SURVEY ON EFFICIENT POWER MANAGEMENT FOR ELECTRIC VEHICLE CHARGING STATION BASED ON SOLAR ENERGY

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Abstract: This research basically focus wide range variable speed operation, especially at low-speed condition is obtained. At low irradiance, solar voltage is dropped due to V/f strategy and a boost converter is used to increase the voltage level to meet the higher and constant voltage requirement, such as in voltage source converter DC-link or offshore DC network applications. In the proposed topology fuzzy is controlled voltage and current variation of model and control excitation of wind. Here we optimized conversion ration and power quality. Power quality aspects of EV charging are also investigated, with a focus on harmonic distortion. A robust system design using delta-wye grounded transformers was shown to prevent any excessive harmonic currents from flowing upstream into the microgrid. Additionally, a diversity of EV charging loads promotes favorable harmonic cancellation.

Keywords: Charging Station, Electric Vehicles, Solar, State of Charge, Battery Energy Storage System

I. INTRODUCTION

As a result, balancing electricity production and EVs charging is necessary to ensure and maintain secure constant grid operation. One of the most important issues that must be resolved for the electricity grid to function in the future is the unpredictable nature of RES production. Load fluctuation control has historically been ineffective at preserving grid equilibrium, implementing operational strategy, and controlling power across a range of load operating states. As further electricity production scheduling is crucial for the operation of the power system, controlling the rate of RES production has been suggested as a potential remedy. Additionally, EVs have demonstrated their ability to support the main grid in maintaining a particular level of demand-supply equilibrium, which raises the possibility of RES penetration. Numerous published research articles, such as those in [7], discussed this subject. Additionally, since the energy demands of these vehicles do not significantly increase the total load, PV production may lead to a rise in the penetration of EVs [8]. Careful planning is necessary to integrate EVs and PVs into the grid, whether they are used separately or together. Otherwise, system reliability may be compromised. The most important factor in PV production for power grid operators is time uncertainty [9]. The problem with EVs is that they can overload the grid and disrupt demand, which lowers grid stability and power quality. EVs and PV grid integration needs to be planned and controlled, for instance by using a scheduled load, according to the authors of [10].

The following points demonstrate the advantages of using renewable energy in EV charging systems: I it lessens the load that EVs place on the grid; (ii) it fixes voltage regulation issues with the electricity grid; (iii) it lowers the cost of utility supply; (iv) it increases energy storage by increasing renewable production; and (v) it enhances the efficiency of both V2G and V2H strategies. Hydroelectricity, biogas, fuel cells, photovoltaic, wind turbines, and other RES are excellent potential sources for EV charging and powering. These systems satisfy electric vehicle charging requirements along with energy storage systems (ESS), associated electrical equipment, and suitable connection techniques. Local power sources, such as those utilizing renewable energy sources.

Increasing the amount of electricity produced by the power grid is currently possible thanks to renewable energy sources, particularly solar, wind, and biomass energy. Due to their high energy density, low construction cost, simplicity of use, and improved electricity production efficiency, they are frequently used to charge EVs [11, 12]. Solar energy is gaining popularity due to its high intensity on Earth's surface, as well as its non-polluting and silent nature. Due to the influence of weather and other environmental factors on PV electricity production, a stand-alone PV system is typically unreliable. On the other hand, PV modules stand out for their straightforward design, compact size, light weight, and stability during transport and installation. Additionally, the PV system can be installed in homes and/or public areas and is easy to integrate with other power sources. The variability of PV power output can be significantly reduced by an energy storage system based on charging stations.

II. SOLAR PHOTOVOLTAIC (PV) SYSTEMS

Solar photovoltaic (PV) systems have grown in popularity as a form of distributed generation over the previous ten years. The total installed capacity reached 300GW by the end of 2016, with a record 75GW installed in just that year [10]. Two things in particular have contributed to this: PV system costs have been steadily falling over time, but system efficiency has been rising. Residential and commercial solar PV costs have more than halved over the past seven years, and utility-scale solar projects recently set records for the cheapest electricity ever [11], [12]. Because of this, solar energy has become a trustworthy source of both cheap and clean electricity.

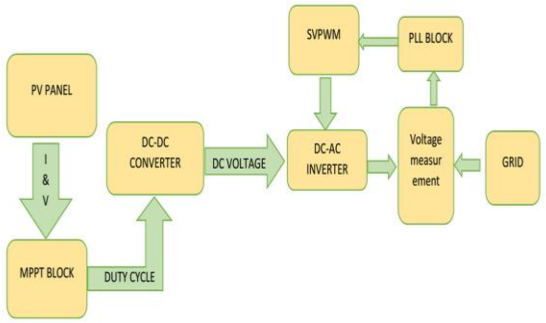

Fig.1 Block Diagram of Solar (PV) System.

Energy storage, which is a costly component in and of itself, is also necessary due to diurnal and seasonal variations in solar generation. Second, distribution system operators (DSOs) all over the world anticipate lowering solar feed-in tariffs in the upcoming years to align with wholesale electricity prices. The economics of grid-integrated solar prices may be significantly impacted by this, and it may also promote the use of solar power for EV charging and domestic loads. The potential for solar generation on parking lots and office rooftops is currently underutilized, as was mentioned in Chapter 1. All of this demonstrates the enormous potential of solar PV for EV charging. [2].

III. CHARGING STRUCTURE DESIGN

Building a dependable and efficient charging station that can meet the expanding power needs of EVs at the chosen location while also recharging the grid or using it for conventional loads is the aim of studying and analyzing EVs charging system design. However, in this case, installation location, seasonal variations, daily weather changes, problems with the stability of the power grid (such as variations in power quality and voltage), and storage system capacity are all important factors to take into account. As a result, the integrated system design for an EVs charging hybrid PV/grid/storage system is implemented in this thesis.

We look at the discrepancy between energy supply and demand and its effects on the design of charging systems. An analysis of EV users' daily travel habits and comprehensive meteorological data modeling, including solar irradiation and temperature, are also necessary. When designing the EV charging system, the nominal power of the PV/grid/BSS should be taken into consideration in order to determine the necessary power conversion steps. The ESS can simultaneously control changes in the electricity grid or solar energy production, as well as store energy during times of excess production to power the charging system during times of low production. To ensure that the EV charging process adheres to the production variables of the power source, modern charging systems use intelligent charging techniques.

The charging station is constructed with hierarchical control in mind. It is demonstrated that the first level control and online energy management maximize the use of PV power, improve charging system capacities, reduce the cost of grid electricity purchases, and lessen the load on the grid caused by the simultaneous charging of many EVs. By integrating the electricity grid with the use of PV and ESS as well as by implementing the appropriate control and energy management system(EMS), the process of charging EVs can be improved.

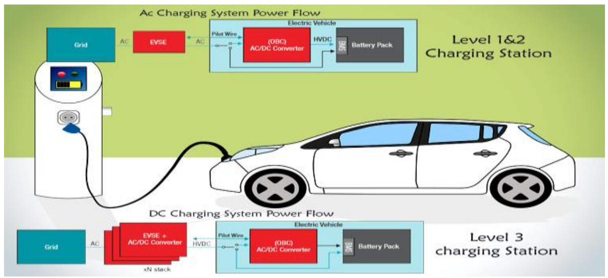

Fig.2 Charging station structure design

IV. LITERATURE SURVEY

T.S.Biya et al. in [1] has with more EVsi on the road, EVsi charging has become a crucial issue that needs to be addressed. To meet the varying needs of all connected EVs throughout the day, a charging station with solar panels, a battery system, and supplemental grid support presents. a potentially efficient solution. The desired power is achieved by maintaining the station's iDC bus voltage with PIDi, current control, and voltage control. The idesign and power imanagement of the suggested station are described and validated in MATLAB/Simulinki while keeping in mind 5 different types of operation and researching 2i cases of EV requirement. This makes the design and algorithm robust. If it has a high power rating, it can serve as an EVi power outlet at work or in public areas.

Vimala Juliet et al. in [2] has concluded Continuous charging is possible with an electric car charging station operated by distributed energy sources such as DC Nanogrid (NG). The NG is powered by photovoltaic (PV) and wind energy, both of which are renewable energy sources (RES). when a local energy storage unit (ESU) produces excess renewable energy that is then used when renewable energy is in short supply. When NG is overloaded and there is a need for energy in the iESU, the mobile charging station (MCS)i offers continuous charging. Battery iswapping and vehicle-to-gridi connectivity are made possible by the MCS. The MCS is in charge of keeping track of the battery's health and State of Chargei (SOC) (iSOH). monitoring the ivoltage, icurrent, and temperature of the ibattery in relation to the SOC and SOH. To demonstrate the viability of EV to NG conversion and IoT-based battery parameter monitoring, a lab prototype is being created and tested.

Rajanand PatnaikNarasipuram et al. in [3] has reported in irecent years, iIn order to lessen the impact of greenhouse gases, the market for electric vehicles has expanded significantly. The deployment of efficient and affordable electric vehicle charging stations with cutting-edge control algorithms, similar to gasoline and diesel stations, is necessary for the implementation to be successful. This review paper provides an overview of electric vehicles and various rechargeable battery configurations. In order to achieve an ideal design, the charging stations are categorised according to their power consumption, and various optimisation algorithms, techniques, and future directions are presented. Along with the potential for the future, the key aspects of grid-connected sustainable power and grid-connected, off-grid configurations are also described. The heavy load placed on the grid, particularly during peak hours, can be reduced by incorporating storage and renewable sources of energy into the charging station. The review study aims to give industry experts and researchers deep insight into these important areas for future developments.

WajahatKhan et al. in [4] has suggested As the automotive industry is under pressure to create iclean and iefficient ifuel-based itransportation due to the expanding problem of air pollution, ielectric ivehicles (EVs)i appear to be the best ialternatives to conventional iiIC engine-powered vehicles. iFast charging of iEVs is required because charging times are the main barrier to EV adoption. Several deployment and integration strategies for public fast charging have been proposed, with an emphasis on ipower quality and icharging load imanagement techniques. This study presents a imodel of a quick charging station for electric vehicles that is grid-connected, ensures high-quality power transfer, and uses low harmonic currents. Electric vehicles are connected to a DC bus at charging stations using battery chargers via a iconverter that connects the igrid to the DC bus. Both individual vehicle charging and decentralised ipower transfer from the iAC igrid to the iDC bus are implemented. As part of an energy imanagement strategy ibased on optimal power flow, a solar PV generation system is integrated with a charging station to reduce the impact of fast charging on the grid. Utilizing the power output of the iEV fleet batteries that are available iat the icharging istation, the combined system reduces nett energy.

Anjeet Verma et al. in [5] has discussed To provide electric vehicle uninterruptible charging, The use of a solar photovoltaic (PV) array, battery energy storage system (BES), the grid, and a diesel generator (DG) is recommended (EVs). The CS's operating costs are reduced by the efficient use of these energy sources. As a result, the cost of charging electric vehicles are reduced (EVs). An uninterruptible charging strategy that prioritises the use of energy sources is suggested in order to achieve uninterruptible charging while lowering charging costs. Therefore, solar iPV and iBES energy are given top priority. The grid is then used, and when all other energy sources have run out, a DG set is used. This tactic makes use of the price per kWh of electricity. Typically, a irooftop solar PV iarray's electricity costs iINR i4.5–5/kWh. The grid charges iINR 10 per ikWh, whereas DG sets charge iINR 17–20 per kWh. In order to ifurther lower charging costs, the isingle phase two iwinding iself-excited induction igenerator (iSEIG) based iDG set is operated at an only one point of saturation, going to produce significantly more power than its rated power. In addition to controlling power flow, a single two-leg voltage source converter (VSC) can also reduce the initial cost of the CS, accommodate for reactive power, minimise harmonic current, generate voltage waveform in standalone mode, and control generator voltage and frequency. To achieve continuous icharging while connecting the igrid/DG set, the point of common icoupling i(PCC) voltage is combined with the igrid/DG set voltage. The CS has two ports with both iAC and iDC power for charging EVs. The CS icreates a sinusoidal ivoltage of i220V and i50Hz using power from a solar PV array and BES in order to charge the iEVs through the iAC port. The CS also has a present itotal iharmonic idistortion (THD) of less than 0 and a power factor (PF) of 1.

Parag K. Atri et al. in [6] has Conclusion provides a comprehensive analysis of the various imaximum power point itracking (MPPT)i methods for isolar charge icontroller applications with a range of iconverter topologies. A iPV panel, a iDC to iDC converter, a icharge controller, and a battery make up the system. To ensure proper solar battery charger application, various imaximum power point itracking techniques, including iPerturb and Observe (Pi & Oi), iIncremental Conductance (IC), and iFractional Open Circuit Voltage i(FOCV), were simulated and compared in iMATLAB. Any electrical vehicle, such as a golf cart, can be powered by this solar charger. The solar battery charger is closely analysed and dissected in this essay.

C. Chellaswamy et al. in [7] has described the battery packs for electric vehicles are charged using a SWCM, or solar and wind energy-based charging mechanism (EVs). The renewable charging station is powered by wind turbines and solar photovoltaic (PV) modules. Lower CO_2 and CO-related emissions are produced as a result of the SWCM's reduction in the need for fossil fuels to produce electricity. A single diode model and analytical modelling have both been used to simulate the generation of wind energy. The proposed SWCM simulation model was developed using MATLAB-Simulink. A variety of wind turbine parameters were examined under two different loading (1 kW and 3 kW) conditions, and the I-V and PV characteristics of the solar panel were examined under various irradiance levels. The PV modules and wind turbine are powered by two unidirectional DC-DC converters, and the ten charging points are powered by six bidirectional DC-DC converters. A three phase bidirectional DC-AC (alternating current) inverter is used to connect the proposed system to the grid and balance load demand. According to the findings, the recommended renewable charging technique is suitable for EV charging and will result in a pollution-free environment.

Joseph, et al. in [8] has suggested the quest for energy conservation is a difficult riddle for scientists. On occasion, they made a contribution to this cause. The idea of electric cars was fascinating in the nineteenth century (EVs). Because conventional energy is used by the majority of developing countries, the integration of EVs with renewable sources of electricity was justified. Unlimited sources of clean energy have been created from parking spaces. To make charging simpler and improve energy management, the charging station now features wireless power transfer technology. Vehicle-to-grid (V2G) integration was implemented as technology advancement. By utilising renewable energy, it facilitated the bidirectional power flow between the vehicle and the grid. This study takes a close look at wireless charging powered by renewable energy and EV V2G integration. utilising diagrams and mathematical explanations.

Gautham RamChandra Mouli et al. in [9] has reported Solar-powered electric vehicle charging offers a sustainable mode of transportation. This paper describes the design of a solar-powered ie-bike charging station that can charge e-bikes in iAC, iDC, or contactless mode. The iDC charger eliminates the need for an external AC charger iadapter by allowing the ie-bike to be icharged directly from the iDC power of the photovoltaic panels (PV). The contactless charger provides the user with the greatest level of convenience by enabling the bike to be charged without the use of any cables. The charging station also has a battery that allows grid-connected and off-grid operation, which brings us to the end of the list.

Yongmin Zhang Et Al. in [10] has investigated the best time to recharge ielectric vehicles i(EVs) in a iparking lot at a workplace that is ipowered by a photovoltaic system and the power grid. Solar energy is erratic and unpredictable, and EV charging requirements change over time, making it difficult to iguarantee the significant profit of the vehicle iparking charging istation. We iformulate the planning of EV charging in the parking area as a benefit maximisation problem to address this issue. We first derive a number of prerequisites for making an optimal decision by examining the relationship between the EV charging requirements, the charging load, and the iharvested solar energy in order to simplify the main optimisation problem. Then, using real-time data on iEV charging requirements and isolar energy, we create a dynamic icharging scheduling ischeme (iDCSS) that uses the model ipredictive control method to regulate EV charging procedures. The simulation outcomes show how successful and effective the DCSS..

V. CONCLUSION

Today, live in digital word and power requirement is very high this system also updates how we manage this requirement. From reading different author work planning find issue behind not feasible Electrical vehicle and also find how to make smart charging station for EV’s. The infrastructure of charging stations and energy storage technologies are then reviewed. According to existing work of different author today electrical vehicle is possible but having lots of issue like most of vehicle not cover lots of distance its battery charging is taking more time and its charging power consumption is high as expected.

The various power electronic interface methods, such as switching modulation techniques, both-directional isolated and non-isolated converters, and converter connected to the micro grid control strategies.

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