

ELECTRIC VEHICLE GUIDE



Why electric vehicles?

The transportation sector is the largest source of greenhouse gas (GHG) emissions (see chart below).

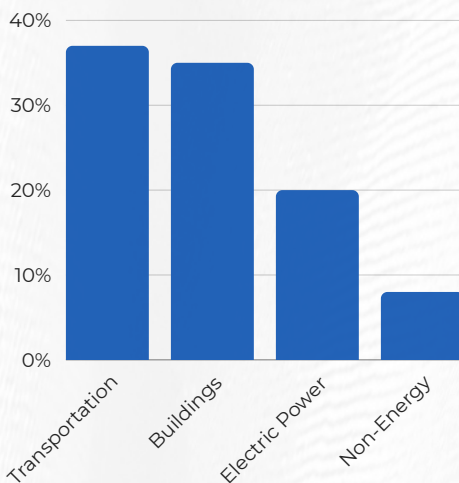
What are electric vehicles?

A zero emission vehicles (ZEV) that use a battery to store the electrical energy needed to power the motor. The battery is charged by plugging the vehicle into a charger.

What are plug-in hybrid electric vehicles?

A zero emission vehicles (ZEV) that uses both an electric battery and an internal combustion engine (ICE). The vehicle can operate on all-electric mode or by the internal combustion engine (ICE) when going on longer trips. The battery is charged by plugging the vehicle into a charger.

Massachusetts GHG Emissions Inventory (2020)



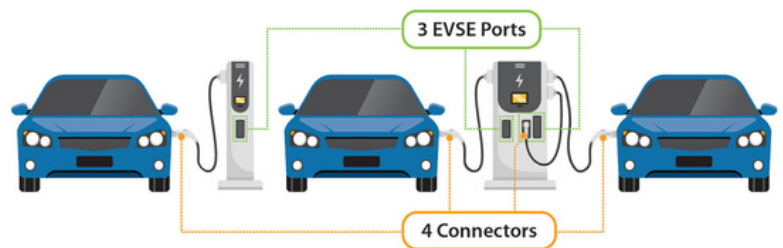
Benefits of Driving Electric

- Emissions reduction
- Improve air quality & health benefits
- Fuel cost savings
- Reduced maintenance & operations costs
- Incentives
- Noise level reduction
- Batteries
- Energy security

Challenges of Driving Electric

- Lack of EV charging infrastructure
- Range anxiety
- EV purchase cost
- Grid capacity
- Charging speeds
- Charger compatibility
- Charging price structures
- Charging operations and maintenance
- Qualified maintenance and technicians

1 Station Location



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EV CHARGING INFRASTRUCTURE



Types of Chargers

Level 1 Charging

- Charges by standard 120V outlet
- Can be charged through a standard household wall outlet or Level 1 charging unit
- Uses J1772 connector
- Charges at about 5 miles of range per one hour of charging
- Most ideal for residential charging

Level 2 Charging

- Charges by 240V or 208V
- Most homes have 240V service
- Uses J1772 or NACS connectors
- Charges at about 25 miles of range per one hour of charging
- Most ideal for residential charging, workplace charging, or public charging.

Direct Current Fast Charging (DCFC)

- Enables rapid charging
- Not available for residential purposes
- Uses CCS, CHAdeMO, or NACS connectors
- Charges at about 100 to 200 miles of range per one hour of charging
- Most ideal for charging along heavy traffic corridors and dense areas

Where to Install?

- Near major corridors
- Municipal buildings
- Shopping centers
- Recreational facilities
- Schools, Universities
- Parking lots
- Business areas/workplaces
- Fleet facilities
- Libraries
- Hotels

Connector Types



J1772



NACS



CCS



CHAdeMO

Factors to Consider

- Unit costs
- Installation costs
- Operations and maintenance costs
- Incentives
- Permitting and inspection
- Pricing structures
- Grid capacity
- Electrical upgrades

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EV CHARGING OPERATIONS & MAINTENANCE



Operations & maintenance are integral considerations of the installation process of EV charging stations.

Costs

Electricity Costs

- Type of equipment installed
- Charging times and lengths
- Rates & rate incentives

Maintenance & Warranty Costs

- Maintenance costs vary by charging level and if it is networked or non-networked
- Storing charging cables securely
- Periodically checking parts
- Keeping equipment clean
- Repairs & troubleshooting
- Warranty pricing varies by manufacturer (fixed, renewable, or included with equipment costs)
- Maintenance can be costly if not under warranty

Data Collection

- Capture & analyze charging station uptime and utilization data to improve management
- Most charging networks provide utilization data to site hosts through an online portal
- Non-networked charging stations can have separate infrastructure installed to capture data
- Data can be used to track progress towards emissions & energy goals, determine if pricing structures are successful, & evaluate if additional charging stations are needed

Fees

Pricing Structure

- Recover costs and/or generate revenue
- Collect fees via credit card, phone, or at nearby establishment
- Pricing by kWh, by session, by length of time, or through subscription
- Charging a fee is becoming more common
- Pricing for members vs. non-members, user-specific pricing (free charging for certain vehicle owners), site-host specific pricing, or pricing based on rate of charge

Open Access

- Networked charging stations can be members-only or open access
- Members only = requires network membership to use & pay for charging, and gain access to all the features & services of the network
- Open access = non-members can access charging stations

Resources

- [MA Rate Incentives](#)
- [Example Fee Calculator](#)
- [FHWA Operations & Maintenance Information](#)

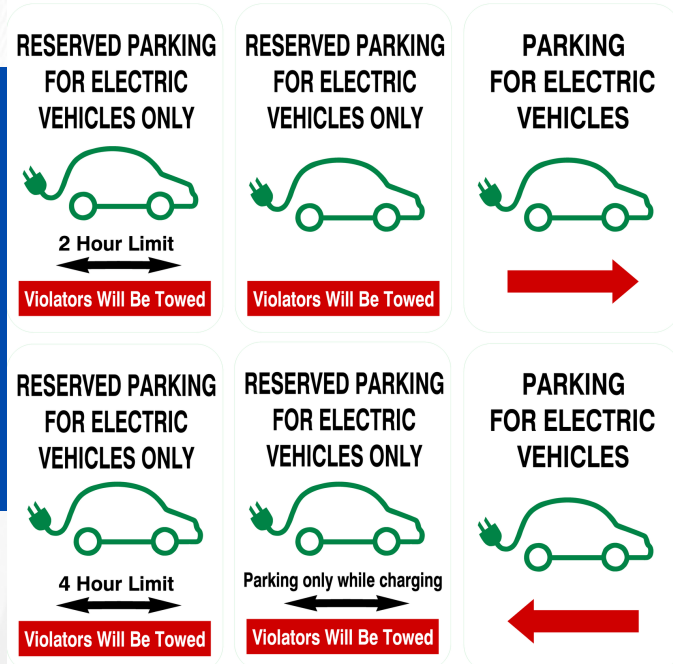
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EV CHARGING SIGNAGE

The process of procuring charging stations includes the consideration of signage.



Two Categories of Signage

1. Wayfinding Signage

- For navigation to charging stations from locations (freeway exit or roadway).
- FHWA defines minimum standards* for signage on public highways, streets, bikeways, and private roads open to the public (shopping centers and airports).
- State and local transportation departments may create and add custom signage, but they must meet minimum requirements defined by MUTCD.



*Manual on Uniform Traffic Control Devices (MUTCD)

2. Station Signage

- Helps drivers identify charging stations.
- Helps hosts communicate and enforce policies for use of charging stations and parking spaces.
- Pavement markings can be used to help reinforce signage requirements.
- Signs posted in a public right of way (ROW) must be supported by local ordinances that specify time limits, penalties, and definitions.
- Any signs posted in public ROW must meet MUTCD requirements.
- Signs in private parking areas not open to the public are not required to meet MUTCD requirements.



Benefits of Signage

- Helps drivers navigate and identify EV charging stations.
- Helps drivers understand that parking spaces at charging stations are for EV's only.
- Provides information about policies (access, time limits, hours of use) and facilitates enforcement.
- Provides visibility for charging infrastructure to prospective drivers.



Resources

- [Alternative Fuels Data Center - Signage](#)
- [FHWA Manual on Uniform Traffic Control Devices \(MUTCD\)](#)
- [California MUTCD](#)
- [Minnesota DOT Electric Vehicle Guidance](#)
- [Massachusetts Installation Guide for EVSE](#)
- [Massachusetts EV Signs for Cities/Towns](#)
- [Purchase MUTCD EV Signage Online](#)
- [Other Resources](#)

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RESIDENTIAL EV CHARGING GUIDE



Two Types of Residential EV Charging

Level 1 Charging: Standard Wall Outlet (120 Volt)

- Charges at about 5 miles of range per one hour of charging
- No installation required - every EV comes with Standard Level 1 charger that you can drive home and plug into the wall.
- Best for overnight charging and low-mileage daily driving. A good option for plug-in hybrid vehicles because of their small batteries.
- J1772 connector or Tesla connector (comes with vehicle)

Level 2 Charging: 240 Volt Outlet (Dryer Plug)

- Charges at about 25 miles of range per one hour of charging
- Charger will need to be purchased and installed by a qualified electrician. It can be either hardwired or plugged into an existing 240 Volt outlet.
- Best for quick charging at home - can get a full charge from empty overnight (8-10 hours).
- J1772, NACS connectors, or Tesla connectors (comes with vehicle)

Charging at home is easier than you think!

Home Chargers to Install

- ChargePoint
- Autel
- Emporia
- Grizzl-E
- Lite-On
- United Chargers
- Lectron
- Blink
- Tesla

[ENERGY STAR Certified Chargers](#)

Installing a Charger

1. Consider your charging needs

Determine what works best for your home.

2. Hire an electrician

Engage licensed and qualified electricians.

3. Research and buy

Research and determine the types and prices of chargers that fit your needs.

4. Get it installed

Have your licensed electrician install your charger of choice.

Charging your EV at night is the cheapest time to charge!

Benefits of Charging at Home

- Inexpensive and convenient
- Charge your car overnight
- Reduced energy costs
- Better for your battery

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ROADMAP TO INSTALL EV CHARGING STATIONS

1 ASSESS THE NEED

Assess what the intended use the charging station will be. This will help guide the station selection and site selection process. It will also help ensure that the use of the station is maximized and costs are minimized.



Who needs to use the station?

Municipal Employee vs. General Public



How will they use the station?

Overnight/9am-5pm vs. During Meetings vs. Long Trips vs. Shopping & Retail



Where will they be parked?

Garage vs. Town Parking Lot vs. Commuter Lot vs. Retail Lot

2 CHOOSE A STATION

There are three primary types of charging stations. Each type can be further customized depending on needs and what the manufacturer offers.

	Power	Time	Use
Level 1	120V	5-10 hours or more	Long-term lot parking or overnight parking needs, workplace charging
Level 2	208V/ 240V	1-5 hours	Workplace charging, commercial/work vehicles used during the day that need midday charge
DC Fast Charging	480V	20 minutes to 1 hour	Best for highway or major roadway sites to enable longer and more essential trips

3 SELECT A SITE

The specifics of site selection are important to minimize installation costs. Selection can sometimes be only determined by the type of station and how it will be used, however other specifics are important to consider during the process.

Location - is there anything about this area that would impact future costs (sun exposure, snow, driver behavior, etc.)

Proximity to Power - Is there enough power? where?

Mounting Type - is there a wall nearby? Does the charger need a pedestal or pole mount?

ADA Compliance - is the site fully accessible to all users?

Wayfinding and Visibility - how will drivers find the site?

4 PROCURE & INSTALL

Green Communities - statewide program that offers grant funding for charging stations. Click [here](#) to learn more.

MassEVIP - provides statewide programs for public charging, workplace/fleet charging, multi-unit dwelling charging, DC Fast Charging, and more.

Eversource - provides programs for home charging and workplace charging and more.

National Grid - provides programs for home charging, workplace charging, public charging, and multi-unit dwelling charging.

VEHI02 - statewide contract to install, maintain, and provide site assessment for alternative transportation equipment, hardware, software, and services. Click [here](#) to learn more.

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HOW TO USE THIS GUIDE

Use this step by step guide as an initial understanding of which types of EV charging stations will meet the needs of your community, and what factors to consider.