

# Electric Vehicle Charging Stations Business Models for India

<sup>1</sup>Rajonr dipak, <sup>2</sup>Jaydip Ughade

<sup>1</sup>Assistant Professor, B.E., Electrical Engineering, SND College of Engineering and Research Centre Yeola, Pune, Maharashtra, India

<sup>2</sup>Student, B.E., Electrical Engineering, SND College of Engineering and Research Centre Yeola, Pune, Maharashtra, India

**Abstract - In recent years, installation of renewable energy facilities is increasing rapidly in response to the movement to suppress the release of greenhouse gasses responsible for the warming of the earth and to save fossil fuels, which are growing increasingly precious. Furthermore, the cost of photovoltaic systems is decreasing year by year. Therefore, it is assumed that price of photovoltaic power will be falling in the future. However, in Japan, the large amount of surplus electricity power from photovoltaic systems exerts a bad influence on the power grid. In this study, an EV charging station utilizing renewable energy is proposed as a business model. The proposed EV charging station purchases power from photovoltaic systems at a low price and use that power to charge a fixed battery. Then the power is sold, being used to charge electric vehicles during the daytime. Moreover, the station can provide power to smart houses at an economical price when load demand is high. The effectiveness of the proposed EV charging station was verified with numerical simulations.**

**Keywords:** EV charging station, Electric vehicle, Photovoltaic, Optimization, Tabu search.

## I. INTRODUCTION

The CO<sub>2</sub> emission, fossil fuel depletion, and capability to balance the electric grid stability make transportation sector shift to electric vehicles (EV) or plug-in hybrid electric vehicles (PHEV). However, the EVs are being developed at a slow pace due to the battery high cost and lack of charging infrastructure. Thus, governments in many countries adopted some policies, such as tax exemption financial subsidies, to boost the EVs purchase rate. Also, many automobile manufacturers have started developing their production lines to include this emerging technology. The EV expected market growth in the associate editor coordinating the review of this manuscript and approving it for publication was Salvatore Favuzza. Conjunction with the policy incentives and technology advancement will result in a significant growth in EV market, which in turn would impact electric networks adversely. Seemingly, the question arises: how would the

additional loading caused by EVs is accommodated by existing electric networks? Uncoordinated charging of EVs would elevate load peaking at rush hours, or even create new load peaking at different times. Hence, a straight solution is to invest in reinforcing the electric grids so as to accommodate the additional EVs load. Nevertheless, the resources required for such an investment is so huge that the whole proposal might be turned out economically infeasible. Several concepts were proposed to formulate so-called coordinated charging that is a cost-effective solution dealing with the EVs load peaking.

## II. METHODOLOGY

An environment friendly and efficient public transport system is essential for major cities, and electric buses are most appropriate candidate. In this paper we examine the possibility of implementing electric road system with dynamic wireless charging of electric buses. Trends and status of dynamic wireless charging technology are discussed. A. Wireless Charging Technology Mainly two types of wireless power transfer (WPT) technologies exists they are Far field and Near field. Far field can transmit power over long distance by using direct line of sight transmission path. It requires complicated tracking strategies.

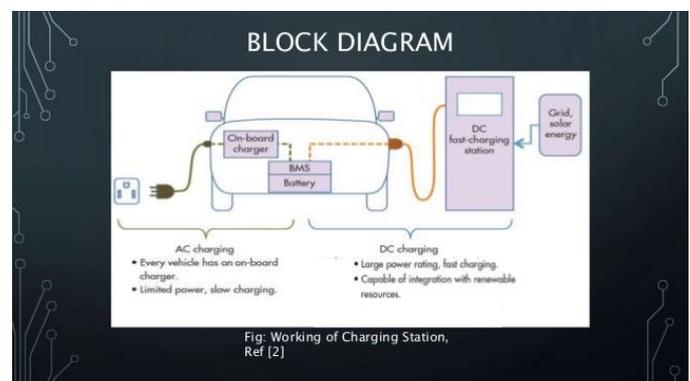


Figure 1: Block diagram

Electricity from the grid is delivered as alternating current (AC) but the EV requires direct current (DC). A rectifier needs to sit between the grid and the battery to convert one to the

other. For home and third party public charging this AC-to-DC conversion is done by the EV's on-board rectifier. AC current at the charge port is converted to DC for the battery by the rectifier. Superchargers deliver high voltage, high current DC electricity directly to the EV's battery, bypassing the on-board rectifier. This allows the Supercharger to push electricity into the battery as fast as the battery can take. For those of a technical bent, here's how a typical DC charging station is configured: the whole setup, takes a 12 kV, 750 kVA feed from the utility, steps it down to 480V three phase on site, pushes that into 2000A switchgear which feeds four banks of charging units at 480V/200A. Each unit contains twelve 10 kW rectifiers (the same "rectifier" that is found in EV's) giving a total of 120 kW per pair of pods.

- Level 1, 120 Volt Charging: The slowest form of charging. Uses a plug to connect to the on-board charger and a standard household outlet. This setup provides between 2- 5 miles per hour.
- Level 2, 220/240 Volt Charging: Provide power at 220v or 240v and up to 30 amps. Drivers can add 10-25 miles of range in an hour of charging at home or at a public station.
- Level 3, 480 Volt Charging: Some refer to this charging as DC Fast charging. In this case, the charger is a gas pump- sized machine. All fast chargers deliver about 80% charge; the charging stations can also be powered by solar energy.
- Number of solar panels can be placed on roof of charging station. This solar panel will deliver power to charging point. • Use of solar will reduce load on power grid and will also save considerable amount of fossil fuel used Fig: Solar Powered Charging Station.

### III. CONCLUSION

In this study, assuming that the price of PV power falls in the future, an EV charging station which uses renewable energy efficiently and economically is suggested as an aggregator. The proposed charging station purchases power from a PV system that is introduced into smart houses at a low price. The EV charging station sells the power to EVs and smart houses, and charges a fixed battery. The numerical simulations were performed in three weather conditions: these weather conditions are sunny, cloudy, and rainy. As seen from the results of the simulation, the EV charging station was able to obtain ample profit.

### REFERENCES

- [1] The Indian Express Dt: 6th April 2017. Title: "100% Electric mobility in India by 2030; Is India really prepared for it?" Author: Epica Mandal Sarkar and Ashish Nigam.

- [2] Mehmet Cem Catalbas, Merve Yildirim, Arif Gulten, and Hasan Kurum, "Estimation of Optimal Location for Electric Vehicle Charging Stations", IEEE 2017. Date: 08/09/2017 Topics Referred: Working of charging stations.
- [3] R. Bengler, R. Heyne, A. Haubrock, and H.P. Beck, "Sustainable Fast Charging Stations for Electric Vehicles," in 5 th, International Renewable Energy Storage Conference (IRES 2010), Berlin, Germany. Date: 08/09/2017 Topics Referred: Levels of charging station.
- [4] Ciprian Vlad, Gabriel Murariu, "Using Renewable Energy Sources For Electric Vehicles Charging" IEEE 2013. Date: 08/09/2017.

### AUTHOR BIOGRAPHY



**Jaydip Ughade**, Student, B.E., Electrical Engineering, SND College of Engineering and Research Centre Yeola, Pune, Maharashtra, India.

**Citation of this Article:**

Rajonr dipak, Jaydip Ughade, "Electric Vehicle Charging Stations Business Models for India" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 5, Issue 6, pp 72-74, June 2021. Article DOI <https://doi.org/10.47001/IRJIET/2021.506014>

\*\*\*\*\*