SURVEY ON EFFICIENT DESIGN AND ANALYSIS RENEWABLE ENERGY BASED GRID CHARGING STATION

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Abstract: The rapid development of electric vehicles (EVs) increases the power demand, which causes an extra burden on the public grid increasing the load fluctuations, therefore, hindering the high penetration of EVs. This paper provides a survey of the current development of EVs charging station. This is show different author work with respect micro grid and smart grid, the power system, converter topology, and power electronics control. This also shows state of development of the power system, as well as the concepts to new development in renewal energy and EVs charging station. It is also update about technology change in power system and which method role to change of this particular system.

Keywords: Electric vehicle, solar PV array, wind energy conversion, bi-directional power flow, power quality.

1. INTRODUCTION

Due to rising energy scarcity and pollution, people are becoming more concerned with their health and the environment. Due to the growing environmental burden and increased resource consumption caused by the automobile industry, EVs have become more and more well-liked because of their eco-friendly and energy saving features [2, 3]. As the number of EVs increases, one of the problems that the public grid will need to solve is charging EVs. [4]. the widespread adoption of EVs necessitates the construction of extensive charging infrastructure, and management strategies are essential to this process [5, 6]. Management strategies should take into account both the power balance of charging facilities as well as the needs of users based on their various options.
Any electrical system basically divided three-part one is the power generation block which is the initial source of the system another is a transmission line which is another block that transfers power from one place to another place another section is distributed network that is distributed power in the local area, this is conventional power system (CPS), here transmission lines used to transmit power between generation units to a load section in the distribution network in one direction. The power generation block is the main block of the system; it is a primary section that produces electricity power by burning fuel or another medium of generating electricity like wind and solar. Everyday power demand is increasing as digitalize economy and world. Power generation with minimum cost is a major section today to fulfill current scenario equipment.

II. AC MICRO-GRID AND SMART GRID

AC micro grid is the lowest subset of AC distribution unit. It is distributed power to every local place that is used by normal users. AC micro grid is a sub-separator part of the main grid architecture; it transfers power without the support of any other setup, controller and converter mechanism. Ac micro grids have been the focus of research from the micro grid's inception, and there are a large number of papers on their operational and control strategies that can be found in the literature. Due to dependable ac power systems and compatible electrical and electronic device modes, this is possible. Basically, the micro grid is working three different categories one is a single phase, another is three phases with a neutral point line and three phases without a neutral point line. Micro grid id shows in figure 1.

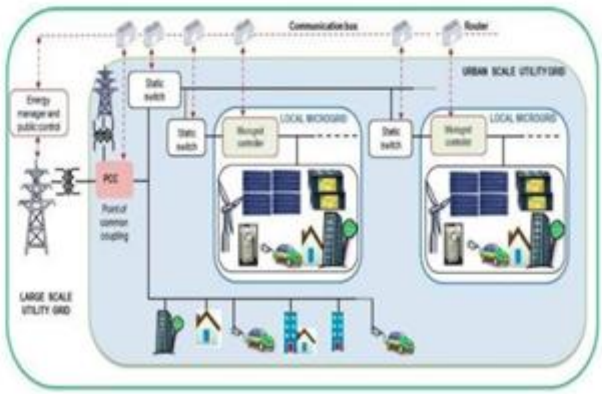

Fig.1 Smart grid topology

An entirely automated power transmission system known as a "smart grid" ensures the bidirectional flow of data and energy between all nodes from the power grid to the end user by continuously monitoring and controlling each end user and power grid node. The potential evolution of the topology of the smart grid is shown in Figure 1.

The smart grid is the best part of today's power requirement system. It is measure user requirements and fulfils them without generating any time delay. A smart grid is a method that measures user electricity consumption by user and requests that demand-supply by the supplier system. The grid also acts to solve nay which is generated in supply if any section has faced any electricity fault smart grid is trip that particular rest of the section working well. Self-healing smart grids will act right away to fix any issues, even if the issue is limited to a few specific faulty lines, so they can recover from outages. Implementing a smart grid can enhance grid power quality. An innovative form of a power grid known as a "smart grid" makes use of cutting-edge information; it establishes good bidirectional communication along with technology for optimizing electricity problems in real time. It fixes the problem of a single command and reduces the cost of maintaining the grid. In comparison to conventional centralized power generation systems, distributed energy has the advantages of cleanliness, environmental protection, and flexibility. The smart grid will increasingly rely on renewable energy sources.

However, a significant number of distributed energy grid-connected operations will seriously paradise the stability of the power system. How to efficiently dispatch distributed energy in the smart grid environment while ensuring the grid's dynamic stability is a crucial problem in smart grid technology research.

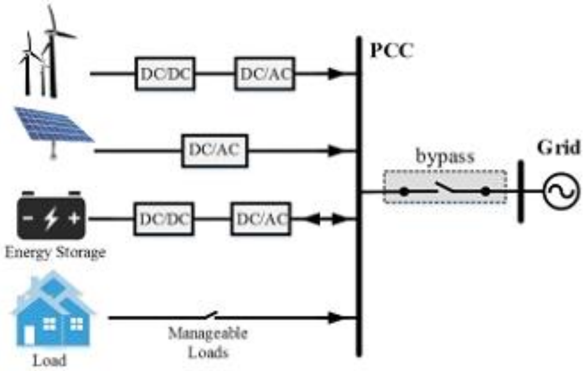

Fig.2 AC Micro grid

Researchers suggest a more adaptable, intelligent, and dependable system the micro grid lessens the adverse effects of distributed power access on the public grid while combining the features and advantages of renewable energy sources.

This proposal is based on the aforementioned analyses. Figure 1.2 shows an example of a micro grid that combines cutting-edge information, control, and power technologies to deliver a dependable power supply that can maximize energy, economic, and environmental benefits while meeting the varied needs of users. Micro grids can also benefit the public grid by increasing energy efficiency, reducing consumption, and saving energy. A micro grid is therefore a crucial element in the creation of smart grids.

In order to encourage energy efficiency, reduce emissions, and achieve sustainable energy development, the DC micro grid is a significant part of the future intelligent power distribution system. A direct current (DC) micro grid can accept distributed renewable energy power generation systems like wind and solar, energy storage devices, electric vehicles (EVs), and other DC power loads more effectively and dependably than an alternating current (AC) micro grid.
Micro Grids (MGs) should be able to locally control the grid using power electronic interfaces since they are the primary components of power generation systems [7]–[8]. Figure 2 depicts the block diagram of a typical MG, which includes manageable loads, an energy storage system, and RESs, as well as their interfaces.

For this MG to be implemented successfully, the MG control system is essential. In order to ensure a smooth transition between the grid-connected and islanded operating modes, the control system should provide reliable operation in both of them [6]. In MGs, different control strategies like power management, grid parameter regulation, and power quality enhancement are carried out using multi-level controllers, also referred to as hierarchical control systems. The power systems' control systems are used to carry out the aforementioned tasks.

The ability to balance the power inside the MG and control voltage/frequency deviations in case of sudden power imbalances are two additional crucial tasks that the control system in the MG must complete in addition to those already mentioned.

III. LITERATURE SURVEY

Anjeet Verma et al. in [1] has presented a multifunctional charging system based on a PV array's WECS has undergone experimental validation. The simulation results show that the charging system not only recharges the EV but also powers the home loads. Test results confirmed the controller's ability to operate the charging station in both grid-connected and islanded modes. In standalone mode, regardless of home load current, the charging station produced sinusoidal voltage with good THD quality. In grid-connected mode, the sinusoidal grid current is preserved in a similar manner. The WECS and PV array-based charging stations have been found to work satisfactorily in both operating modes and under a variety of dynamic conditions. Furthermore, the charging station and controller's power management capability has been validated under a variety of transient conditions, including those caused by changes in solar irradiance, wind speed, home load perturbation, and EV current change, as well as when switching from grid-connected mode to islanded mode.

Bhim Singh et al. in [2] have discussed the charging station is used for home and grid energy control systems in order to meet all EV charging, home supply, and grid needs in a single system. There are solar photovoltaic arrays and wind energy conversions system used. In the case of electricity generation add the proposed systems power and some energy back into the grid. When the grid is a failure, the electric vehicle is charged and the suggested system uses renewable energy to power the load. Furthermore, the EV employs the vehicle-to-home (V2H) approach to supply local loads in the event of insufficient renewable energy generation or a lack thereof. In order to address power quality issues at the grid, the proposed system is intended to act as an active filter, achieving unity power filter (UPF) operation and voltages and currents that comply with the IEEE-519 standard. Furthermore, synchronization of point of common interconnection (PCI) voltages with grid voltages are presented for seamless mode transition from islanded to grid-connected mode (GCM).

Bhim Singh, et al. in [3] has described the management, application, and thorough performance analysis of EVCS based on renewable energy. The result showed that the home supplied load and charging the electric vehicle are both capable for CS. The results showed that there is no effect on electric vehicle charging and home supply, when the changes in EV charging current, changes in wind power and among other things in island mode. Furthermore during various transients the electric vehicle charging and home supply in GCM remained stable. A number of presented results have also confirmed the charging station's additional features, such as vehicle to home, vehicle to grid, harmonics compensation, vehicle to grid reactive power compensation, and synchronization capability. As a result, the charging station being offered is an excellent choice for household loads that require grid power.

Amnjeet Verma et al. in [4] has according to the report, to design an EV charging station the use of WECS and PV array are combined and developed this prototype is used to test CS function. The test results in islanded mode, grid-connected mode, and DG setconnected mode have further demonstrated that the CS is able to continuously supply the household load and charge the EV despite disruptions in the WECS and PV array. Additionally, test results showed that the MPP technique worked well regardless of variations in PV power or WECS power. To maximise fuel efficiency, the CS controller has made sure that the DG set is loaded properly. Additionally, test results confirm that the charging station operates in accordance with IEEE 519. The charging station's other complementary features, including vehicle-to-home, vehicle-to-grid, harmonics elimination, vehicle-to-grid reactive power compensation, and synchronization capability, have also been validated by a number of the results that have been presented.

R. Kannan et al. in [5] has suggested that the need for energy is growing much more quickly and that perhaps the environment has been harmed by conventional resource consumption. The microgrid generation of electrical technology now enables practical access to distributed energy sources. The use of microgrid technology to incorporate renewable energy into widely accessible battery electric vehicles (EVs) is covered in this paper. In modern distributed systems, an EV charging station powered by a hybrid microgrid system ensures smooth control and active power flow. However, the migrogrid system's awkward and heterogeneous charging of EVs results in inefficient use of renewable resources in emergency situations. The switch to EV promotes the construction of charging stations by using charging architecture with multiple port configurations, which makes the microgrid more complex. This paper discusses the use of renewable resources as well as EV in-line charging in distributed microgrid systems. Solar photovoltaic (PV) and wind energy (WE) are combined with energy storage, electric vehicles (EVs), a power electronic interface, and private loads to form a distributed network in this groundbreaking study. A quick look at the EV charging phenomenon is followed by a systematic evaluation of the generated power under various load scenarios. Utilizing the PSCAD/EMTDC simulation platform, the study is validated.

Bhim Singh et al. in [6] has for EV charging, a PV array, storage battery, grid, and DG set-based charging station were built. The findings validated the CS's ability to operate in multiple modes (island operation, grid connection, and DG set connection) with a single VSC. The test results also demonstrated that the charging station performed satisfactorily under a variety of steadystate conditions as well as dynamic conditions caused by variations in solar irradiance, EV charging current, and loading. The results, which have been made public, confirm that the charging station works as a reliable standalone generator. In contrast, the ability of an ANCbased control algorithm to maintain power exchange with the grid at UPF or optimal DG set loading has been validated by test results in DG set or grid-connected mode. With island operation, grid-connected and DG setconnected operations, as well as automatic mode switching, the likelihood of MPP operation of the PV array and optimal loading of the DG set, as well as charging reliability, has increased. The charging station's IEEE compliance operation with voltage and current THD always less than 5% validates the control's effectiveness. The information presented above leads to the conclusion that this charging station, when used in conjunction with the provided control, is capable of utilizing a variety of energy sources.

T. S. Biya et al. in [7] has discussed As a result of global warming, electric vehicles (EVs), which appear to be the best replacement for internal combustion engines, have grown in popularity. Because of the growing number of EVs on the road, charging them on the traditional grid powered by fossil fuels is no longer practical or efficient. As a result, a renewable energypowered electric vehicle charging station has enormous potential and control. In the current scenario, an electric vehicle charging station with solar power and a battery energy storage system (BESS) is planned. additional grid support is used to ensure that the charging station has continuous power without adding to the grid's load. For optimal power management between solar, BESS, the grid, and EVs in the charging station, an effective charging station design with MPPT, PID, and current control strategies is created. MATLAB/Simulink is used to design and validate a charging station while accounting for EVs' dynamic charging requirements.

Vandana Jain et al. in [8] has An electric vehicle charging station (CS) with a three-phase grid interface is proposed (EV). To account for reactive power, it communicates with the grid. The charging station functions in a number of modes, including I EV battery charging and discharging, II reactive power compensation, III concurrent charging and harmonics current compensation, and IV concurrent discharging and harmonics current compensation. The CS operates in distorted and unbalanced grid conditions while connected to the grid. The control of the charging station is configured so that the phase voltages at PCC and the reference grid currents synchronize (Point of Common Coupling). The charging station operates in an isolated mode, with the PV source charging the EV battery, if the grid loses synchronism. When the performance of the charging station was tested under various dynamic conditions, the levels of grid current distortion were within IEEE-519's recommended range.

B Preetha Yesheswini et al. in [9] has reported The popularity of electric vehicles (EVs) has grown as a result of the clean energy they use. The development of EVs has accelerated due to advances in lithium-ion batteries. The demand for electricity will increase along with the number of EVs, which will put pressure on the power grid. This prompts research into alternative and eco-friendly energy sources for recharging EVs. In this project, an electric vehicle charging station is constructed using a solar energy system. The charging station makes it possible for multi-port charging by offering a DC bus with a constant voltage. The charging controllers are built on the concepts of power balance and constant current/constant voltage charging. Results from simulation and testing are used to verify the charging system's performance.

Visal Raveendran et al. in [10] has Electric vehicles (EV) are becoming more and more common as a result of rising gas prices and declining supply. The number of EV charging stations should increase along with the number of EVs, as this will have a significant impact on how much power is drawn from the grid. This paper proposes an EV charging station topology in order to reduce the impact of charging and its effects while also encouraging the use of EVs. The proposed topology includes a grid-powered charging station, a controller, and a solar PV system with integrated storage. To reduce the charging station's reliance on the grid, solar PV is used, and a battery Energy Storage System (BESS) is added to improve the system. By adjusting the charging current based on system conditions, the control technique helps to reduce the impact of charging on the grid. Three charging options (quick, green, and budget) are available, and the customer can select one based on his needs to personalize the EV Charging Station (EVCS). The cost will vary depending on the charging method chosen. Testing and verification of charging current control under various grid conditions is part of the design of a smart electric vehicle charging station. The MATLAB Simulink model and the results are included.

IV. CONCLUSION

A multipurpose charging station based on a PV array and wind energy conversion is suggested by this study. In order to provide EV charging and power to domestic loads in both islanded and grid-connected modes, the proposed integrated charging system connects the PV array and WECS via VSC. The DC link of the charging system is connected to the PV array. However, a diode bridge rectifier, followed by a boost converter, connects the PMBLDC generator-based WECS to the DC link. The boost converter's goal is to collect WECS's peak power. The EV draws power from the charging system using a BDC. At the CPC of the suggested system, the domestic loads are coupled. Between the grid and the PCC of the charging system, a bidirectional static switch is utilized.

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