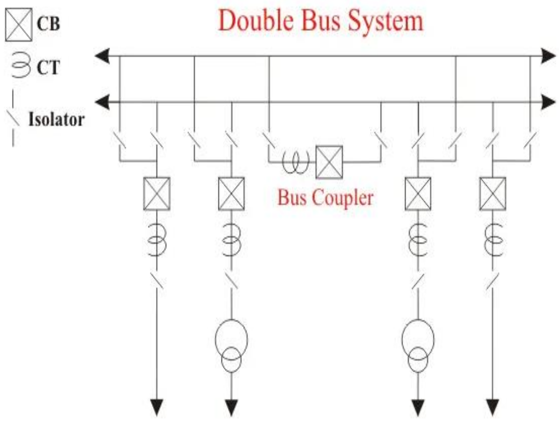

Fig.3 Double Bus System

II. IEEE-75 BUS SYSTEMS

Figure 4 depicts the IEEE - 75 bus test system. The generator's cost and emission coefficients, along with the load, dc link capacitor data, and power grids, are all provided. The IEEE-750 bus system cost parameters have been slightly modified to include nonsmooth fuel cost functions along with ramp rate coefficients. The information is based on a 100 MVA base.:

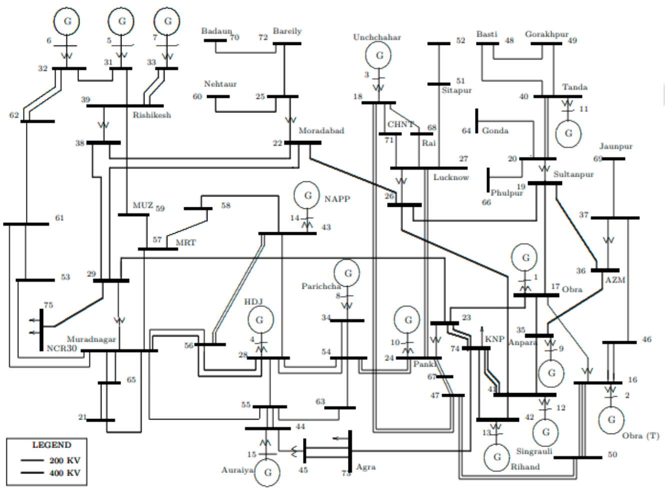

Fig.4 75-bus UPSEB system

III. RESULT

This section is show proposed model MATLAB simulation output.

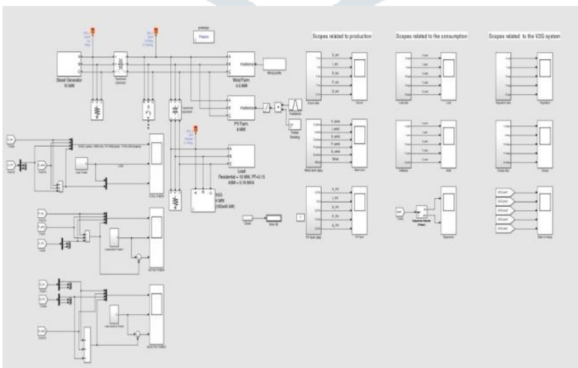

Fig.5 Proposed Model

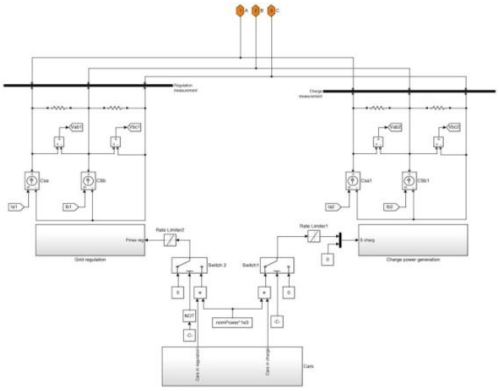

Fig.6 Model of Proposed Bus System

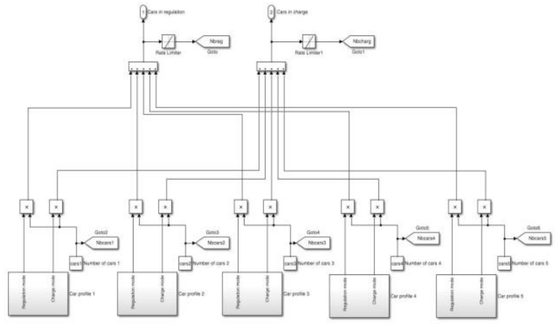

Fig.7 Bus system

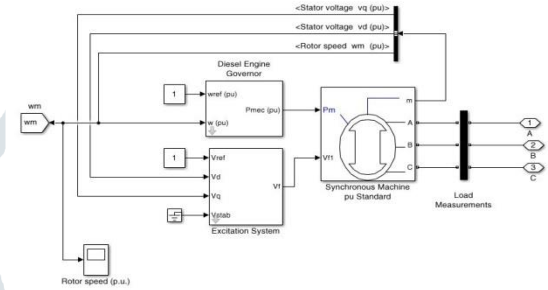

Fig.8 Model of Diesel Engine governor and synchronous machine

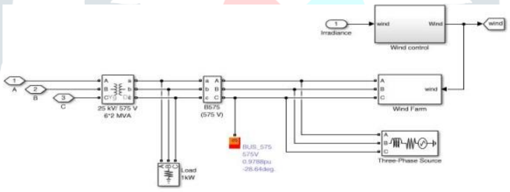

Fig.9 Model of wind with connected bus 75

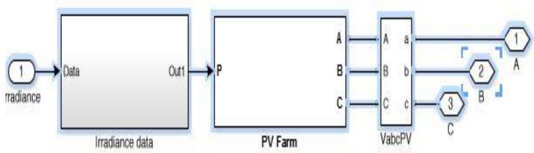

Fig. 10 PV block proposed model

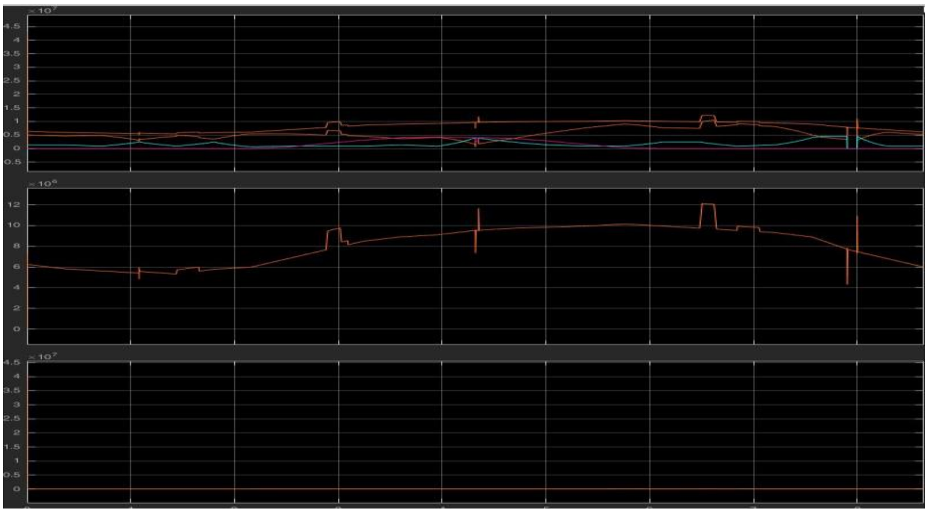

Fig.11 Waveform of total power

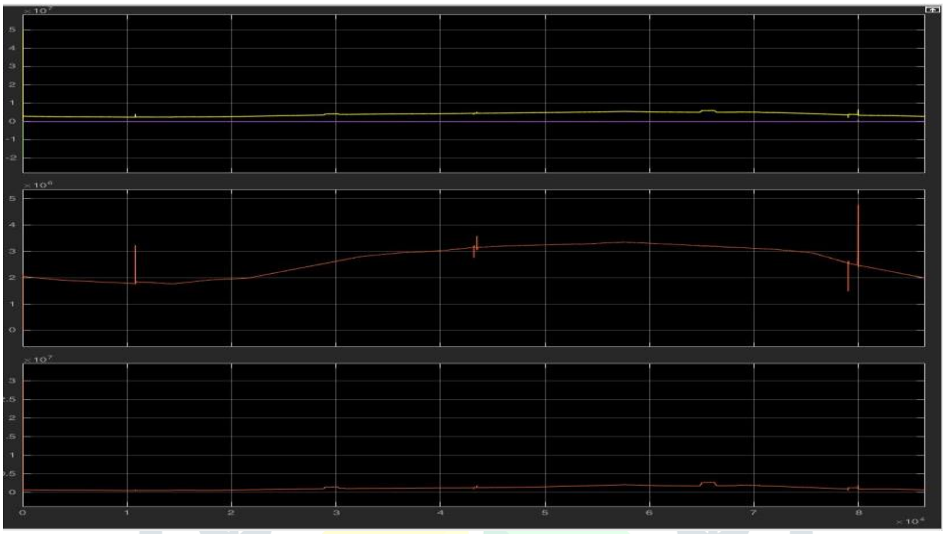

Fig.12 Result of reactive power

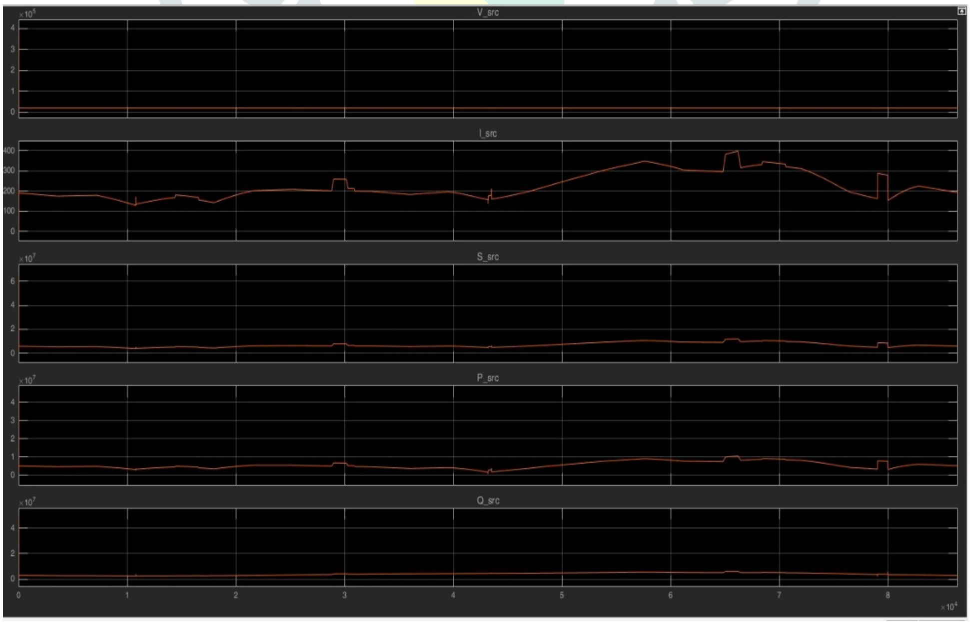

Fig.13 Wave form of voltage, current and power

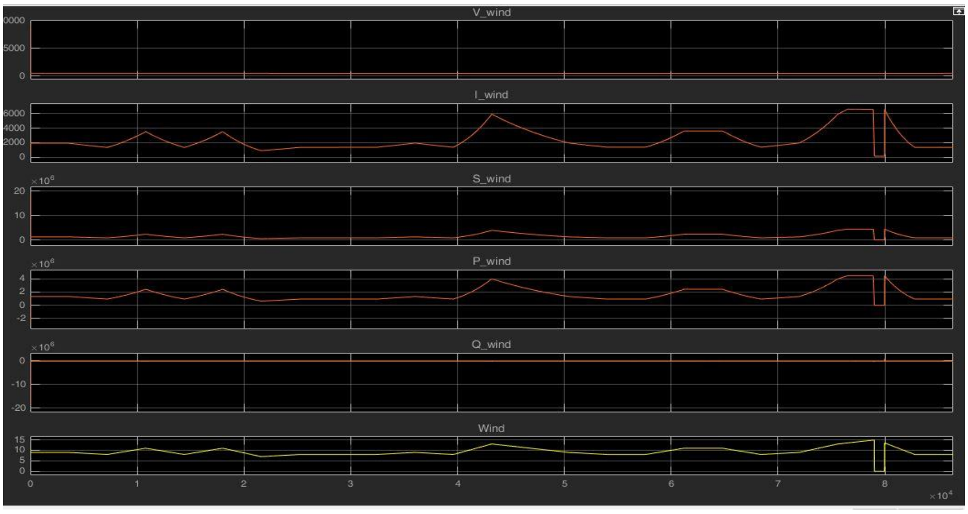

Fig.14 Waveform of Wind voltage, current and wind power

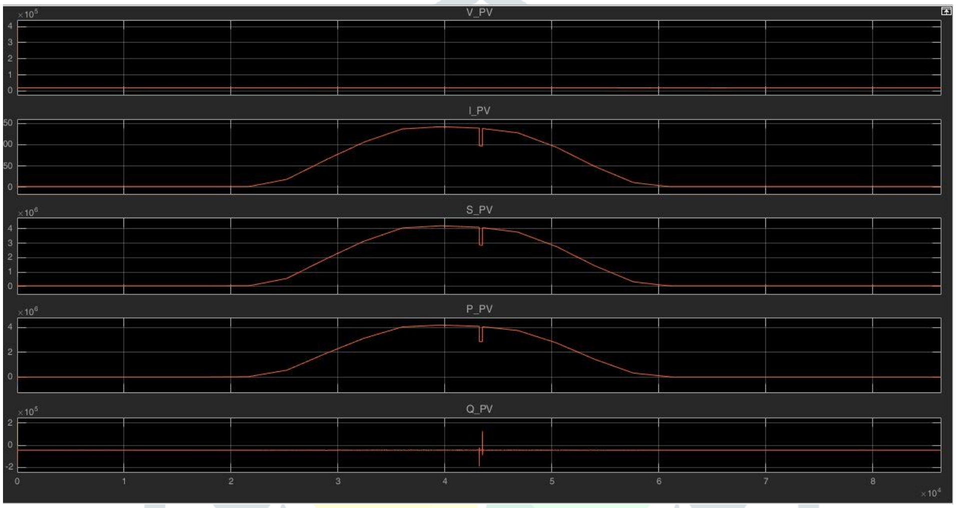

Fig.15 Waveform of solar cell of voltage, current and power

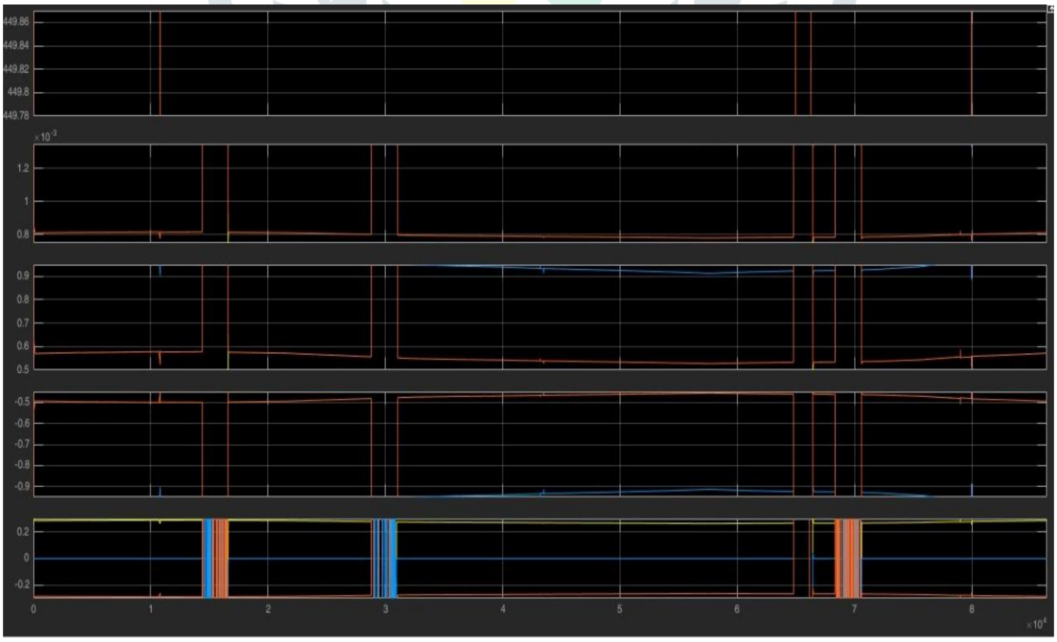

Fig.16 Output of state of charge

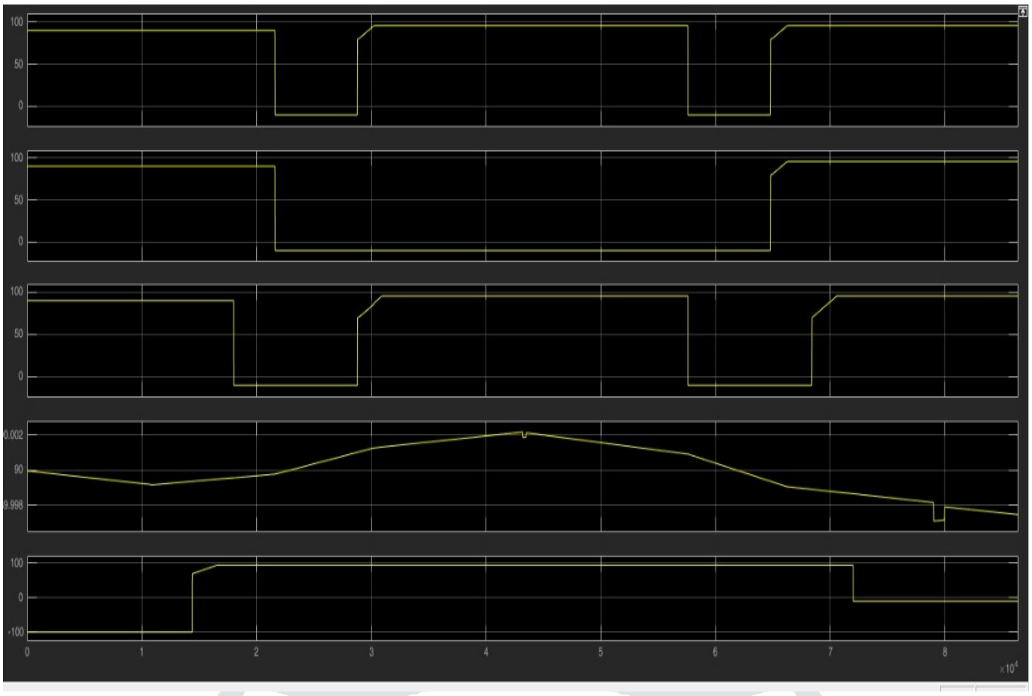

Fig.17 wave forms of active power

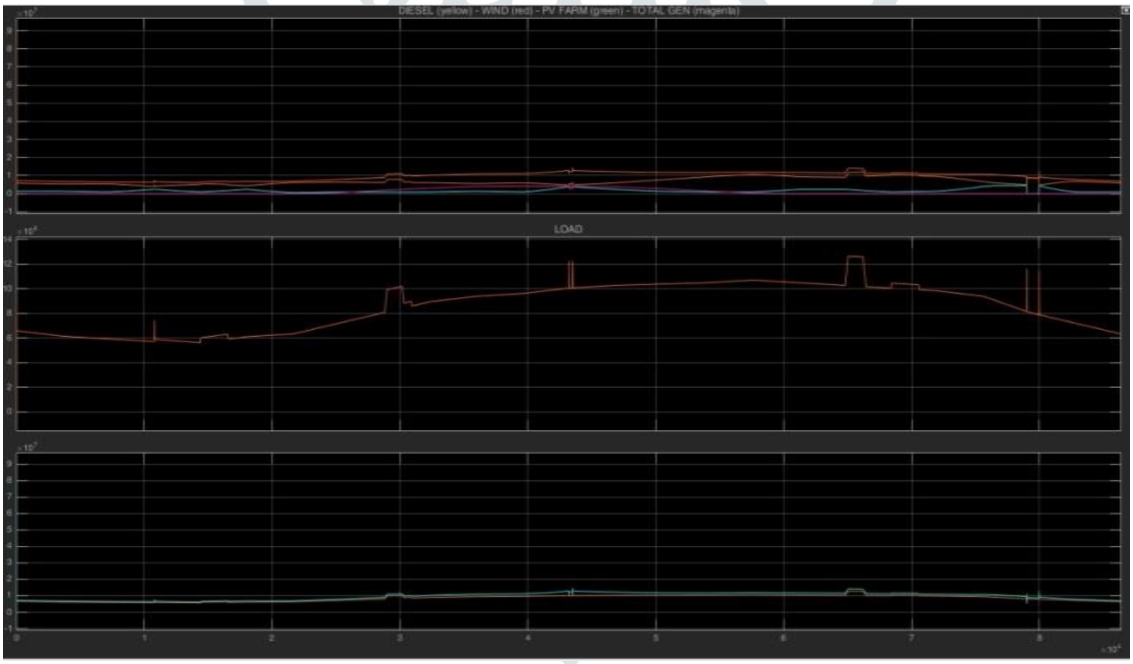

Fig.18 Total generation power of Diesel, wind and PV

IV. CONCLUSION

Simulate with the help of MATLAB simulations and verify waveform as show on Result section. These systems are more dependable and stable than single-source systems, according to the simulation results. here is proposed 75 Bus management system to manage power requirement of charging station when we are connected many car without generate delay and maintain power quality of proposed model. It is used in grid-connected systems as well as off-grid areas. 75 bus system method used in India for the optimal power flow problem is resolved using differential evolution. Differential evolution has a number of advantages over other contemporary heuristics, including modeling adaptability, certain and quick convergence, and reduced computational time. It is possible to draw the conclusion that this battery charger, when used with the provided control, is capable of greatly optimizing various energy sources and offering EVs high-quality and reasonably priced charging.

REFERENCES

[1.] Singh, B., Verma, A., Chandra, A., & Al-Haddad, K. (2020). Implementation of solar PV-battery and diesel generator based electric vehicle charging station. IEEE Transactions on Industry Applications, 56(4), 4007-4016.

[2.] Verma, A., & Singh, B. (2020). Multimode operation of solar PV array, grid, battery and diesel generator set based EV charging station. IEEE Transactions on Industry Applications, 56(5), 5330-5339.

[3.] Verma, A., Singh, B., Chandra, A., & Al-Haddad, K. (2020). An implementation of solar PV array based multifunctional EV charger. IEEE Transactions on Industry Applications, 56(4), 4166-4178.

[4.] Shariff, S. M., Alam, M. S., Ahmad, F., Rafat, Y., Asghar, M. S. J., & Khan, S. (2019). System design and realization of a solar-powered electric vehicle charging station. IEEE Systems Journal, 14(2), 2748-2758.

[5.] Kumar, V., Teja, V. R., Singh, M., & Mishra, S. (2019). PV based off-grid charging station for electric vehicle. IFAC-PapersOnLine, 52(4), 276-281.

[6.] Biya, T. S., & Sindhu, M. R. (2019, June). Design and power management of solar powered electric vehicle charging station with energy storage system. In 2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA) (pp. 815-820). IEEE.

[7.] Singh, A. K., Badoni, M., & Tatte, Y. N. (2020). A multifunctional solar PV and grid based on-board converter for electric vehicles. IEEE Transactions on Vehicular Technology, 69(4), 3717-3727.

[8.] Verma, A., & Singh, B. (2018, September). A solar PV, BES, grid and DG set based hybrid charging station for uninterruptible charging at minimized charging cost. In 2018 IEEE Industry Applications Society Annual Meeting (IAS) (pp. 1-8). IEEE.

[9.] J. Ugirumurera and Z. J. Haas, "Optimal Capacity Sizing for Completely Green Charging Systems for Electric Vehicles," IEEE Trans. Transportat. Electrificat.vol. 3, no. 3, pp. 565-577, Sept. 2017.

[10.] G. R. Chandra Mouli, J. Schijffelen, M. van den Heuvel, M. Kardolus and P. Bauer, "A 10 kW Solar-Powered Bidirectional EV Charger Compatible WithChademo and COMBO," IEEE Trans, Power Electron., vol. 34, no. 2, pp. 1082-1098, Feb. 2019.

[11.] V. Monteiro, J. G. Pinto and J. L. Afonso, "Experimental Validation of a Three-Port Integrated Topology to Interface Electric Vehicles and Renewables With the Electrical Grid," IEEE Trans. Ind. Informat., vol. 14, no. 6, pp. 2364-2374, June 2018.

[12.] S. A. Singh, G. Carli, N. A. Azeez and S. S. Williamson, "Modeling, Design, Control, and Implementation of a Modified Z-Source Integrated PV/Grid/EV DC Charger/Inverter," IEEE Trans. Ind. Electron., vol. 65, no. 6, pp. 5213-5220, June 2018.

[13.] K. Chaudhari, A. Ukil, K. N. Kumar, U. Manandhar and S. K. Kollimalla, "Hybrid Optimization for Economic Deployment of ESS in PV-Integrated EV Charging Stations," IEEE Trans. Ind. Informat., vol. 14, no. 1, pp. 106-116, Jan. 2018.

[14.] F. Kineavy and M. Duffy, "Modelling and design of electric vehicle charging systems that include on-site renewable energy sources," in IEEE 5 th Int. Symp. Power Electron. For Distributed Gene. Syst. (PEDG), Galway, 2014, pp. 1-8.

[15.] Y. Zhang, P. You and L. Cai, "Optimal Charging Scheduling by Pricing for EV Charging Station With Dual Charging Modes," IEEE Trans. Intelligent Transportat. Syst., vol. 20, no. 9, pp. 3386-3396, Sept. 2019.