ELECTRIC VEHICLE SAFETY FOR FIRST RESPONDERS

CHARGING SYSTEMS (EVSE)

FIRE SERVICE EDITION

NFPA

ALTERNATIVE FUEL VEHICLES
SAFETY TRAINING PROGRAM

Program Goal

Prepare first responders to operate safely at incidents involving:

- Hybrid Electric Vehicles (HEVs)
- Plug-In Hybrid Electric Vehicles (PHEVs)
- Electric Vehicles (EVs)

Photo courtesy of the San Jose CA Fire Department

Hybrid and Electric Vehicle Safety Training - Program Modules

Introduction

Basic Electrical Concepts & Hazards

P/HEV & EV Systems & Safety Features

Charging Stations

Initial Response: Identify, Immobilize & Disable

Emergency Operations

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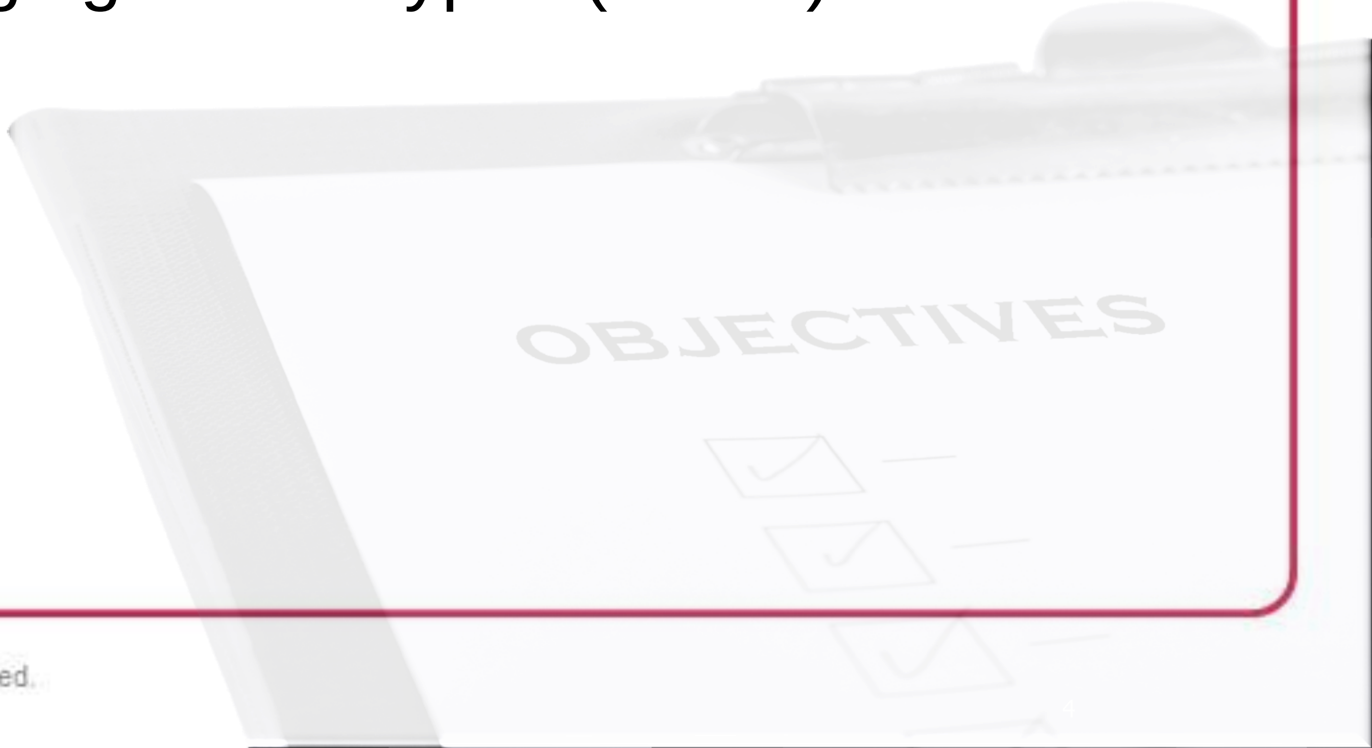
Charging Stations

OBJECTIVES

Following instruction, the student shall be able to:

- Identify and describe the different types of charging stations
- Describe the effect voltage has on the charging times as it relates to the different charging station types (EVSE)



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Electrical Vehicle Supply Equipment (EVSE)

Charging Stations (EVSE)

Service Panel

Typical Setup

Charging Station

Vehicle

Charging component which converts to DC for battery is found on vehicle

Acts as an interface between building power supply and vehicle

Level I Charger

Charging Stations (EVSE)

Uses standard household plug

Utilizes 120 V AC power @ 12-16 Amps

Slowest rate of charge available

Can accompany the vehicle anywhere

Photo courtesy of Delphi

Estimated Charge Time from Empty

- PHEV: 5-6 Hours
- EV: 40-50 Hours
- Typical Power Output: 1kW
- Found in Home Applications

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Level II Charger

Charging Stations (EVSE)

Estimated Charge Time from Empty

- PHEV: 1-2 Hours
- EV: 4-10 Hours
- Typical Power Output: 7-19 kW
- Home and Public Applications

Faster charge time than Level I

Utilizes 208V - 240V AC power @ 12-80 Amps (Typ. 32 Amps)

Can be an installed unit or portable

Found in residential and commercial applications

Level II Charger

Charging Stations (EVSE)

Types of Level II Chargers

Portable

Commercial

Residential

Photos courtesy of Aerovironment and ChargePoint

DC Fast Charger

Charging Stations (EVSE)

Fastest charging system

Utilizes 208V or 480V 3-phase AC power @ <125 Amps (Typ. 60 Amps)

Electrical requirements and expense will limit it to commercial applications

Illustration courtesy of the ChargePoint

Output 400 V – 1000 V DC Output to Vehicle

Estimated Charge Time from Empty

- PHEV: N/A
- EV: 20 Min to 1 Hour
- Typical Power Output: 50-350 kW
- Found in Public Applications

Understanding Charging Times/Ratings

(Volts x Amps) / 1,000 = kW rating

Example – Level II Charger - 240V AC @ 30 Amps

(240 x 30) / 1,000 = 7.2 kW per hour charging capacity

Example – Charge Time Based on Battery Size

EV with 42 kWh battery capacity with 7.2 kW charging

42 / 7.2 = 5.83 kWh or approximately 6 hours

Charging Connector

Charging Stations (EVSE)

J1772

CCS

CHADdeMO

Tesla

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Charging Connector

Charging Stations (EVSE)

SAE J1772

- Multipin charging/communication link between vehicle and charger
- Conducts current
- Relays charge status
- Shuts down charging when battery is "full"
- Prevents vehicle from moving when plugged in
- Used for level I and II charging

Charging Connector

Charging Stations (EVSE)

DC Fast Charge

- CHAdeMO – CHArge de Move
    - Original standard - Japan
- CCS – Combined Charging System
    - Built off J1772 standard

CHAdeMO

CCS

Photo courtesy of SAE

Charging Connector

Charging Stations (EVSE)

Tesla Connector

- Level I, II and DC fast charge for Tesla vehicles
- Currently being looked at to replace J1772/CSS by several OEMs

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Roof Mounted Connection

Charging Stations (EVSE)

Automatic

quick charging stations reduce down time

Inductive Charging

Charging Stations (EVSE)

Charge on the Move

- Charging "plate" or "mat" built in at pre-determined stops
- "Flash" charges the battery
- Now being tested on roadways

Image courtesy of Electroon

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Bidirectional Charging

Charging Stations (EVSE)

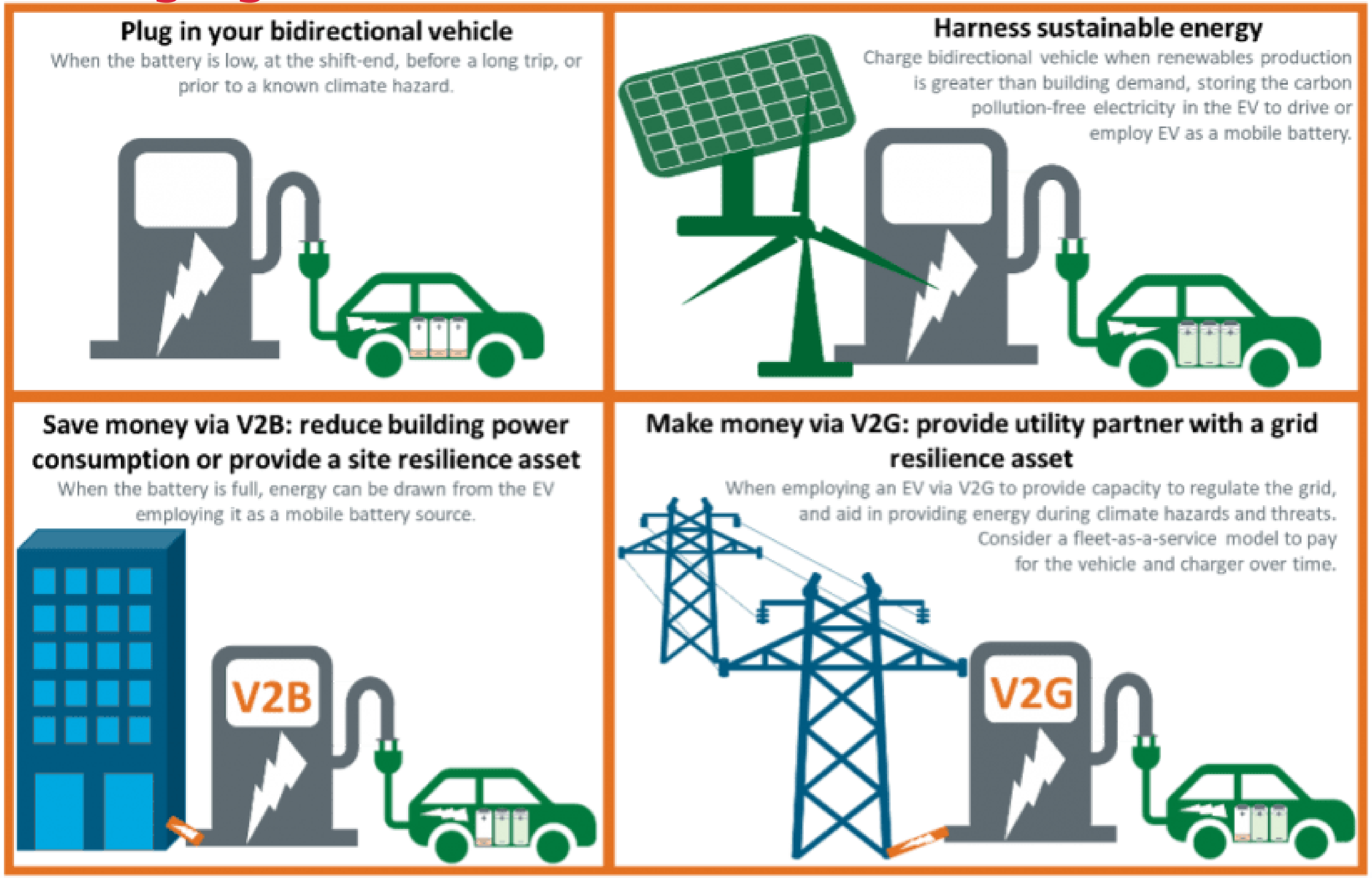

Image courtesy of the Department of Energy

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Resources to Locate Charging Stations and Other Alternative Fuels

Charging Stations (EVSE)

[DOE - Alternative Fuels Data Center]()

Charging Stations - Fires

Charging Stations (EVSE)

- Treat as any energized electrical fire
- Shut down power to charging station – include in preplans
- Perform extinguishment operations

Same procedure for vehicle fires connected to charging stations

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Charging Stations - Collisions

Charging Stations (EVSE)

- Shut down power to charging station
- If a connected vehicle is struck, secure station power prior to operations
- Identify, immobilize and disable vehicle as required

Module Review

Charging Stations (EVSE)

Charging Stations

- What are the operating voltages for each type?
- Where would you anticipate each to be located?

Photos courtesy of Delphi and ChargePoint