GROWTH OF ELECTRIC VEHICLES IN INDIAN MARKET BY INCREASING THE ELECTRIC VEHICLE PUBLIC CHARGING STATIONS

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ABSTRACT

India is potentially the largest market for automobiles with electric vehicles constituting less than 1% of total automobiles on-road. One of the primary factors being lack of public charging infrastructure for such vehicles. This paper presents the potential to increase charge stations by utilizing electricity from electric poles and charge electric vehicles, while charging rate is limited through a charge controller which takes the inputs from electronic data capture machine. Hence every electric pole has a potential of becoming a charge station in its own right. This improvement in charging infrastructure will foster the growth of electric vehicles in Indian market and lead to a better and eco-friendly future.

Keyword: - *Charging stations,Electric vehicle,Charging pole,Make in India,Eco-friendly*

1. **Introduction**

As the world is progressing at a rapid rate in terms of technologies, by utilizing fossil fuels we are moving away from greener earth. There is a need in finding alternative sources of energy which can sustain the geological balance of our earth and compensate for the depleting fossil fuels. To cope up with the above mentioned issues and crisis,electric vehicles are brought out which are our near future.

There should be a good charging infrastructure to support the growth and use of electric vehicles in a country. India is the third largest market for automobiles in the world supported by approximately 45,000 petrol/diesel refueling stations[1]. In comparison there are only 224 charging stations of Mahindra Reva e2o car across approximately 17 cities of India[2]. Also the public charging stations tend to be concentrated to particular areas of those cities. These charging stations include both paid and free stations. The major challenge faced by the OEM's is the installation of charging infrastructure to support their EV customer base and distribution.

2.Fostering the growth of charging stations in India

Setting up of Charging Stations

One immediate opportunity to address the lack of EV charging infrastructure is to develop public charging station alongside electric poles which carry 220V supply for domestic consumption. This can be done using a household socket outlet through a NEMA 5-15 connector. This presents the Type 2 charging station (AC level 2) potential to support EV usage.

The next stage would be developing Type 1 charging stations (AC level 1) with a voltage 440V from the electric grid. This is step-down to 220V for domestic purpose using a transformer. In order to meet the specifications of the type AC level 1 the voltage can be further reduced to 120V using another transformer that converts the 220V AC to 120V AC. A public charging station grid can be developed between selected feeders to address the charging requirement of EV customers.

Many countries have already developed a systematic charging infrastructure to boost the market acceptance of Electric Vehicles (EV) [3]. Typical charging equipment and their specifications according to Alternative Fuel Data Center (AFDC), United States, are summarized below in Table 1.

Table 1. Different types of charging, time required and the types of connectors/plugs used in charging the electric vehicle [4].

Type	**Current Specifications**	**Charging Rate**	**Time For Full Battery Charging**	**Connectors/ Plugs Used**
AC level 1	120V AC	3.2Km to 8Km/ hour of charging	6-8 hrs	NEMA 5-15 connector
AC level 2	240V or 208V AC	16Km to 32 Km/ hour of charging	3-4 hrs	NEMA 5-15 connector
DC fast	240V DC Or maximum 600V DC	80Km to 113 Km/ 20 min of charging	10-20 min	CHAdeMO SAE J1772

(Source: AFDC, a resource of the U.S. Department of Energy's Clean Cities program)

Another advantage of setting up Type 1 and Type 2 public charging stations is that it can be developed in the existing electrical infrastructure set up by the government and the local distribution companies.

DC fast charge stations pose certain amount of difficulty due to their requirement of AC to DC converters and the risk it presents in terms of electric injury compared to Type 1 and Type 2 stations.

Charging Grid

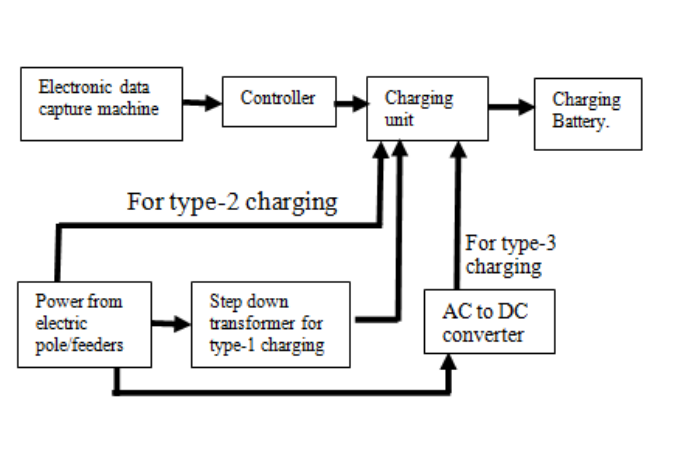
As with any system, the infrastructure changes for charging station need to be evaluated in terms of existing infrastructure, current demand, customer charging patterns and anticipation of future growth.

A study was conducted by U.S. Department of Energy for their Smart Grid Investment Program in December 2014, some of its observations like majority of EV users preferring to use in-home charging during off peak periods and use of public charging stations only during business hours for short charging sessions to keep the battery completely charged.It has helped them shape and plan charging infrastructure accordingly. Such studies from Indian electricity distribution companies are essential to evaluate current and future needs of EV market.

Public charging stations need to be equipped with smart payment solutions. Typical charging station consists of following components- a swipe machine, a controller, electric vehicle charge equipment, AC to DC converter, connector/plug. For the charging equipment the power supply is taken from the electric poles where 230-240 v of electricity is available. This charging unit is connected to a controller which controls the flow of electric charge in to the battery while charging. The controller is given the inputs from the electronic data capture machine.

The methodology overview for charging can be whenever the electric vehicle needs to be charged the driver uses his ATM/Debit card for the payment through the swiping machine. The money is transferred from the driver's account to the stake-holder of that charging station. The driver is allowed to choose for what amount his vehicle should be charged through the electronic data capture machine. This input from the electronic data capture machine will be fed to the controller. The controller takes the input and controls the flow of electric to charge the battery. The amount per unit of charge will be decided by the stake-holder. After the battery is charged for desired money the controller stops the flow of electricity.

3.Algorithm for charging stations



4.Challenges

Grid Load During Peak Hours

Grids can get overloaded during peak hours, especially in business areas due to EV charging. This can have an adverse impact on the grid circuit. Even the installation of fast DCcharges in domestic areas will overload the circuit and hence their locations need careful selection.

Theft

Theftmay be of two types one is the hacking of electronic data capture machine and the other will be the physical one (theft of electronic data capture machine and the components of charging station). This consequence may be eliminated by installing the security systems (like CCTV cameras, sensors etc.)

Quality of Equipment

Choosing the quality of equipment for building the charging infrastructure is vital since the consequences of inappropriate equipment selection may lead to improper working of the charging unit, short circuits, energy losses etc.

Many of the equipment of electric connection (viz., transformers, electric cables from one pole to another etc.)already in use in India are outdated and should be taken into consideration since the system may be easily

disturbed by nature (like trees, rain, wind etc.) & humans. Hence the equipment selected must be sophisticated or the existing system must be replace with sophisticated equipment.

5.Conclusion

Increasing number of charging stations in India will encourage the electric vehicle ownership. This in-turn will support the OEM's to release their products in India. The stake-holders are benefitted as well. The electric vehicle market increases in India.

Other opportunities being that, different government and non-government organizations have an opportunity in fulfilling this project, as the scope for electric vehicles will be high as they are eco-friendly.

This will help in strengthening the "MAKE IN INDIA" concept since the electric vehicle OEM's increase as well.

6.Future scope

According to studies, India will have close to 1 lakh EVs by 2020. To support this huge network, there is a requirement for smart chargers. Apart from public charging stations, India needs to work on mass charging stations at work places and parking towers. To minimize peak load charging, smart chargers have to cut off power to particular vehicles once it reaches a 70%-80% of charging and divert the same to other cars. Most of the offices in India are small and distributed. So we can have a common parking tower for all the offices at a particular zone where smart charging can be implemented, which will otherwise minimize the individual implementation cost.

7.References

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