# SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A++ Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## UNIT III: REQUIREMENTS IN HYBRID AND ELECTRIC VEHICLES

TOPIC: **EV and EV charging standards,**
**Introduction to charging stations**

# Introduction

- **What are Electric Vehicles (EVs)?**
  - Vehicles powered by electricity instead of traditional fossil fuels.
  - Types of EVs:
    - **Battery Electric Vehicles (BEVs)** – Fully electric, zero emissions.
    - **Plug-in Hybrid Electric Vehicles (PHEVs)** – Combine electric and internal combustion engines.
    - **Hybrid Electric Vehicles (HEVs)** – Primarily combustion engine with battery-assisted power.
- **Why EVs?**
  - Zero tailpipe emissions
  - Reduced dependency on fossil fuels
  - Lower operating and maintenance costs

# EV Market Growth

- **Current Trends:**
  - Rapid growth in EV sales globally.
  - Major automakers transitioning to electric fleets.
- **Government Initiatives:**
  - Incentives and subsidies for EV buyers.
  - Investment in charging infrastructure.
- **Future Projections:**
  - EVs expected to dominate the automotive market by 2030.

# Introduction to EV Charging Stations

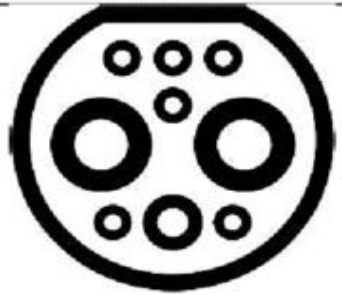
- **What is an EV Charging Station?**
  - A facility that supplies electrical energy to recharge EV batteries.
- **Components of a Charging Station:**
  - Power source (grid, renewable energy)
  - Charging connector (plug)
  - Control unit for safety and power management
  - Communication interface (for user interaction and network connection)

# Types of EV Charging

1. **AC (Alternating Current) Charging**
   - **Level 1:**
     - Voltage: 120V
     - Charging Time: 8–12 hours for full charge
     - Suitable for home charging
   - **Level 2:**
     - Voltage: 240V
     - Charging Time: 4–6 hours for full charge
     - Used in residential, commercial, and public spaces
2. **DC (Direct Current) Fast Charging**
   - **Level 3 (DCFC):**
     - Voltage: 400–800V
     - Charging Time: 30 minutes to 1 hour for 80% charge
     - Ideal for highways and long-distance travel

# EV Charging Standards

- **AC Charging Standards:**
  - **IEC 62196 Type 1 (SAE J1772)** – Common in North America.
  - **IEC 62196 Type 2** – Standard in Europe and other regions.
- **DC Charging Standards:**
  - **CHAdeMO:** Developed in Japan, supports bidirectional charging.
  - **Combined Charging System (CCS):** Widely used in Europe and the US.
  - **GB/T:** Chinese fast charging standard.
  - **Tesla Supercharger:** Proprietary standard for Tesla vehicles (now adapting CCS in some regions).

| Standard | CHAdeMO<br>IEEE 2030.1.1<br>IEC 62196-3<br>(Configuration AA) | GB/T<br>GB/T 20234.3<br>IEC 2196-3<br>(Configuration BB) | CCS Type 1<br>SAE J1772<br>IEC 62196-3<br>(Configuration EE) | CCS Type 2<br>IEC 62196-3<br>(Configuration FF) | Tesla |
|---|---|---|---|---|---|
| Coupler Inlet |  |  |  |  |  |
| Maximum Voltage | 1000 V | 1000 V | 600 V | 1000 V | 410 V |
| Maximum Current | 400 A | 250 A | 200 A | 200 A | 330 A |
| Available Power | 400 kW | 120 kW | 150 kW | 175 kW | 135 kW |

# Charging Station Networks

- **Major Charging Networks:**
  - **Tesla Supercharger Network**
  - **ChargePoint**
  - **Electrify America**
  - **EVgo**
  - **Ionity** (Europe)
- **Features of Charging Networks:**
  - Real-time availability and status updates
  - Mobile app integration for payment and navigation
  - Subscription-based or pay-per-use models

# Challenges in EV Charging Infrastructure

- **Infrastructure Gaps:**
  - Insufficient charging stations in rural and remote areas.
- **Compatibility Issues:**
  - Different connectors and charging standards.
- **Grid Demand:**
  - Increased load on power grids due to EV charging.
- **Cost:**
  - High initial investment for charging station deployment.

# Future Trends in EV Charging

- **Ultra-Fast Charging (UFC):**
  - Charging times reduced to under 15 minutes.
  - Higher voltages (800V+) and advanced cooling systems.
- **Wireless Charging:**
  - Inductive charging technology for seamless energy transfer.
  - Dynamic charging for EVs while in motion (under development).
- **Vehicle-to-Grid (V2G) Technology:**
  - Bi-directional charging allowing EVs to supply energy back to the grid.
- **Renewable Energy Integration:**
  - Solar-powered charging stations for sustainable energy supply.

# Case Studies

1. **Tesla Supercharger Network:**
   - Over 45,000 chargers globally.
   - Integrated with Tesla's navigation system.
2. **Electrify America:**
   - Largest open DC fast charging network in the US.
   - Focus on ultra-fast charging and renewable energy.
3. **Ionity (Europe):**
   - Joint venture by major automakers.
   - Focused on high-speed charging along highways.


# Conclusion

- **Summary:**
  - EV charging infrastructure is critical for the widespread adoption of electric vehicles.
  - Standardization, network expansion, and technological innovations will shape the future of EV charging.
- **Call to Action:**
  - Governments, industries, and individuals must collaborate to accelerate the transition to electric mobility.

# …THANK YOU