Types of Charging in ELECTRIC VEHICLES

knowles

LEVEL 1 CHARGING

It typically provides a charging power of around 1-2 kilowatts (kW) and can take several hours to fully charge an EV battery.

Power Stages Needed:
- Level 1 Charger
- On Board Charger:
  - » Converts 120V AC to 400+ V DC for the vehicles battery
    - – AC to DC Converter + Front end rectification
    - – DC to DC Converter

Applications:
- This is the slowest charging method and uses a standard 120V AC household outlet

LEVEL 2 CHARGING

It is faster than level 1 charging and is commonly used in residential settings and public charging stations.

Power Stages Needed:
- Level 2 Charger
- On Board Charger:
  - » Converts 240V AC to 400+ V DC for the vehicles battery
    - – AC to DC Converter + Front end rectification
    - – DC to DC Converter

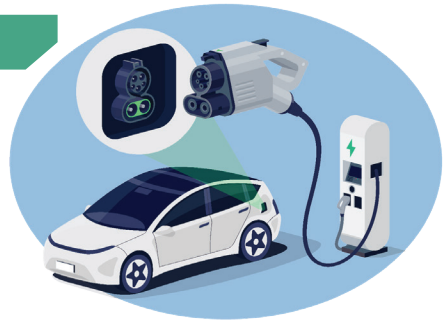
Applications:
- It is faster than level 1 charging and is commonly used in residential settings and public charging stations

LEVEL 3 CHARGING/DC FAST CHARGING

It uses high-powered charging stations and can charge an EV battery to around 80% capacity in 30 minutes or less.

Power Stages Needed:
- Level 3 Charger
- Off Board Charger:
  - » Converts 240V AC to 400-800+ V DC for the vehicles battery
    - – AC to DC Converter + Front end rectification
    - – DC to DC Converter(s)

Applications:
- DC fast charging delivers high power directly to the EV's battery, bypassing the vehicle's onboard charger

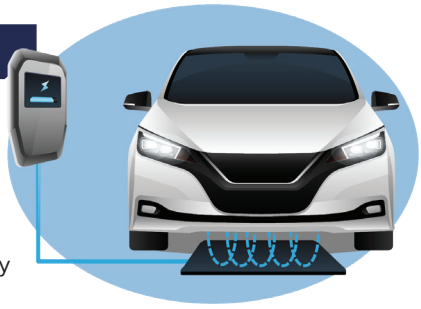


WIRELESS CHARGING

It uses electromagnetic fields to transfer power from a charging pad or station to the vehicle.

Key components of a wireless charging system include:
- Charging Pad/Station
- Vehicle Receiver
- Power Electronics
- Communication System

Applications:
- Wireless charging, also known as Inductive Charging or Wireless Power Transfer (WPT), is an emerging technology for charging electric vehicles without the need for physical cables and connectors



BI-DIRECTIONAL CHARGING

Bi-directional charging enables electric vehicles to not only consume energy but also serve as energy storage devices, allowing them to discharge power back into the grid or other energy-consuming systems.

The implementation of bi-directional charging introduces design challenges on the component level, as it requires power electronics and energy management systems capable of:
- Efficiently and safely handling bidirectional power flow
- Managing voltage and current fluctuations
- Ensuring compatibility with various grid standards and protocols