INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

IJARIIT

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 3 - V7I3-2065)
Available online at: https://www.ijariit.com

Charging station infrastructure and its management

Jaydeep Gupta
jaydeepgupta37@gmail.com
Thakur College of Engineering and Technology, Mumbai, Maharashtra

ABSTRACT

Due to increasing pollution, global warming, and various environmental problems, 21st-century people are moving toward hybrid and electric vehicles. The electric vehicle is the combination of two or more fields of engineering such as mechanical, electrical, and electronic engineering. Electric Vehicles powered by an Electric Motor which draws current from a rechargeable. The battery is termed an Electric Vehicle. The electric vehicle replaces IC engine vehicle in such a way that engines are replaced by an electric motor and rechargeable batteries. These vehicles have a good scope in future due to scarcity of fossil fuel because most of the vehicle i.e., 90% of vehicle depends upon fossil fuel to run the vehicle. Some other alternatives are carried out in today life is running the vehicle from electricity. In India, the electric vehicles had been published but charging stations are not organized completely like petrol pumps in every street/landmark/area. So are first step is to decide infrastructure of charging station and its management. Because it is not to introduce the electric vehicle it is also necessary to develop the charging station source in every street and area as like petrol pump and also some other alternatives about charging the vehicle is also important in emergency cases or some other reason. If the infrastructure of the charging station and its management well settled and executed then the only electric vehicles will be a wide change in the society in terms of environment and saving of the fossil fuel.

Keywords*— Charging Station, Electric Vehicle, Hybrid Vehicle, Charger, AC & DC Current, Chargers*

1. INTRODUCTION

Electric Vehicles (EVs) are those vehicles that use one or more electric motors instead of gasoline to propel the vehicle. The energy to run the motors is derived from the battery packs contained in them. The batteries are rechargeable in nature & can be recharged either by using solar energy or connecting it to the mains supply. EVs these days aren't only limited to cars or motorcycles but have evolved in the form rails, buses & trucks as well. An electric vehicle charging station, also known as an EV charging station, an electric charging station, a charging hub, an ECS (Electronic Charging Station), and an EVSE (Electric Vehicle Supply Equipment) charging station, is a part of a grid that provides electricity for charging electric plug-in vehicles, such as electric vehicles, community electric vehicles, and plug-in hybrids.

A number of heavy-duty or special connections are offered by charging stations that adhere to a variety of requirements. Multi-standard chargers fitted with two or three of the Combined Charging System (CCS), Caedmon, and AC fast charging have become the de facto industry standard in many regions for mainstream DC quick charging.

For charging at home or at work, both electric cars include onboard converters that can be hooked into a conventional electrical socket or a high-capacity appliance outlet. Others either need or can use a charging station that offers connectivity for electrical conversion, tracking, or protection. When traveling, these stations are often needed, and many endorse faster charging at higher voltages and currents than residential EVSEs have available. Usually, public charging stations are on-street installations provided by power providers or situated in retail shopping malls, restaurants, and car parks managed by a variety of private corporations. A technology-agnostic approach shall be considered allowing the adoption of charging standards as per market demand.

The electric mobility market of India differs from those of the countries having higher levels of penetration of electric vehicles and mature market conditions. The difference is primarily due to various aspects such as geographical area, public policy, social norms as well as economy. Several challenges to the broad adoption of e-vehicles exist, including heterogeneous growth in metropolitan areas, a big population, a lack of public infrastructure, and a lack of affordability. In order to address the barriers, governments at both Central and state levels have taken proactive steps. Initiatives such as the National Electric Mobility Mission (Hybrid and) Electric Vehicles (FAME) have been crucial in increasing the participation of the private sector in electric mobility space. In addition, MOP's landmark clarification that operation of charging infrastructure shall not be considered as the resale of electricity has further given a boost to the sector. In addition to the policy and regulatory initiatives, standardization plays a critical role in proliferating uptake of any technology. However, as per the observations in globally mature Markets, resorting to a technology-agnostic approach (allowing the adoption of standards as per market conditions) has been a key strategy for increasing the market uptake.

Accordingly, stations can provide all options (Bharat charger AC001, DC001, ChaDemo, CCS, and GB/T) to EV users on a common board/kiosk. Responding to the proactive approach of the policymakers, the electric mobility market has witnessed Strategic partnerships between the various players of the EV supply chain. This has been done with dual objectives of diversifying product portfolio and reducing operational Risks thereby increasing the readiness of the industry to respond to the electric mobility disruption.

2. EXECUTIVE SUMMARY

2.1 What are Energy Sources used in EV's?

Batteries: Electrochemical devices that store electrical energy in the form of chemical energy.

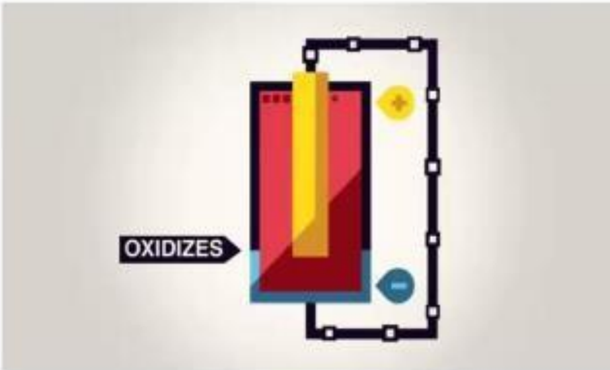

Fig 1: Batteries

Fuel Cells: It uses Hydrogen as the fuel energy.

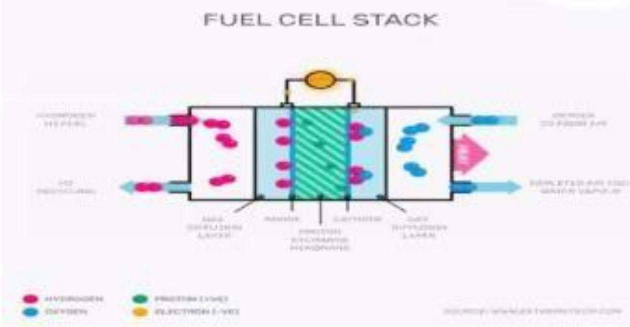

Fig 2: Fuel Cell

Super Capacitors: IT store energy in electrostatic form & mostly use high values of capacitance for the same.

Fig 3: Super Capacitors

Ultra-Flywheels: Electrical machines that spin at higher speeds to store energy in kinetic form.

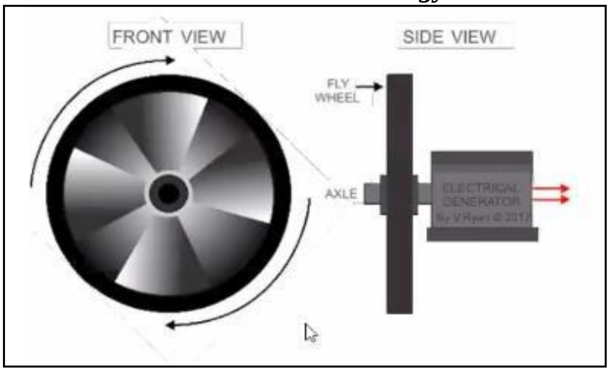

Fig 4: Ultra-Flywheels

2.2 What challenges for Charging of Electric Vehicle?

(a) Access to efficient charging could become a roadblock to electric-vehicle uptake.
(b) Recognizing the charging-capacity gap
(c) Big energy demand, but where to charge?
(d) From home to work to public charging
(e) Poor range and limited attractiveness have long been the two biggest bottlenecks to EV uptake.
(f) Alternative charging method
(g) Charging management
(h) Fastest Charging in minimum time.
(i) Cost effective of charging vehicle.
(j) Low demand of electric vehicle in market.

2.3 What Challenges for Charging Station Infrastructure?

(a) High Capital Expenditure with no returns during initial years
(b) Real estate / location of charging stations - big challenge (Parking Issues)
(c) Most of the charging sessions expected at homes, offices
(d) Vehicles are expected to lag behind the Charging Infrastructure
(e) Substantial numbers of Chargers may attract EV adoption by public at large
(f) Too many players

2.4 What are the challenges for the EV Market in INDIA?

(a) Charging Infrastructure
(b) High Price of Electric Vehicle
(c) Range Anxiety
(d) FAME Policy Flip – Flops

3. LITERATURE REVIEW

3.1 Literature Survey

Since a well-established charging station network is a key element of the spread of EVs, several studies focus on charging infrastructure development. In charging infrastructure preparation, there are two key points of view: the electricity network and passengers. Studies derive the positions of the charging station from travel actions from the traveler's point of view. These studies were then separated into two categories: inter-city charging network building and intra-city charging network building. The tactics used by these organizations are also diverse. Inter-city charging network development is often flow-based (Hodgson, 1990), but intra-city charging network development is often node-based (Hakimi, 1964), though there are exceptions. The explanation for the disparity is that, for short trips in the metropolitan area, the selection of BEVs is adequate, but not enough for a long trip. Thus, the need for charging in the metropolitan environment exists at the origin or destination of the ride, while the need for inter-city charging arises after the trip. Node-based methods assume point specifications that are unique to intra-city charging requirements, whereas flow-based models assume that the demands are provided as flows of origin-destination (O-D) and that as many O-D flows as possible are expected to represent. Flow-based models are thus ideally suited to optimizing the charging station at the state level (Upchurch and Kuby, 2010). A flow-based or also referred to as a flow capture position model (FCLM) is the basis of papers dealing with inter-city charging requirements; however, the implementation of the models and the collection of variables may vary. The positions of charging stations are calculated primarily by Sathaye and Kelley (2013), taking into account the characteristics of traffic flows. Furthermore, demographics have now been taken into consideration. Tan and Lin (2014) developed a stochastic FCLM that accounts for stochastic consumption needs along routes, as well as charging station construction costs and service efficiency. However, owing to statistical variations, the sole use of the stochastic model gives a lower operation coverage rate than the deterministic model. Lin and Hua (2015) have an FCLM-based particle swarm optimization model to determine an optimum location for charging station collection. The optimization is carried out according to the cost of construction, the service area of the charging station and the traffic flow rate. To evaluate the best location of refueling stations, Kuby and Lim (2005) are applying FCLM to alternative-fuel vehicles. For a refueling rationale, the FCLM was generalized, where a flow is captured only if the engine never runs out of gasoline. The positioning of the fuel stations depends on the range of the car, the duration of the arc, and the transport network's node spacing. Subsequently, by incorporating candidate positions along the arcs, they expand the flow refueling location model (Kuby and Lim, 2007) and suggest successful heuristic algorithms for fuel station location (Lim and Kuby, 2010The candidate locations and driving routes are also calculated by Davidov and Pantoš (2017), and then a discrete range modeling approach is used to reduce the difficulty of position modeling.

3.2 Authors and afflictions

Jaydeep Gupta
Department of mechanical engineering
Thakur College of engineering and technology, Mumbai, India

4. VEHICLE METHODOLOGY

4.1 Components of EV'S

The Major Components of an EV include:

- Battery Pack
- Electric Motors
- Battery Management system
- Cooling System
- Transmission System
- Power Electronic Controller
- DC/DC Converter
- Inverter
- On-board charger

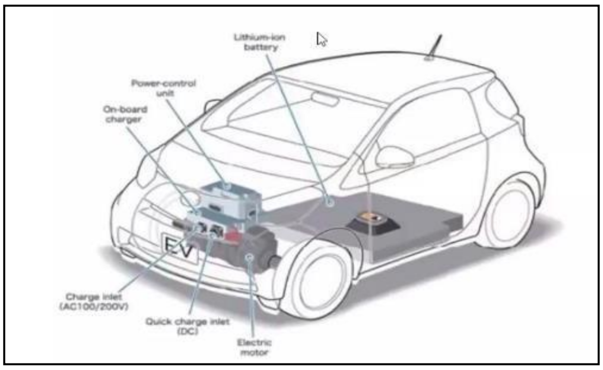

Fig 5: Components of EV's

4.2 Layout of EV'S

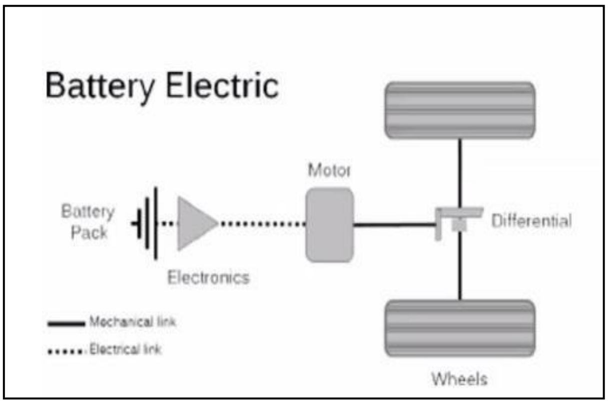

Fig 6: Layout of EV's

5. WORKING PRINCIPLES

Current Flows from the energy source (battery, fuel cell, liquid energy) to the power electronics controller. The controller acts as a gateway to flow of electricity. Potentiometer near throttle pedal signals the controller to draw the desired amount of power from the battery pack and provide it to the motor.

If DC motor has been used, a DC/DC convertor is placed in between the battery pack and the other equipment in order to reduce/increase the voltage depending on the requirement. An inverter is used if an AC motor is used, to convert the DC power from the battery into AC power of motor.

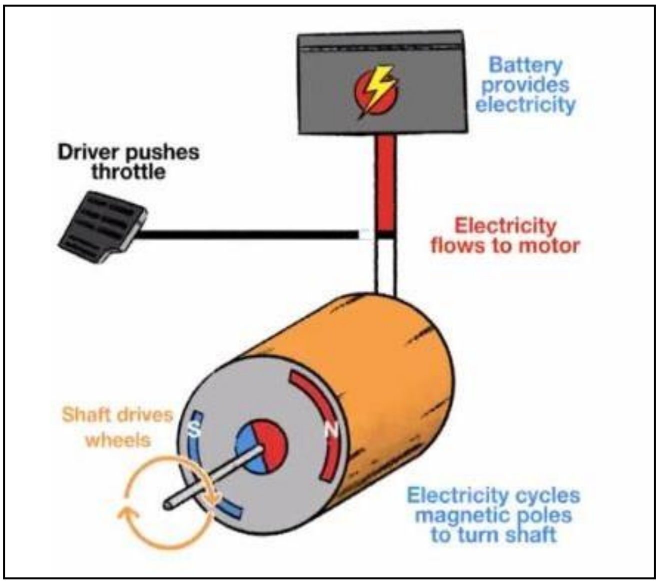

Fig 7: Working Principle

5.1 Type of EV'S

(a) Hybrid Electric Vehicles (HEV)

- Can be powered both by petrol & electricity.
- Uses energy recovery methods for battery recharging.
- Gives enhanced fuel economy than a conventional ICE vehicle.
- E.g.: Toyota Camry Hybrid, Toyota Prius, and Honda Civic Hybrid etc.

(b) Plug-in Hybrid Electric Vehicle (PHEV)

- Hybrids may be charged via the internal combustion engine, regenerative braking, or by hooking into an external electrical power source.
- Have higher range when compared to conventional hybrids.
- E.g.: Chevrolet Volt, Audi A3 E-Tron, BMW i8, Jeep Compass 4xe, etc.

(c) Battery Electric Vehicle (BEV)

- Fully electric vehicles with rechargeable batteries & no ICE.
- Store electricity onboard with high-capacity battery packs.
- Charged by electricity from an external source.
- Eg, Hyundai Kona, MG Z5 EV, Tata Nexon EV, Tesla cars, etc.

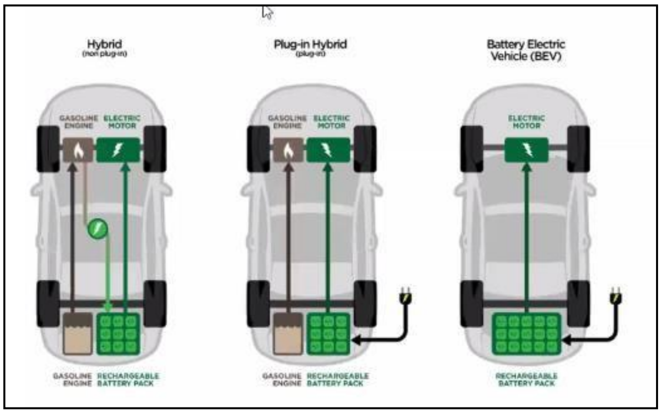

Fig 8: Type of EV's

6. CHARGING METHODOLOGY

6.1 Charging Methods

(a) On Board Charger (AC Charger)
- Slow Charging
- Overnight Charging

(b) Off Board Charger (DC Charger)
- Fast Charging

(c) Swapping (Battery Swapping)
- Requirement of Standardization
- Size, Rating, Communication Protocol.

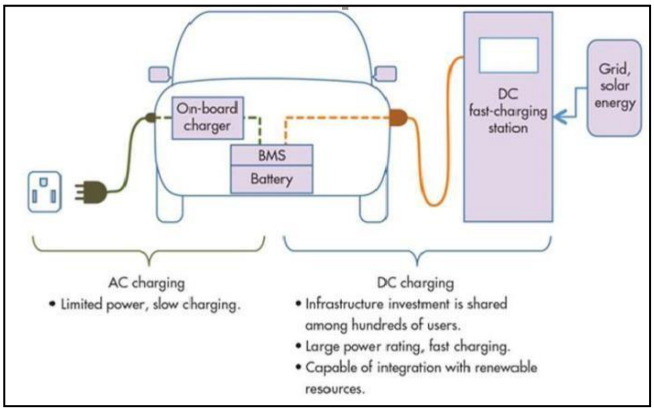

Fig 9: Charging Methods

6.2 EV Chargers and Type of Charging

(a) Electric Vehicle Supply Equipment (EV Charger) : Equipment which supplies Electrical Energy to recharge the battery of vehicles
- AC Charger (220 V/415 V, 15 A -80 A supply) - 3.3.KW to 44 KW
- DC Charger (higher voltage & Current) - 15 KW to 350 KW

(b) Type of Charging:
- Level 1 (120 V AC, standard house outlet) - Overnight charging
- Level 2 (240 V AC, Household appliances) - 4 to 6 hours
- Level 3 (500 V-1000 V DC Charging) - 20 to 30 minutes

(c) Fast Charging Standards

(d) CCS (Combined Charging Standard)- Europe & US

(e) ChaDemo (Japan)

(f) GB/T (China)

(g) Bharat DC -001 (India) up to 100 V.

Fig 10: Type of Chargers

- Alternate-current charging (AC) also referred to as level 1 or level 2. An in-car inverter turns AC into direct current (DC) in this method, and then charges the battery at either level 1 (the equivalent of a US household outlet) or level 2. (240 volts). It runs at power ranges of up to around 20 kilowatts.
- DC charging, also referred to as level 3 or fast charging direct-current (DCFC). This charging device converts the AC from the grid to DC until it reaches the car and charges the battery without the need for an inverter. It operates with power ranging from 25 kilowatts to more than 350 kilowatts, commonly referred to as direct-current fast charging or level 3.
- Wireless charging. In order to charge batteries, this device utilizes electromagnetic waves. A charging pad is normally linked to a wall socket and a plate is connected to the car. Current technologies are compatible with level 2 chargers and can supply up to 11 kilowatts of electricity.

6.3 Modes of charging

Mode 1: Domestic socket and extension cord

The vehicle is connected to the power grid through standard socket outlets in residences, which are usually rated at around 10 A, depending on the region. The electrical installation must comply with safety regulations in order for mode 1 to be used and must have an earthling system, a circuit breaker for overload reduction and an earth leak protection system. In order to avoid unintended communication, the sockets have blanking devices. The first constraint is the power available, to avoid the possibility of:

- Heating of the socket and cables after intensive use for many hours at or above maximum power (which varies from 8 to 20 a depending on the country).
- Risks of fire or electrical injury, whether the electrical installation is redundant or where such protection precautions are not possible. The second constraint has to do with the power control of the installation.
- Because the charging socket shares a switchboard feeder with other sockets (there is no separate circuit), if the consumption quantity exceeds the full protection (typically 16 A), the circuit breaker skips, and charging is interrupted.

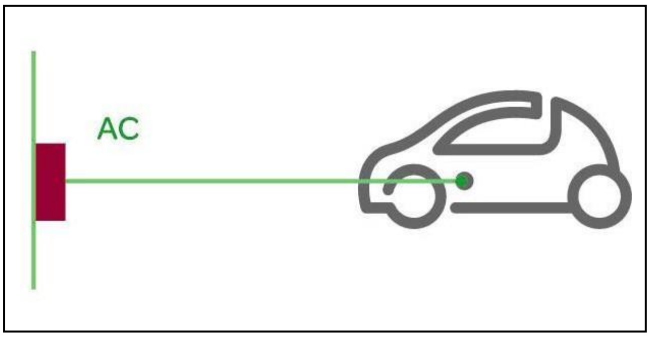

Fig 11: Domestic socket and extension cord

Mode 2: Domestic socket and cable with a protection device
Household socket-outlets connect the automobile to the main power grid. A single-phase or three-phase network performs the charging and an earthling cable is installed. The cable is fitted with a protection system. This solution is more expensive than Mode1, owing to the specificity of the cable.

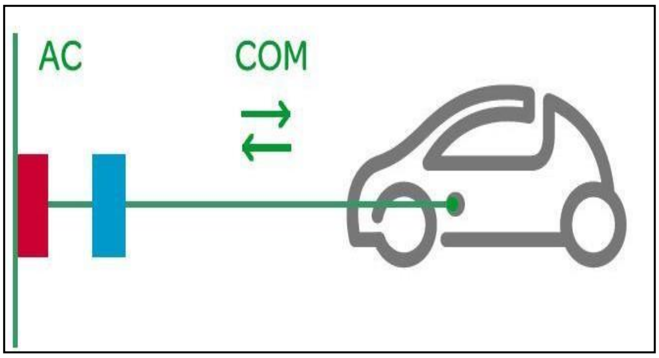

Fig 11: Domestic socket & cable with a protection device Mode 3: Specific socket on a dedicated circuit

The car is directly connected to the electrical network by a separate socket and plug and a dedicated circuit. A control and protection functionality is also permanently included in the installation. This is the only charging mode that satisfies the relevant specifications for electrical construction (IEC 61851). It also allows load shedding such that electrical home appliances can be run or, on the opposite, optimizes the electric vehicle's charging time during car charging.

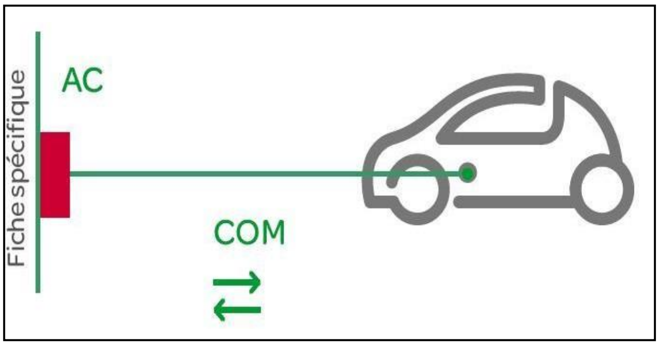

Fig 12: Specific socket on a dedicated circuit

Mode 4: Direct current (DC) connection for fast recharging the electric automobile is connected to the main power grid through an extra charge. In the house, the control and surveillance functions and the charging cable for the car are permanently installed.

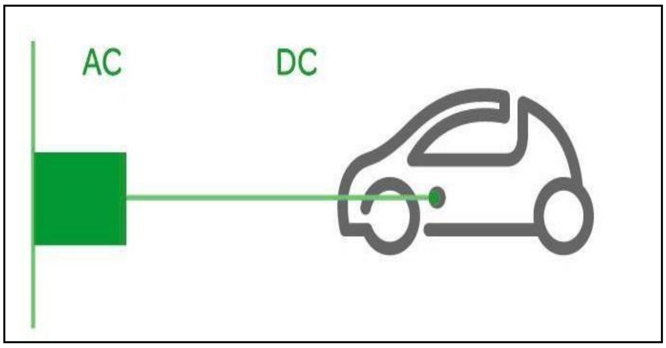

Fig 13: DC connect for Fast Recharging

6.4 Type of charging station

Charging stations fall into four basic categories:

(a) Residential charging stations: When an EV owner returns home, he or she plugs the car into a standard outlet, and the car recharges overnight (such as a NEMA connector in the US). Generally speaking, a home charging station requires no user verification, no special metering, but a dedicated circuit can require wiring to provide quicker charging. Some portable chargers can also be wall-mounted, as charging stations.

(b) Charging while parked (including public charging stations)-A private or corporate operation is sold for a fee or free, often in partnership with the owners of the parking lot. This fee can be slow or high speed and also requires EV owners to use nearby facilities to refill their cars. This would have spaces for a company's employees, parking in shopping malls, small centers, and public transit stations. AC Type1 / Type2 connectors are usually used.

(c) Quick charging at public charging stations > 40 kW, capable of 10-30 minutes of transmission over 60-mile (97 km) of coverage. These chargers can be at rest stops in order to allow longer distance journeys. They can also be used by commuters in urban areas on a regular basis and for charging while parking for shorter or longer periods. Form 2 (Europe), CCS, ChaDemo, the SAE Hybrid Charging System, and Tesla Superchargers are typical examples.

(d) The battery swaps or charges in less than 15 minutes. A reported CARB credit goal is to extend a zero-emission vehicle's range by 200 miles (320 kilometers) in less than 15 minutes. This was not possible in 2014 for charging electric vehicles, but it's imaginable with EV battery exchanges. It seeks to satisfy the refueling needs of regular drivers and provide discharged vehicles with a mobile crane facility where no charging station is available. The battery size and the ability to accommodate fast charging are also growing, and it is important to change and enhance charging methods. New option were also implemented, too (on a small scale, including mobile charging stations and charging via inductive charging mats). The emergence of common charging methods has been postponed by various producers' varied specifications and solutions, and there is a strong understanding of the need for standardization in2015.

6.5 Alternative charging method

(a) Smart grid communication: When recharging a large battery pack, there is a high demand on the power grid, but this could be prepared for periods of reduced load or decreased energy prices. Either the charging station or the automobile can connect with the smart grid to plan recharge. Some plug-in automobiles allow the vehicle operator to track recharging via a web interface or mobile app. In addition, the car battery can supply power to the grid at times of high demand in a car-to-grid scenario. This includes additional communication with the grid, the charging station and the car's electronics. SAE International is developing a set of standards for energy transportation to and from the grid, including SAE J2847/1 "Communication between Plug-in Vehicles and the Utility Grid," which will be released later this year. ISO and IEC are also developing a similar set of standards called as ISO/IEC 15118: "Vehicle to grid communication interface for road vehicles"

(b) Renewable electricity and RE charging stations: Charging stations are usually connected to the electrical grid, which implies that their energy comes from fossil fuel or nuclear power plants. Solar power is suitable for electric vehicles as well. A system has been developed by Nidec Industrial Solutions that can be powered by either grid or renewable energy sources such as PV (50-320 kW). Solar City is promoting its solar energy systems in conjunction with electric vehicle charging stations. The organization has partnered with Rabobank to make free electric car charging available to Tesla drivers travelling on Highway 101 between San Francisco and Los Angeles. Other vehicles that employ the same charging technology are invited to join us.

(c) SPARC station: The SPARC (Solar Powered Automotive Recharging Station) generates 2.7 kW of peak power from a single custom-made monocrystalline solar panel, allowing it to charge pure energy or plug-in hybrid vehicles to 80 percent capacity without drawing power from the local grid. A connected non-grid scheme is included in the SPARC proposals, as well as grid-link solar electricity. This confirms their argument that electric cars are net-zero driving.

(d) E-Move charging station: The E-Move Charging Station is equipped with eight monocrystalline solar panels which can produce 1.76 kWp of solar power. With future adjustments, the designers hope to generate around 2000 kWh of power from the panels over the course of the year.

(e) Wind-powered charging station: In 2012, Urban Green Energy unveiled the world's first wind-powered electric vehicle charging station, the Sanya SkyPump. The architecture incorporates a 4 kW vertical-axis wind turbine combined with a GE Watt Station.

6.6 EV Charging Station Sign

The EV Charging Station Sign approved by government of India is shown below:

Fig 14: Charging Station Sign

6.7 Charging Time

The charging time depends on the battery size and the charging power. Simply put, the duration of charging time depends on the amount of charge used, and the degree of charge depends on how the voltage is handled by the batteries and converter circuitry in the car. Level 1 (household 120V AC) is described by the U.S.-based SAE International as the slowest, Level 2 (household 240 VAC upgraded) in the middle and Level 3 (super charge, 480V DC or higher) as the highest. Level 3 Charging times can be as swift as 30 minutes with an 80 percent fee, but there has been strong rivalry from industry about whose efficiency should be broadly embraced. Charge time can be calculated using the formula:

Charging Time [h] = Battery Capacity [kWh] / Charging Power [kW]

A first-generation electric car, such as the original Nissan Leaf, has a usable battery power of about 20 kWh, giving it a range of about 100 miles (160 km). Tesla was the first company to launch electric vehicles with a longer mass production range, initially launching their Model S with battery capacities of 40 kWh, 60 kWh and 85 kWh, with the latter having an estimated range of approximately 480 km (300mi). Plug-in hybrid vehicles have a power of about 3 to 5 kWh and an electric range of 20 to 40 kilometers, but the maximum range of the standard vehicle is assured by the gasoline engine.

Car manufactures have mounted a battery charger in the car for regular charging (up to 7.4 kW). A charging cable is used to connect it to the electrical network to provide 230 volts of AC current. Manufacturers have chosen two quicker charging options (22 kW, 43 kW and more):

- Use the car's built-in battery, designed for 230 V single-phase or 400 V three-phase charging from 3 to 43 kW.
- Usage of an external charger that turns AC current into DC current and charges the vehicle at or above 50 kW (e.g. Nissan Leaf) (e.g. 120-135 kW Tesla Model S).

Charging time for 100 km of BEV range	Power supply	Power	Voltage	Max. current
6–8 hours	Single phase	3.3 kW	230 V AC	16 A
3–4 hours	Single phase	7.4 kW	230 V AC	32 A
2–3 hours	Three phase	11 kW	400 V AC	16 A
1–2 hours	Three phase	22 kW	400 V AC	32 A
20–30 minutes	Three phase	43 kW	400 V AC	63 A
20–30 minutes	Direct current	50 kW	400–500 V DC	100–125 A
10 minutes	Direct current	120 kW	300–500 V DC	300–350 A

Fig 15: Charging Time for 100km of BEV range

The consumer finds it as simple as attaching a normal electrical appliance to charge an electric car; however, the charging unit must perform several safety tasks and dialogue between attachment and charging with the vehicle to ensure that this operation takes place in total safety.

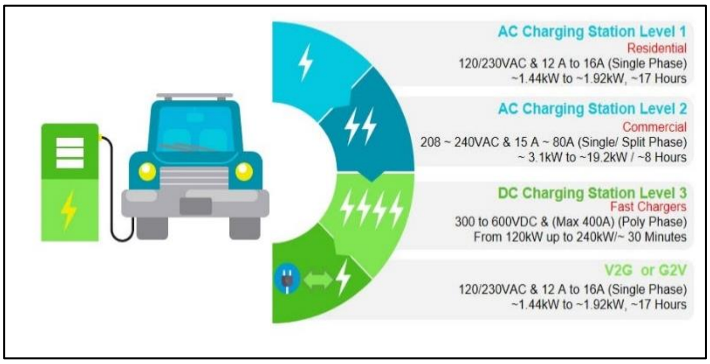

Fig 16: Charging Time

6.8 Safety

Although rechargeable electric vehicles and devices may be recharged from a domestic wall socket, there is usually access to a charging station for multiple electric vehicles and external current or communication sensing systems to disconnect the power when the EV does not charge.

Two major categories of safety sensors exist:

- Present sensors that track the absorbed energy and maintain the link only if the demand is smaller than the predetermined range. Sensor cables adapt better, have less malfunctioning parts, which can be less expensive to build and mount current sensors, but can use typical connectors which may easily provide suppliers with an option to track or charge for the actually energy consumed.
- Additional physical "sensor wires," such as the above-mentioned SAE J1772 and IEC 62196 systems, that need unique (multi-pin) power plug fittings to produce a feedback signal.
- There was an issue with Wink chargers overheating and destroying both the battery and the car prior to 2013. The solution adopted by the company was to limit the overall current.

7. MARKET IN INDIA

India's electric vehicle charging infrastructure market is categorized according to three segments, such as charging method, location, and component:

The charging form involves direct charging and switching of the battery:

(a) The electric vehicle charging infrastructure industry in India is divided into two categories: direct charging and battery swapping. Fast charging and slow charging are two types of direct charging. The most commonly used rapid charging methods are ChaDemo and CCS. ChaDemo is used mainly by Japanese automotive makers, while CCS is commonly used by most of the European, US, and South Korean vehicle manufacturers. Since India has failed to standardize rapid charging techniques, the government has mandated the production of both ChaDemo and CCS techniques for charging stations for electric vehicles, which has increased the cost of setting up a charging station for electric vehicles in the country. In July 2019, the government changed the guidelines because of the cost problem and allowed developers of electric vehicle charging stations to select the system they prefer.

(b) Location includes cities and highways: The electric car charging infrastructure sector in India is divided into two categories based on modules: hardware and technology and services. Ports, cables, and charging devices are all part of electronics. Charging system installation and maintenance, network as a service and other services such as software & services other services include battery distribution service and towing service, which are in India at a very nascent level.

(c) Component includes solutions and services: India's electric vehicle charging infrastructure sector is segmented into region-based highways and cities. Any of the electric vehicle charging stations in India is deployed in villages. However, more charging points on major highways and highways, including the Mumbai-Pune Expressway, the Delhi-Agra Yamuna Expressway and the Bengaluru-Chennai Expressway, are proposed by the government.

In India, demand for charging infrastructure for electric vehicles is expected to increase during the 2019-2025 forecast period at a CAGR of over 40 percent. The aim of this report is to define, assess and forecast the electric vehicle charging infrastructure market in India on the basis of segments, including area, mode of charging and part of the market. In addition, the Indian study on the demand for electric vehicle charging infrastructure helps venture capitalists better understand markets and make well-informed decisions, and is specifically intended to provide strategically relevant awareness of competitors, data analysis, and market perspectives, expansion, and execution of a competitive market for the executives of the company.

- An overview of providers, including financial status, organizational divisions, key business priorities, SWOT, business plan, and opinions, is given in the report on the electric vehicle charging infrastructure market in India.
- The research covers the corporate sector, including M&A, cooperative ventures & alliances, and rivals comparison study.
- The financial accounts and sales of the divisions will be limited in the company profile segment for organizations that are privately owned.

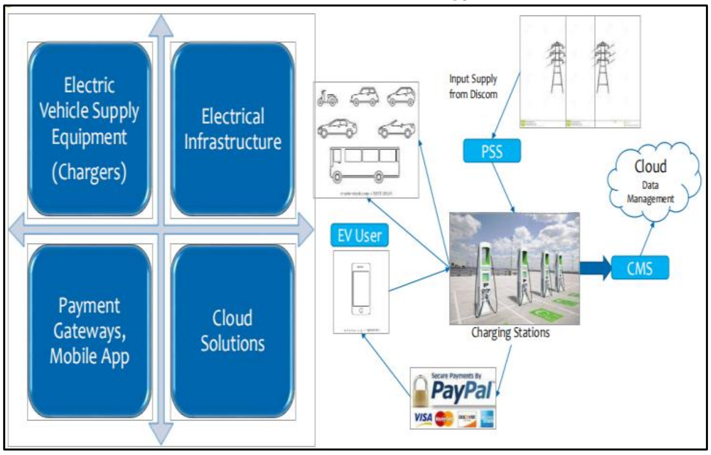

Fig 17: Charging Infrastructure Business

(a) Cost of EVSE
  - Fast DC Charger – 15 KW to 150 KW (Rs 2 Lac to Rs 20 Lac)
  - Slow AC Charger- 3.3 KW to 22 KW (Rs. 0.40 Lac to Rs. 5 Lac)

(b) AMC Charges
(c) System Strengthening cost
(d) Charger Integration Charges, Mobile App, Payment gateways
(e) Operational expenses

8. CONCLUSION

We learned about the type of charging, charging station and modes of charging present all over the world. After a brief learning about charging station, it give various ideas should carried out for charging station infrastructure. An alternative idea should be accepted as a second option charging of EV. The Government of India had taken keen step toward promoting the electric vehicle. After seeing too many survey about the interest of people toward electric vehicle, most of reason are of not well establish charging station in street and area. Once charging station are manufactured in all the power station then only people will think about electric vehicle over IC engine vehicle. It will only happen by proper planning of charging station infrastructure and its management. Since the EV have too many advantages over IC engine vehicle but only drawback is the charging station and charging time. These two factors can be achieved by proper infrastructure of charging station and its management. After seeing the success of EV on other countries, India has a good market in future. Some other factor are should be considered is costs of charging, safety and finance of charging station infrastructure.

9. REFERENCES

[1] Panorama of public policies in favor of vehicles with very low emissions International Energy Agency, 2019.
[2] Global EV Outlook Cai et al., 2014.
[3] Sitting public electric vehicle charging stations in Beijing using big-data informed travel patterns of the taxi fleet Syvia et al., 2016.
[4] Comparing the p-median and flow-refueling models for locating alternative-fuel stations Wu, Sioshansi, 2017
[5] Simulation–optimization model for location of a public electric vehicle charging infrastructure Sun, Gao, Li, Wang, 2018.
[6] Market dynamics and indirect network effects in electric vehicle diffusion Loi n° 2019-1428 du 24 décembre 2019 d'orientation des mobilités, Article 64.