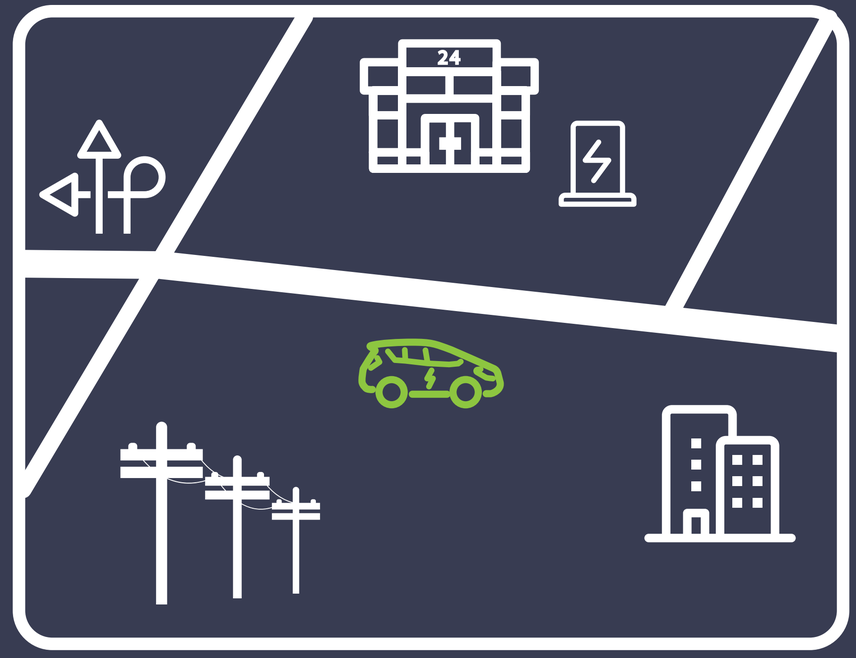
AMERICAN PUBLIC POWER ASSOCIATION

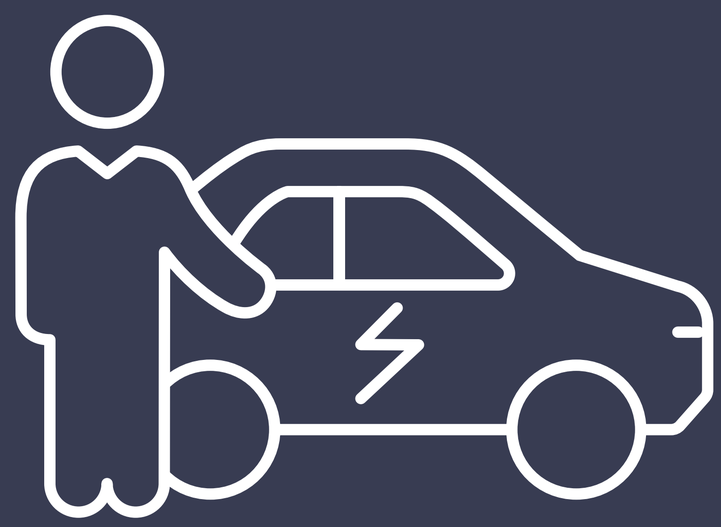
80 Years of Powering Strong Communities

Navigating the EV Market

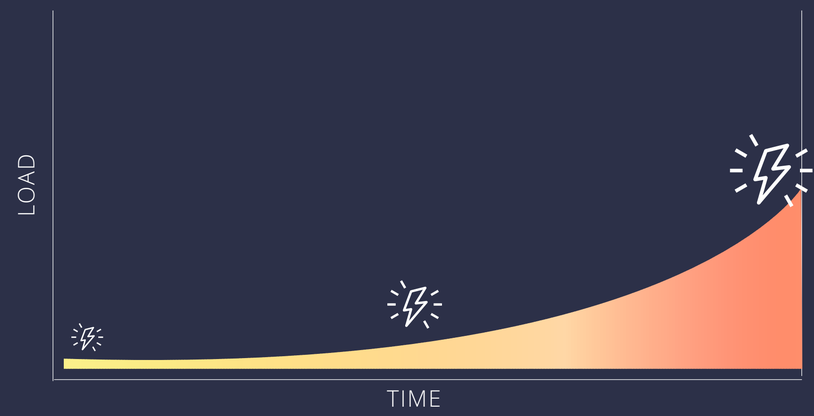
Trends and Changes for Public Power to Know



Why Should Utilities Pay Attention to Electric Vehicles?



EVs are an opportunity and challenge for electric utilities.



On one hand, EVs present a load and revenue growth opportunity for electric utilities

On the other, if the new load is left unmanaged, EV charging can add to system peak demand and stress grid infrastructure

Utilities might also consider how EVs can support goals such as

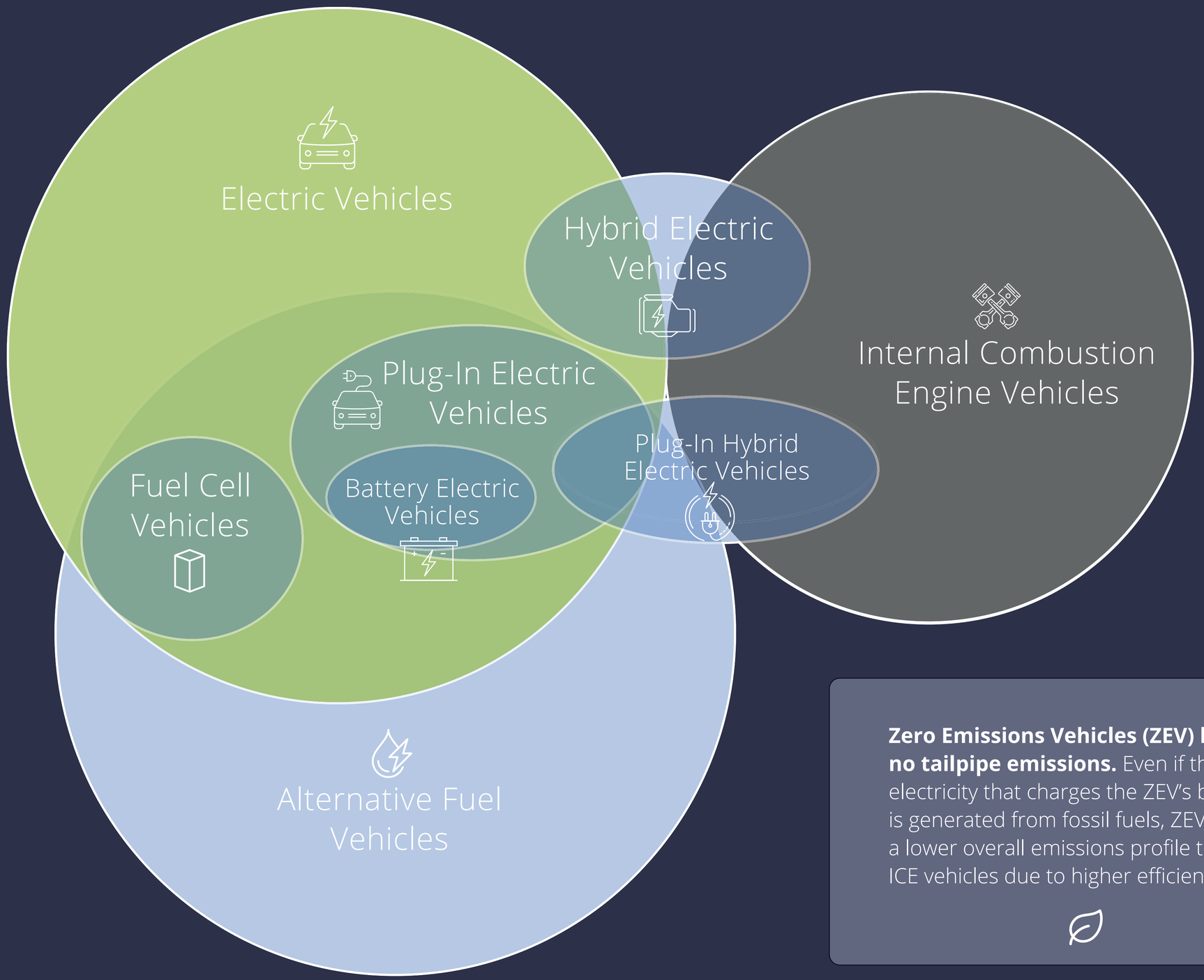
Reducing vehicle operating and maintenance costs for customers and fleet operators

Improving public and environmental health within the community through reduced tailpipe emissions

Different Vehicle Types

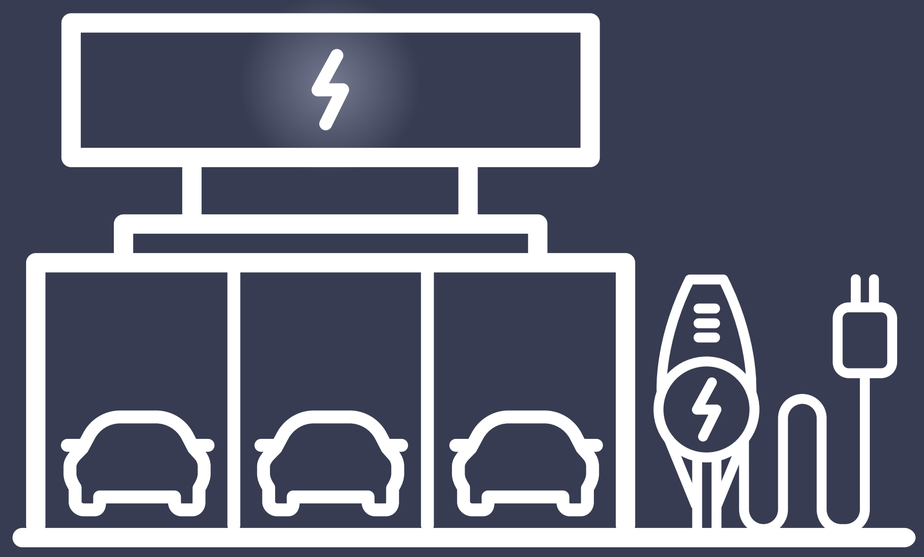
Electric vehicles are part of a broader category of alternative fuel vehicles, and include a variety of different types of vehicles.

Click the icon to see each vehicle description.



Zero Emissions Vehicles (ZEV) have no tailpipe emissions. Even if the electricity that charges the ZEV's battery is generated from fossil fuels, ZEVs have a lower overall emissions profile than ICE vehicles due to higher efficiencies.

EV Charging 101



Different infrastructure allows for plug-in vehicles to recharge their batteries.

The speed of charging depends on how much electricity can go to the vehicle at once.

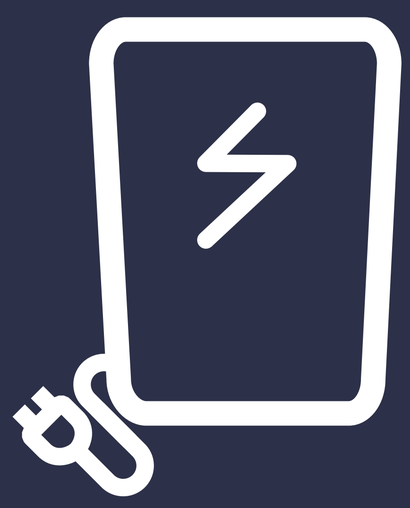
Hover for details

LEVEL 1

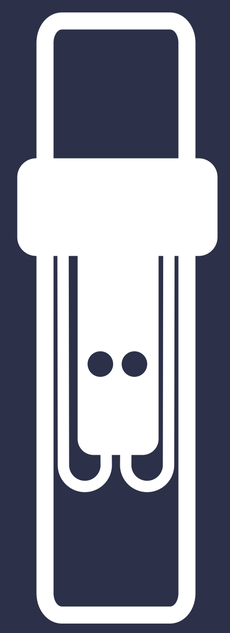
(REGULAR WALL OUTLET)

LEVEL 2

(240 VOLT HOME CHARGER)

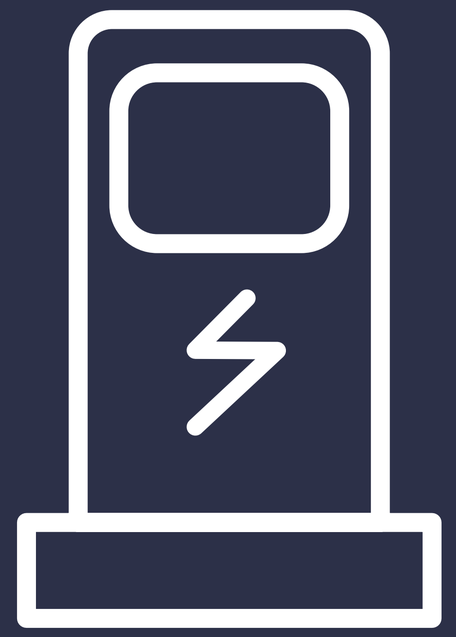


(PUBLIC CHARGER)



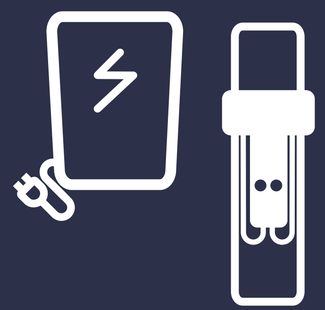
DC FAST CHARGING

(PUBLIC CHARGER)

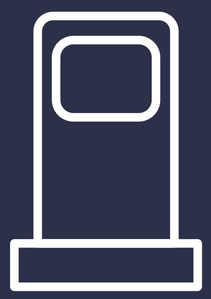
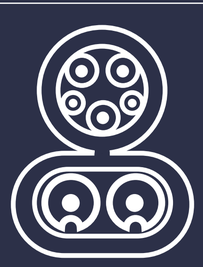


For Level 1 and 2 charging, all plug-in vehicles use the same connector.

LEVEL 1	CONNECTOR TYPE
	

LEVEL 2	CONNECTOR TYPE
	

For DC fast charging, different models use different connectors.

DC FAST CHARGER	CONNECTOR TYPE			
				
		SAE Combo coupler system (CCS)	CHAdeMO	Tesla
	WHICH CARS USE IT	Audi, BMW, Chrysler, Ford, GM, Honda, Hyundai, Kia, Mercedes, Nissan* (Beginning 2021 in the US), Porsche	Nissan*, Mitsubishi	Tesla

What’s Keeping People From Driving EVs?

More than

one-third of prospective car buyers

in the United States reported considering a PEV for their next purchase.[1]

Despite this interest, there are still

several barriers to adoption.

A 2019 survey of public power customers found [2]

charging infrastructure availability

range

and upfront cost

as the top three concerns about electric vehicles.

General **awareness** of and **access** to EV models is also lacking.

In a 2017 survey, less than half of respondents could name a single electric make and model. [3]

A 2019 study found that 74% of dealerships in the U.S. did not offer a single EV model for sale. Even in states with zero emissions vehicle incentives, 59% of dealerships did not offer any EVs. [4]

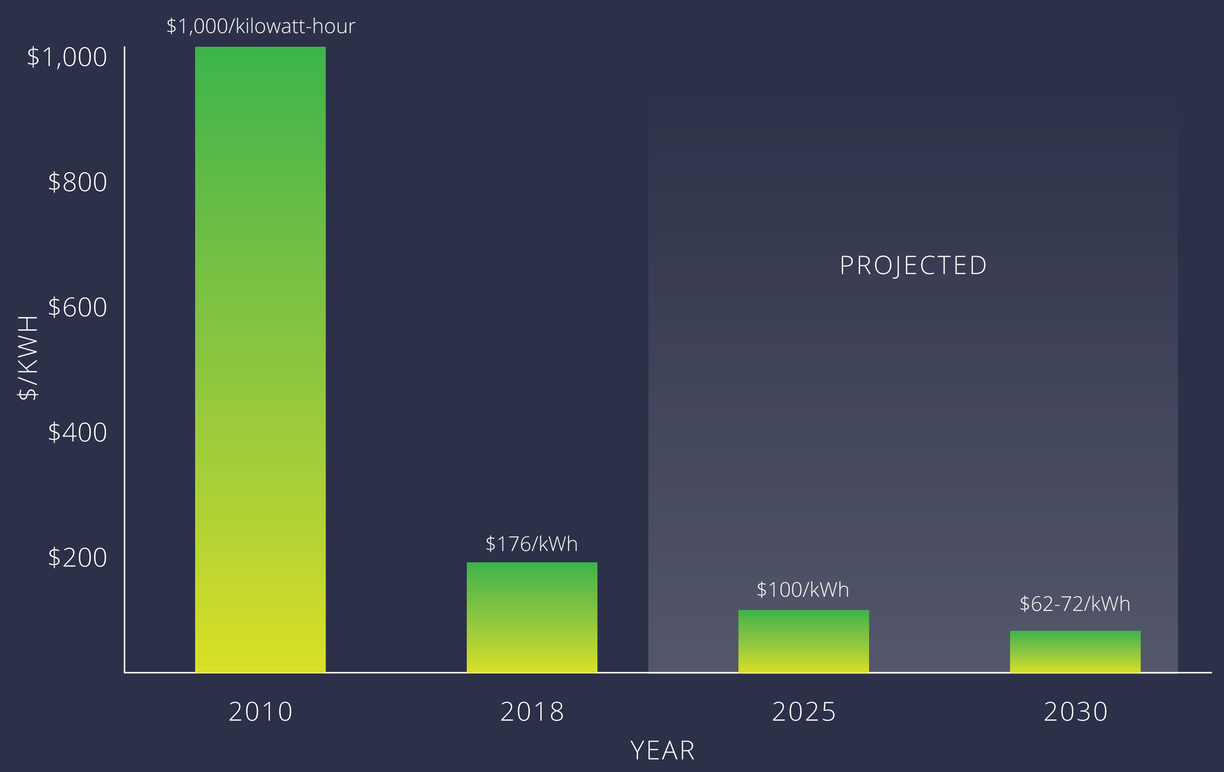
Addressing Barriers to Adoption

EV prices are coming down.

Decreasing battery costs are bringing down the upfront cost of EVs.

Experts expect EVs to reach cost parity with internal combustion engine vehicles once lithium-ion battery packs cost $100 per kilowatt-hour — which is likely within the next few years.

The falling cost of battery packs [5]



Adapted from M.J. Bradley & Associates

The median upfront costs across different vehicle types, including for longer range vehicles, are expected to be less than ICE vehicle costs before the end of the decade.

Click on the icons below to see the purchase price of conventional vehicles and electric vehicles for 2020 – 2030.[6]

CAR

CROSSOVER

SPORT UTILITY VEHICHLE

As for total cost of ownership, EVs are already less expensive to operate than ICE vehicles, due to lower maintenance and fuel costs. [7]

Cost to fuel vehicles, gasoline vs electricity (U.S. Average)

regular gasoline	2.25
electric eGallon*	1.15

an eGallon is the estimated cost of fueling a vehicle with electricity compared to a similar vehice that runs on gasoline

EV range is improving

Range anxiety remains a top concern for many prospective EV drivers.

Current BEV models have sufficient range for daily driving needs.

29

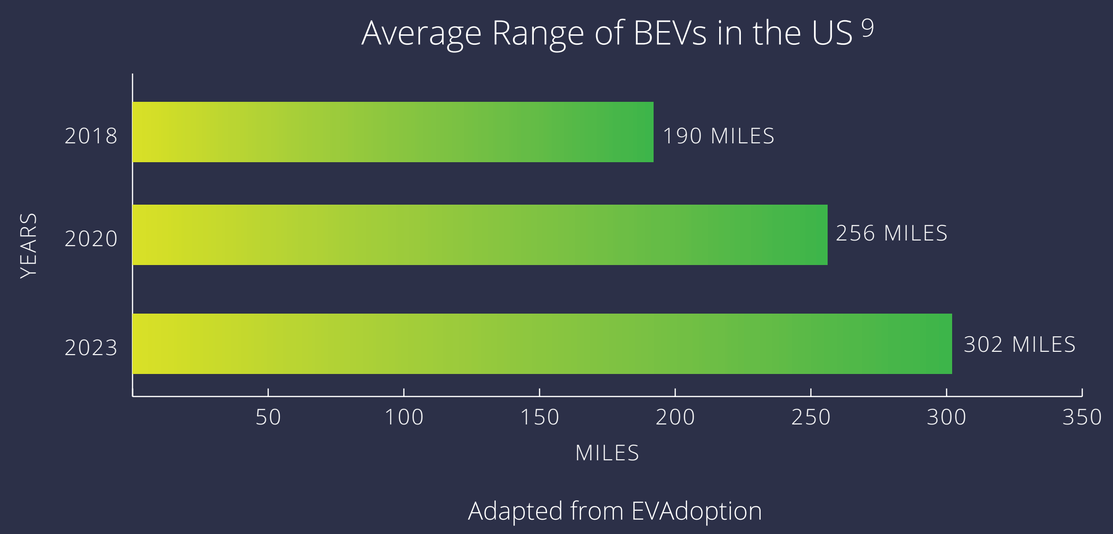
Average miles driven/day [8]

220

Average range of BEV models in 2019 [9]

However, drivers likely want their vehicle to support 100% of their driving needs, not just typical daily trips.

As vehicle battery capacity increases, newer models can travel further on a single charge. Within the next few years, the average BEV will have a range of over 300 miles.



Adapted from EVAdoption

More Electric Models are Entering the Market

Despite the Great Recession, from 2008-2018 there was

a 50% average annual increase

in the number of EV models available in the market.

From 2014-2019, manufacturers brought 243 EV models to market (includes all-electric and plug-in hybrid electric vehicles). [10]

From 2020-2025, vehicle manufacturers have announced plans to launch about 400 new EV models. [11]

And by 2030, automakers have announced plans for more than 700 models.[5]

These models will be made by nearly all leading name brand automakers and new, EV-only brands.

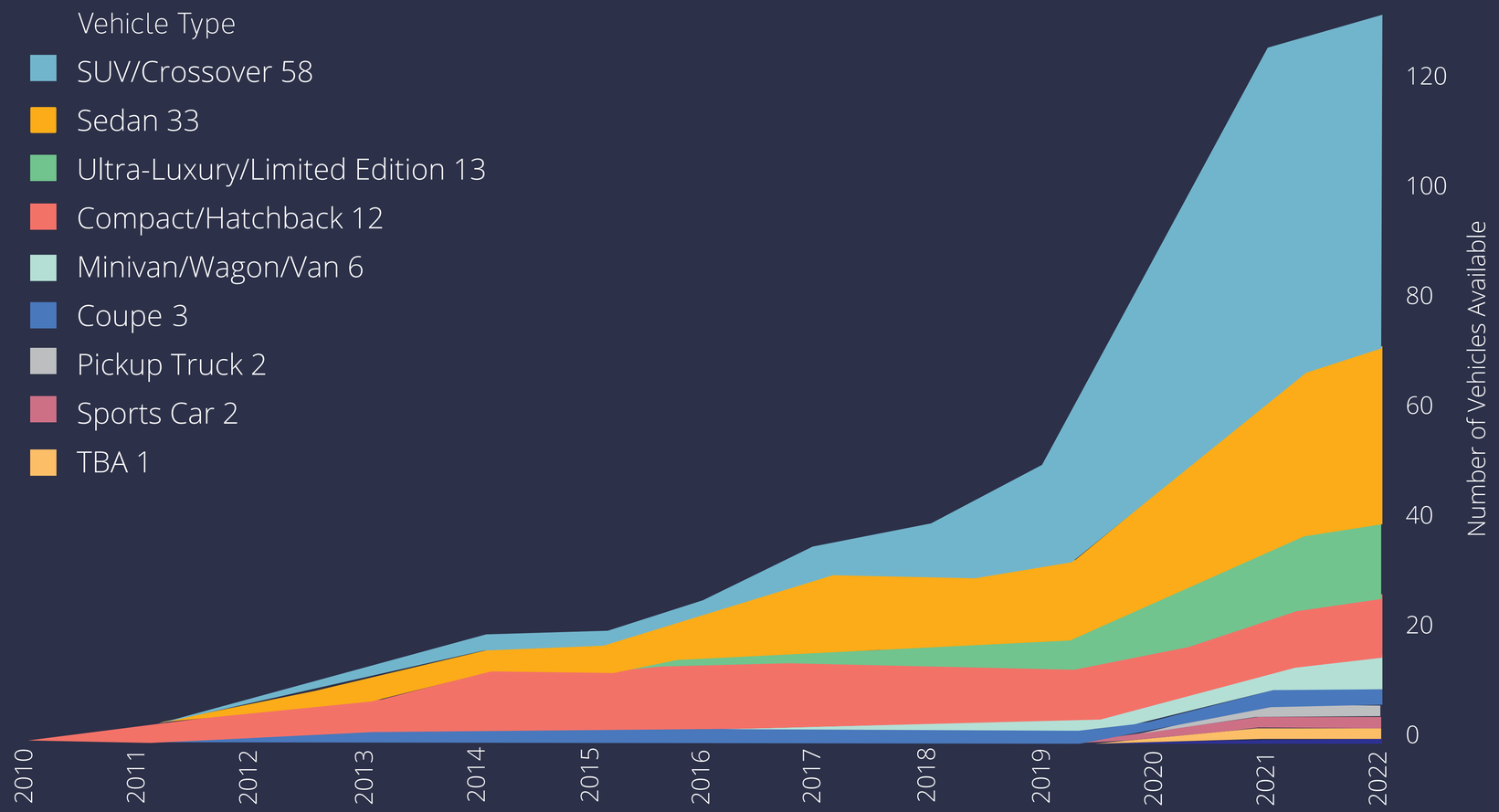
As of this publication, it is unclear how model releases will be affected by the COVID-19 pandemic.

By 2023, IHS Markit forecasts 43 brands will offer at least one EV option ... compared to 14 brands offering EVs in 2018.[12]

The EV models available are beginning to better match the types of vehicles that Americans drive.

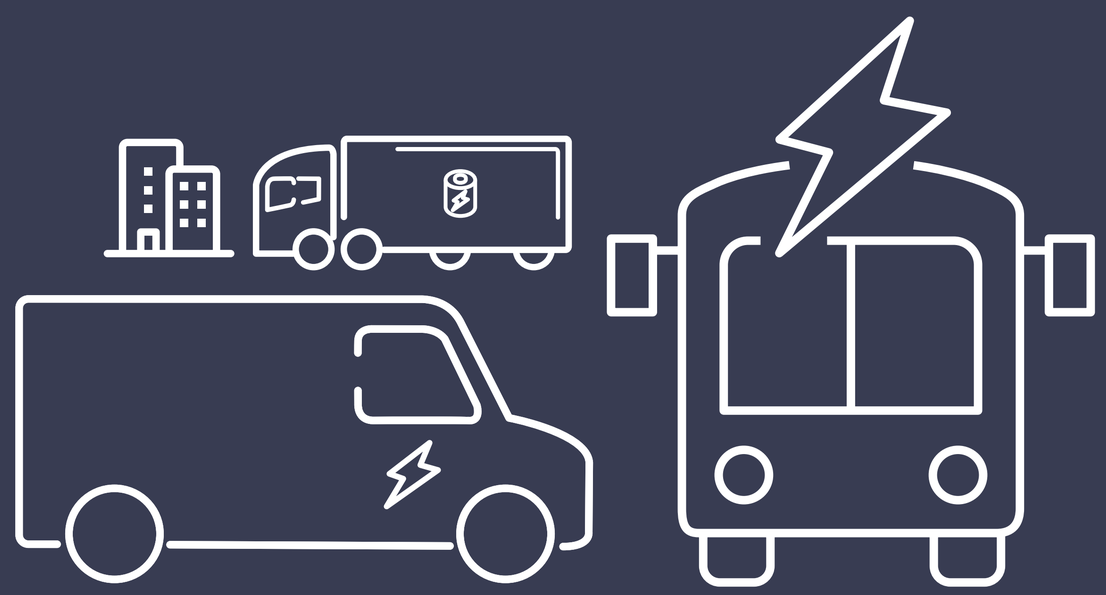
As shown in the chart from the Electric Power Research Institute,
although the previous decade saw primarily compact cars and sedans in EV models,
the next few years will see many more electric crossover and SUV models,
as well as some larger models like vans and trucks.

The Number and Variety of Electric Vehicle Models Contiues to Grow [13]



Adadpted from Electric Power Research Institute

EVs Aren’t Just for Personal Use



Electrifying transportation includes light-duty to heavy-duty vehicles.

Fleet operators considering electrification include:

Public transit

Government

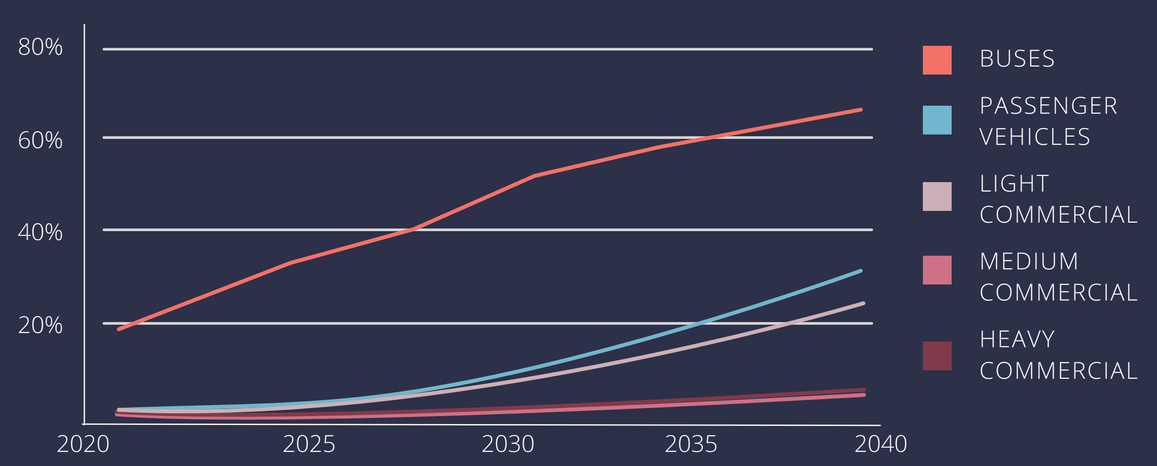
Schools

Commercial trucking

Transportation network companies

EV Share of Global Fleet, by Segment[14]

EVs are projected to take on a larger share of all kinds of vehicle segments — buses are expected to be the fastest adopters, whereas medium and heavy-duty commercial fleets are expected to have a slower adoption curve.



Adapted from BloombergNEF

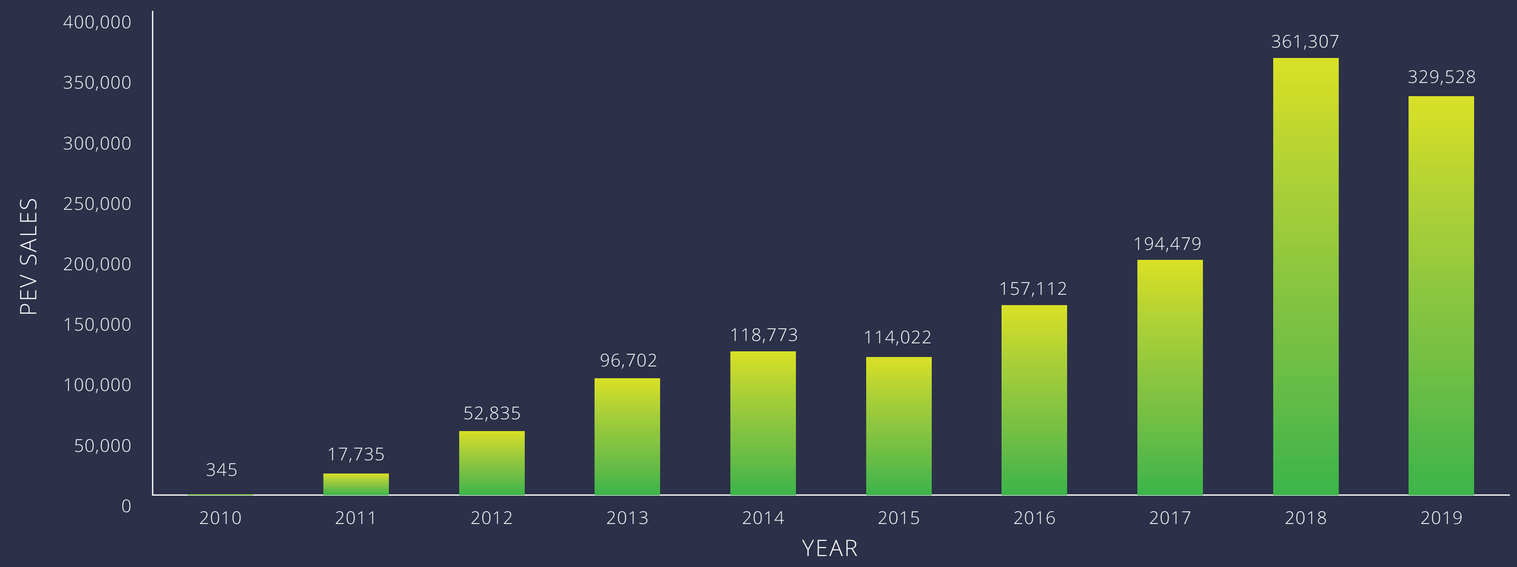
Autonomous vehicles are also expected to go electric.

EV Sales Are Increasing

In 2018, the US surpassed 1 million EVs on the road.[15]

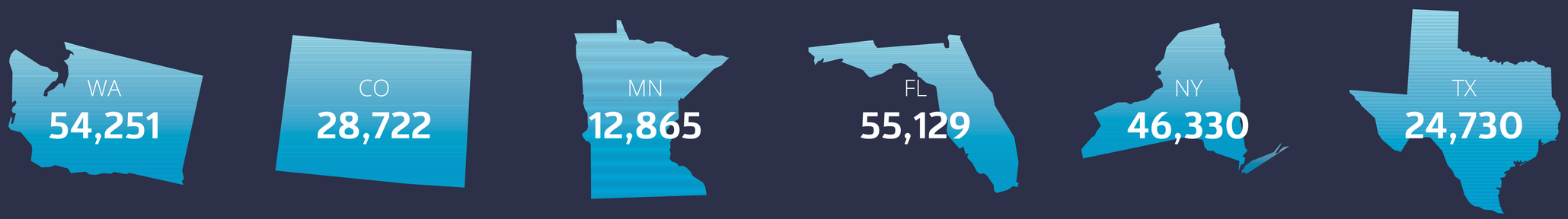
As of late 2019, EVs comprise about 2% of auto sales nationwide.[16]

Sales of light-duty PEVs have been increasing.[17]



Adapted from Electric Drive Transportation Association

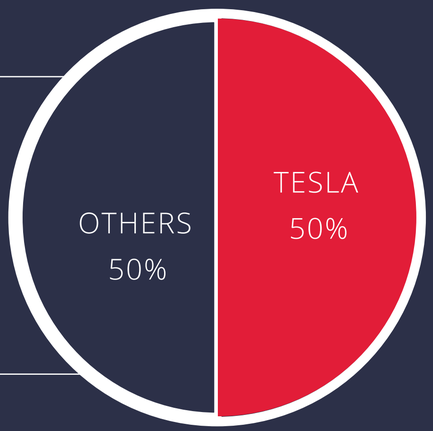
Sales vary regionally and based on environment type (rural vs. suburban vs. urban).[18]



Who is buying EVs?

EV adopters tend to be younger-middle aged, higher income, more educated, tech savvy, environmentally motivated, live in a suburban setting in a single detached dwelling, and have more than one vehicle.

Sales are up from a few years ago, but have been flat the past two years for most manufacturers (except Tesla, which has seen growth). EV sales forecasts vary by company, but consistently show an upward trend in sales.[13]

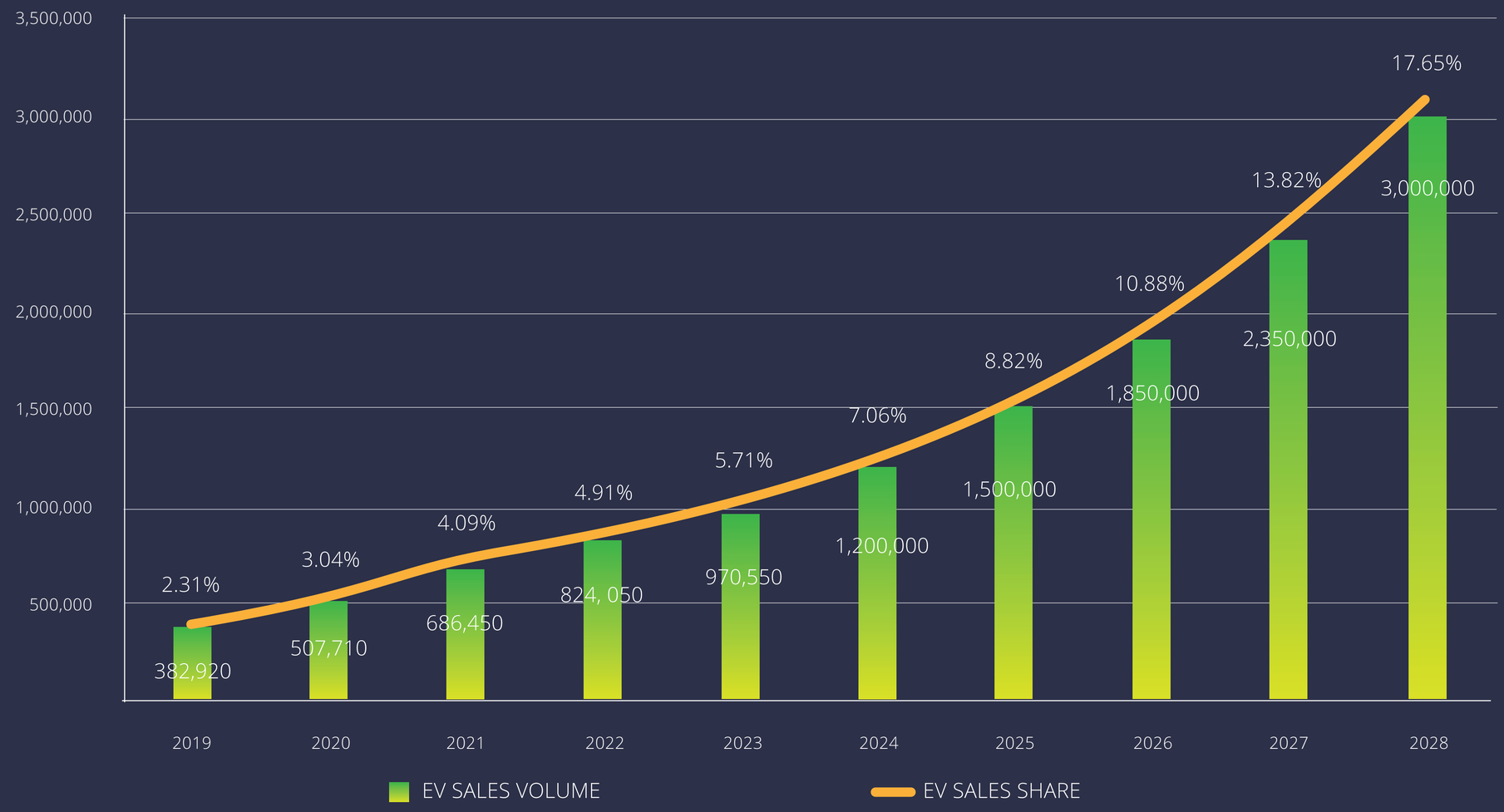


As of this publication, it is too soon to tell the extent the COVID-19 pandemic will affect sales forecasts, although early indications expect disruption only in the short term.

> “The long-term trajectory has not changed, but the market will be bumpy for the next three years.” [14]
>
> *Bloomberg New Energy Finance.*

Forecasts predict that EV sales in the US will exceed a few million sales per year before the end of this decade.

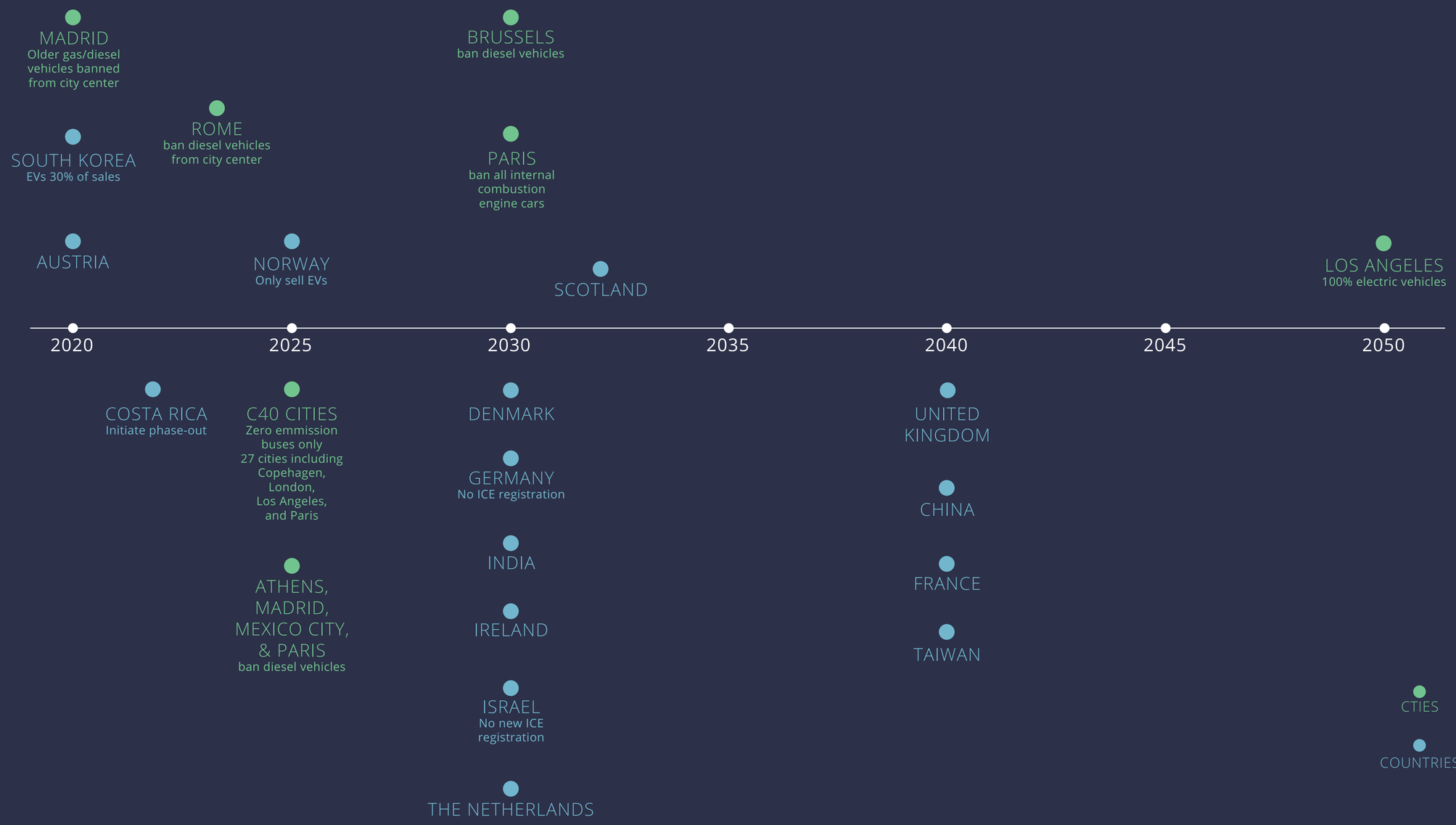
U.S. Electric Vehicle Sales Forecast: 2019-2028 [20]



Adapted from EVAdoption

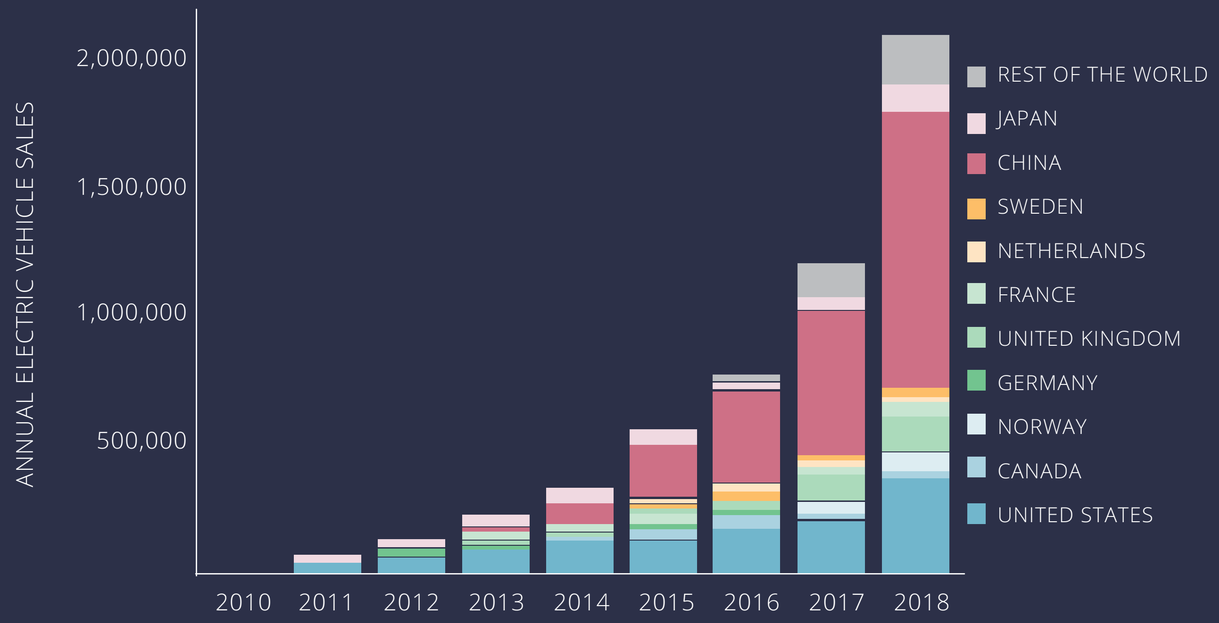
A global shift

The United States is looking at a slower adoption curve than many countries across the world, several of which have considered phasing out ICE vehicles.[5]



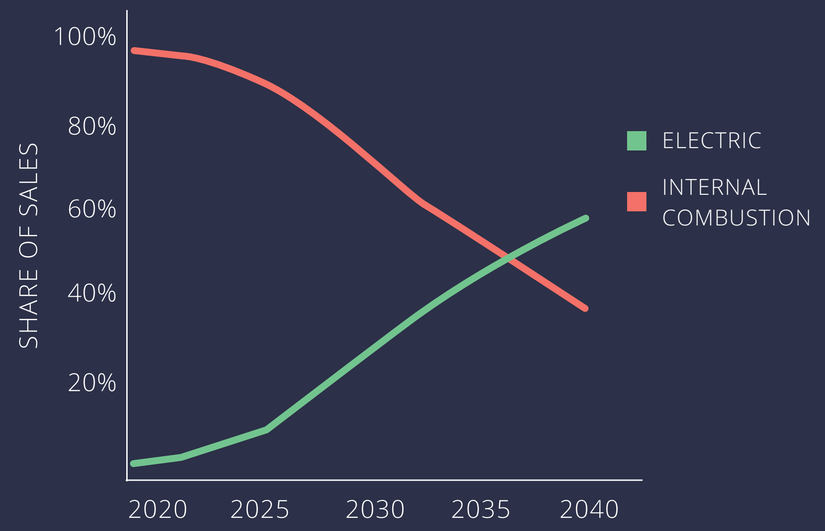
Adapted from M.J. Bradley and Associates

Globally, China has by far the most EV sales, followed by the United States.[6]



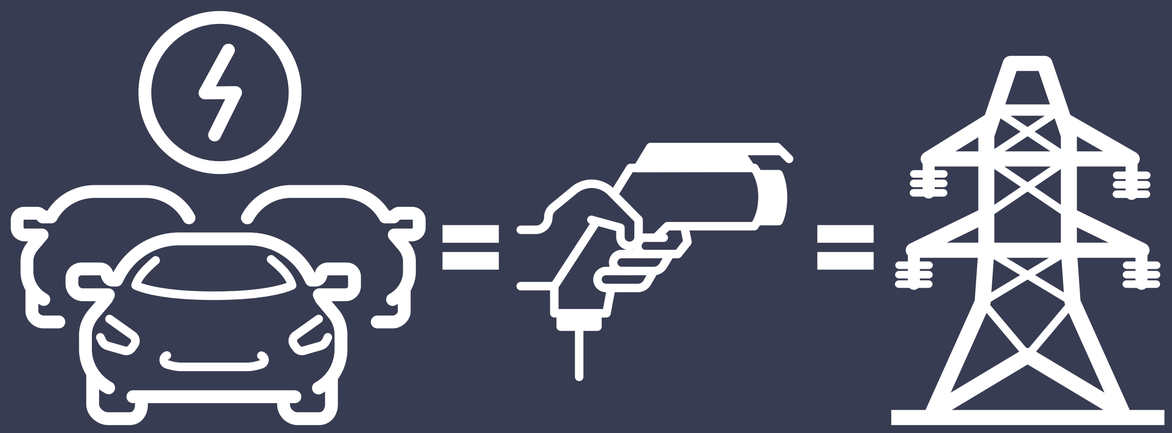
Adapted from The International Council on Clean Transportation

Global EV sales will surpass ICE vehicle sales before 2040.[14]



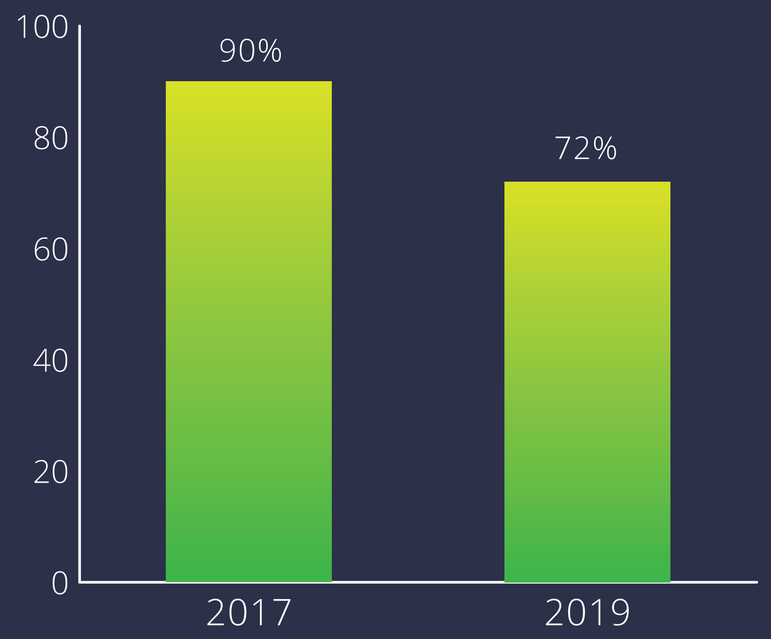
Adapted from BloombergNEF

More EVs =
More Charging =
More Demand



Charging infrastructure is increasingly being deployed at home, at work, and in public areas.

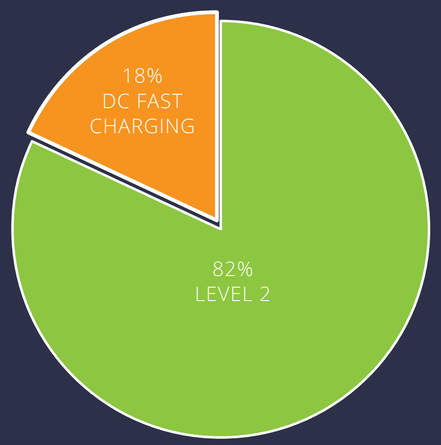
Home charging of EVs [21]



Most EV drivers charge at home, but are able to rely on home charging less as other options, such as workplace charging, increase.

Public charging is becoming more available, but varies considerably from state to state.

Click the icons for more detail on certain states



25,517 public charging stations, with **80,507** charging outlets.[22]

How much public charging does my community need?

Assuming the US has 15 million PEVs on the road in 2030,
then the US Department of Energy projects that the following
public charging infrastructure will be necessary to meet demand.[23]

	INTERSTATE CORRIDORS	RURAL AREAS	TOWNS	CITIES
DC FAST CHARGING 	2,500 PLUGS AT 400 STATIONS	2,000 PLUGS	4,000 PLUGS	19,000 PLUGS
LEVEL 2 	51,000 PLUGS	99,000 PLUGS	451,000 PLUGS	

At the local level, the US Department of Energy's Electric Vehicle Infrastructure Projection Tool Lite helps cities and communities determine charging needs. For example, the **City of Sacramento, California** has a goal of putting 75,000 ZEVs on the road by 2025. If 100% of the ZEVs are PEVs, the tool recommends: [24]

1,487
WORKPLACE LEVEL 2 PLUGS

911
PUBLIC LEVEL 2 PLUGS

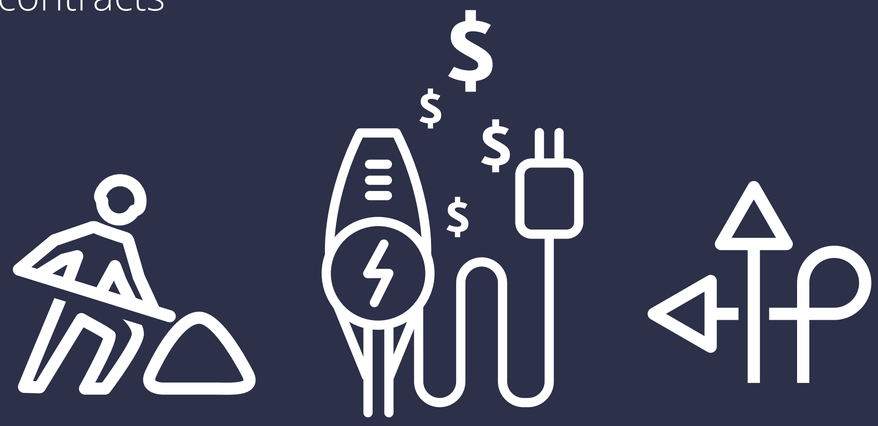
103
PUBLIC DC FAST CHARGING PLUGS

What costs are involved in deploying charging infrastructure?

Deploying charging infrastructure includes more than the upfront cost of the charger.

Other costs to consider include:

- upgrades
- site preparation (e.g. dredging and signage)
- the service drop
- data contracts
- network contracts
- credit card readers
- cable costs
- installation



Learn more about EV infrastructure costs in Reducing EV Charging Infrastructure Costs from the Rocky Mountain Institute.

EVs Will Lead to Increased Electricity Demand

Electricity consumption for the transportation sector is expected to grow significantly in the coming decades.

Changes to load growth and reliability depend on the **5Ws:**
Click on each word to learn more.

Who

What

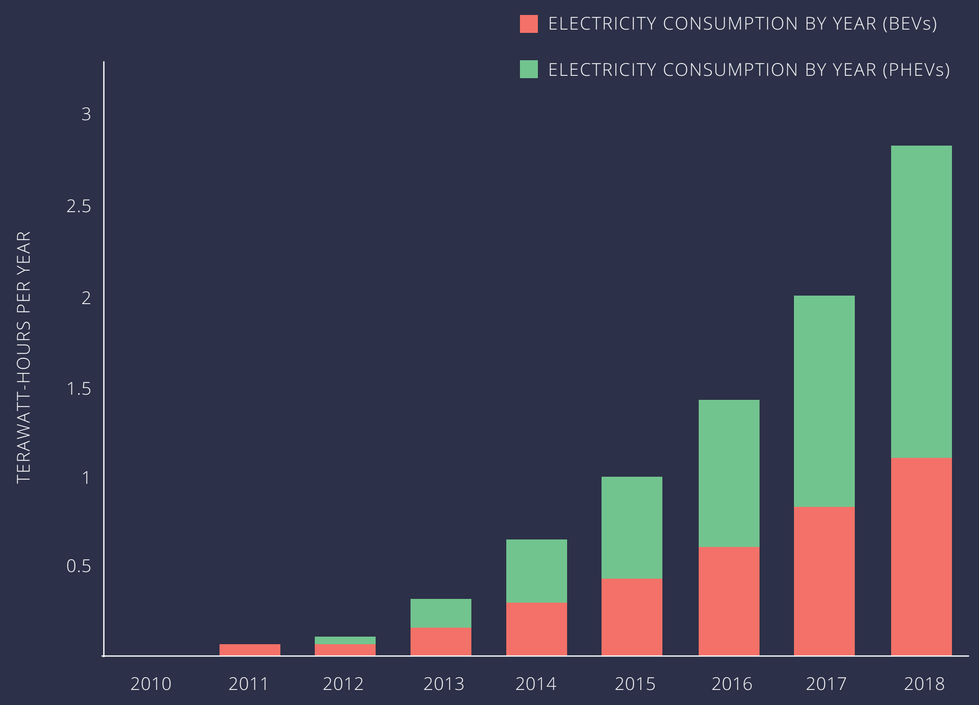
When

Where

Why

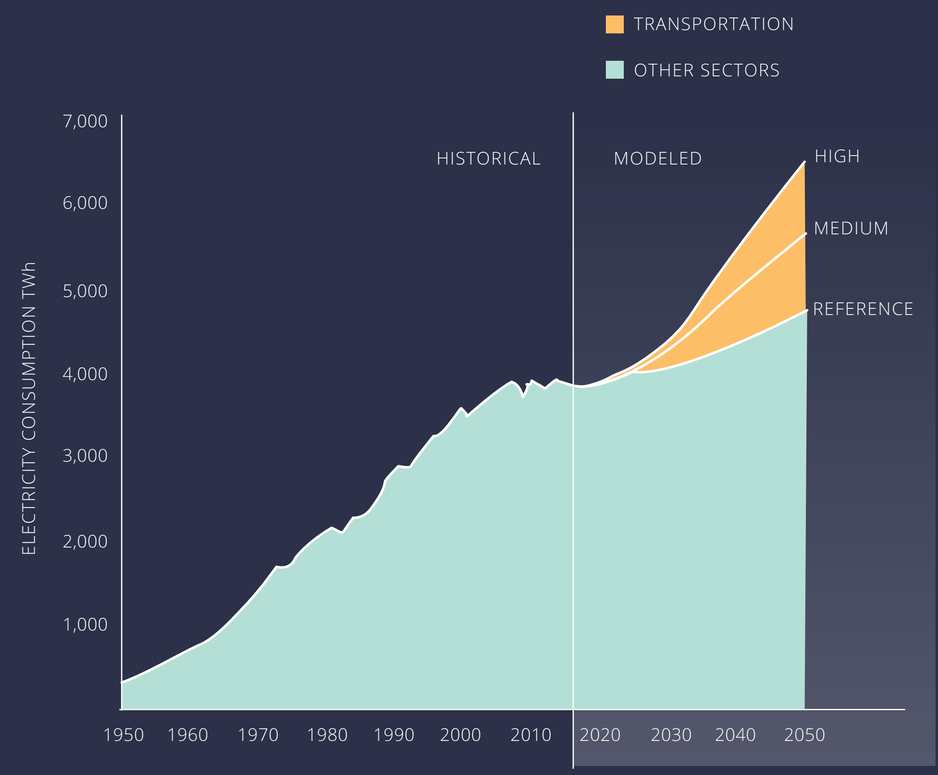
How much electricity will EVs use?

From 2010 to 2018, total electricity consumption of PEVs went from 0 to nearly 3 terawatt-hours.[26]



Adapted from Argonne National Laboratory

Looking ahead, the National Renewable Energy Laboratory projects that the transportation sector will use electricity for anywhere from 2 – 28% of needs, which could add as much as 80 TWh per year through 2050.[27]



Historical and Projected Annual Electricity Consumption

Adapted from National Renewable Energy Laboratory

Players new and old in the market

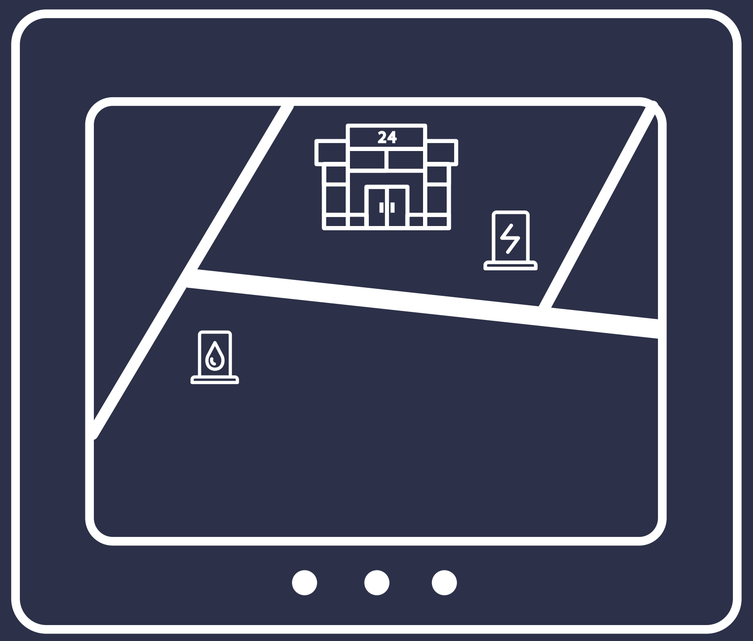
Third parties like ChargePoint, auto manufacturers like Tesla, and utilities (including public power) are deploying charging infrastructure

- Utility involvement ranges from incentivizing other companies to deploy charging stations within their communities, to deploying make ready investments, to owning the charging stations

Oil and gas companies are also taking note

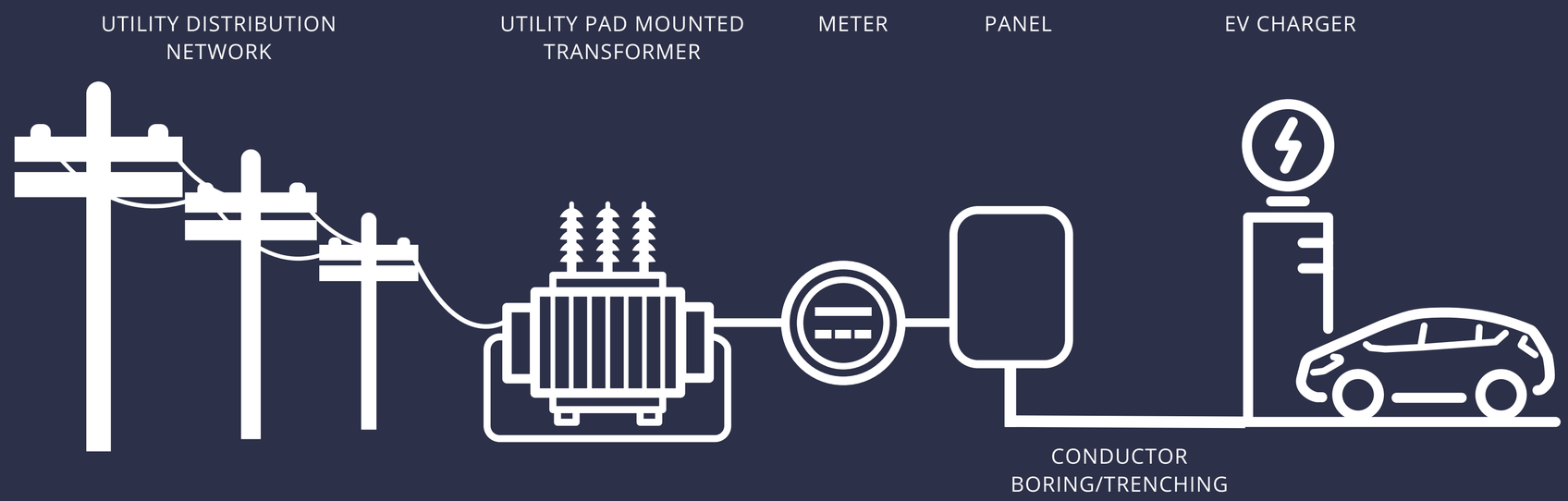
- Shell acquired Greenlots, a charging infrastructure company
- Some gas stations now also have EV chargers

Many public charging stations to date are located near retailers and shopping centers.



When utilities are (or can be) involved in EV charging infrastructure

Electric utilities are involved in all EV charging connected to the distribution network. There are four main models for how utilities can be involved in charging infrastructure.[28]



BUSINESS AS USUAL

UTILITY/CONTRIBUTION IN AID OF CONSTRUCTION → HOST SITE INVESTMENT

MAKE-READY

UTILITY INVESTMENT → HOST SITE INVESTMENT

OWNER-OPERATOR

UTILITY INVESTMENT

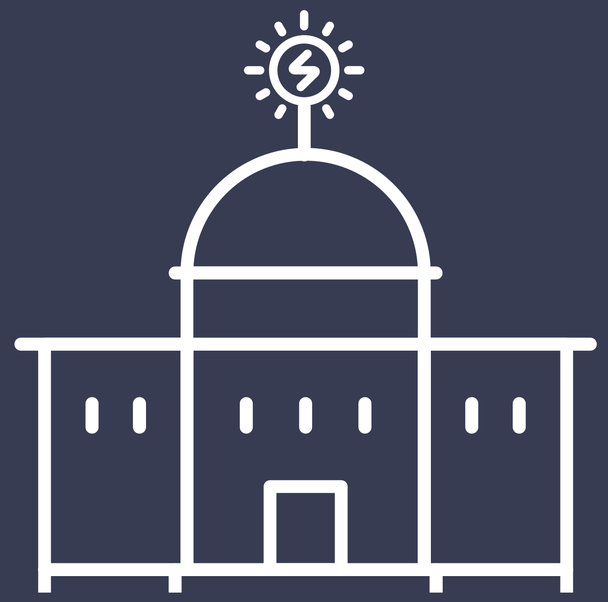
UTILITY INCENTIVE

UTILITY/CONTRIBUTION IN AID OF CONSTRUCTION → HOST SITE/THIRD PARTY INVESTMENT

UTILITY INCENTIVE PAYMENT

Adapted from M.J. Bradley and Associates

What to Watch:
Policies and Regulations

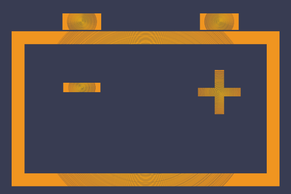


Local, state, and federal policies can influence what type of entities are involved in EV-related activities, such as deploying charging infrastructure.

- Federal policies impact tax incentives and grants for alternative fuels as well as CAFE standards for vehicle fuel-economy
- Many states and localities have taken, or are considering, actions including zero emission vehicle programs, state tax incentives, and grant programs
- The US Department of Energy is supporting research and development on EV-related technologies
- Other entities are debating charging station ownership and regulatory models.

Read the American Public Power Association's issue brief on EV policy.

What Utilities Can Do



Monitor and evaluate EV adoption and grid impacts within your community

- Track adoption within your community
- Monitor state policies and regulations that may impact adoption
- Study driver and charging behavior
- Analyze charging station utilization

Educate employees, customers, and auto-dealers as trusted energy advisors

- Educate your community about the technology, benefits and challenges associated with driving an EV, available incentives, and rate options
- These efforts can range from having information on your website to hosting or participating in “ride and drive” events

Electrify utility fleet and support external fleet operators as they electrify

- Lead by example by electrifying the utility’s fleet
- Assist fleet operators in understanding charging needs, operational considerations, and costs

Evaluate rates and payment options

- Examine how your rate offerings might be incentivizing or de-incentivizing EVs
- Consider how rate options, such as time-of-use, can be a tool to help manage new load or to encourage EV drivers to charge off peak

Provide incentives

- Consider offering rebates for EVs and/or charging infrastructure

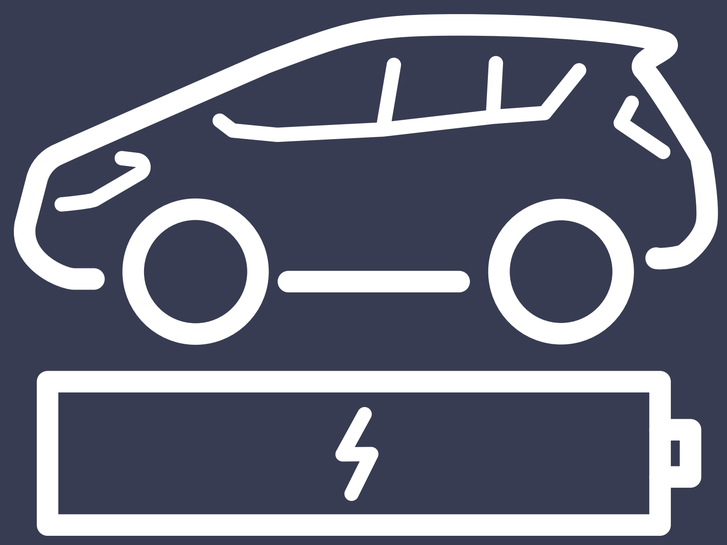
Pilot vehicle-grid integration technologies to help with load management

- Smart charging/V1G enables utilities to slow down or stop vehicle charging, like in a traditional demand response program
- Vehicle-to-grid/V2G is where EV batteries can supply power back to the grid

Support charging infrastructure

- Educate stakeholders on charging infrastructure
- Incentivize companies to deploy charging stations within your community
- Conduct make-ready investments
- Deploy utility-owned charging stations

More EV Resources for Public Power



Creating an Electric Vehicle Blueprint for Your Community

Get guidance on preparing EV programs and activities.

Getting Involved in Fleet Electrification

Learn what fleet operators should know about switching to electric vehicles.

Public Power EV Activities Tracker

A searchable database of what other public power utilities are doing in regards to EVs and charging stations in their communities.

Join the Electric Vehicle Interest Group

Sign up through the Public Power Forward listserv.

EV Issue Brief

Read how the policies being considered by Congress and other federal entities could impact EV adoption in your community.

EV Communications Templates

Share and customize these graphics to educate your customers and other stakeholders about electric vehicles.