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Electric Vehicle Charging landscape aiming for Self Reliant India

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Abstract – One of the revolutionizing global strategies for the de-carbonization of the transport sector is the transition to electric mobility. India is amongst the nations which spread the worldwide EV-30 movement, targeting by 2030 least thirty percent electric vehicles (new). An indispensable condition to achieve this transformation consists accessible & strong web work of infrastructure for electric vehicles charging. Inview of the scenario of this new infra-structure, customizing to the transport system (India) is the need of the hour along with facilitation of the stakeholders to support the on-ground expansion. This paper aims at giving the efficient & timely implementation of electric vehicle charging structure ensuring proper integration of transportation & supply networks.

Keywords: Electric Vehicle, Battery Swapping, Rating

I. INTRODUCTION

With the rising demand for electric vehicle it can eventually lead to replacement of conventional vehicles. The paper aims for understanding the Electric vehicle charging structure along with the introduction to concepts (technical) of EV equipment's, AC/DC charging, power ratings & charging standards. It also emphasizes on electrical supply for the charging structure along with financial viability for the same.

II. EV CHARGING STRUCTURE

The basic unit of EV charging structure comprises of the Electric vehicle supply equipment (EVSE). This facilitates power for the electrical supply and makes usage of a control system & wired connection to safely charge Electric Vehicles. Electric vehicle's supply equipment enables many different functions such as user authentication, recording of information & exchange of network management along with ensuring data privacy & security. It is advised to use Electric vehicle supply equipment. Conductive charging or charging with plug-in, is the main technology in practice for charging.

EV charging depends on the specification of batteries for Electric Vehicle, in view of power requirements to be met with the battery at the exact voltage & current levels to give charging permission. In India, in view of the EVs, transport electrification is expected to be driven by light electric vehicle which primarily comprises of two-wheelers and hree-wheelers.

Electric Vehicle (EV) charging requirements primarily depend on specifications of batteries of EV. The voltage & capacity of Electric Vehicle batteries differ amongst the various EV segments, as shown in Table 1.

VEHICLE SEGMENT	BATTERY CAPACITY	BATTERY VOLTAGE
E-2W	1.2-3.3 kWh	48-72V
E-3W (passenger/ goods)	3.6-8 kWh	48-60V
E-cars (1st generation)	21 kWh	72V
E-cars (2nd generation)	30-80 kWh	350-500V

Table 1: Voltage & Capacity of EV vehicles

It is evident that low-voltage batteries are able to power the E-(2Ws and 3Ws). The batteries with low voltage were the ones to power the first generation of e-cars. The 2nd gen. of cars can be v in visualized in the subsequent e-car models in the future which are powered from voltage batteries (high).

III CHARGING METHODS & POWER RATINGS

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The charging method comprises of direct current to the battery pack. A converter provides (DC) power to the battery, as the electrical distribution system supplies (AC) alternate current. Conductive charging can be both Alternating Current and Direct Current. In the case of an AC electric vehicle supply equipment, the AC power gets delivered to the on-board charger of the Electric Vehicle which results in conversion into Direct Current. A Direct Current electric vehicle supply equipment results in external conversion of the power and supplying the Direct Current power to the battery and thus avoiding the on-board charger.

As per depiction in Figure 1 , charging via AC & DC are divided into different modes of four types of AC charging depicted by Modes 1-3 & DC charging shown by Mode 4.

As per figure 1, modes 1/2 apply to the Electric vehicle thru a socket outlet of standard type which utilizes a cable along with a plug. Mode One is very well known as dumb charging.. They have improvised control systems & are primarily used for commercial & public charging.[1].

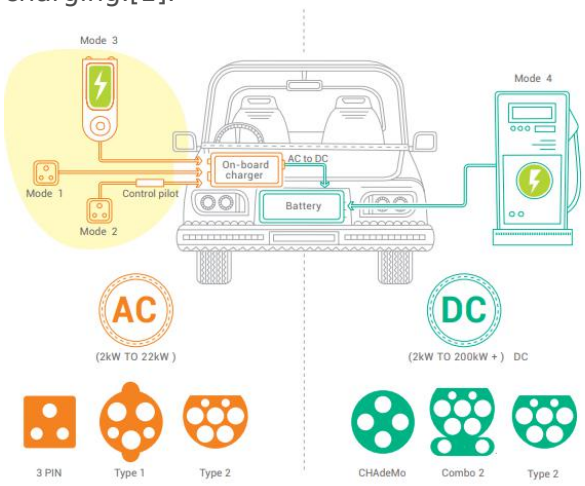

Fig 1: Classification of AC & DC Charging

IV POWER RATINGS

Electric vehicle supply equipment have various ratings of power, which lead to the determination of the power requirements for structure required for charging. The Table no 2 depicts the categorization of electric vehicle charging via power as well as with the normal power. The power charging thru normal mode goes up to 22 kilo Watt, whereas the power charging of higher levels goes upto 200 Kilo Watt.

	Power level	Current type	Compatible EV segments
Normal power charging	P ≤ 7kW	AC & DC	E-2Ws, e-3Ws, e-cars, other LCVs (up to 1 ton)
	7kW < P ≤ 22kW	AC & DC	
High power charging	22kW < P ≤ 50kW	DC	E-cars, LCVs and MCVs (1-6 tons)
	50kW < P < 200kW	DC	

Table 2: Normal & High power Charging

Supply equipment's below 500 kilo watt are available worldwide, however being applicable for vehicles like trucks. Primarily normal power Alternating current charging is sufficient for e-(3Ws & 2Ws). Power DC charging normally is limited to India as being very common in Light EVs . This is also caused due to the batteries in electronic cars with low capacity voltages.AC chargers(1 phase) which have capacity of power rating of 7kilo watt(maximum) which are adequate for Light Electric

V. SWAPPING OF BATTERY

One of the recharging procedure for the battery is battery swapping. The process includes removal of the depleted EV battery and corresponding replacement with a charged one. The technology is under working phase for various Electric vehicle segments. The battery swapping includes of both manual and automatic.

VI. EV CHARGING STANDARDS

Standards ensure compatibility of any Electric vehicle supply equipment's with all Electric Vehicles. [2]The (BIS) Bureau of Indian Standard is primarily responsible for formulating Electric vehicle standards for the charging in India. It is to be noted that Electric Vehicle charging do comply with the standards.

VII. FROM CHARGING STATIONS TO CHARGING POINTS

EV charging structure are to be ensured at places where vehicles are parked on a regular basis for e.g at parking lots in malls, rather than finding out new locations as hubs for EV charging. This approach eventually leads to a charging structure implementation which promotes a distributed network of Electric vehicle. It enables charging points to the users

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at various locations - at apartments, office, malls, railway stations, bus depot etc. Such network approaches which are distributed have various benefits along with financial viability to users.

VIII ELECTRICITY SUPPLY FOR CHARGING

As soon as the power demand in totality is known, an Electric Vehicle owner can select any of the 3 keys for provision of electricity for the Electric vehicle charging structure which comprise of (i) Drawing electricity from the existing power connection (ii) Arranging a new electricity connection (iii) Using a renewable energy generation system.

CONCLUSION

Electric Vehicles represent a revolution for both the power and transportation sectors, with having the potential to move ahead in the reduction of carbonization in both sectors by coupling them. Though the transportation sector has a very low share of renewable energy, it is presently undergoing a revolutionizing change, specifically in the vehicle segment on plying on the roads where the EVs are ready to rule the roads.. This paper describes upon giving the efficient implementation of electric vehicle charging structure along with ensuring proper integration of transportation & supply networks.

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