City of La Crosse

Electric Vehicle (EV) Ready Guide

January 2023

Prepared By

making change personal
paleBLUEdot

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Acknowledgements

This guide was developed in conjunction with the City of La Crosse's 2022 Climate Action Plan (CAP) to assist the City of La Crosse in achieving the energy reduction goals outlined in the CAP.

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EV Tools Included in This Guide

This guide includes many resources and tools for planning a transition to electric vehicle use. These resources are identified throughout the guide by the EV Tool icon: EV Tool


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Section 01

Introduction to EV Technology

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Introduction to EV Technology

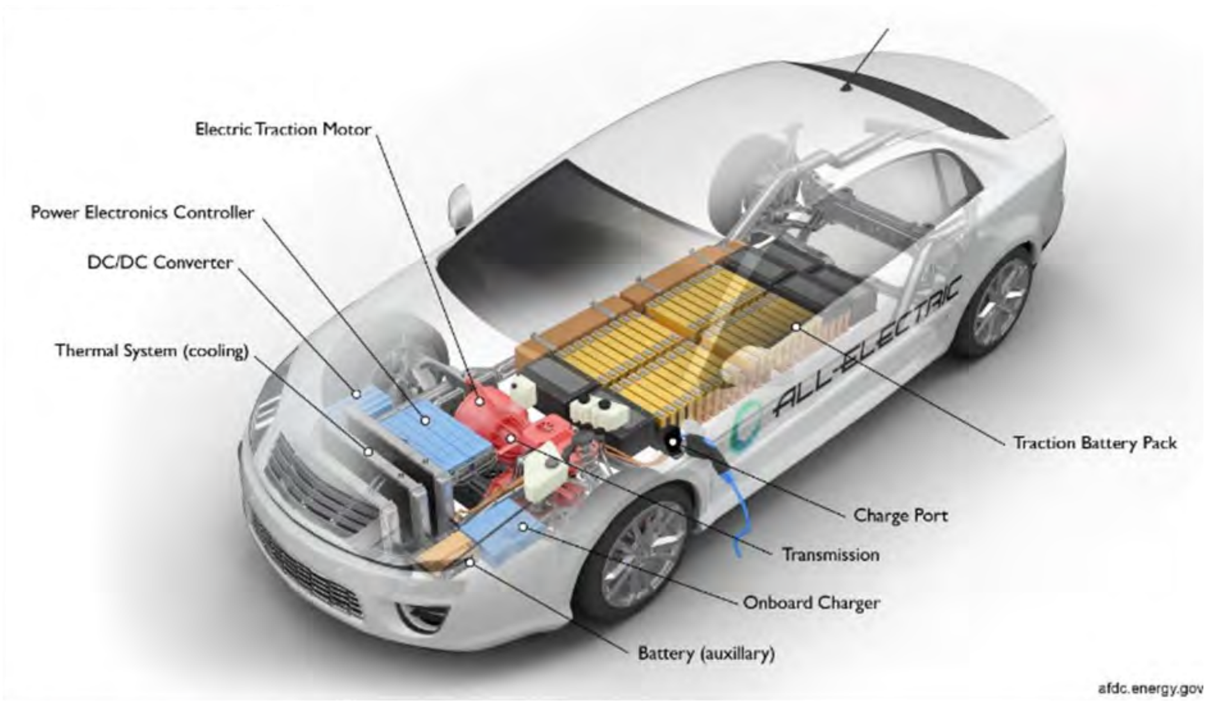
Since electric vehicles (EVs) are an emerging technology that is rapidly changing, it is important to build a common understanding of the technology and terminology used in this report. This section explains the basics of currently available types of vehicles and charging stations and the associated uses, barriers, and benefits.

WHAT IS AN ELECTRIC VEHICLE

Put simply, an electric vehicle is a one powered by an electric motor rather than a traditional petrol/diesel engine. This electric motor is powered by rechargeable batteries that can be charged by common household electricity.

WHAT ARE THE TYPES OF ELECTRIC VEHICLES

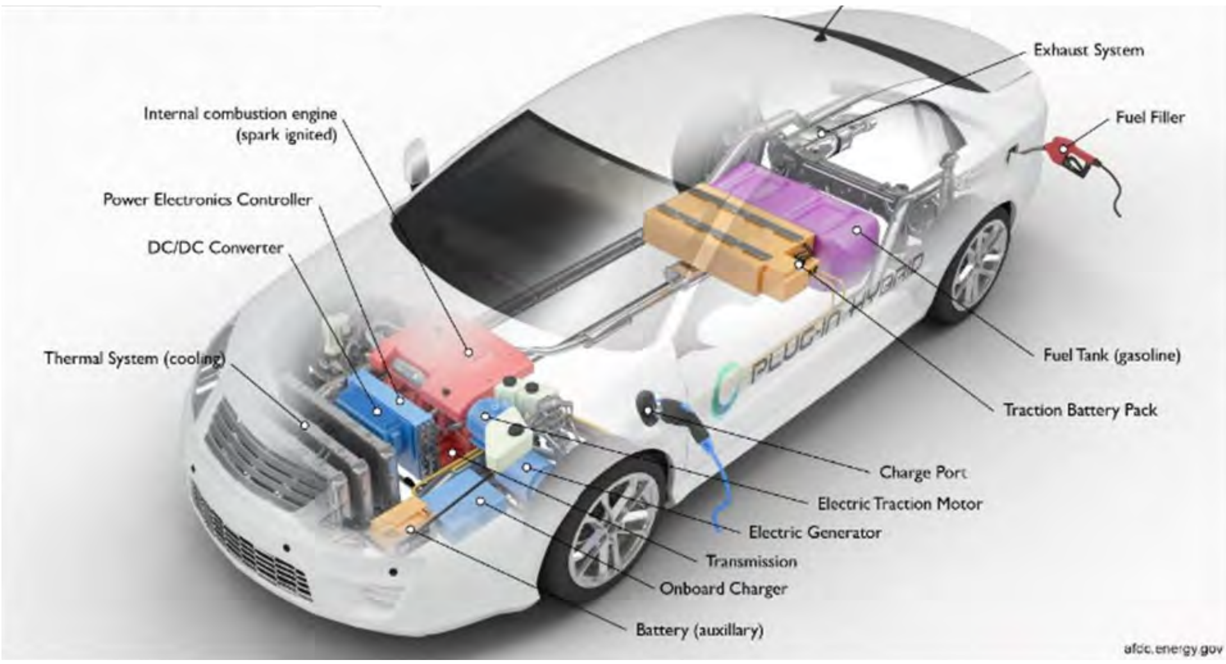
Battery Electric Vehicle (BEV)



A battery electric vehicle is a car that is 100% powered by an electric motor. There is no gasoline required, and owners “fuel up” by plugging in overnight at home or to an expanding network of charging stations. Like a cellphone, the battery stores the charge to power the car when it is running. With a variety of battery electric vehicles on the market, you can choose one that drives anywhere from 80 to 250 miles on a full charge. “Refueling” times can vary – typically, 30 minutes for fast charging and 4 to 6 hours with Level 2, depending on the size and current depletion of the battery.

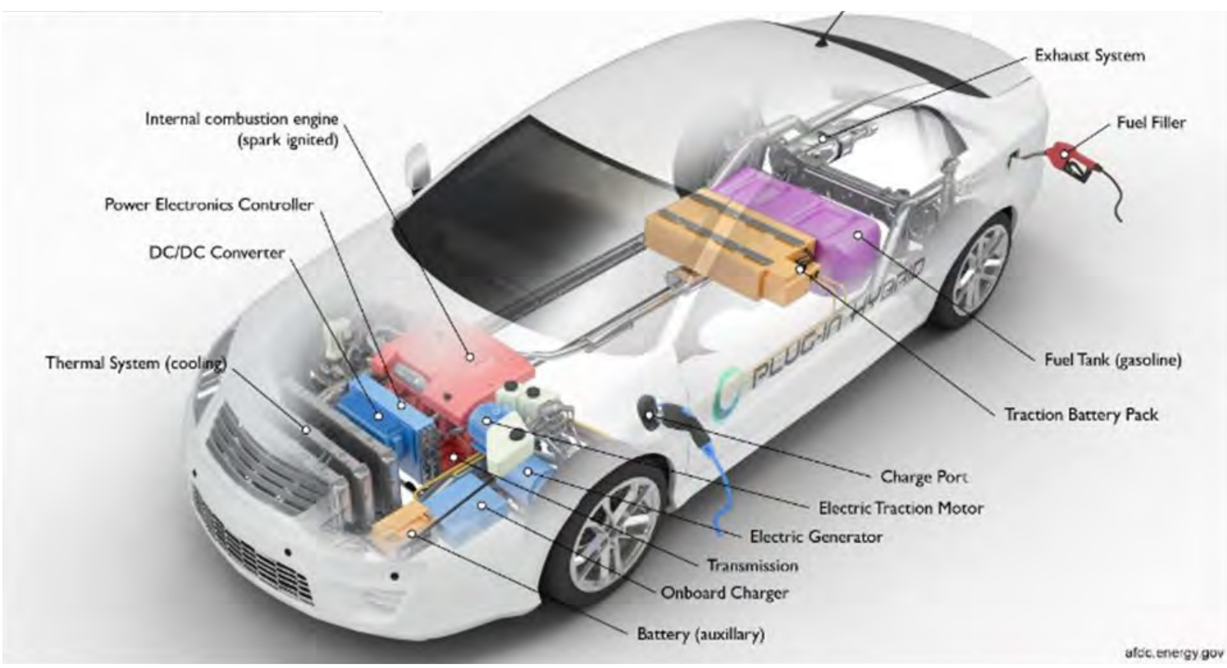
Introduction to EV Technology

Plug-In Hybrid Electric Vehicle (PHEV)



A plug-in hybrid electric vehicle is a vehicle that is powered by a combination of an electric motor and a gasoline engine. Like a battery electric vehicle, the vehicle can be plugged in to charge and will run on the battery for some or all of your drive – from 15 to 50 miles. Unlike a battery electric vehicle, once the battery charge is depleted, the gasoline kicks in and the vehicle runs like a fuel efficient gas-powered hybrid car to extend the range of the vehicle. This makes the combined range from electricity and gasoline, 350-600 miles, comparable to a gas-powered car. Recharging the battery is completed easily overnight using either Level 1 (120V) or Level 2 (240V) charging, and a quick stop by the gasoline station can fill up the tank in about 5 minutes.

Hybrid Electric Vehicle (HEV)



Introduction to EV Technology

Hybrid Electric Vehicle (HEV) (continued)
Similar to the PHEV, an HEV has both an electric motor and a gasoline engine. In an HEV, the gasoline engine is used to power a generator, which powers the electric motor. The benefit of this system is that the ICE can run at a constant speed which greatly increase the vehicle's fuel efficiency compared to traditional ICE vehicles. However, the battery cannot be charged by an external electricity source, which means the vehicle always needs to rely on the gasoline engine.

Mild Hybrid Electric Vehicle (MHEV)
A mild hybrid sits between a conventional gasoline vehicle and a full hybrid. A mild hybrid uses a smaller battery, and a motor-generator that can both create electricity and help boost the gas engine's output. Though mild hybrid vehicles aren't capable of all-electric propulsion, and though they don't offer as significant a fuel savings as a "full" hybrid, they're able to boost performance while reducing fuel use.

When extra power is needed, the motor-generator uses stored electricity to apply torque to the engine, boosting its output without burning additional fuel. When coasting or cruising, the gasoline engine spins the motor-generator to create electricity that recharges the battery. In a mild hybrid, the gas engine can be turned off, and fuel saved, in more situations – like while coasting down hills or when stopped at traffic lights.

Fuel Cell Electric Vehicles (FCEVs)
A fuel cell electric vehicle is powered by hydrogen. They are more efficient than conventional internal combustion engine vehicles and produce no tailpipe emissions—they only emit water vapor and warm air. Like a gas-powered car, they are capable of refueling in 3-5 minutes, but at a hydrogen dispenser instead of a gas pump. Driving range is comparable to gas cars, about 300-350 miles on each tank of hydrogen. FCEVs and the hydrogen infrastructure to fuel them are in the early stages of implementation and as of October 2020, these vehicles are currently only available for sale in California.

DIFFERENTIATING ELECTRIC VEHICLES

Vehicle Technology	Internal combustion engine	Hybrid-electric vehicle	Plug-in hybrid electric vehicle	All-electric vehicle
Internal combustion engine & petroleum fuel	✓	✓	✓	
Electric motor & traction battery pack		✓	✓	✓
External electricty			✓	✓

Source: CRS from U.S. Department of Energy (DOE); DOE, Office of Energy Efficiency and Renewable Energy (EERE), *Electric-Drive Vehicles*, September 7, 2017.

COMPARISON OF TYPES OF ELECTRIC VEHICLES

Electric Vehicle Type	**Power Source**	**Travel Range** (miles)
Battery Electric Vehicle (BEV)	Electric Motor	80 – 345
Plug-in Hybrid Electric Vehicle (PHEV)	Electric Motor + Gasoline Engine	350 – 600
Hybrid Electric Vehicle (HEV)	Electric Motor + Gasoline Engine	350 – 600
Fuel Cell Electric Vehicle (FCEV)	Electric Motor	300 – 350

Introduction to EV Technology

CHARACTERISTICS OF VEHICLE TYPES BY FUEL

	Internal Combustion Engine (ICEV)	Hybrid-Electric (HEV)	Plug-In Hybrid-Electric (PHEV)	All-Electric (AEV)
Fuel Economy Rating[a]	29 mpg (average)[b] Up to 39 mpg	45 mpg (average)[b] Up to 58 mpg	60 mpge (average)[c] Up to 133 mpge	107 mpge (average)[c] Up to 136 mpge
Driving Range[d]	Up to 640 miles	Up to 690 miles	Up to 640 miles (combined) Up to 130 miles (battery only)	Up to 370 miles (single charge)
Fuel Costs[e]	10¢-15¢ per mile	5¢-10¢ per mile	5¢-10¢ per mile 2¢-4¢ per mile (battery only)	2¢-4¢ per mile
Battery Pack and Size[f]	None	Lithium ion or nickel-metal hydride Up to 1.6 kWh	Lithium ion 7.6-42 kWh	Lithium ion 18-100 kWh
Greenhouse Gas Emissions[g] and Fuel Type	4.1-14.7 metric tons per year Gasoline/diesel	2.8-9.0 metric tons per year Gasoline/diesel	2.5-7.0 metric tons per year[h] Gasoline/diesel; electricity	1.8-3.5 metric tons per year[h] Electricity
Types of Existing Policies	—	State incentives	Federal tax credits State incentives	Federal tax credits State incentives
Examples	Ford Mustang Jeep Wrangler	Hyundai Ioniq Toyota Prius	Chevrolet Volt Chrysler Pacifica Hybrid	Nissan Leaf Tesla Model 3

Source: U.S. Department of Energy (DOE) and Environmental Protection Agency (EPA), FuelEconomy.gov, *Fuel Economy Guide: Model Year 2019* [datafile], modified December 18, 2019. EPA, *The 2018 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology Since 1975*, March 2019. DOE, Office of Energy Efficiency and Renewable Energy (EERE), *Electric-Drive Vehicles*. DOE, Alternative Fuels Data Center (AFDC), "Vehicle Cost Calculator Assumptions and Methodology," updated May 18, 2017, https://afdc.energy.gov/calc/cost_calculator_methodology.html. InsideEVs, "Compare EVs: Guide to Range, Specs, Pricing and More," July 22, 2019, https://insideevs.com/reviews/344001/compare-evs/.

Notes: Typical values presented for comparison purposes. Model year (MY) 2019 except where noted.

a. Miles per gallon (mpg) or miles per gallon of gasoline equivalent (mpge; a quantity of fuel with same energy content as gallon of gasoline). Ratings based on laboratory testing and vary from real-world fuel economy due to a range of factors, including driving conditions, vehicle load, etc. FuelEconomy.gov, *Fuel Economy 2019*.

b. Production-weighted average for MY2017 includes sedan/wagons and car SUVs, but not light-duty trucks. EPA, *2018 Trends Report*, p. 52.

c. Highest combined fuel economy for MY2017 from CRS estimation from EPA figure; EPA, *2018 Trends Report*, figure 4.14.

d. ICEV includes flex-fuel vehicles; DOE does not provide ranges for all ICEVs. FuelEconomy.gov, *Fuel Economy 2019*.

BENEFITS OF ELECTRIC VEHICLES

EVs have both environmental and economic benefits. By replacing ICE vehicles with EVs, transportation-related Greenhouse Gas (GHG) emissions are significantly reduced and air quality is improved. As the need for imported petroleum to support transportation decreases through the integration of EVs, domestically available fuel sources can shift into focus, resulting in improved energy security and domestically regulated fuel prices. Furthermore, individual consumers will experience lower fuel and maintenance costs with the transition to EVs, as well as continued advancements in battery and charging technologies. The benefits of Electric Vehicles for individual, business, and fleet use include:

- Lower fueling costs (3-5 cents/mile for electric vs.15-20 cents/mile for gasoline)
- Lower maintenance costs (studies show that PEVs average 1/3 less in maintenance costs)
- Lower total cost of ownership (TCO) over the life of the vehicle
- Extending vehicle longevity (fewer mechanical parts to wear out)
- Reduced greenhouse gas emissions and pollution in community (no tailpipe emissions in electric mode)
- Improved community air quality
- Cleaner roadways and parking lots for reduced contamination runoff(no oil, transmission, coolants in BEVs)
- Reduced noise in community (nearly silent in electric mode)
- Improved driver satisfaction (less noise, vibration; excellent performance)
- Energy Security and elimination of imported fuel from foreign countries as well as other US States.
- Improved fuel economy – as an example, FuelEconomy.gov lists the 2019 Honda Accord Hybrid at an EPA combined city-and-highway fuel economy estimate of 48 miles per gallon, while the estimate for the conventional 2018 Accord (four cylinder, automatic) is 33 miles per gallon
- Infrastructure availability – PHEVs and EVs have the benefit of flexible fueling: Since the electric grid is in close proximity to most locations where people park, they can charge overnight at a residence, as well as at a fleet facility, workplace, or public charging station when available.


EV

Section 02

Introduction to EV Charging Technology

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Introduction to EV Charging Technology

WHAT ARE THE TYPES OF EV CHARGERS

Charging an EV requires plugging into a charger connected to the electric grid, also called electric vehicle supply equipment (EVSE). There are four major categories of chargers, based on the maximum amount of power the charger provides to the battery from the grid:

Level 1: Provides charging through a 120 V AC plug and does not require installation of additional charging equipment. Can deliver 2 to 5 miles of range per hour of charging. Level 1 chargers are most often used in homes, but sometimes can be found at workplaces.

Level 2: Provides charging through a 240 V (for residential) or 208 V (for commercial) plug and requires installation of additional charging equipment. Can deliver 10 to 20 miles of range per hour of charging. Level 2 chargers are used in homes, workplaces, and for public charging.

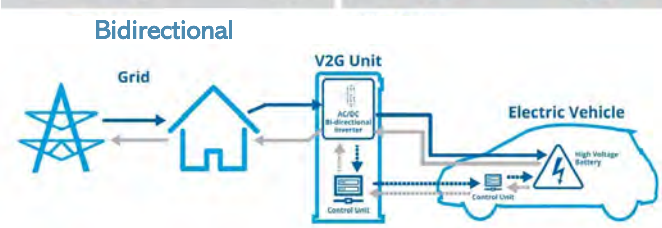
DC Fast Charge: Provides charging through 480 V AC input and requires highly specialized, high-powered equipment as well as special equipment in the vehicle itself. (Plug-in hybrid electric vehicles typically do not have fast charging capabilities.) Can deliver 60 to 80 miles of range in 20 minutes of charging. Used most often in public charging stations, especially along heavy traffic corridors.

Inductive Charging (DC): Inductive charging is a type of wireless power transfer. Inductive charging equipment uses an electromagnetic field to transfer electricity to a plug-in electric vehicle without a cord. Inductive charging can be used as both a stationary charging method as well as an in-motion charging method – most often for in-route charging on bus routes. Currently, there are a limited number of companies offering the wireless charging technology, however this technology is likely to become more prevalent in the future.

Resilient Bidirectional Charging

Bidirectional EV charging refers to EV charging that goes two ways. Unlike typical EVSE charging, electricity flows unidirectionally—from grid to vehicle. With bidirectional (two-way) EV chargers, electricity can flow both ways. This enables “Vehicle to Grid (V2G)”, “Vehicle to Building (V2B)”, and “Vehicle to Grid/Building (V2X)” energy management in which EV can be seen as a mobile energy management asset rather than simply a piece of equipment requiring intermittent fueling.

In a V2G configuration, the EV and charger can send electricity to the grid supporting the grid at high demand times while earning revenue for the EV/charger owner. In a V2B configuration the EV and charger can send electricity to the building at high building electrical use demand times enabling “peak shaving” and a reduction of the building’s monthly demand charges. V2B charging configuration also enables the EV battery to function as backup power, increasing the building’s energy resilience.



Charging times range from less than 30 minutes to 20 hours or more based on the type of EVSE, as well as the type of battery, how depleted it is, and its capacity. All-electric vehicles typically have more battery capacity than plug-in hybrid electric vehicles, so charging a fully depleted all-electric vehicle takes longer.

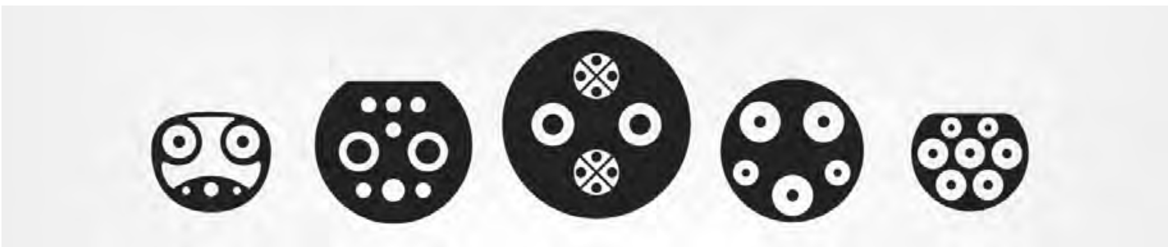
Level 1	overnight	16 hours
Level 2	longer stops	3.5 hours
DC Fast	on the go	30 minutes*

Introduction to EV Charging Technology

TYPES OF PLUGS

Most modern chargers and vehicles have a standard connector and receptacle, called the SAE J1772. Any vehicle with this plug receptacle can use any Level 1 or Level 2 EVSE. All major vehicle and charging system manufacturers support this standard, so your vehicle should be compatible with nearly all non-fast charging workplace and public chargers.

Fast charging currently does not have a consistent standard connector. SAE International, an engineering standards-setting organization, has passed a standard for fast charging that adds high-voltage DC power contact pins to the SAE J1772 connector currently used for Level 1 and Level 2. This connector enables use of the same receptacle for all levels of charging, and is available on certain models like the Chevrolet Spark EV. However, other EVs (the Nissan Leaf and Mitsubishi i-MiEV in particular) use a different type of fast-charge connector called CHAdeMO. Fortunately, an increasing number of fast chargers have outlets for both SAE and CHAdeMO fast charging. Lastly, Tesla's Supercharger system can only be used by Tesla vehicles and is not compatible with vehicles from any other manufacturer. Tesla vehicles can use CHAdeMO connectors through a vehicle adapter.



HOME CHARGING FOR PLUG-IN ELECTRIC VEHICLES

Many BEV and PHEV owners will be able to meet their daily driving range requirements by charging overnight with Level 1 equipment, requiring no additional cost or installation. The only infrastructure needed for this is a power outlet on a dedicated branch circuit available near the parking location. For drivers with less regular schedules, or longer commutes, Level 2 charging equipment may need to be installed to ensure complete charges within the available "down time". Electricians can inform homeowners whether their home has adequate electrical capacity for Level 2 vehicle charging. Some homes might have insufficient electric capacity for Level 2 equipment. However, homeowners may have a qualified electrician add circuits to accommodate the capacity needed for Level 2 charging. See the Estimating EV Charging Infrastructure Costs section of this report for estimating charger installation costs.

Introduction to EV Charging Technology

WORKPLACE CHARGING FOR PLUG-IN ELECTRIC VEHICLES

With proper workplace charging implementation, employers can help increase the convenience and affordability of driving electric for their employees. Workplace charging can demonstrate leadership in adopting advanced technologies.

EV Tool

Evaluating and Planning for Workplace Charging

Determining if a workplace charging program is right for an organization often begins by gauging employee interest through a survey (**See Appendix 2**). Employers should consult their utility, electrical contractor, charging equipment provider, and other stakeholders early in the process to identify and discuss potential challenges. For example, special consideration is needed when determining whether to offer charging at workplaces located in leased facilities.

Level 1, Level 2, direct-current (DC) fast charging each offer benefits and require different considerations for workplace charging:

Level 1 stations are less expensive than Level 2 stations, but they charge vehicles at a slower rate and generally may only be used by one vehicle during the standard work day. See Level 1 Electric Vehicle Charging Stations at the Workplace (PDF) for more information.

Level 2 stations are the most commonly used at workplaces and are capable of charging more than one vehicle per day. It is often necessary for organizations to establish policies that encourage employees to share the stations and move their charged vehicles after a certain amount of time.

DC fast charging may be used as part of a strategy to alleviate charging congestion or to allow employees to charge in a very short amount of time. Often, DC fast charging stations are the most expensive to install.

By evaluating goals and needs, employers can select the best workplace solution. Employers seeking to procure charging infrastructure and offer workplace charging must also plan for costs associated with equipment, installation, maintenance, and electricity. See the Estimating EV Charging Infrastructure Costs section of this report for estimating charger installation costs.

Introduction to EV Charging Technology

SOLAR + EV CHARGING

There are emerging use cases that indicate potential advantages of using solar photovoltaics (PV) to power EV charging stations. Some of the potential reasons for integrating solar PV with EV charging include:

Increasing demand for electric vehicle (EV) charging provides an opportunity for market expansion of distributed solar technology

Enabling significant day-time EV charging while minimizing peak load demand on the electric grid and minimizing demand charges.

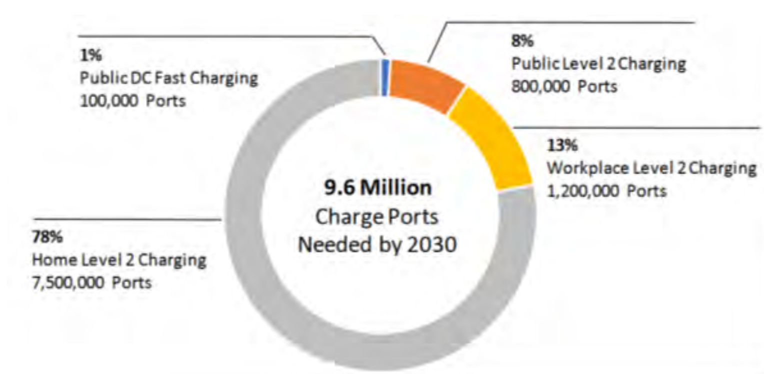
Deploying Solar PV and EV technologies together can improve the performance of both technologies and assist with the integration of higher levels of solar generation on the utility grid. According to the National Renewable Energy Laboratory (NREL), "Installing solar in proximity to EV charging infrastructure can reduce or eliminate demand spikes and increases in peak load caused by daytime charging. In some locations, encouraging daytime charging with solar may displace fossil fuel generation. In all cases, the use of controlled charging, which synchronizes the timing of EV charging to match the production of the solar system, increases the benefits for both technologies."

PROJECTED EV INFRASTRUCTURE NEEDED FOR LA CROSSE—2030

According to the Edison Foundation, Electric Vehicle stock in the United States is projected to reach 18.7 million in 2030, up from slightly more than 1 million at the end of 2018. This means EV's will make up at least 7% of the vehicles on the road by that time.

For the city of La Crosse, based on the 2022 Climate Action Plan, there is a goal to increase battery electric vehicles (BEV's) to over 11,800 owned and operated by La Crosse residents by 2030. Based on the Edison Foundation study, these EV's will require a minimum of 492 public level II charging ports, 801 workplace level II charging ports, and 60 public CD Fast Charging ports.

EV Charging Infrastructure Required in the US by 2030
(serving 18.7 million EV's in use)



AMERICANS WITH DISABILITIES ACT REQUIREMENTS TO CONSIDER FOR EV CHARGING INSTALLATION

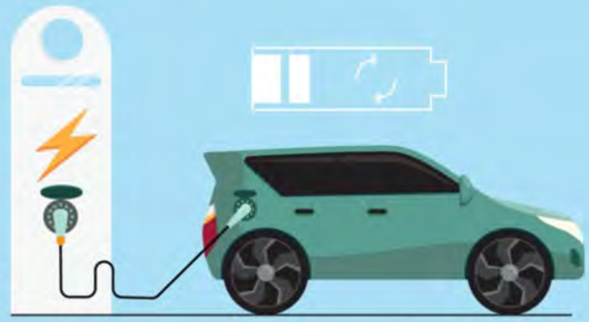
The Americans with Disabilities Act (ADA) is a federal civil rights law that prohibits discrimination in public places – including retail and workplace environments - against individuals with disabilities. Businesses or organizations EV charging stations, also known as electric vehicle supply equipment (EVSE), need to follow special design guidelines to accommodate people with disabilities, as required by the ADA. Although the ADA does not provide design standards for charging station-equipped parking spots, several industry studies and PEV planning guides do.

When planning installations for EV charging stations, consider accessibility, ease of use, and safety for disabled drivers. Key considerations include ensuring adequate space for vehicle access, unobstructed access to the charging equipment and its connections, and clear paths and close proximity to building entrances. A summary of some of the most important applications of ADA considerations for EV equipment are as shown in the table below and illustrated on the following page.

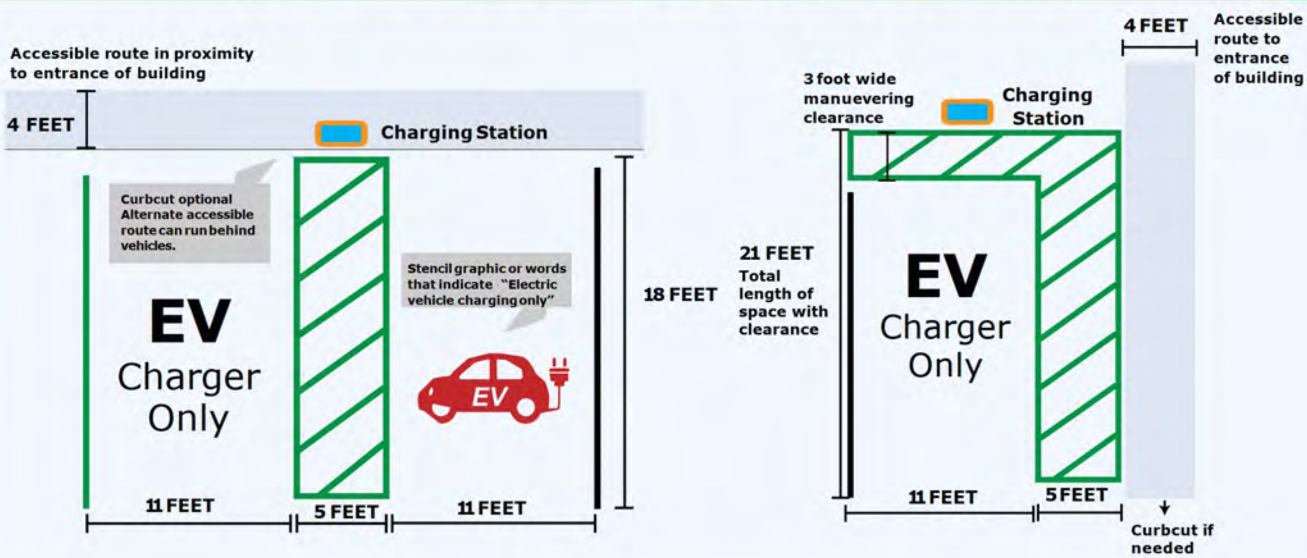
Summary of Important ADA Requirements

Element	ADA/ABA 2004 ANSI A117.1 2003 Guidance
Number of Spaces	**4% of parking spaces, or 1 for every 25 spaces, in any given lot, be designated as accessible; 1 out of every 6 spaces should be van accessible**
Parking Stall	**8x18 feet for a car and 11x18 feet for a van**
Accessible Route	**Width Minimum 36 inches wide**
Accessible Route Slope / Cross Slope	**Maximum 1:20 (5%) running slope and 1:48 (2%) cross slope; Accessible vehicle spaces 1:48 (2%) in all directions and 90-inch clearance for vans**
Reach Range	**48 inches front and side to allow reach to all operable parts from a wheelchair**
Accessible Controls	**Operable with one hand and not requiring grasping, pinching, or twisting of the wrist or force more than 5 lbs. Exception: Gas pumps**
Accessible Ramps	**A ramp or curb-cut must be accessible in order to allow for operation of charging station**
Facility Accessibility	**Must be connected by a minimum of 50-inch-wide accessible route in proximity (not necessarily adjacent) to the entrance of the building**
Side Access	**Aisle Side access aisle of 60 inches wide to allow space for wheelchair and equipment in and out of space**
Accessible Card Reading Devices	**Must be connected by a minimum 50-inch-wide accessible route in proximity (not necessarily adjacent) to the entrance of the building**
Other Considerations	**Ensure that bollards, wheel stops, or curb do not obstruct use of charging station**

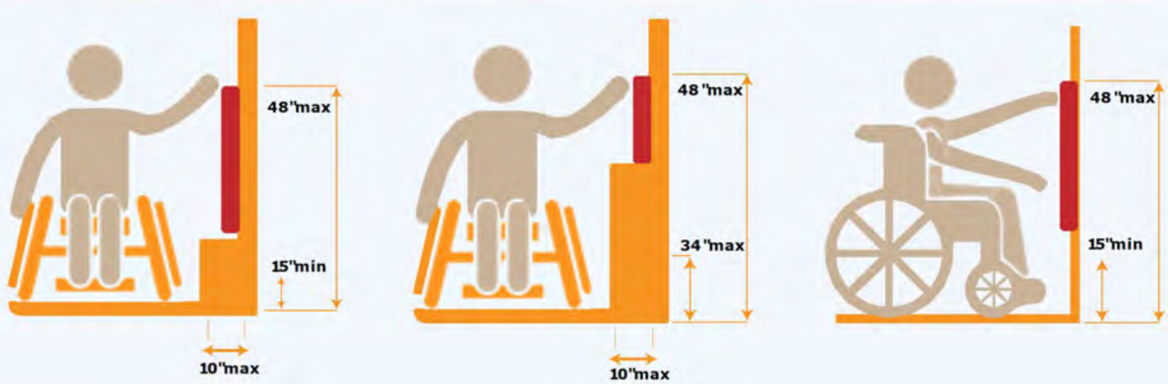
ADA
REQUIREMENTS FOR ELECTRIC VEHICLE CHARGING STATIONS



ONE CHARGING STATION IN 25 MUST BE ACCESSIBLE.
NO LESS THAN 1 IN EACH PARKING FACILITY.



ADA Forward And Side Reach Limits



Section 03

Driving and Maintaining Electric Vehicles

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Driving and Maintaining Electric Vehicles

WHAT ARE THE TYPES OF EV CHARGERS

PEVs are at least as easy to operate and maintain as conventional vehicles, but some special considerations apply.

VEHICLE MAINTENANCE

Because of their differing technologies, all-electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) have different types of required maintenance. Both will require minimal scheduled maintenance to their electrical systems, which can include the battery, electrical motor, and associated electronics.

In general, maintenance needs for hybrid electric vehicles (HEVs) and plug-in hybrid electric vehicles (PHEVs) are similar to those of conventional vehicles. BEVs, however, require less maintenance than conventional vehicles. BEVs typically require less maintenance than conventional vehicles because:

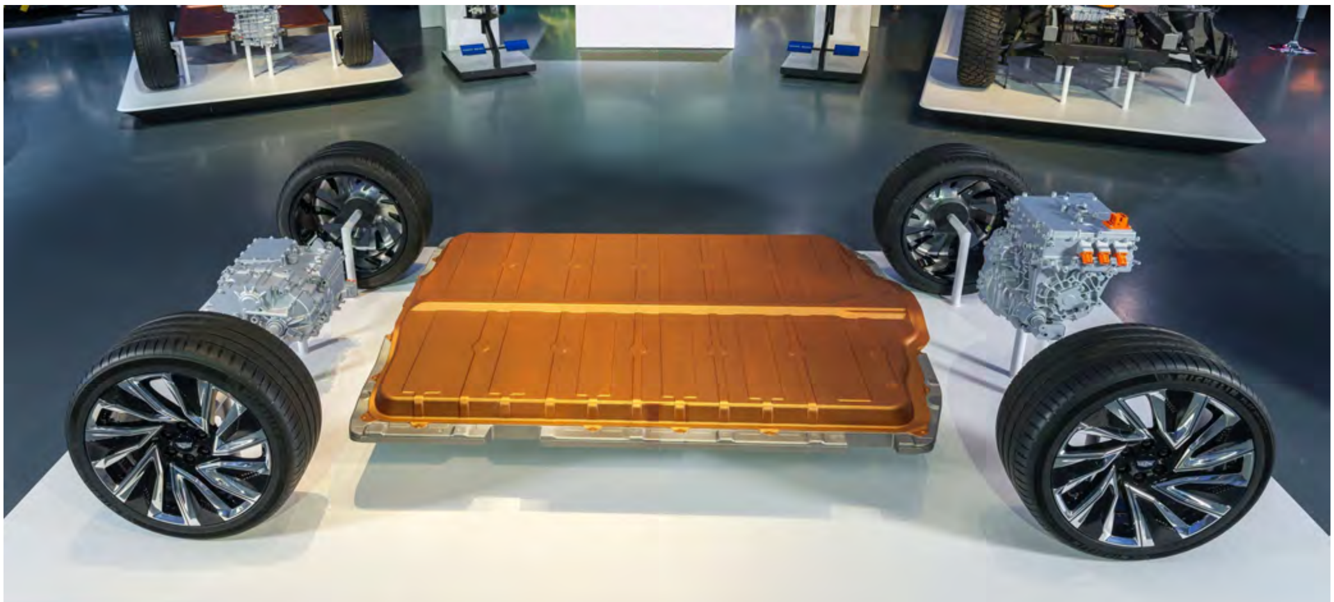
- The battery, motor, and associated electronics require little to no regular maintenance
- There are fewer fluids to change
- Brake wear is significantly reduced due to regenerative braking
- There are far fewer moving parts relative to a conventional gasoline engine.

Driving and Maintaining Electric Vehicles

BATTERY LIFE

Like the engines in conventional vehicles, the advanced batteries in EVs are designed for extended life, but will wear out eventually. Currently, most manufacturers are offering 8-year/100,000-mile warranties for their batteries. Nissan is providing additional battery capacity loss coverage for 5 years or 60,000 miles. Manufacturers have also extended their coverage in states that have adopted the California emissions warranty coverage periods, which require at least 10-year coverage for batteries on partial zero-emissions vehicles (which include EVs).

All electric car batteries will degrade over time, meaning the total amount of energy they can hold will reduce over time. Batteries for BEV's require cooling during operation. Cooling systems are typically either air cooled or liquid cooled (sometimes called "active thermal management"). Air-cooled batteries will experience 3-5% degradation per year, while liquid-cooled batteries will experience 1-2% degradation. Liquid cooled systems may require regular checks. Ask your dealer or refer to your owner's manual for more information.



SAFETY

EVs must undergo the same rigorous safety testing and meet the same safety standards required for conventional vehicles sold in the United States as well as EV-specific standards for limiting chemical spillage from batteries, securing batteries during a crash, and isolating the chassis from the high-voltage system to prevent electric shock. In addition, EVs tend to have a lower center of gravity than conventional vehicles, making them less likely to roll over and often improving ride quality.

One safety concern specific to EVs is their silent operation; pedestrians may be less likely to hear an EV than a conventional vehicle. The National Highway Traffic Safety Administration is studying ways to address this issue, such as requiring EVs to emit audible sounds at low speeds. This option is already available on many EVs, including the Chevrolet Volt and Nissan Leaf. In any case, you should use extra caution when driving your EV in pedestrian areas.

EMERGENCY RESPONSE AND TRAINING

Emergency response for electric-drive vehicles is not significantly different from that of conventional vehicles. Electric-drive vehicles are designed with cutoff switches to isolate the battery and disable the electric system, and all high-voltage power lines are clearly designated with orange coloring. Manufacturers publish emergency response guides for their vehicles and offer training for emergency responders.

The National Fire Protection Association has training and information resources available at http://evsafetytraining.org/ .

EV Tool

Section 04

The Electric Vehicle Market

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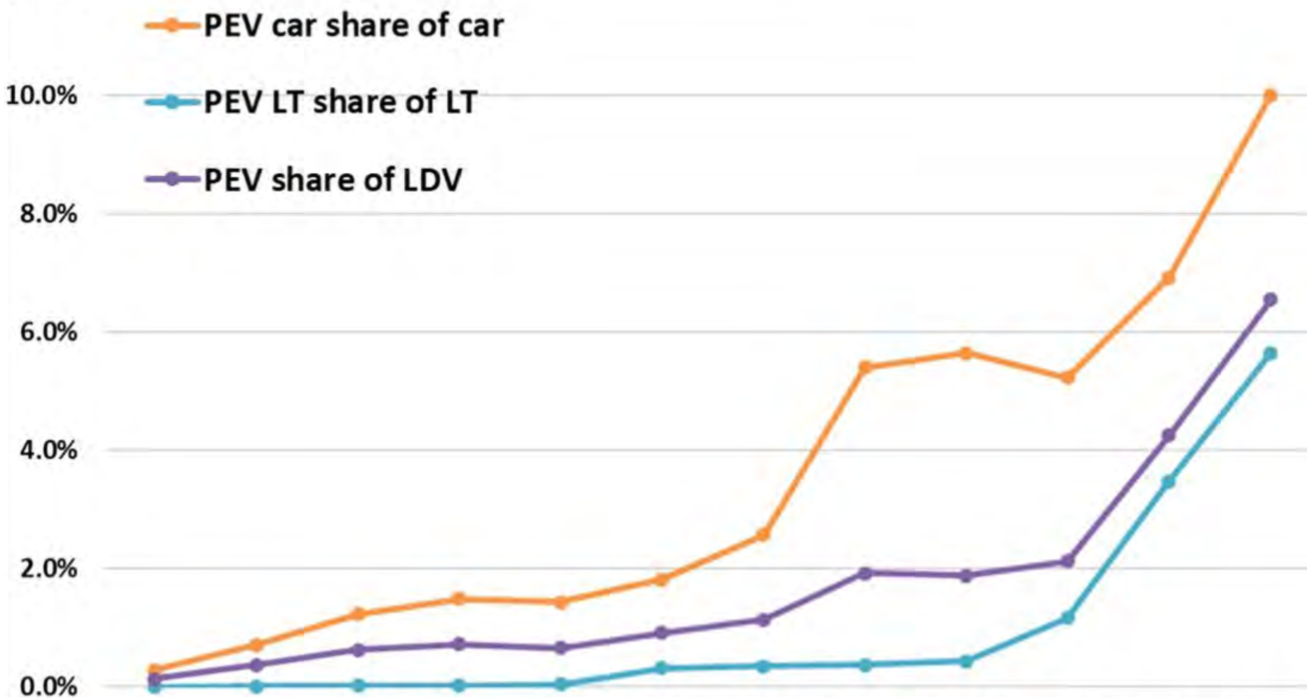
The Electric Vehicle Market

Plug-in electric vehicle sales—which include Plug-in Hybrid (PHEV) and Battery Electric (BEV) - tripled between 2014 and 2018. As of November 2022 their share of the light duty vehicle (LDV) market stood at 6.25 percent in the United States. Manufacturers are continuing to add new electric vehicle models into their range of vehicles offered. As of December 31, 2022, there were 29,120 electric vehicles (BEV and PHEV) registered in the State of Wisconsin. The total stock of electric vehicles in Wisconsin at that time was less than 1.5% of all vehicles registered in the State.

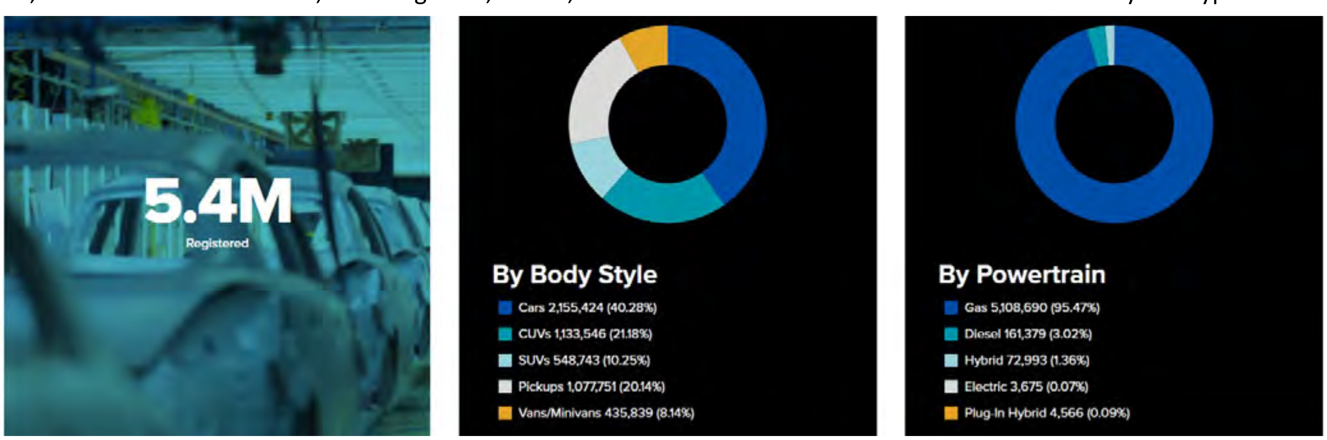
ELECTRIC VEHICLES ON THE ROAD IN THE U.S.



Source: Argonne National Laboratory

ELECTRIC VEHICLES IN WISCONSIN

As of December 31st 2018, there were a total of 5.4 million vehicles registered in the State of Wisconsin. Of those, 81,234 were electric vehicles, including BEVs, PHEVs, and HEVs. See breakdown of Wisconsin vehicles by fuel type below:



Source: Alliance of Automobile Innovation

The Electric Vehicle Market

CHARGING STATIONS IN WISCONSIN

According to US Department of Energy, as of 2022, there were 434 publicly accessible charging stations in the State of Wisconsin. The average charging station had 2.43 charging outlets meaning that there were 11.15 electric vehicles in the State for every one outlet. As outlined below, Wisconsin has slightly more charging locations that the US median, however, the average outlets per location is slightly lower than the US median. Overall, Wisconsin matches the US median for the number of EV's to charging outlets (11.15 EVs to 1 outlet)

State	Charging Locations	Charging Outlets	Outlets Per Location	EV Stock	EVs to Charging Outlets
Wisconsin	434	1,039	2.39	29,120	28.03
U.S Total	49,931	129,237	2.58	1.7 Million	13.15

U.S. ELECTRIC VEHICLE MARKET FORECAST

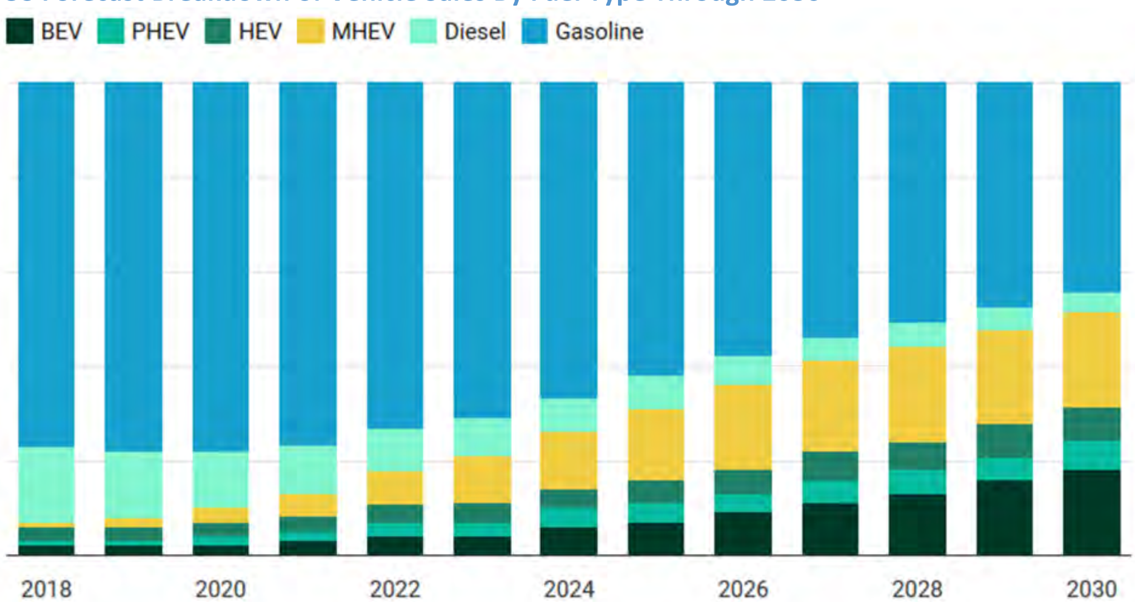
Creating forecasts of when mass adoption will occur is challenging as there are a couple of dozen variables (gas and battery prices, regulations, battery range, charger speed and availability, supply of new EV models, etc.) that can either speed up or slow down EV adoption. As of June 2020, however, sales of electrified vehicles — particularly plug-in hybrids and full battery electrics — are growing faster than expected, according to a new study from Boston Consulting Group (BCG).

The study by BCG projects all forms of electric vehicles will account for 1/3rd of all vehicle sales by 2025 and 52% by 2030. The breakdown, by vehicle type, of the study's projections are to the right:

US Forecast Breakdown of Vehicle Sales By Fuel Type Through 2030

Year	2020	2025	2030
BEV	2%	7%	18%
PHEV	2%	4%	6%
HEV	3%	5%	7%
MHEV	3%	15%	20%
Diesel	12%	7%	4%
Gasoline	78%	62%	44%

US Forecast Breakdown of Vehicle Sales By Fuel Type Through 2030



Projections except for 2018 and 2019
BEV = battery electric; PHEV = plug-in hybrid electric; HEV = full hybrid electric; MHEV = mild hybrid electric
Source: BCG analysis

Section 05

Electric Vehicle Fleet Use Cases

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Electric Vehicle Fleet Use Cases

Fleet electrification brings widespread benefits. As more companies that operate fleets consider electrification, fleet customers and their electric companies have an opportunity to partner to ensure that these benefits are realized. Currently, EVs require greater initial investment than traditional fleet vehicles. However, fuel cost savings can be significant. Managing the cost of electricity is an important factor in the total cost of ownership. Making sure the EV selected is a good fit for your use case is key to a successful fleet transition to electric.

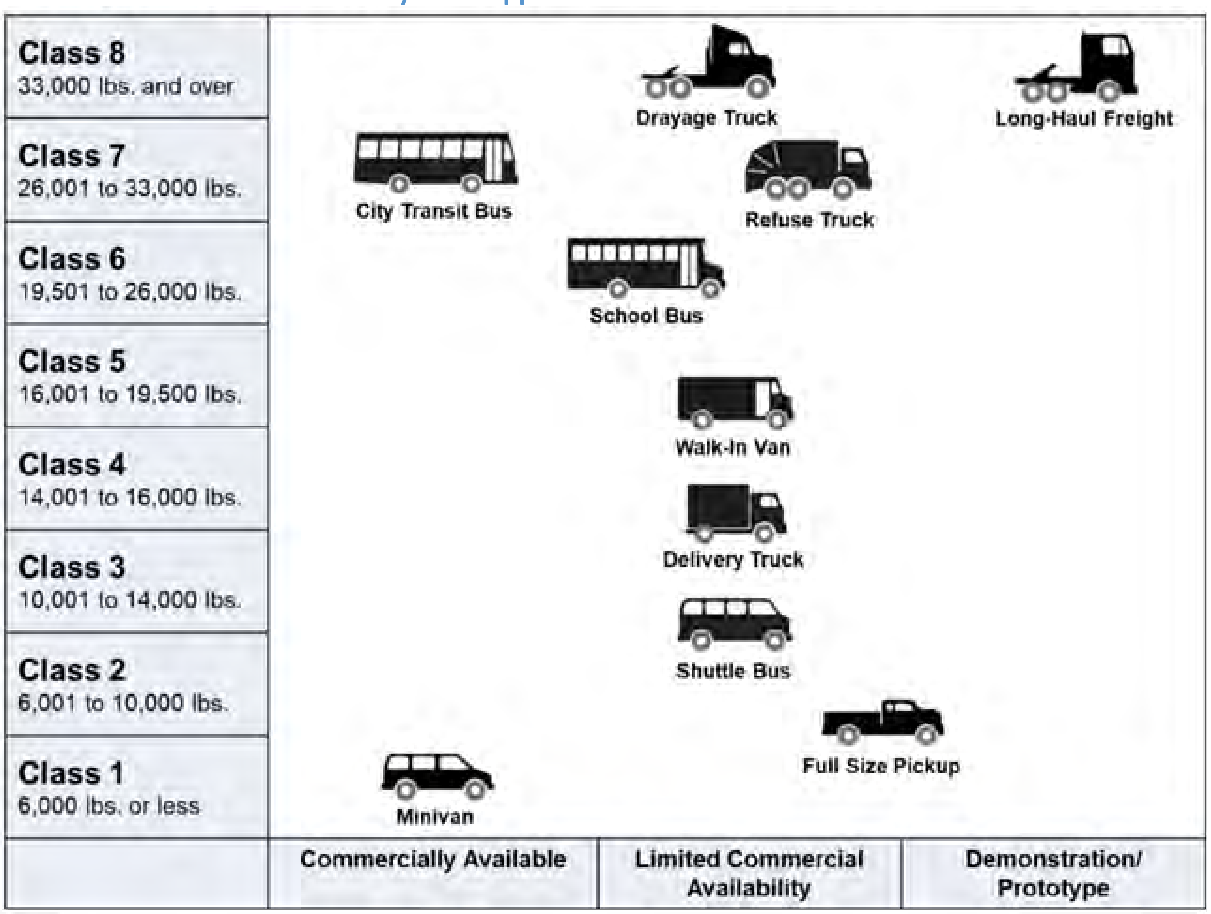
MAKE SURE THE EV SELECTED IS A GOOD FIT FOR YOUR USE CASE

Not every fleet application is a good fit for electrification today. Some of the factors that contribute to a fleet operating profile that is well-suited to electrification include:

- Return-to-base: Fleets may find it easier to charge their EVs at their own facilities instead of relying on limited public charging infrastructure.
- Fixed routes with relatively short daily mileage: EVs currently are better suited for routes that operate within a well-defined range, with enough downtime to allow for the battery to charge.
- High utilization scenarios: Applications with high vehicle utilization (high annual mileage) help maximize fuel costs savings to achieve a favorable TCO.

These factors help explain why electric transit buses have seen such success to date. Transit buses typically drive 35,000 miles per year within fixed routes, which helps transit agencies significantly reduce their fuel costs. As manufacturers continue to invest in EV technology and to overcome challenges related to battery weight and range, more applications will move from demonstration and limited commercial availability to full commercialization, as illustrated conceptually below:

States of EV Commercialization By Fleet Application



Source: Edison Electric Institute in collaboration with the American Public Power Association and the National Rural Electric Cooperative Association

Electric Vehicle Fleet Use Cases

FLEET TRANSITION PLANNING

Planning is a crucial part of transitioning fleets to electric vehicles. An Electric Vehicle (EV) transition strategy, and fleet adoption plans, should account for the political and organizational buy-in and the financial and budgetary concerns that an organization faces before they can map out a plan to transition to EV's. The EV Transition Plan should include the following components:

Fleet Inventory Baseline

Establish a clear fleet inventory. The inventory should include existing stock, annual fleet fuel consumption, and currently known vehicle replacements scheduled.

EV Suitability Assessment

An Electric Vehicle Suitability Assessment (EVSA) is an assessment that will help fleet managers**:**

- select the right vehicles for starting the EV transition
- Identify vehicles covering distances that are currently EV range capable
- and select vehicles that make the most financial sense.

This foundational assessment will support the creation of the EV Transition Plan. The EVSA delivers the data analysis needed to make the case on the best way to transition the fleet to electric in a way that makes sense for PIIC's budget and time frame.

Ideally, the EVSA should use data collected through telematics monitoring installed within fleet vehicles over an appropriate monitoring period (typically 3 months except for specialty seasonally used vehicles). A telematics device is a vehicle tracking device installed in a vehicle that allows the remote sending, receiving and storing of vehicle utilization characteristics data.   Telematics solutions provide access to a rich set of data points that can be used to refine the accuracy of such an EV assessment.

EV Tool

An example of vehicle telematic device monitoring for use in EVSA are those provided by GeoTab (https://www.geotab.com/fleet-management-solutions/evsa/)

EV Transition Plan

Based on the information and recommendations collected in the Fleet Inventory and Suitability Assessment, an EV transition plan should be drafted to identify the strategies and timescales to transition the fleet to EV's cost effectively through EV purchases over a span of years. The plan's focus should be to help fleet management and other decision makers determine the fiscal impact of an EV deployment in each year and establish plans for subsequent years.

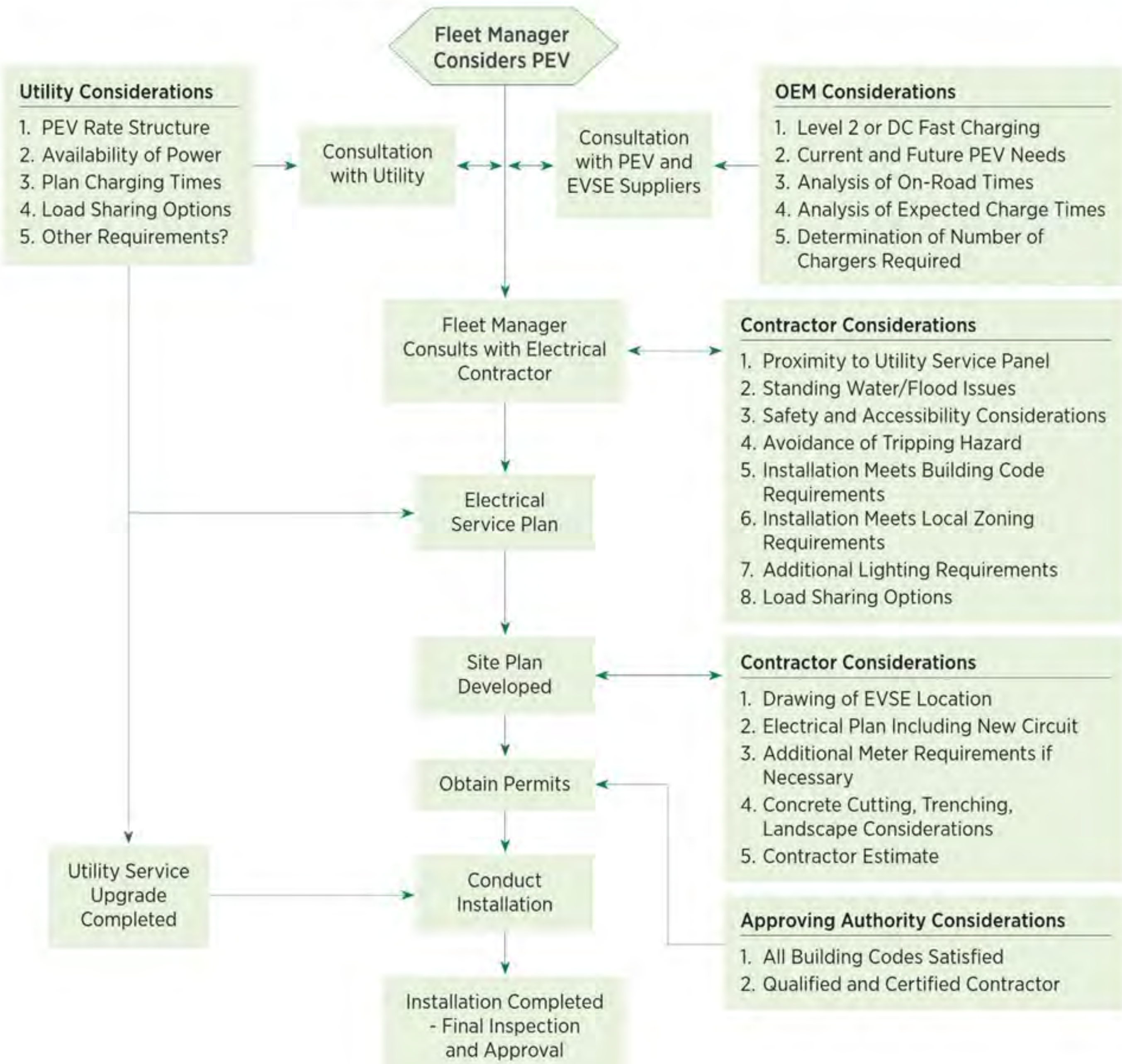
The EV Transition plan should include an identification of vehicles compatible with conversion to EV, as well as vehicles whose utilization may be met through other alternative fuels like hydrogen. The plan should provide an identification of specific vehicle options available on the market to meet the vehicle use profiles. The plan will also include an overview and comparison of fuel and operational costs, vehicle replacement costs, emissions reductions, and other impacts.

Electric Vehicle Fleet Use Cases

ELECTRIC VEHICLE SUPPLY EQUIPMENT FOR FLEETS

Fleets that choose to incorporate BEVs and/or PHEVs into their operations must consider several factors when planning for charging stations—also known as Electric Vehicle Supply Equipment (EVSE). Peak demand, duty cycles, garaging locations, vehicle models, and availability of off-site public charging stations can all factor into decisions about the number, location, and type(s) of charging units. Planners, fleet managers, and utilities can work together with installers to determine the best locations. The chart below summarizes the process for installing fleet EVSE.

General Process for Installing EVSE at a Fleet Facility



Source: U.S Department of Energy

Electric Vehicle Fleet Use Cases

KEY PLANNING CONSIDERATIONS FOR FLEET CHARGING

Thorough planning is essential to successful installation of fleet Electric Vehicle Service Equipment (EVSE). The following are important considerations.

Number and Type of EVSE Units:
Determine your EVSE requirements by estimating your fleet's needs over at least the next several years. This should include projected PEV acquisitions and potential changes in PEV technologies and charging requirements (e.g., switching from PHEVs to EVs). If you are considering eventual expansion of your PEV fleet, consider adding extra circuits, electrical capacity, and conduit from the electrical panel to future EVSE locations. It is usually less expensive to install extra panel and conduit capacity during initial construction than to modify the site later. Analyze your fleet's electricity and charging-time needs by plot-ting electricity-use and time requirements for all of your PEVs. This will enable you to assess electrical-upgrade needs and choose the appropriate number and type of EVSE units, in consultation with your utility and the manufacturers of the PEVs and EVSE you are using.

Convenience:
Locate EVSE and associated PEV parking as close as possible to the electric service while accommodating other activities within your fleet's facility. Keep in mind that PEVs can be parked for hours at a time for charging.

Avoiding Hazards:
Cords and wires associated with EVSE should not interfere with pedestrian traffic or present tripping hazards. PEV charging spaces should not be located near potentially hazardous areas.

Ventilation:
Although most of today's advanced batteries do not require ventilation during charging, some older types emit gases during charging. If PEVs are charged with these types of batteries in an enclosed space, there must be adequate ventilation, which may include installation of fans, ducts, and air handlers. Depending on the installation, the National Electrical Code may also require ventilation. Verify the requirements with the PEV manufacturer's documentation.

Battery Temperature Limits:
Because some PEV batteries have operating- and charging-temperature limits, EVSE may need to be located within an enclosed, climate-controlled area in extreme climates.
Pooled Water and Irrigation: EVSE is designed to operate safely in wet areas. However, users will be more comfortable if it is not located where water pools or where irrigation systems spray.

Preventing Impact:
Curbs, wheel stops, and setbacks should be used to prevent PEVs from colliding with EVSE. However, accessibility issues must also be considered when using these strategies.

Vandalism:
Assess the risk of vandalism and mini-mize risk through use of preventive strategies, such as motion detectors, security lighting, tamper alarms, and locked enclosures.

Signage:
Use signs that can be seen over parked vehicles to designate PEV-only parking spaces.

Accessibility:
Evaluate and address requirements for complying with the Americans with Disabilities Act, as well as state, local, and organizational accessibility policies. Compliance measures may include adjusting connector and receptacle heights, cutting curbs, and providing handicap-accessible parking spaces

Section 06

Site and Building EV Readiness Standards

(Excerpt from City of La Crosse Net Zero Energy Building Guide)

This section outlines strategies and approaches to designing new buildings or building expansions "Electric Vehicle Ready". EV Ready means that the building and site are designed to support the anticipated increased electric vehicle utilization.

According to the Edison Foundation, Electric Vehicle stock in the United States is projected to reach 18.7 million in 2030, up from slightly more than 1 million at the end of 2018. This means EV's will make up at least 7% of the vehicles on the road by that time. For the city of La Crosse, based on the 2022 Climate Action Plan, there is a goal to increase battery electric vehicles (BEV's) to over 11,800 owned and operated by La Crosse residents by 2030. Based on the Edison Foundation study, these EV's will require a minimum of 492 public level II charging ports, 801 workplace level II charging ports, and 60 public CD Fast Charging ports.

The average mileage driven per household in La Crosse is 22,624 miles annually (2019). Just as with gasoline cars, some electric vehicles are more efficient than others, and the average EV needs 28 to 32 kWh of electricity to power the vehicle for 100 miles. This means that each electric vehicle will require 2,800 KWh annually, assuming average annual driver mileage and average EV KWh per 100 miles driven.

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Section 07

Estimating EV Charging Infrastructure Costs

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Estimating EV Charging Infrastructure Costs

EV Charging infrastructure costs for home installations and public/workplace installations vary. There are a number of variables that can effect the cost of charger installations including the condition and capacity of the building's existing electrical system as well as contractor availability, familiarity with EV infrastructure, proximity to the site, and level of competition. Below is an overview of typical EV charging infrastructure installation costs for residential and workplace/ public applications based on a 2019 nationwide study by the International Council on Clean Technologies. Federal and state laws and incentives as well as utility incentives can provide discounts that lower residential, workplace and public charging costs. Please see the Incentives section of this report for more.

WORKPLACE/PUBLIC EV CHARGING INFRASTRUCTURE COSTS

Workplace/Public EV charging infrastructure outlined here look at the hardware costs and installation costs separately. To estimate the total infrastructure costs, simply combine the hardware costs and installation costs.

Workplace/Public EV Charging Hardware Costs

Public and workplace charging infrastructure hardware costs include the charger and its pedestal. The main cost drivers are the power of the unit, in kW; whether it requires a pedestal; and whether it is networked with communication or payment gathering capability.

EV Tool

Per Charger Public and Workplace Hardware Costs

Level	Type	Chargers per pedestal	Per-charger cost
Level 1	Non-networked	One	$813
Level 1	Non-networked	Two	$596
Level 2	Non-networked	One	$1,182
Level 2	Non-networked	Two	$938
Level 2	Networked	One	$3,127
Level 2	Networked	Two	$2,793
DC fast	Networked 50 kW	One	$28,401
DC fast	Networked 150 kW	One	$75,000
DC fast	Networked 350 kW	One	$140,000

Source: International Council on Clean Technologies

Workplace/Public EV Charging Installation Costs

Installation costs are composed of labor, materials, permits, taxes, and utility upgrades. These are based on the most recent and detailed cost estimates among the various investigations into costs for nonresidential infrastructure, including a study by the Electric Power Research Institute (EPRI) of 637 sites with 1,294 Level 2 charging units, including disaggregated costs for labor, materials, permits, and taxes. Costs for DC Fast Chargers (DCFC) are based on studies by the Rocky Mountain Institute and a study by Hajo Ribberink, Larry Wilkens, Raed Abdullah, Matthew McGrath, and Mark Wojdan.

Estimating EV Charging Infrastructure Costs

EV Tool

Installation Costs for Level 2 Public and Workplace Chargers

		1 charger per site	2 chargers per site	3-5 chargers per site	6+ chargers per site
Average Costs Outside California	Labor	$1,544	$1,827	$1,647	$1,316
	Materials	$1,112	$1,039	$1,272	$874
	Permit	$82	$62	$59	$38
	Tax	$96	$89	$110	$75
	Total	**$2,836**	**$3,020**	**$3,090**	**$2,305**

Source: International Council on Clean Technologies

Installation Costs for DC Fast Chargers

EV Tool	50 kW				150 kW				350 kW			
	1 charger per site	2 chargers per site	3-5 charger per site	6-50 chargers per site	1 charger per site	2 chargers per site	3-5 chargers per site	6-20 chargers per site	1 charger per site	2 chargers per site	3-5 chargers per site	6-10 chargers per site
Labor	$19,200	$15,200	$11,200	$7,200	$20,160	$15,960	$11,760	$7,560	$27,840	$22,040	$16,240	$10,440
Materials	$26,000	$20,800	$15,600	$10,400	$27,300	$21,840	$16,380	$10,920	$37,700	$30,160	$22,620	$15,080
Permit	$200	$150	$100	$50	$210	$158	$105	$53	$290	$218	$145	$73
Taxes	$106	$85	$64	$42	$111	$89	$67	$45	$154	$123	$92	$62
Total	$45,506	$36,235	$26,964	$17,692	$47,781	$38,047	$28,312	$18,577	$65,984	$52,541	$39,097	$25,654

Source: International Council on Clean Technologies

Similar to Level 2 charging, installation costs per charger fall as more chargers are installed per site. Also, costs do not rise proportionally with power so a charger with triple the power does not result in triple the cost.

RESIDENTIAL EV CHARGING INFRASTRUCTURE COSTS

Home charging hardware and installation is typically less expensive than for public chargers. Costs for residential charging hardware can vary based on housing type – attached home, detached home, and multifamily apartment. For the residential infrastructure costs outlined below, hardware and installation costs are included, and installation is composed of labor, materials, taxes, utility upgrades, and permits.

EV Tool

Installation And Hardware Costs for Home Chargers

Home charging category	Detached house	Attached house	Apartment
Level 1 outlet upgrade	$400	$500	$600
Level 1 charger upgrade	$700	$800	$900
Level 2 outlet upgrade	$680	$2,000	$3,300
Level 2 charger upgrade	$1,400	$2,800	$4,100

Source: International Council on Clean Technologies

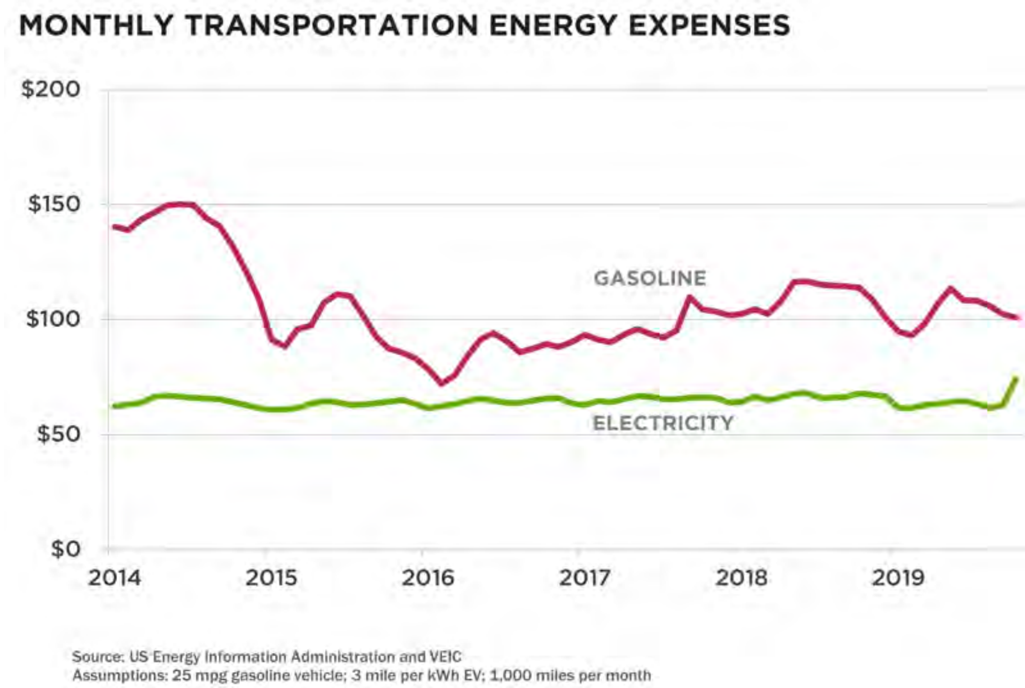
Section 08

Estimating Electric Vehicle Power Consumption

Click to Return to TOC

Estimating Electric Vehicle Power Consumption

Operational costs for electric vehicles are lower—both in terms of maintenance costs as well as fuel costs. Within the United States, on average, the fuel costs for EV's is roughly half that of fuel costs for traditional gasoline vehicles. Perhaps one of the most valuable considerations is the relative cost consistency of operating an EV compared to the much more volatile gasoline market prices. The chart below compares the national average fuel costs for gasoline vehicles against electric vehicles since 2014.

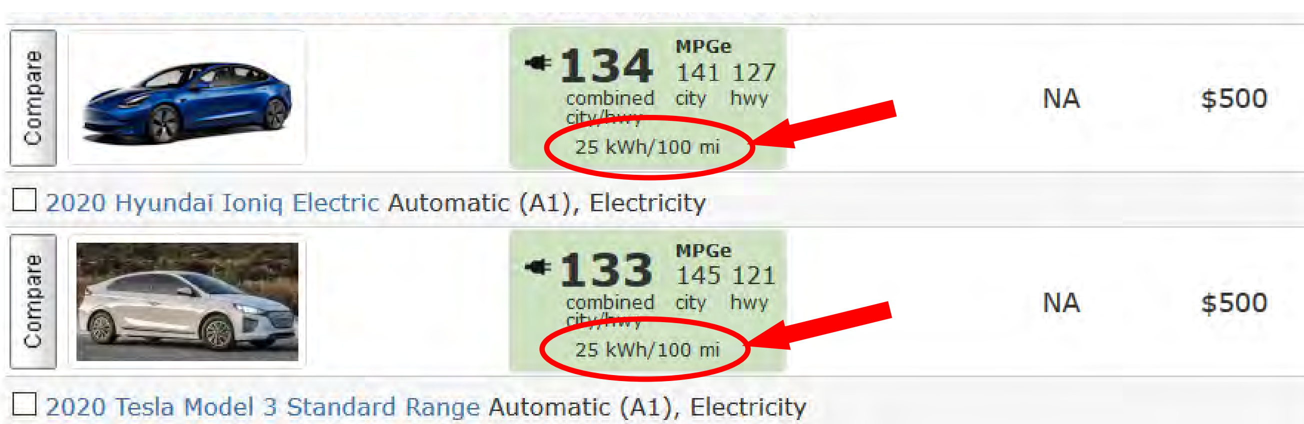


Although operating costs should be much less for electric vehicles—whether for an individual, household, or commercial/ governmental fleet—anticipating the electrical consumption of BEVs and PHEVs is an important initial step in planning a transition.

DETERMINING VEHICLE RATED FUEL ECONOMY

EV Tool

Identifying the rated fuel economy of the electric vehicle to be used is key to determining both daily and annual electric consumption. The rated fuel economy of all electric vehicles sold in the United States can be found here: https://www.fueleconomy.gov/feg/alternatives.shtml As shown below, use this tool to identify the vehicle's rated economy as indicated in kWh/100 miles.



Estimating Electric Vehicle Power Consumption

ESTIMATING EV ELECTRIC CONSUMPTION FOR INDIVIDUALS/HOUSEHOLDS

Estimating an EV's typical daily consumption supports determining the amount of daily charge time that will be needed for a vehicle's use and can help in selecting the correct vehicle and charger equipment. Meanwhile, estimating the total annual electrical consumption of the anticipated use of a vehicle supports estimating annual operational costs and savings compared to a typical gasoline vehicle.

EV Tool

Calculating Typical Daily Electrical Consumption

Understanding typical daily consumption is important for determining the vehicle range needed to support daily use as well as anticipating daily charge time needed. Typical daily consumption should be based on the miles traveled on a typical day—this may include commute to work or school as well as typical daily errands. To calculate the estimated typical daily electricity consumption to operate an EV divide the typical daily milage by 100, then multiply by vehicle's rated electric consumption in kWh/100 miles:

(Note: if you have only the vehicle's MPGe rating convert here: 3370.5 / ______ = ______ kWh/100 miles)

MPGe

______ ÷ 100 × ______ = ______

Typical **daily** miles driven | Rated electric consumption **(kWh/100 miles)** | Typical daily kWh consumption

EV Tool

Estimating Typical Daily Charge Time

Anticipating the typical daily charge time can help evaluate how charger options will fit a vehicle's use. To calculate the estimated typical daily charge time divide the typical daily kWh consumed by the charger's hourly KW capacity.

Step 1—Calculate the charger's hourly KW capacity multiply the charger's rated amps by the operational voltage and divide by 1000:

______ × ______ ÷ 1000 = ______

Charger's rated Amps | Charger operational voltage | Charger's rated KW/hour

Note—If the Charger's rated Amps and operational voltage is not yet known simply select the type of charger from the drop down list:

______ = ______

Select charger type above | Estimated rated KW/hour

Step 2—Divide the Typical Daily kWh consumption by the charger's rated KW/Hour capacity (or the estimated rated KW/hour capacity):

______ ÷ ______ = ______

Typical daily kWh consumption | Enter Charger's rated KW/hour or Estimated rated KW/hour from above | Hours of charging daily

EV Tool

Calculating Annual Electrical Consumption

Anticipating total annual consumption can help project total annual fuel cost for operating the electric vehicle annually. Annual consumption should be based on the total anticipated annual miles driven which will include longer trips or special uses in addition to the typical daily use. To calculate the estimated annual electricity consumption to operate an EV divide the estimated annual milage by 100, then multiply by vehicle's rated electrical fuel economy in kWh/100 miles (note to translate a vehicle's a vehicle's economy in kWh/100 miles see above):

______ ÷ 100 × ______ = ______

Estimated Annual miles driven | Rated electric consumption **(kWh/100 miles)** | Estimated annual kWh consumption

Estimating Electric Vehicle Power Consumption

ESTIMATING EV ELECTRIC CONSUMPTION FOR WORKPLACES

As with EV's owned by individuals or households, estimating the typical daily and annual electricity consumption for workplaces can help plan for energy consumption and anticipated charge times. For workplaces, the EV's that may need to be planned for include EV fleets operated by the organization, EV's used by employees for their personal transportation to and from the workplace, and EV's used by visitors and guests of the organization. To determine the requirements of any individual fleet use case, fleet managers can use the calculations included in the Estimating EV Electric Consumption For Individuals/Households section.

FLEETS

EV Tool

Calculating Typical Daily Electrical Consumption For EV Fleet

Typical daily consumption should be based on the miles traveled on a typical day for all vehicles in the Fleet. To calculate the estimated typical daily electricity consumption of the EV fleet multiply the average EV typical daily miles driven by the total number of EV's in the fleet, then divide by 100 and multiply by average vehicle rated electric consumption in kWh/100 miles:

(Note: if you have only the vehicle's MPGe rating convert here: 3370.5 / _____ = kWh/100 miles)

MPGe

________ × ________ ÷ 100 × ________ = ________

Ave typical **daily** miles driven | Total number of EVs in fleet | Ave rated electric consumption **(kWh/100 miles)** | Typical daily kWh consumption for fleet

EV Tool

Estimating Typical Daily Charge Time For EV Fleet

Anticipating the typical daily charge time can help evaluate how charger options will fit a vehicle's use. To calculate the estimated typical daily charge time divide the typical daily kWh consumed by the charger's hourly KW capacity.

Step 1—Calculate the charger's hourly KW capacity multiply the charger's rated amps by the operational voltage and divide by 1000:

________ × ________ ÷ 1000 = ________

Charger's rated Amps | Charger operational voltage | Charger's rated KW/hour

Note—If the Charger's rated Amps and operational voltage is not yet known simply select the type of charger from the drop down list:

________ = ________

Select charger type above | Estimated rated KW/hour

Step 2—Divide the Typical Daily kWh consumption for fleet by the charger's rated KW/Hour capacity (or the estimated rated KW/hour capacity):

________ ÷ ________ ÷ ________ = ________

Typical daily kWh consumption for fleet | Total number of EVs in fleet | Charger's rated KW/hour | Hours of charging daily per vehicle in fleet

Estimating Electric Vehicle Power Consumption

FLEETS (continued)

EV Tool

Estimating Fleet EV Charger Station Requirements

Determining the optimal number of chargers required for an EV fleet depends on a number of variables including operational parameters such as if vehicle rotation will be possible during charging, whether vehicle operations occur during the same "shifts" or if vehicles have staggered use, etc. Individual vehicles may also have significantly different use cases and charging requirements which also need to be reflected in a final determination of EV charger stations. The calculations provided here, however, enable an initial, high-level estimation of charger infrastructure that might be required to serve a fleet. A more detailed assessment incorporating the parameters outlined above should be conducted prior to finalizing EV fleet infrastructure plans.

Number of EV 2 plug chargers required to serve fleet if fleet requires charging over a single period of time each day and if vehicle rotation is not possible during recharging timeframe:

________ (Total number of EVs in fleet) ÷ 2 plugs/charger = ________ (Chargers Required by Fleet)

Estimating number of 2 plug chargers required to serve fleet when more than one recharging period is available daily or when vehicle rotation is possible requires us to first estimate how many EVs will need to be charged per period and the number of possible vehicle rotations that can occur per charging period.

Step 1—Calculate the number of EVs to be charged per period:

________ (Total number of EVs in fleet) ÷ ________ (Recharging periods available per day) = ________ (EVs recharged per period)

Step 2—Calculate the number of vehicle rotations possible per recharging period:

________ (Ave length of each available recharging period (hours—must be equal to or greater than "hours of charging daily per vehicle in fleet" or charger capacity must be increased)) ÷ ________ (Hours of charging daily per vehicle in fleet) = = ________ (Rotations possible per recharging period (rounded down to closest whole number))

Step 3—Calculate the number of chargers required by fleet:

________ (EVs recharged per period) ÷ ________ (Rotations possible per recharging) ÷ 2 plugs/charger = ________ (Chargers Required by Fleet)


E
V

Estimating Electric Vehicle Power Consumption

FLEETS (continued)

EV Tool

Calculating Annual Electrical Consumption For EV Fleet

Anticipating total annual consumption can help project total annual fuel costs for operating the electric vehicle fleet annually. Annual consumption should be based on the total anticipated annual miles driven which will include longer trips or special uses in addition to the typical daily use. To calculate the estimated annual electricity consumption to operate an EV divide the estimated annual milage by 100, then multiply by vehicle's rated electric consumption in kWh/100 miles:

(Note: if you have only the vehicle's MPGe rating convert here: 3370.5 / ______ = kWh/100 miles)
MPGe

______ × ______ ÷ 100 × ______ = ______

Estimated Annual miles driven per EV × Total number of EVs in fleet ÷ 100 × Ave rated electric consumption **(kWh/100 miles)** = Estimated annual kWh consumption for fleet

SERVING EMPLOYEE EVs

Determining the EV infrastructure appropriate to serve employee EV use is driven by a number of variables. How many employees currently drive EV's, how many anticipate switching to EV's in the future, the number of BEV's vs PHEV's being used, the average commute distance to the workplace, the length of time each employee's vehicle has for recharging all are important in determining the appropriate type and quantity of EV charging infrastructure that should be made available for employee use. The process for establishing appropriate electric vehicle infrastructure for employees should begin with a Workplace EV Survey. Please see **Appendix 2 for an example Workplace EV Survey** for use in beginning the process.

EV Tool

SERVING PUBLIC AND VISITOR EVs

Communities are beginning to establish EV infrastructure requirements for multi-family, commercial, and government facilities as a part of their parking ordinances. In communities which do not yet have ordinance requirements, the EV charging recommendations by facility use below may be used in estimating infrastructure to serve the public and facility visitors:

EV Tool

Land Use Type	Percentage of Parking Spaces
Multi-household residential	5-10%
Lodging	3-5%
Retail, eating and drinking establishment	1%
Office, medical	3%
Industrial	1%
Institutional, municipal	3%
Recreational/entertainment/cultural	1%
Other	3%

Section 09

Electric Vehicle Buying Guide

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Electric Vehicle Buying Guide

Many people hear the words electric vehicle and expensive immediately comes to mind. This association contributes to the perception that electric vehicles are only accessible to wealthy people. In reality, the two-dozen electric vehicle models available on the market have diverse price and size options. Changing the perception of electric vehicles from expensive to accessible to all income levels will help bring the benefits of cleaner, lower cost transportation to more households, as well as accelerate the transition away from fossil fuels. As with any vehicle purchase, you should assess your driving requirements and price range, then compare your requirements with the available PEVs.

DETERMINE YOUR DRIVING REQUIREMENTS

Many of your PEV driving requirements are similar to what they would be for any vehicle. Do you want two seats or four? A sedan or a hatchback? A commuter car or a long-distance cruiser? But PEVs raise other questions as well. Most importantly, do you want an EV, which typically drives about 100 miles on electricity, or a PHEV, which may have a shorter all-electric range but can use gasoline for extended driving?

EV Tool

Compare the fuel economy and range of PEVs and conventional vehicles using the Find A Car widget here: https://palebluedot.llc/llbo-ev

COMPARING THE TYPES OF ELECTRIC VEHICLES

As noted in the Introduction to EV technology section, the design of the most common electric vehicle powertrains has split into three classes: BEV, PHEV, and HEV. Below are the common pros and cons for each type to help determine the most appropriate approach for your driving needs and goals

Hybrid Electric Vehicle (HEV) Advantages and Disadvantages

Advantages

- Fast and easy fill-ups at any gas station
- Most inexpensive type of electrified vehicle
- No need to think about plugging in
- No issues for apartment dwellers

Disadvantages

- Not as much gas-saving potential as a plug-in hybrid
- A hybrid's gas engine tends to be meek and lack powe
- No rated electric range
- Not as energy-efficient as an electric car
- Need to change oil and look after the engine
- Lacks an EV's drive-away smoothness and silence
- Initial acceleration feels weak by comparison

Plug-in Hybrid Electric Vehicle (PHEV) Advantages and Disadvantages

Advantages

- Can function as an EV during a typical weekday commute
- Run it out of electricity and it'll keep going
- Gasoline engine allows for road trips
- Federal and state tax incentives may offset higher cost (than HEV)

Disadvantages

- Costs more than a regular hybrid
- Not enough electric driving range to fully avoid gasoline
- Need to regularly plug it
- Space taken up by the powertrain may compromise space or functionality of vehicle (models vary)

Electric Vehicle (BEV) Advantages and Disadvantages

Advantages

- Zero tailpipe emissions
- Smooth, immediate and quiet acceleration with no shifting
- Little regular upkeep apart from tires and wipers
- Per-mile electricity costs less than gasoline
- No need to stop at gas stations

Disadvantages

- Range anxiety is a concern because it takes time to recharge
- You must plug it in (and may need a 240-volt home station depending on your use case and vehicle)
- Difficult for renters to manage charging
- Long trips require finding fast-charging stations
- More expensive to buy

Electric Vehicle Buying Guide

CONSIDERING ELECTRIC RANGE

With BEV vehicles "range anxiety" is often talked about. Range Anxiety is the fear that a vehicle has insufficient range to reach its destination and would thus strand the vehicle's occupants. The concern is considered to be one of the major barriers to large scale adoption of all-electric cars. Studies indicate that the perception of range anxiety diminishes with vehicles of 200 miles of electric range or more. Further, a 2020 study by AAA indicated that 95% of EV owners reported they have never run out of range while driving and, more importantly, 75% of owners just charge their cars at home. This underscores the reality for most vehicles which is that few will be driven through a full 200 mile range in a single day. In fact, the average EV driver goes 39 miles per day. Understanding the electric range of vehicle options, however, is critical in determining the right option.

When buying a battery-electric vehicle (BEV), there is only one range figure provided – the total electric range on a full battery charge. Current lower-end BEVs like the Nissan Leaf and Hyundai Ioniq typically have a range between 100-200 miles, mid-level BEVs typically have a range of 200-300 miles, and premium BEVs typically have a range of 300 miles or more.

When buying a plug-in hybrid (PHEV), several range figures are commonly provided: electric range, gas range, and combined range. Electric range is the distance you can travel on energy stored in the battery and the gas range is how far you could travel if the battery was empty but the gas tank was full. The combined range is the sum of those two figures. PHEVs typically have ranges of 230-400 miles before you need to refill the gas tank, battery or both.

Comparison of Electric Range of Types of Electric Vehicles

Electric Vehicle Type	Power Source	Travel Range (miles)
Battery Electric Vehicle (BEV)	Electric Motor	80 – 345
Plug-in Hybrid Electric Vehicle (PHEV)	Electric Motor + Gasoline Engine	350 – 600
Hybrid Electric Vehicle (HEV)	Electric Motor + Gasoline Engine	350 – 600
Fuel Cell Electric Vehicle (FCEV)	Electric Motor	300 – 350

SELECTING THE RIGHT TYPE OF ELECTRIC VEHICLE FOR YOUR NEEDS

As outlined above, the key to selecting the right type of electric vehicle begins with understanding your driving needs, the advantages and disadvantages of each type of EV and their electric range. To explore further how well a BEV, HEV, or PHEV would fit your typical daily driving needs, use the University of California's EV Explorer tool. This calculator is an interactive tool to explore which type of EV is right for a particular use case. The calculator will indicate the cost of operation differences for any daily commute of up to four vehicles including BEV, HEV, and PHEV options.

EV Tool

Find the EV Explorer tool here:
https://gis.its.ucdavis.edu/evexplorer/#!/locations/start

BATTERY TECHNOLOGY AND WARRANTIES

All electric car batteries will degrade over time, meaning the total amount of energy they can hold will reduce over time. However, studies based on the first generation of mass-market-ready EV's which have been retired off their first leases are finding that battery degradation may be slower than thought. Although no BEV's are 'unusable' after their first few years, the BEV's that experience non-negligible degradation tend to be ones that have battery packs that are air cooled and have been driven in areas with extreme temperature swings. Air cooled battery technology is not as effective as liquid-cooling (sometimes called "active thermal management") at preventing battery degradation. Air-cooled batteries will experience 3-5% degradation per year, while liquid-cooled batteries will experience 1-2% degradation.

Almost all EV manufacturers provide a battery warranty, however, the quality of these warranties vary. Warranties on the market differ in the number of years or miles that the warranty covers as well as variations in coverage when ownership changes and what battery issues are covered. Some warranties only cover catastrophic issues ("my car won't charge") while the better ones cover excessive degradation. Currently, the industry standard warrantee tends to be no more than 30% degradation over 10 years while current industry-leading warranties cover 10 years and 100,000 miles.

Electric Vehicle Buying Guide

LEASE VS BUY NEW VS BUY USED

Understanding the advantages and disadvantages of leasing, buying new, and buying used vehicles is particularly important for determining the correct option for electric vehicle purchases.

Leasing

As purchase prices of brand-new cars continue to rise, more drivers are opting to lease instead of purchase their new cars. As with most lease agreements, leasing an EV typically involves a smaller down payment and lower monthly payments compared to financing a brand-new car because lease payments are calculated according to how much value the car will lose during the contract period. In addition, any federal or state tax credits typically get applied to the transaction price to reduce the monthly lease payments even further.

Because modern electric powertrain technology is still relatively new and rapidly evolving, new engineering innovations are constantly arriving. One potential advantage of leasing an EV instead of buying is that it allows you to trade in the model out for a newer version every couple of years ensuring you have the latest EV technology. Trading in a purchased EV is still an option, however, the credit received is frequently lower than what leases may provide.

The biggest maintenance cost of owning an electric vehicle is replacing the battery. It can cost multiple thousands of dollars and usually happens 8-10 years into its life. Leasing an EV allows a driver to avoid this maintenance concern by returning the car well before battery replacement may be an issue.

Buying New

Buying the vehicle could be a better choice for users who intend to drive the EV for as long as possible and want full control of it. The longer you own an EV, the more value you get from your investment (once you pay off the remaining balance). If you purchase an electric vehicle, you may be eligible to receive a substantial state or federal tax credit. Monthly payments are typically higher than a lease agreement, however, you'll receive the full tax credit within your first year of ownership on your next income tax return.

Buying an EV allows buyers to avoid constraints and restrictions that may come from a lease agreement. Leasing an electric vehicle typically comes with certain restrictions such as capping monthly mileage, and prohibiting major modifications to the car.

Because of how rapidly electric vehicles depreciate in value, there's a chance that purchasing one brand-new could result in owing more on the vehicle than it's worth if the length of ownership is not long enough. To avoid this it is important to make certain that the model purchased is one that is projected to retain its value in line with your ownership plans.

Buying Used

Edmunds has found that most EVs lose their value more quickly than do comparable gas-powered vehicles. This means that buying a recently manufactured, used EV may offer opportunities to save initial purchase costs. The increased value reduction pace may be caused by a few factors including the Federal EV Tax Credit which is not available on a used EV, consequently this is reflected in the market values. An important consideration in purchasing a used EV is battery performance and anticipated battery life. As noted above, EV batteries can degrade from 1-5% per year. Depending on the specific vehicle, this may be negligible or very significant when considering a used EV. EV batteries can be replaced, and when a replacement occurs, typically receive a battery warrantee equal to a new vehicle. Anticipating the timeframe and costs for a battery replacement of a used EV may be important in determining if a used purchase is the right choice for your needs.

This means that buying a recently manufactured, used EV may offer opportunities to save initial purchase costs.

Electric Vehicle Buying Guide

VEHICLE AVAILABILITY

PEVs are widely available today, and the number of available models continues to grow. For information on currently available PEVs, see the AFDC Light-Duty Vehicle Search (https://afdc.energy.gov/vehicles/search/). There are PEVs available to meet the needs of a wide range of consumers, from luxury vehicles to small compact vehicles. To find currently available and new and upcoming PEVs, visit FuelEconomy.gov. It is important to note that when new PEV models are first released, they may only be available in certain markets or at particular dealerships. However, availability typically increases over time. Models that have been on the market for some time can often be found everywhere in the country.

PRICES AND INCENTIVES

Purchase prices for today's PEVs can be considerably higher than for similar conventional vehicles, though the prices for PEVs are coming down quickly as the technology improves. For information on current prices, see the AFDC's Vehicle Cost Calculator (https://afdc.energy.gov/calc/). While the up-front cost may be high, drivers are typically able to reduce the overall cost of owning a PEV through lower operating costs (see the PEV Benefits section), as well as incentives (see Incentives section)

FIND AN ELECTRIC VEHICLE

For new EVs, see all the specs by downloading the latest Midwest EV Info List from Shift 2 Electric (https://www.shift2electric.com/evinfolist) With the help of the list you can focus on the vehicles that fit your use case and budget. Specific Electric Vehicle models can be compared using the US Department of Energy's Car Finder Tool (https://www.fueleconomy.gov/feg/findacar.shtml)

Once you've identified the appropriate models you can then explore the following for leasing, buying new, and buying used:

EV Tool

Exploring Current Lease Agreements:
https://electrek.co/best-electric-vehicle-leases/

EV Tool

Buying New
Then check out Cars.com (https://www.cars.com/) to see which dealers have the models that you are interested in and go to test drive all of them before making any decisions.

EV Tool

Buying Used:
https://www.myev.com/cars-for-sale

E B A T
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EURO

Section 10

Incentives

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Incentives

There are a number of incentives supporting the purchase of electric vehicles and electric vehicle charging infrastructure. Below are current incentives at the Federal, State, and local utility levels relative to the City of La Crosse.

FEDERAL INCENTIVES

Federal tax credits are available for purchasing qualified vehicles and installing charging equipment. As of January 2022, the Clean Vehicle Tax Credit and the Alternative Fuel Infrastructure Tax Credit are the two primary Federal tax credits benefiting conversion to Electric Vehicle use.

Clean Vehicle Tax Credit

The federal Internal Revenue Service (IRS) Clean Vehicle Tax Credit is available for PEV purchases of qualified vehicles. The tax credit is up to $7,500 per new PEV purchase. The Inflation Reduction Act of 2022 changed the rules for this credit for vehicles purchased from 2023 to 2032. The credit is available to individuals and their businesses. To qualify, the vehicle must be bought for use rather than resale and must be used primarily in the US. Buyers must also meet household adjusted gross income (AGI) criteria.

For more information see:
https://www.irs.gov/credits-deductions/credits-for-new-clean-vehicles-purchased-in-2023-or-after

For the index of qualified manufacturers and vehicles see:
https://www.irs.gov/credits-deductions/manufacturers-and-models-for-new-qualified-clean-vehicles-purchased-in-2023-or-after

Alternative Fuel Infrastructure Tax Credit

Beginning January 1, 2023, fueling equipment for natural gas, propane, hydrogen, electricity, E85, or diesel fuel blends containing a minimum of 20% biodiesel, is eligible for a tax credit of 30% of the cost or 6% in the case of property subject to depreciation, not to exceed $100,000. Permitting and inspection fees are not included in covered expenses. Eligible fueling equipment must be installed in locations that meet the following census tract requirements:

- The census tract is not an urban area;
- A population census tract where the poverty rate is at least 20%; or
- Metropolitan and non-metropolitan area census tract where the median family income is less than 80% of the state medium family income level.

Eligible projects must also meet apprenticeships and prevailing wage requirements.

Consumers who purchase qualified residential fueling equipment between January 1, 2023, and December 31, 2032, may receive a tax credit of up to $1,000.

STATE OF WISCONSIN INCENTIVES

The State of Wisconsin has a few of incentives relative to electric vehicle transition including:

Wisconsin's National Electric Vehicle Infrastructure (NEVI) Planning

The U.S. Department of Transportation's (DOT) NEVI Formula Program requires the Wisconsin Department of Transportation (WisDOT) to submit an EV Infrastructure Deployment Plan (Plan) to the DOT and U.S. Department of Energy (DOE) Joint Office by August 1, 2022, describing how the state intends to distribute NEVI funds. Plans must be established according to NEVI guidance.

For more information about Wisconsin's NEVI planning process, see the WisDOT Electrification of Wisconsin website. For more information about Wisconsin's NEVI plan, see the Joint Office's State Plans for EV Charging website.

Incentives

Links:
US DOT NEVI: https://afdc.energy.gov/laws/12744
WisDOT https://wisconsindot.gov/Pages/projects/multimodal/electrification.aspx
Joint Office: https://driveelectric.gov/state-plans/

Heavy-Duty Transit Bus Grants
The Wisconsin Department of Administration (DOA) offers grants for the replacement of eligible public transit buses. Funding is available for the replacement and scrapping of model year 1992-2009 heavy-duty public transit buses with new replacement diesel or alternative fueled buses. The program is funded by Wisconsin's portion of the Volkswagen Environmental Mitigation Trust. For more information, including how to apply, see the DOA VW Mitigation Program website.
Renewable Fuel Producer Excise Tax and Inspection Exemption

The first 1,000 gallons of renewable fuel that an individual produces each year are exempt from the motor vehicle fuel excise tax, the petroleum inspection fee, and any petroleum inspection requirements not required under federal law. These exemptions only apply if the fuel is used in the individual's personal vehicle and is not sold. An individual may also produce renewable fuel for personal use without a business tax registration certificate or a motor vehicle fuel tax license. For more information see the Wisconsin Department of Revenue Motor Vehicle Fuel Tax website:
https://www.revenue.wi.gov/Pages/FAQS/ise-mofuel.aspx
(Reference Wisconsin Statutes 78.01(2n) and 168.05(6))

Vehicle Battery and Engine Research Tax Credits
A corporation involved in qualified research is eligible for a tax credit equal to 11.5% of the qualified research expenses that the corporation incurs in Wisconsin during the taxable year. Qualified research includes, but is not limited to, automotive batteries for use in hybrid electric vehicles that improve the efficiency of electricity use, and research related to designing internal combustion engines for vehicles, including expenses related to designing vehicles that are powered by such engines and improving production processes for such engines and vehicles. For the purpose of the tax credit, internal combustion engines include fuel cell, electric, and hybrid electric vehicles. Corporations may claim an additional tax credit equal to 5% of the amount paid or incurred during the taxable year to construct and equip new facilities or expand existing facilities used in Wisconsin for qualified research. For more information see the Wisconsin Department of Revenue Research Credits website:
https://www.revenue.wi.gov/Pages/Businesses/incentives-research.aspx
(Reference 71.28(4)(ab)(2), 71.28(4)(ad), and 71.28(5)(ad))

Clean Diesel Grant Program
The Wisconsin Department of Natural Resources (DNR) provides U.S. Environmental Protection Agency Diesel Emission Reduction Act (DERA) funding for projects that reduce diesel emissions in Wisconsin. Funding for 25% to 100% of eligible projects costs is available to businesses, nonprofits, and public entities that reduce diesel emissions by replacing engines, retrofitting exhaust controls, purchasing new vehicles, or installing idle reduction equipment. Eligible projects include school buses, transit buses, and non-road engines, equipment, or vehicles. For more information, including funding amounts and application details, see the DNR Clean Diesel Grant Program website.
https://dnr.wisconsin.gov/Aid/CleanDiesel.html

Alternative Fuel Tax Refund for Taxis
A person using alternative fuel to operate a taxi used to transport passengers may be reimbursed for the cost of the Wisconsin state fuel tax. Refund claims must be filed within one year of the fuel purchase date and must be for a minimum of 100 gallons of alternative fuel.
(Reference Wisconsin Statutes 78.75(1m)(a)(1) and 78.75(1m)(b))

Incentives

Alternative Fuel Tax Exemption
A county, city, village, town, or other political subdivision may not levy or collect any excise, license, privilege, or occupational tax on motor vehicle fuel, alternative fuels, or the purchase, sale, handling, or consumption of motor vehicle fuel or alternative fuels.
(Reference Wisconsin Statutes 78.82)

Idle Reduction and Natural Gas Vehicle (NGV) Weight Exemption
Any vehicle or combination of vehicles equipped with fully functional idle reduction technology may exceed the state's gross and axle weight limits by up to 550 pounds (lbs.) to compensate for the additional weight of the idle reduction technology. To qualify, the vehicle operator must be able to prove the weight of the idle reduction technology with written certification and demonstrate that the idle reduction technology is fully functional at all times.

NGVs may exceed the weight limits by an amount equal to the difference of the weight of the natural gas tank and fueling system and the weight of a comparable diesel tank and fueling system or by up to 2,000 lbs., whichever is less.
(Reference Wisconsin Statutes 348.15(3)(f) and 348.15(3)(h))

Biodiesel Fuel Use Incentive for Schools
The Wisconsin Department of Public Instruction (DPI) may provide school districts financial aid to cover the incremental cost of purchasing biodiesel to operate school buses, as compared to the cost of petroleum diesel fuel. If in any fiscal year insufficient funds are available to provide school districts with the full amount of reimbursement for which a school district qualifies, DPI will prorate the available funds among the entitled school districts on a per pupil basis. For more information, see the Wisconsin Public Service Commission's Office of Energy Innovation Funding website.
(Reference Wisconsin Statutes 121.575)

Wisconsin Renewable Energy and Energy Storage Programs
The Wisconsin Public Service Commission's Office of Energy Innovation (OEI) offers grant opportunities and programs to support the development of renewable energy and energy storage technology. Eligible activities include, but are not limited to, comprehensive energy planning for fleets and electric vehicles. For more information, see the OEI Energy Innovation Grant Program website.
https://psc.wi.gov/Pages/ServiceType/OEI/EnergyInnovationGrantProgram.aspx

ELECTRIC UTILITY INCENTIVES

Electric utilities frequently offer incentives supporting the transition to electric vehicles. The following are incentives currently offered by electric utilities within the City of La Crosse:

Xcel Energy

Xcel Energy offers multiple charging infrastructure and rate programs to incentivize EV use including:

Electric Vehicle (EV) Time-Of-Use (TOU) Rates
Xcel Energy offers TOU rates to residential customers that own an EV. For more information, see the Xcel Energy EV Accelerate at Home website: https://ev.xcelenergy.com/ev-accelerate-at-home-wi

Electric Vehicle (EV) Charging Station Incentive
The Xcel Energy EV Accelerate at Home program offers to install and maintain Level 2 EV charging stations at residential locations. Participants will also be enrolled in a TOU rate for electricity used to charge EVs. For more information, including how to apply, see the Xcel Energy EV Accelerate at Home website: https://ev.xcelenergy.com/ev-accelerate-at-home-wi

Section A1

Appendix A1:
Glossary of Terms

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Glossary of Terms

AC: Alternating Current

AFV: Alternative Fuels Vehicle

AEV: All Electric Vehicle

BEV: Battery Electric Vehicle

CCS: Combined Charging System

CNG: Compressed Natural Gas

DC: Direct Current

DCFC: Direct Current Fast Charging

DSO: Distribution System Operator

EV: Electric Vehicles

EVI: Electric Vehicle Initiative

EVSE: Electric Vehicle Supply Equipment

FCEV: Fuel Cell Electric Vehicles

GHG: Greenhouse Gas

HDV: Heavy-duty Vehicle

HEV: Hybrid Electric Vehicle

ICEs: Internal Combustion Engines

kW: Kilowatt

LNG: Liquified Natural Gas

LSEV: Low-speed Electric Vehicle

MURB: Multi-unit Residential Building

MVI: Manufacturers' Vehicle Inventory

NMHC: Non-methane Hydrocarbons

NOx: Nitrogen Oxide

OEM: Original Equipment Manufacturer

PHEV: Plug-in Hybrid Electric Vehicle

PM: Particulate Matter

PSPC: Public Services and Procurement Canada

TCO: Total Cost of Ownership

ULEV: Ultra-low Emission Vehicle

VAC: Volts Alternating Current

ZEV: Zero Emission Vehicle

.

Section A2

Appendix A2:

EV Tool

Workplace EV Survey

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Sample Employee Survey for Workplace Charging Planning

Batter electric vehicles (BEVs) and plug-in hybrid electric vehicles (BHEV) use electricity as either their primary fuel or to improve fuel efficiency. Dozens of BEV and PHEV models are available with more added each year, expanding driver options. We are considering the installation of charging infrastructure to assist employees who drive BEVs and PHEV's to work. Your responses to this survey will be used to determine employee interest in this benefit.

Participation in this survey is voluntary and you do not need to respond to any of the questions that you do not wish to answer.

Visit the Department of Energy's website to learn more about Plug-In Vehicle Electric Vehicles (http://www.afdc.energy.gov/vehicles/electric.html).

1. If you drive to work, approximately how far is your trip (one way)?
   - ○ a. Less than 10 miles
   - ○ b. 10-25 miles
   - ○ c. 26-50 miles
   - ○ d. More than 50 miles

2. Throughout the workday, what is your usual travel pattern?
   - ○ a. I stay at the worksite and do not move my vehicle
   - ○ b. I leave the worksite and move my vehicle once per day
   - ○ c. I leave the worksite and move my vehicle more than once per day

3. Do you own or are you considering purchasing or leasing an electric or plug-in hybrid electric vehicle?
   - ○ a. Yes, I already own one
   - ○ b. Yes, I'm considering purchasing in the next 6 months
   - ○ c. Yes, I'm considering purchasing in 12-24 months
   - ○ d. Yes, I'm considering purchasing but I'm not sure when
   - ○ e. No

4. If yes, what type of vehicle are you most interested in?
   - ○ a. Plug-in hybrid electric vehicle (ex. Chevy Volt, Ford C-MAX energi, etc.)
   - ○ b. Electric vehicle (ex. Nissan Leaf, BMW i3, etc.)

5. Do you or would you have the ability to install a charging station at your residence?
   - ○ a. Yes
   - ○ b. No
   - ○ c. I don't know

6. Should our organization install electric vehicle charging stations at your employee parking garage/lot?
   - ○ a. Yes
   - ○ b. No

7. If our organization installs electric vehicle charging stations at your facility, would you use them?
   - ○ a. Yes
   - ○ b. No

Sample Employee Survey for Workplace Charging Planning

8. What is the most you would be willing to pay for use of the charging stations?
   - ○ a. $0 per charging session
   - ○ b. $0-$2 per charging session
   - ○ c. $2-$4 per charging session
   - ○ d. $4-$6 per charging session
   - ○ e. More than $6 per charging session
   - ○ f. N/A because I will not ever use the charging stations

9. Would having access to an electric vehicle charging station at your employee parking garage/lot increase the probability that you would purchase an electric or plug-in hybrid electric vehicle in the future?
   - ○ a. Yes
   - ○ b. No

10. Are you interested in offering continued feedback as part of a designated task force on workplace charging?
    - ○ a. Yes If "yes" please enter your name and email below:
    - ○ b. No

Thank you for your participation in this survey!

Section A3

Appendix A3:

EV Tool

US EV Availability List

December 2022

Source:

https://www.shift2electric.com/evinfolist

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American Lung Association. Clean Air Choice. | MINNESOTA CLEAN CITIES

Manufacturer										Range			Charging speed (miles/hr)			Performance				
Make	Model	Photo	Seating	EV Type	FWD/ RWD/ AWD	Base MSRP	Federal tax credit	Price after federal tax credit	Battery size (kWh)	Electric Range (miles)	Total Range (miles)	Charging rates (kW) L2/DCFC	Level 1 120V	Level 2 240V	DCFC 400+V	MPGe/ MPG	Top Spd (mph)	0-60 mph (sec)	Towing capacity (lbs)	Crash Ratings: IIHS/NHTSA
Audi	**Q4 e-tron**		5	BEV	AWD	$48,800	TBD	**$48,800**	82	241	241	11/125	3	31	282	95	112	5.8	2600	Not Rated
Audi	**Q4 Sportback e-tron**		5	BEV	AWD	$56,800	TBD	**$56,800**	82	241	241	11/125	3	31	282	95	112	5.8	2600	Not Rated
Audi	**e-tron (S)**		5	BEV	AWD	$70,800	TBD	**$70,800**	95	222	208-222	9.6/150	3	22	278	78	124-130	4.3-5.5	4000	Top Safety Pick +/ Not rated
Audi	**e-tron Sportback (S)**		5	BEV	AWD	$74,000	TBD	**$74,000**	95	218	218	9.6/150	3	22	274	77	124-131	4.3-5.6	4000	Top Safety Pick +/ 5 star
Audi	**e-tron GT**		5	BEV	AWD	$104,900	TBD	**$104,900**	93	238	238	9.6/270	3	23	292	82	155	3.1-3.9	0	Not Rated
Audi	**Q5 TFSI e**		5	PHEV	AWD	$55,400	TBD	**$55,400**	17.9	20	390	7.4	2	14	N/A	61/26	130	5	4400	Top Safety Pick +/ Not rated
BMW	**i4**		5	BEV	WD/ AW	$55,900	TBD	**$55,900**	81	227-301	227-301	11/195	4	33	462.908	80-109	140	3.7-5.5	0	Not Rated
BMW	**i7**		5	BEV	AWD	$119,300	TBD	**$119,300**	106	318	318	11/195	4	33	411.9881	89	130	4.5	0	Not Rated
BMW	**iX**		5	BEV	AWD	$84,100	TBD	**$84,100**	112	315-324	315-324	11/195	3	28	393.4718	83-86	124	3.6-4.4	0	Not Rated
BMW	**X5 xDrive45e**		5	PHEV	AWD	$65,700	TBD	**$65,700**	24	31	400	3.7	2	5	N/A	50/20	130	5.3	0	Top Safety Pick + / Not rated
BMW	**330e**		5	PHEV	RWD/ AWD	$43,300	TBD	**$43,300**	12	23	320	3.7	3	8	N/A	75/28	130	5.6	0	Top Safety Pick / Not rated
BMW	**530e**		5	PHEV	RWD/ AWD	$55,550	TBD	**$56,400**	12	21	350	3.7	2	8	N/A	69/27	146	6	0	Top Safety Pick + / Not rated
BMW	**745e**		5	PHEV	AWD	$95,900	TBD	**$95,900**	12	16	290	3.7	2	6	N/A	56/22	155	4.9	0	Not rated / Not rated

Manufacturer										Range			Charging speed (miles/hr)			Performance				
Make	Model	Photo	Seating	EV Type	FWD/ RWD/ AWD	Base MSRP	Federal tax credit	Price after federal tax credit	Battery size (kWh)	Electric Range (miles)	Total Range (miles)	Charging rates (kW) L2/DCFC	Level 1 120V	Level 2 240V	DCFC 400+V	MPGe/ MPG	Top Spd (mph)	0-60 mph (sec)	Towing capacity (lbs)	Crash Ratings: IIHS/NHTSA
Chevrolet	**Bolt EV**		5	BEV	FWD	$25,600	TBD	**$25,600**	65	259	259	11.5/50	4	41	142	120	98	6.5	0	Top Safety Pick / 5 star
Chevrolet	**Bolt EUV**		5	BEV	FWD	$27,200	TBD	**$27,200**	65	247	247	11.5/50	4	39	136	115	98	7	0	Not rated
Chrysler	**Pacifica Hybrid (PHEV)**		7	PHEV	FWD	$46,978	TBD	**$46,978**	16	33	570	6.6	3	16	N/A	84/32	107	7.8	0	Top Safety Pick / 5 star
Ford	**Escape PHEV**		5	PHEV	FWD	$35,455	TBD	**$35,455**	14.4	37	520	5	4	15	N/A	105/40	85	8.8	1500	Top Safety Pick / Not rated
Ford	**F-150 Lightning**		5	BEV	AWD	$51,974	TBD	**$51,974**	98-131	230-320	230-320	11.6-19.6 /150	2	24-40	249	66-70	110	3.9	7700-10,000	Not Rated
Ford	**Mustang Mach-E**		5	BEV	RWD/ AWD	$54,975	TBD	**$54,975**	76-99	247-314	247-315	11/ 115-150	3	30	331	82-103	124	3.5-6.1	0	Top Safety Pick / Not rated
Hyundai	**Ioniq 5**		5	BEV	RWD/ AWD	$39,950	TBD	**$39,950**	58-77	220-303	220-303	11/199	4	35	503	98-114	115	5.2-8.0	1650	Not Rated
Hyundai	**Kona EV**		5	BEV	FWD	$34,000	TBD	**$34,000**	64	258	258	7.2/75	4	26	214	120	124	6.6	0	Top Safety Pick + / 5 star
Hyundai	**Santa Fe PHEV**		5	PHEV	AWD	$40,000	TBD	**$40,000**	13.8	31	440	3.3	4	20	N/A	76/33	123	8.4	2000	Not Rated
Hyundai	**Tucson PHEV**		5	PHEV	AWD	$35,400	TBD	**$35,400**	13.8	33	420	7.2	4	20	N/A	80/35	130	7	2000	Not Rated
Jaguar	**I-PACE**		5	BEV	AWD	$71,300	TBD	**$71,300**	90	234	234	7.0/100	3	16	180	76	124	4.5	0	Not rated
Jeep	**Wrangler 4xe**		5	PHEV	AWD	$53,995	TBD	**$53,995**	17.4	22	370	7.7	2	11	N/A	49/20	100	6	3500	Not Rated
Jeep	**Grand Cherokee 4xe**		5	PHEV	AWD	$60,260	TBD	**$60,260**	17.4	26	470	7.7	2	13	N/A	56/23	100	6	6000	Not Rated

This table is updated by Jukka Kukkonen, Shift2Electric. Photos and information sources: Manufacturers' websites and www.fueleconomy.gov **Get the latest version: www.EVInfoList.com**

Manufacturer										Range			Charging speed (miles/hr)			Performance				
Make	Model	Photo	Seating	EV Type	FWD/ RWD/ AWD	Base MSRP	Federal tax credit	Price after federal tax credit	Battery size (kWh)	Electric Range (miles)	Total Range (miles)	Charging rates (kW) L2/DCFC	Level 1 120V	Level 2 240V	DCFC 400+V	MPGe/ MPG	Top Spd (mph)	0-60 mph (sec)	Towing capacity (lbs)	Crash Ratings: IIHS/NHTSA
Kia	**EV6**		5	BEV	WD/ AW	$48,500	TBD	**$48,500**	58-77	206-310	232-310	11/200	4	36	527	105-117	120-161	3.4-8.0	2300	Not Rated
Kia	**Niro EV**		5	BEV	FWD	$39,450	TBD	**$39,450**	64	253	253	7.2/75	4	24	199	112	104	7.5	0	Top Safety Pick + / 4 star
Kia	**Niro PHEV**		5	PHEV	FWD	$33,740	TBD	**$33,740**	11.1	33	560	3.3	4	10	N/A	105/46	107	9	0	Top Safety Pick + / 4 star
Kia	**Sorento PHEV**		6	PHEV	AWD	$49,890	TBD	**$49,890**	13.8	32	460	7.2	4	22	N/A	79/34	123	8.4	2000	Not Rated
Kia	**Sportage PHEV**		5	PHEV	AWD	$38,490	TBD	**$38,490**	13.8	34	430	7.2	4	22	N/A	84/35	107	7.1	2000	Not Rated
Land Rover	**Range Rover Sport PHEV**		5	PHEV	AWD	$83,000	TBD	**$83,000**	12.4	19	480	7.4	2	9	N/A	42/19	140	5.7	0	Not Rated
Land Rover	**Range Rover PHEV**		5	PHEV	AWD	$104,500	TBD	**$104,500**	12.4	19	480	7.4	2	9	N/A	42/19	137	6.4	0	Not Rated
Lexus	**NX 450h+**		5	PHEV	AWD	$57,705	TBD	**$57,705**	18.1	37	550	3.3-6.6	3	16	N/A	84/36	124	6	2000	Not Rated
Lincoln	**Corsair Grand Touring (PHEV)**		5	PHEV	AWD	$51,810	TBD	**$51,810**	14.4	28	430	6.6	3	15	N/A	78/33	121	7	2000	Not Rated
Lincoln	**Aviator Grand Touring (PHEV)**		7	PHEV	AWD	$69,910	TBD	**$69,910**	13.6	21	460	6.6	2	11	N/A	56/23	145	5	5600	Top Safety Pick / Not rated
Lucid	**Air**		5	BEV	AWD	$87,400	TBD	**$87,400**	118	471-520	471-520	19/300	4	69	876	116-131	167	2.5-3.1	0	Not Rated
Mercedes	**EQS**		5	BEV	WD/ AW	$102,310	TBD	**$102,310**	108	340-350	340-350	9.6/200	3	27	456	95-97	130	3.4-5.9	0	Not Rated
Mini	**Cooper SE**		4	BEV	FWD	$34,225	TBD	**$34,225**	33	114	114	7.4	4	24	128	108	93	6.9	0	Not Rated

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Manufacturer										Range			Charging speed (miles/hr)			Performance				
Make	Model	Photo	Seating	EV Type	FWD/ RWD/ AWD	Base MSRP	Federal tax credit	Price after federal tax credit	Battery size (kWh)	Electric Range (miles)	Total Range (miles)	Charging rates (kW) L2/DCFC	Level 1 120V	Level 2 240V	DCFC 400+V	MPGe/ MPG	Top Spd (mph)	0-60 mph (sec)	Towing capacity (lbs)	Crash Ratings: IIHS/NHTSA
Mitsubishi	**Outlander PHEV**		7	PHEV	AWD	$39,845	TBD	**$39,845**	13.8	38	420	3.7/22	3	8	33	64/26	106	6.5	1500	Good-Acceptable/ 5 star
Nissan	**Leaf**		5	BEV	FWD	$28,040	TBD	**$28,040**	40-62	150-226	150-226	6.6/70	4	22	189	114	90	6.5	0	Good/ Not rated
Polestar	**2**		5	BEV	FWD/ AWD	$48,400	TBD	**$48,400**	78	260-270	260-270	11/150	3	30	328	92	128	4.2	2000	Not Rated
Porsche	**Panamera E-hybrid**		2	PHEV	AWD	$109,000	TBD	**$109,000**	17.9	19	480	3.6-7.2	2	11	N/A	51/23	167	3.0-4.3	0	Not rated/ Not rated
Porsche	**Cayenne E-hybrid**		5	PHEV	AWD	$94,400	TBD	**$94,400**	17.9	15	370	3.6-7.3	2	10	N/A	46/22	151	3.6-4.7	0	Not rated/ Not rated
Porsche	**Taycan**		4	BEV	RWD/ AWD	$86,700	TBD	**$86,700**	79-93	201-227	201-227	11/270	2	23	442	69	162	2.6-5.1	0	Not Rated
Rivian	**R1S**		7	BEV	AWD	$78,000	TBD	**$78,000**	135	260-320	260-320	11.5/209	2	24	349	70	125	3	7700	Not Rated
Rivian	**R1T**		5	BEV	AWD	$73,000	TBD	**$73,000**	135	260-320	260-320	11.5/210	2	24	344	69	125	3	11000	Not Rated
Subaru	**Solterra**		5	BEV	AWD	$44,995	TBD	**$44,995**	72	228	228	6.6/100-150	4	23	353	104	110	6.5-7.1	0	Not Rated
Subaru	**Crosstrek Hybrid (PHEV)**		5	PHEV	AWD	$36,345	TBD	**$36,345**	8.8	17	480	3.3	3	9	N/A	90/35	90	8.3	0	Top Safety Pick + / 5 star
Tesla	**Model 3**		5	BEV	RWD/ AWD	$46,990	TBD	**$46,990**	60-75	263-353	263-353	11.5/250	4	41	712	113-141	140-162	3.1-5.3	0	Top Safety Pick + / 5 star
Tesla	**Model Y**		5-7	BEV	AWD	$65,990	TBD	**$65,990**	75	303-326	303-326	11.5/250	4	41	712	121	135-145	3.5-4.8	3500	Top Safety Pick + / 5 star
Tesla	**Model S**		5	BEV	AWD	$104,990	TBD	**$104,990**	100+	395-405	395-405	11.5/250	4	38	653	110	155-175	2.0-3.1	0	Good-Acceptable/ 5 Stars
Tesla	**Model X**		5-7	BEV	AWD	$120,990	TBD	**$120,990**	100	340-360	340-360	11.5/250	3	33	570	96	155-163	2.5-3.8	5000	Not rated/ 5 star

Manufacturer										Range			Charging speed (miles/hr)			Performance				
Make	Model	Photo	Seating	EV Type	FWD/ RWD/ AWD	Base MSRP	Federal tax credit	Price after federal tax credit	Battery size (kWh)	Electric Range (miles)	Total Range (miles)	Charging rates (kW) L2/DCFC	Level 1 120V	Level 2 240V	DCFC 400+V	MPGe/ MPG	Top Spd (mph)	0-60 mph (sec)	Towing capacity (lbs)	Crash Ratings: IIHS/NHTSA
Toyota	**bZ4X**		5	BEV	RWD/ AWD	$42,000	TBD	**$42,000**	72	242-252	242-252	6.6/100-150	4	23	353	114-119	110	6.5-7.1	0	Not Rated
Toyota	**Prius Prime**		5	PHEV	FWD	$28,770	TBD	**$28,770**	8.8	25	640	3.3	5	13	N/A	133/54	90	11	0	Top Safety Pick/ Not rated
Toyota	**RAV4 Prime**		5	PHEV	AWD	$41,590	TBD	**$41,590**	18.1	42	600	3.3-6.6	3	9	N/A	94/38	120	5.7	0	Not Rated
Volkswagen	**ID4**		5	BEV	RWD/ AWD	$37,495	TBD	**$37,495**	62-82	205-275	245-280	11/140-170	4	34	416	95-112	99-111	5.7-8.7	2700	Top Safety Pick + / Not rated
Volvo	**C40 Recharge**		5	BEV	AWD	$55,300	TBD	**$55,300**	78	226	223	11/149	3	28	310	87	112	4.7	3307	Top Safety Pick + / Not rated
Volvo	**XC40 Recharge**		5	BEV	AWD	$53,550	TBD	**$53,550**	78	223	226	11/150	3	28	303	85	112	4.7	3307	Top Safety Pick + / Not rated
Volvo	**S60 Recharge**		5	PHEV	AWD	$51,250	TBD	**$51,250**	18.8	40	530	3.6	2	7	N/A	74/31	155	4.3	2000	Top Safety Pick + / Not rated
Volvo	**V60 Recharge**		6	PHEV	AWD	$70,550	TBD	**$70,550**	18.8	40	530	3.6	2	7	N/A	74/31	155	4.3	2000	Good / Not rated
Volvo	**S90 Recharge**		5	PHEV	AWD	$70,500	TBD	**$70,500**	18.8	38	500	3.6	2	6	N/A	66/29	140	4.6	1650	Top Safety Pick/ Not rated
Volvo	**XC60 Recharge**		5	PHEV	AWD	$57,200	TBD	**$57,200**	18.8	36	560	3.6	2	6	N/A	63/28	140	4.5	3500	Top Safety Pick/ 5 star
Volvo	**XC90 Recharge**		7	PHEV	AWD	$71,900	TBD	**$71,900**	18.8	35	530	3.6	2	6	N/A	66/26	132	5	5000	Top Safety Pick/ Not rated

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