NFPA | ALTERNATIVE FUEL VEHICLES SAFETY TRAINING PROGRAM

ELECTRIC VEHICLE SAFETY FOR FIRST RESPONDERS

INTRODUCTION TO HYBRID AND ELECTRIC VEHICLES

FIRE SERVICE EDITION

Photo courtesy of Rivian

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 Ve[illegible]ing - Program Modules

Introduction

Basic Electrical Concepts & Hazards

P/HEV & EV Systems & Safety Features

Charging Stations

Initial Response: Identify, Immobilize & Disable

Emergency Operations

Introduction to Hybrid and Electric Vehicles

OBJECTIVES

Following instruction, the student shall be able to:

- Define the following:
  - ✓ Hybrid Electric Vehicle (HEV)
  - ✓ Electric Vehicle (EV)
  - ✓ Plugin Electric Vehicle (PHEV)
- List the two (2) main safety concerns for first responders

Why Is This Course Important to Responders?

Introduction

Provides answers to important questions

Photo courtesy of the Westport CT Fire Department

- Will it shock me?
- Can I touch it?
- Is it going to change my response?
- Can I cut it?

Prevents lack of action or dangerous actions from occurring

A Basic Question…..

How much do you really know about hybrid & electric vehicles?

Is it enough to make educated decisions?

Photo courtesy of the San Jose CA Fire Department

Vehicle Fires – NTSB Report – 11/13/20

Determinations

- Most FDs not prepared
- Inadequate ERGs (ISO 17840)
- Gaps in safety standards and research
- NHSTA to conduct testing and include ERGs in safety ranking

NTSB EV Fires Report

Photo courtesy of the Lake Forest Fire Department

Hybrid Electric Vehicle (HEV)

Two types of propulsion working together

Toyota Prius

Photo courtesy of Toyota

Characteristics

- Use batteries and electric motors to assist internal combustion engine (ICE)
- Better fuel economy than conventional vehicle
- ICE shuts down when not needed
- No external action needed to recharge battery

Plugin Hybrid Electric Vehicle (PHEV)

Two types of propulsion working together and external charging

Characteristics

- HEV which allows battery to be charged from external source
- Increased power capacity over HEV
  - Improves range on battery
  - Greater reduction of ICE use

Photo courtesy of Toyota

Electric Vehicle (EV)

Introduction

Single type of propulsion

Characteristics

- Uses only electric motors for propulsion
- Vehicle must be charged by an external power source

Photo courtesy of Mitsubishi

Extended Range Electric Vehicle (EREV)

Characteristics

- Electric motors propel the vehicle
- Engine/generator supplies electrical current to motors when needed
- Battery is recharged via external power source
- Treat as a PHEV in emergencies

Electric vehicle with backup power

Photo courtesy of GM

Electric Truck/Bus (EV)

Introduction

In Addition to Passenger Vehicles…

…Commercial/Transit models are available as well

Electric Truck/Bus (EV)

Introduction

Characteristics

- Same operating principles as passenger EV
- Larger - often multiple high voltage batteries

Hybrid Electric Truck/Bus (HEV)

Introduction

Characteristics

- Same principle as hybrid passenger vehicles
- Diesel motor and larger scale HV system
- The ICE may or may not shut down when stationary

Supplemental Hybrid Systems Applications

Characteristics

- Medium or high voltage system powers components to eliminate idling
  - Heating / air conditioning
  - Pumps
  - Man lifts

Hybrid and Electric Conversions

Introduction

Aftermarket Hybrid Systems

Characteristics

- Electric system supplements traditional drivetrain
- Look like conventionally powered vehicles
- Used primarily for fleet operations

Photo courtesy of XL Hybrid

Hazards by Vehicle Type

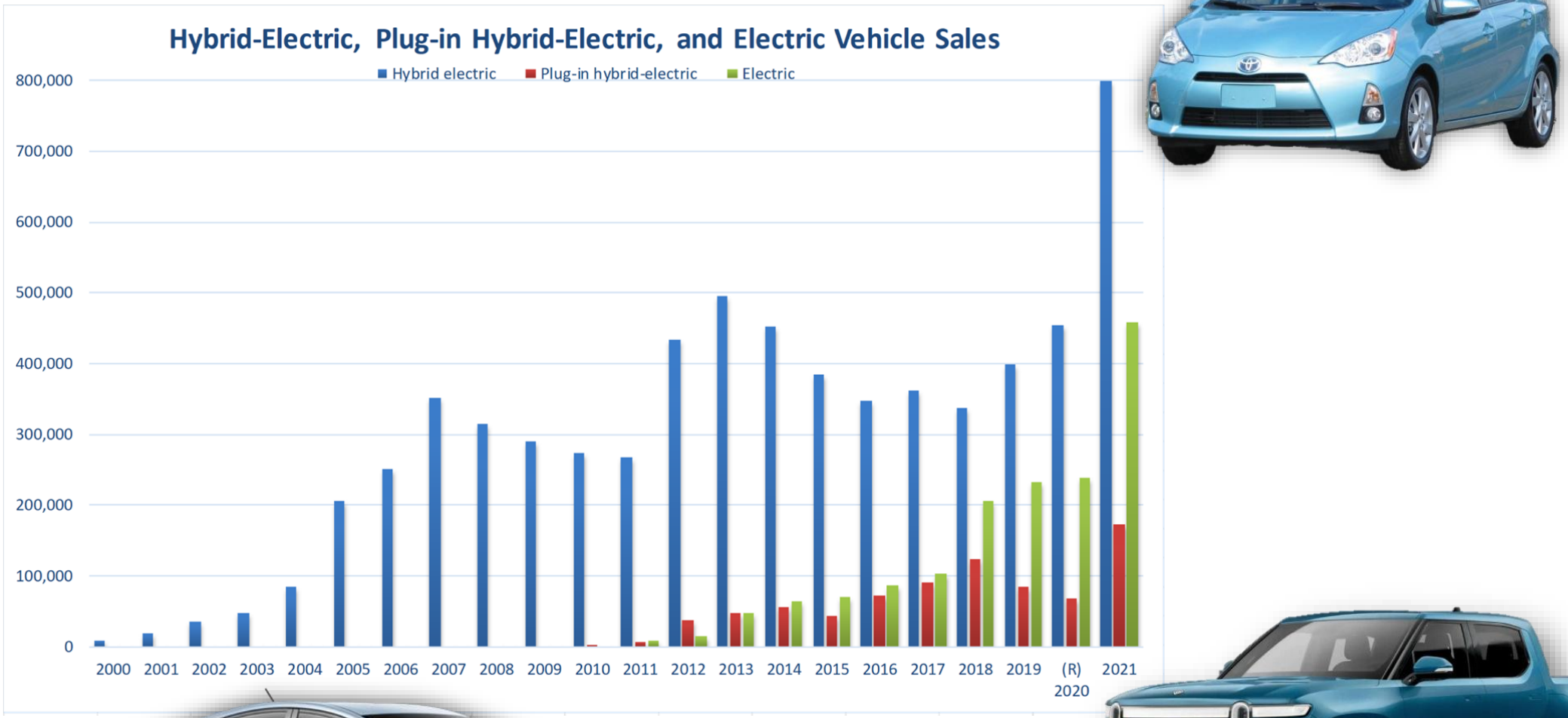
Introduction

High Voltage and Fuel	High Voltage Only
• Hybrids • Plug-in Hybrids • Extended Range EVs	• Pure EVs

Photo courtesy of Toyota

Sales Figures

Introduction



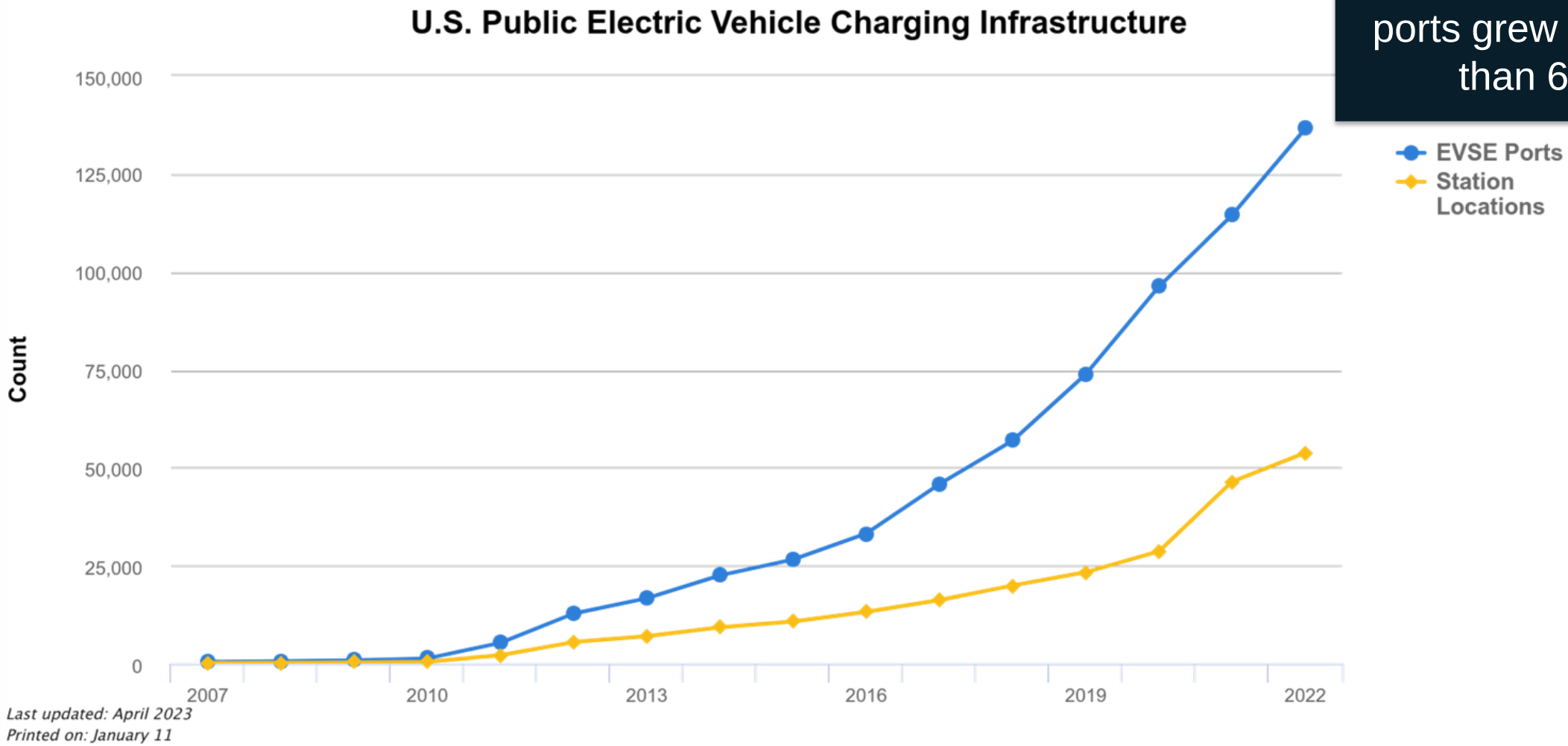
Courtesy of US Department of Transportation

Photos courtesy of Toyota and Rivian

Infrastructure Improvements

Introduction

In 2021 alone, the number of public ports grew by more than 60%



Courtesy of the US Department of Energy

Infrastructure Improvements

Introduction

U.S. Goals

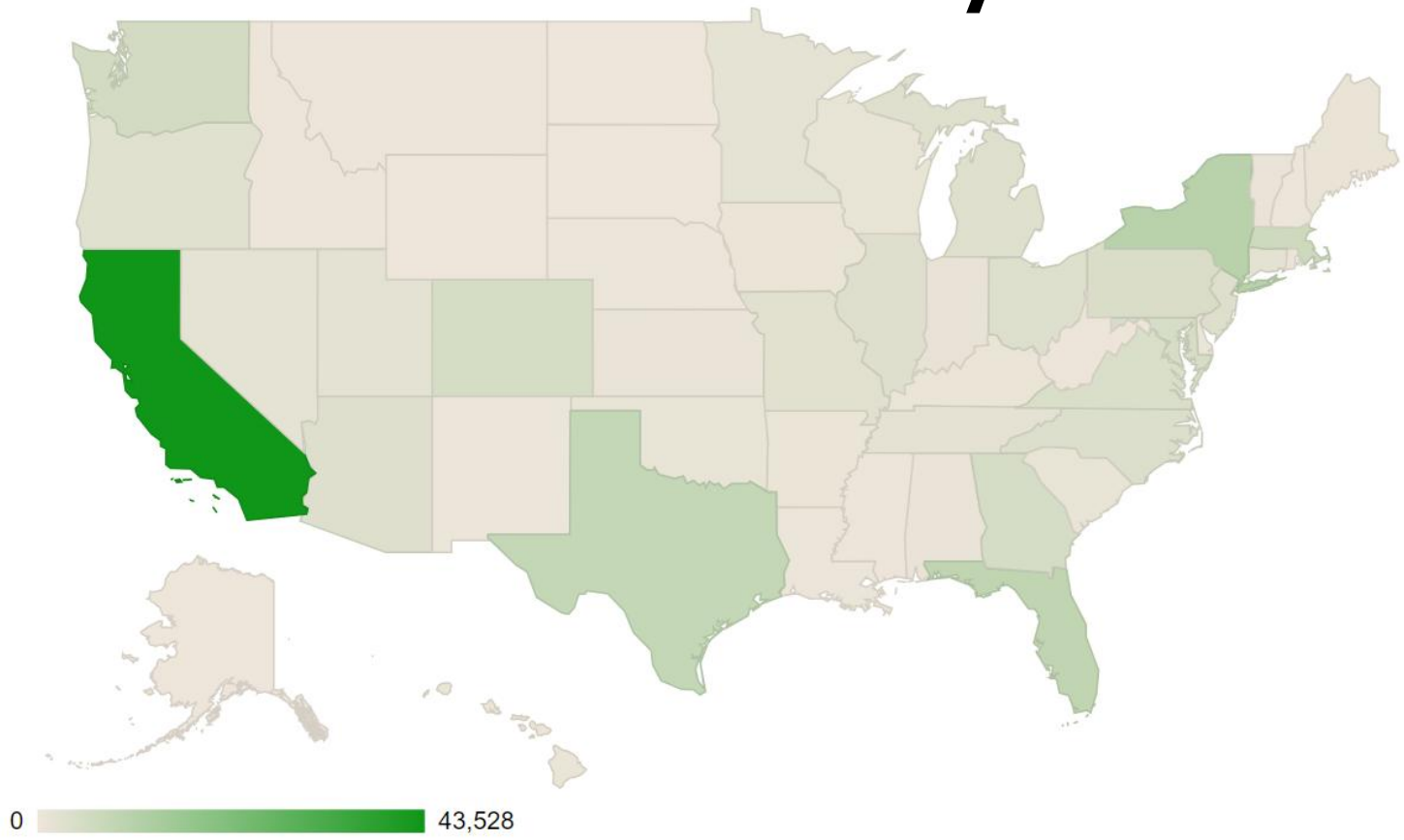
- Promote public access to charging
- 500,000+ public chargers by 2030
- Supported by grant funding and other initiatives

Photo courtesy of ChargePoint

Infrastructure Improvements

Introduction

Public Charging Ports by State

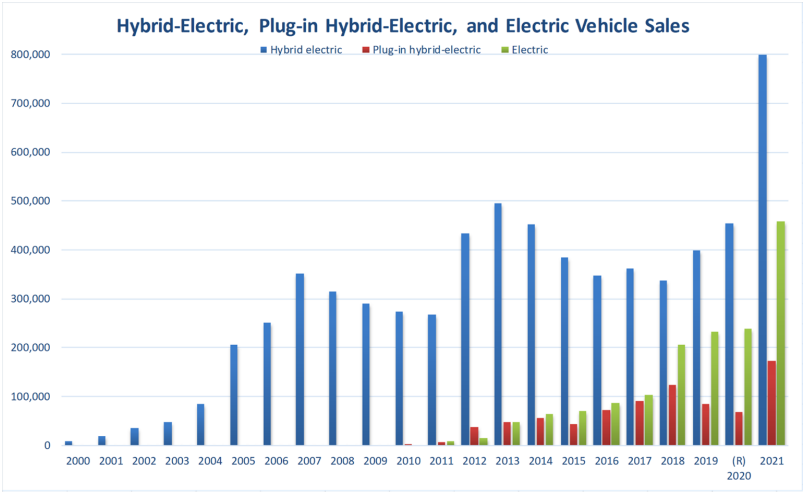


Public Charging Ports By State

Introduction Review

Introduction

Why is HEV/EV safety training important to responders?



Are these vehicles becoming more popular?

Module Review

Vehicle Types:

HEV

EV

How do each of these vehicle types function?

What are their hazards?

PHEV

EREV

Images courtesy of Toyota, GM and Mitsubishi

