

EV scenario in India and EV charging

Objectives: At the end of this lesson you shall be able to

- explain about EV scenario in India
- state the basic theory of EV charging batteries
- state the safety requirements for EV charging.

Introduction to Electric Vehicle

In recent years, green house gas problem increases and also the gasoline fuel rate also increases days by day in India and global wide so that public also suffer financially due to this reason, automobile manufacture and new companies put their effort to convert the conventional vehicle into electric vehicle that provide reliable solution.

Electric vehicle is propelled with electric motors and draw power from on board electric source in an electric vehicle, it is more durable and mechanically simpler than gasoline vehicle. It gives more fuel efficiency than gasoline because it does not produce emission like internal combustion engine. However, automobile industry is not completely moving towards pure electric vehicle production, because there is in here problem of existing batteries technology for storing the electric energy.

However now a days increasing the usage of hybrid and electric vehicle in our country and globalise.

Electric Vehicle: This type of vehicle uses one or more electric motor for propulsion. Electric vehicle are the automobiles that are propelled by one or more electric motors using the energy stores in batteries.

India need to reduce dependency on a fossil-fuel based economy. India's crude oil imports for 2021-22 was 163.91 billion dollars approximately 13,000,00 crore rupees.

Air quality indices related to India indicate that the air in many cities of India is no longer healthy. Automobile related pollution has been one of the causes for this.

People living in some of Indian cities are being affected by noise pollution. Some of the Indian cities have the worst noise pollution levels in the world Electric Vehicles may contribute to a reduction in noise pollution levels in the cities.

Current Status of EV in India

The Indian Electric Vehicles (EV) market is at a very initial stage comprising of only 2% of the total automobile sales. 95% of the Indian EV market is dominated by 2 and 3 wheelers. The EV market in India is set to see the entry of a flurry of new players of foreign and domestic origin in the 2 and 3 wheeler segments.

In 2012 the National Electric Mobility Mission Plan (NEMMP) 2020 was established to promote hybrid and Electric Vehicles. In early 2018 the Ministry of Power launched the New National Electric Mobility Programme to focus on creating the charging infrastructure and a

policy frame work to set a target of more than 30% electric vehicles by 2030.

EV Charging Basic Theory

EV charging is the process of using EV charging equipment to deliver electricity to the Car's battery AM EV charging stations taps into electrical grid to charge an EV. The technical term for EV charging stations is Electric Vehicle Supply Equipment (EVSE).

Methods of Charring an EV

Three methods of charging an EV (Electric Vehicle)

- Trickle charging method
- AC charging method (charging from AC mains)
- DC charging method

Types of Electric Vehicle

- Battery Electric Vehicles (BEVs)
- Plug-in Hybrid Electric Vehicles (PHEVs)
- Hybrid Electric Vehicles (HEVs)

Electric traction motor is used in EV. Most EVs can take in about 32 amps adding around 25 miles of Range Per Hour of charging so a 32 amp charging station is a good choice for many vehicles.

Generally electric Cars charged at home use about 7200 watts of electricity which can vary depending on the mode and home charger.

A charging station also known as a charge point or Electric Vehicle Supply Equipment (EVSE) is a piece of equipment that supplies electrical power for charging plug in electric vehicles (including electrical Cars, electrical trucks, electric buses, neighborhood electric vehicles and plug in hybrids).

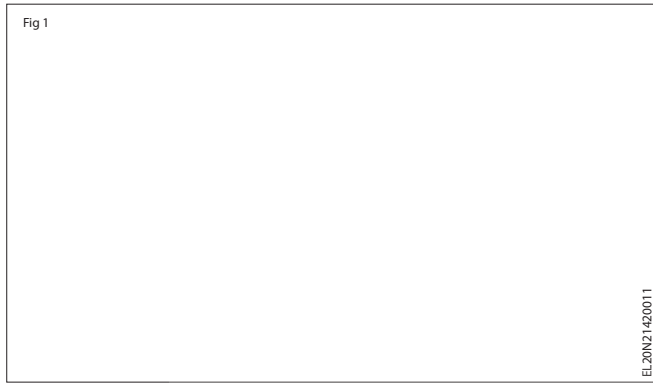
Hybrid Electric Vehicles (HEVs)

Today's Hybrid Electric Vehicles (HEVs) are powered by an internal combustion engine in combination with one or more electric motors that use energy stored in batteries. HEVs combine the benefits of high fuel economy and low tailpipe emissions with the power and range of conventional vehicles. (Fig 1)

Plug-In Hybrid Electric Vehicles (PHEVs)

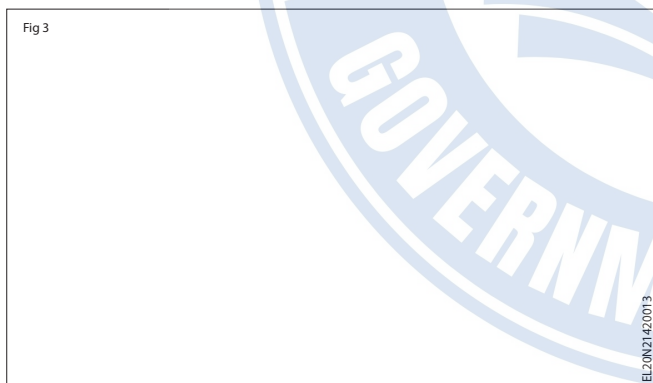
Plug-in Hybrid Electric Vehicles (PHEVs) use batteries to power an electric motor and another fuel, such as gasoline to power in Internal Combustion Engine (ICE). The vehicle typically runs on electric power until the battery is nearly

depleted and then the car automatically switches over to use the internal combustion engine. (Fig 2)



Battery Electric Vehicles (BEVs)

A Battery Electric Vehicles (BEVs), pure electric vehicle, only electric vehicle or all electric vehicle is a type of electric vehicle (EV) that exclusively uses chemical energy stores in rechargeable battery packs, with no secondary source of propulsion (e.g. hydrogen fuel cell, combustion engine etc) (Fig 3)



EV Basic Working Principle

An electric vehicle works on a basic principle of conversion of Electrical energy into mechanical energy. There is a motor used in the electric system to carry on this duty of conversion.

Main Components of EV Chargers

- Battery
- Power Conversion System
- Software

EV battery voltage is 12V for the lead acid battery any typically some where between 400-800 V for the lithium-ion battery pack. Lithium-ion battery capacity is measures in KWH (Kilo Watt Hours). The average capacity is around 40 kwh, but some Cars now have upto a 100 kwh capacity.

EV batteries are projected to last between 1,00,000 and 2,00,000 miles or about 15 to 20 years.

An electric current is a flow of charges particles. The size of an electric current is the rate of flow of charge

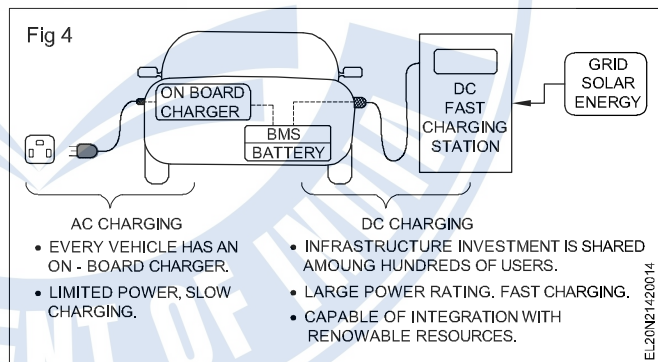
Quantity of Charge (Q) = Current (I) x Time (t)

$$(Q) = It$$

In rainy season there is no issue regards to driving your EV. Plus even in the worst case there are many protective layers to a car and battery will remain safe and separate itself if at all water come in.

Working of Public charging Stations

- Electricity from the grid is delivered as Alternating Current (AC) but the EV require Direct Current (DC). A rectifier needs to sit between the grid and the battery to convert one of the other. For home and third party public charging this AC-to-DC conversion is done by EV, on-board rectifier. AC current at charge port is converted to DC for the battery by the rectifier.
- Supercharges deliver high voltage, high current DC electricity directly to the EV's battery, by passing the on-board rectifier. This allows the supercharger to push electricity into the battery as fast as the battery can take it- typically ten times faster than home charging. (Fig 4)



- Using induction, which is more energy efficient, the taxis can be charged as they wait in what's known as a taxi rank, or a slow-moving queue where cans line up to wait for passengers.
- The project aims to install wireless charging using induction technology. charging plates are installed in the ground where the taxi is parked and a receiver is installed in the taxi. This allows for charging up to 75 kilowatts.
- The project will be the first wireless fast-charging infrastructure for electric taxis anywhere in the world, and will also help the further development of wireless charging technology for all EV drivers.

- Fortnum charge & Drive has long been working with the taxi industry to enable electrification of the taxi fleet.

Public charging station (Fig 5)

EV charging Safety Requirements

The global safety standards are marked as following:

1 Unintended Vehicle Movement

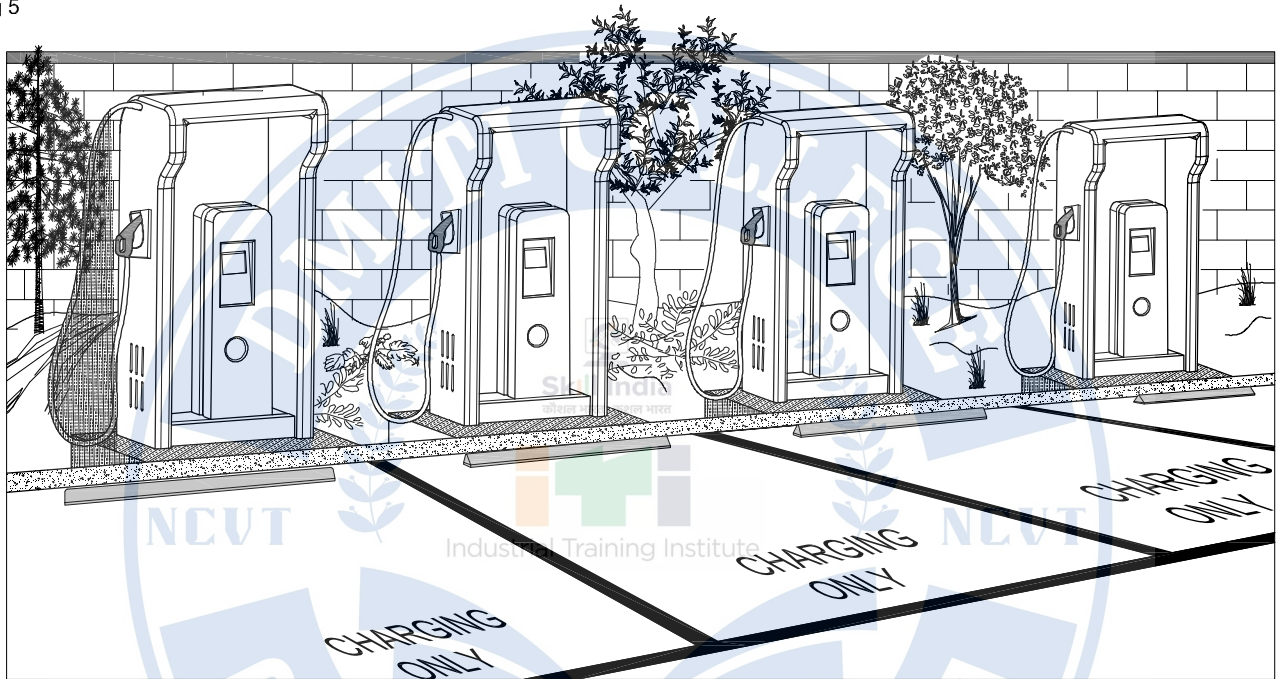
- Indication to driver when vehicle is first put into "active driving possible mode".
- Signal to driver when exiting the vehicle if the vehicle is still in "active driving possible mode".

- Indication to driver of vehicle drive direction

2 Shock Protection

- Protection against direct contact
- Physical barrier/access protection
- Marking (enclosures/electrical protection barriers and colour coding of high voltage wires/cables)
- Protection against indirect contact
- Minimum isolation resistance
- Fuel cell isolation resistance monitoring
- Protection against water effects

Fig 5



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3 Elimination Explosive Events

- Vibration (Component test)
- Over Charge Protection
- Over Discharge Protection
- Over Temperature Protection
- Over Current Protection

4 "Rechargeable Energy Storage System (REESS)"

- Installation Integrity/Protection
- Restricts mounting locations for impact protection.
- REESS placed/shielded from contact with road debris
- Shall remain attached and not enter the passenger compartment
- Battery placement management

Indian Safety standards of Electric Vehicles

Some Basic electric Vehicle safety requirement are as follows

- Occupant protection from electric shock
- Safety requirement for rechargeable energy storage systems
- Electrical isolation
- Battery integrity
- Best practices or guidelines for manufactures and/or emergency responders.

Advantages of Electric Vehicles

- 1 ECO friendly - Because electric vehicles do not utilise fuel for combustion, there are no emissions or gas exhaust.
- 2 Renewable Energy Source - Electric vehicles run on renewable power, where as conventional auto- mobiles function on the combustion of fossil fuels which reduces the world's fuel stocks.

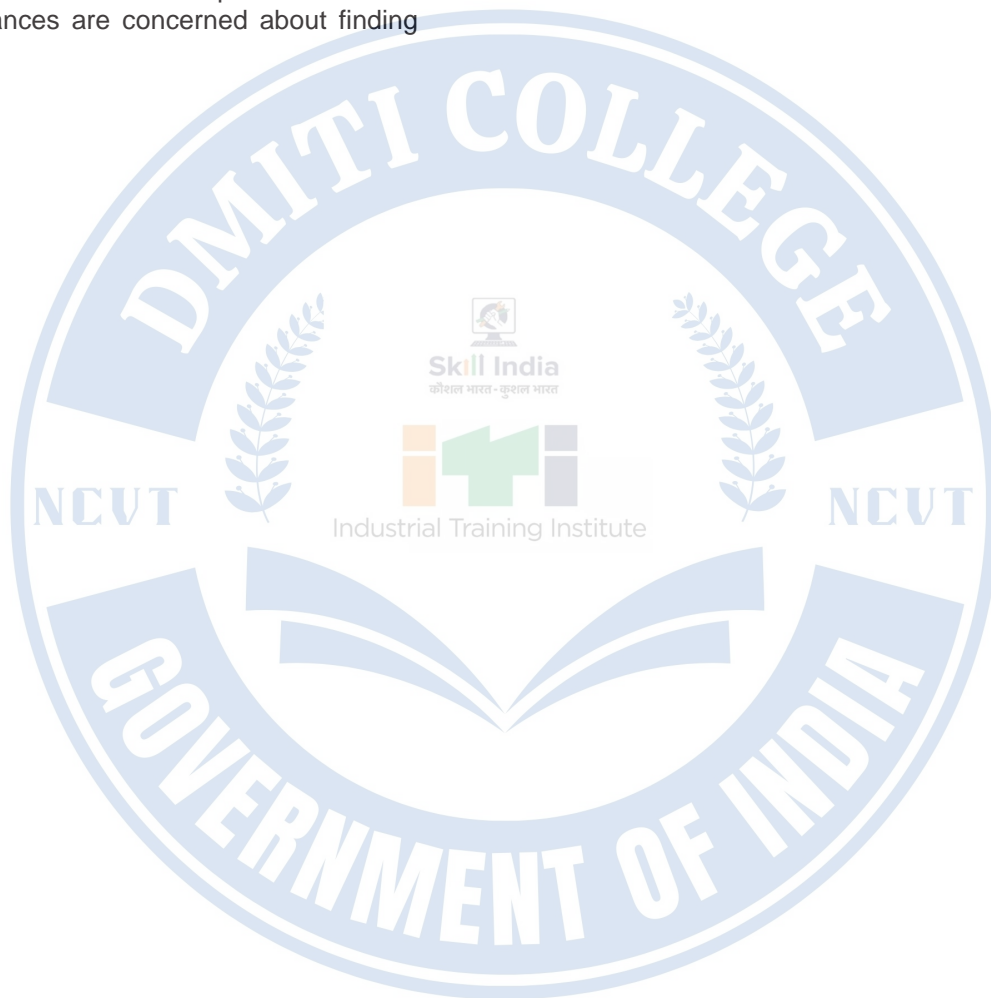
- 3 Less Noise and Smoother motion - Electricity is far less expensive than fuel such as gasoline and diesel which are subject to regular price increases.
- 4 Low maintenance - Because electric cars have fewer moving components, wear and tear is reduced when compared to traditional auto parts.
- 5 Government Support - Governments thought the world have granted tax breaks to encourage people to drive electric vehicles as part of green program.

Disadvantages of Electric Vehicles

- 1 High Initial Cost - Electric Vehicles continue to be quite expensive and many buyers believe they are not as in expensive as traditional automobiles.
- 2 Charging Station Limitations- People who need to travel long distances are concerned about finding

adequate charging stations in the middle as their journey which are not always accessible.

- 3 Recharging Takes Time - Unlike conventional automobiles which require only a few minutes to replenish their gas tanks, charging an electric vehicles takes many hours.
- 4 Limited Options - Currently there are not many electric car models to pick from in terms of appearances style or customized variations.
- 5 Less Driving Range - When compared to conventional automobiles electric vehicles have a shorter driving range.



Project work

Objectives: At the end of this project, you shall be able to

- plan to prepare the project report for selected project
 - draw circuit diagram/layout diagram
 - list the specification of the material/component to be procured
 - list the plan of action to be executed
 - develop the project report complete and submit it.
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Selection of project and its execution

- Discuss in details of the project - necessity, marketing facility, cost involvement, availability of material and hope of future development and expansion.
- Collect all materials and tools required to start the work.
- The project has to be agreed by all the members involved and get the approval of the concerned authority.
- Prepare an action oriented plan to execute the work within a stipulated time table which is to be accepted by all the members and also the approval of instructor concerned.
- Complete the project as per the plan.
- Test, calibrate and finish the project as per the plan and execution.
- Keep the project with optimum finish and good workmanship.

Preparation of project report

- Report should start with an introductory information connected with a known subject and highlight its importance in present conditions.
- A survey to be conducted regarding the marketing and its commercial applications.
- A brief working principle and its operation has to be illustrated in the report.
- Highlight the maintenance, repair and periodic servicing etc in the report.
- Costing should be competitive and affordable to the concerned without any reservations.

- Project should have the flexibility for further expansion to an advanced version without major changes.
- Report should be listed with reference books and website details.
- Complete the report and submit

List of project works

- 1 Battery charger/Emergency light
- 2 Control of motor pump with tank level
- 3 DC voltage converter using SCRs
- 4 Logic control circuits using relays
- 5 Alarm/indicator circuits using sensors

Note :

- 1 Some of the sample project works (indicative only) are given against each semester.
- 2 Instructor may design their own project and also inputs from local industry may be taken for designing such new project.
- 3 The project should proudly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit Project report.
- 4 If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.