GSA Fleet®

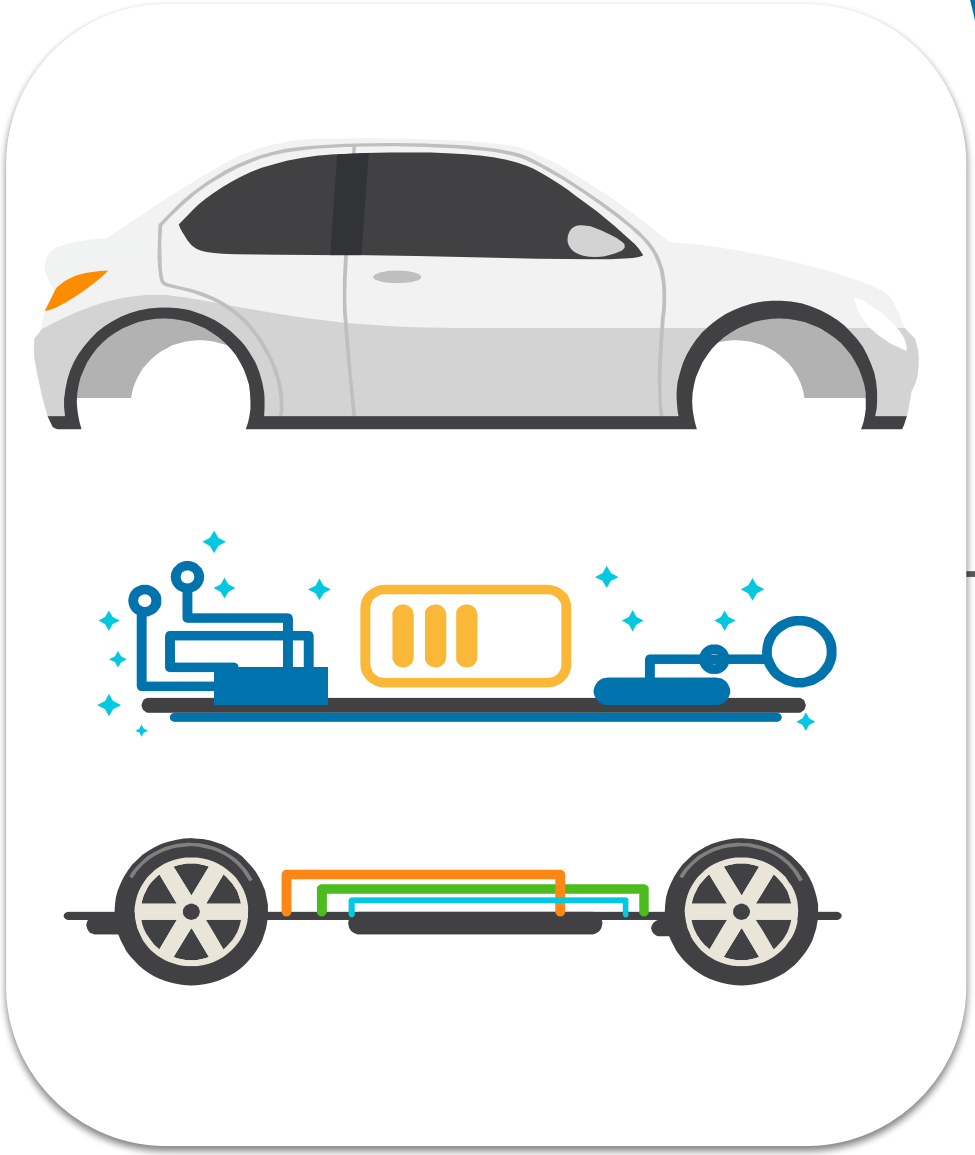
ZEV & EVSE 101

June 26th, 2024
GSA Fleet

Agenda

- What is a ZEV?
- Market trends
- Operating my ZEV
- Charging
- Smart Charging 101
- Federal Fleet Electrification Support
- Q&A

What is a ZEV?



- (potential for) **ZERO** Scope 3 Greenhouse gas emissions
- (potential for) **ZERO** smog forming particles
- Includes Battery-Electric Vehicles (BEV), Plug-in Hybrids (PHEV), and hydrogen powered Fuel Cell Vehicles (FCEV).

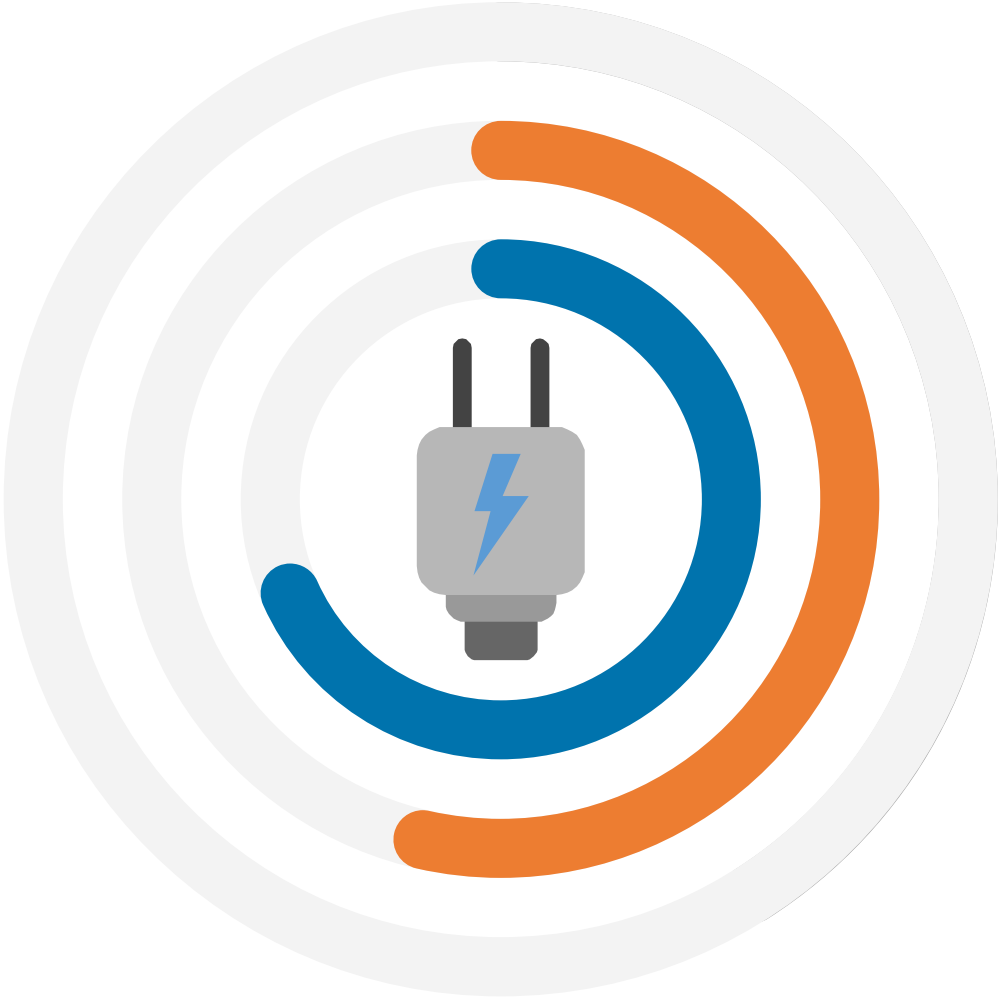
Types of ZEVs

Executive Order 14057, *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*, signed December 8, 2021, requires all Executive Agencies, including DoD, to acquire 100 percent of non-tactical vehicles as ZEVs by 2035, including 100 percent zero-emission light-duty vehicle acquisitions by 2027. **Memorandum M-22-06 states that for the purposes of meeting this requirement, plug-in hybrid vehicles may be considered ZEVs.**

BEVs

100% Electricity & Battery

Ranges 100-350
0 emissions
LD Acquisition Cost 50% more
Charging plentiful & # of models growing



FCEVs

100% Hydrogen & Battery

Ranges 350-450
0 emissions
LD Acquisition Cost 200% higher
Charging Limited (mostly in CA)
Models Limited (likely to take off in long-haul trucking or busing)

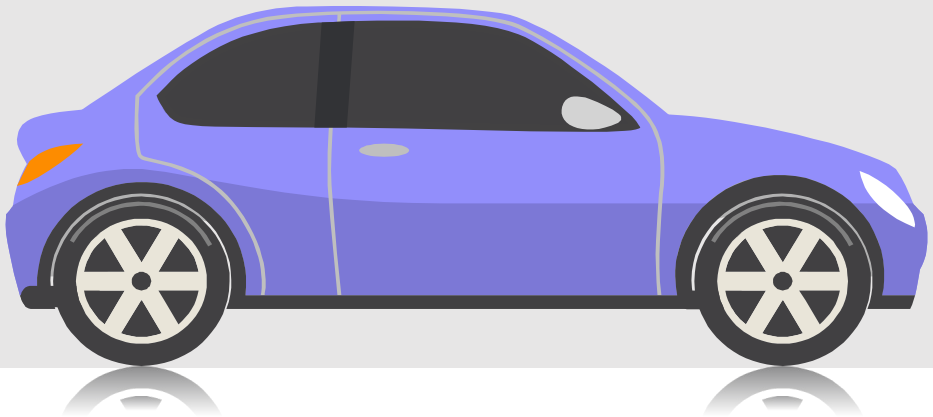
PHEVs

Gasoline + Electricity

All electric range: 20-50
Total Range (on gas): 310-640
15%–55% less tailpipe CO_2
LD Acquisition Cost 50% more
Limited to Light-duty vehicles

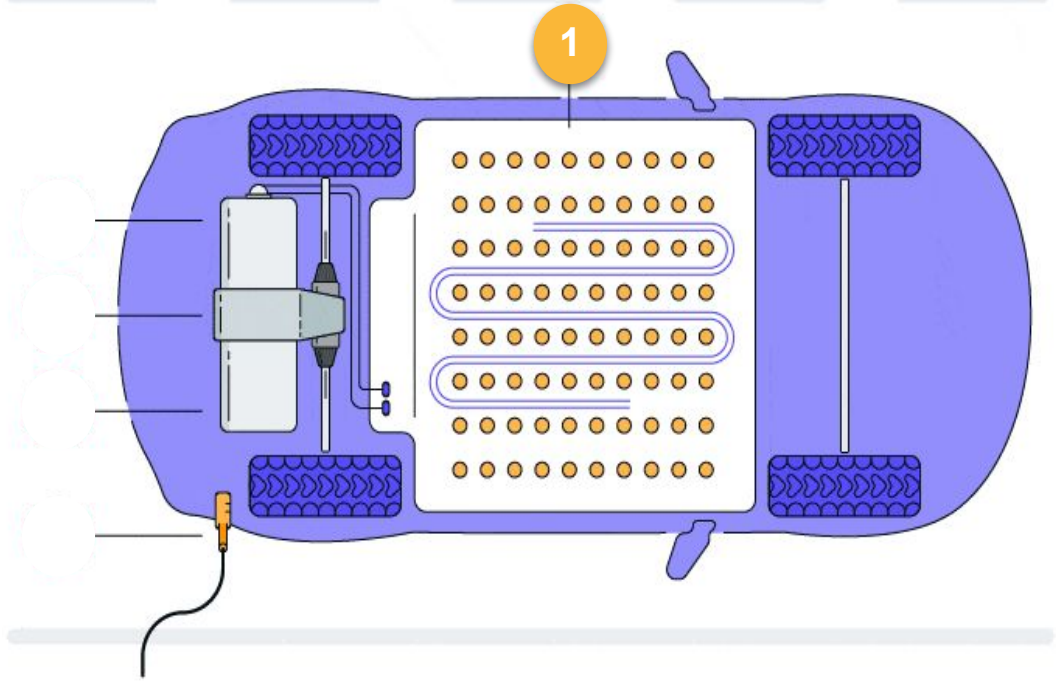
How does a battery electric car work?

There are **5** major components of the **battery electric vehicle**



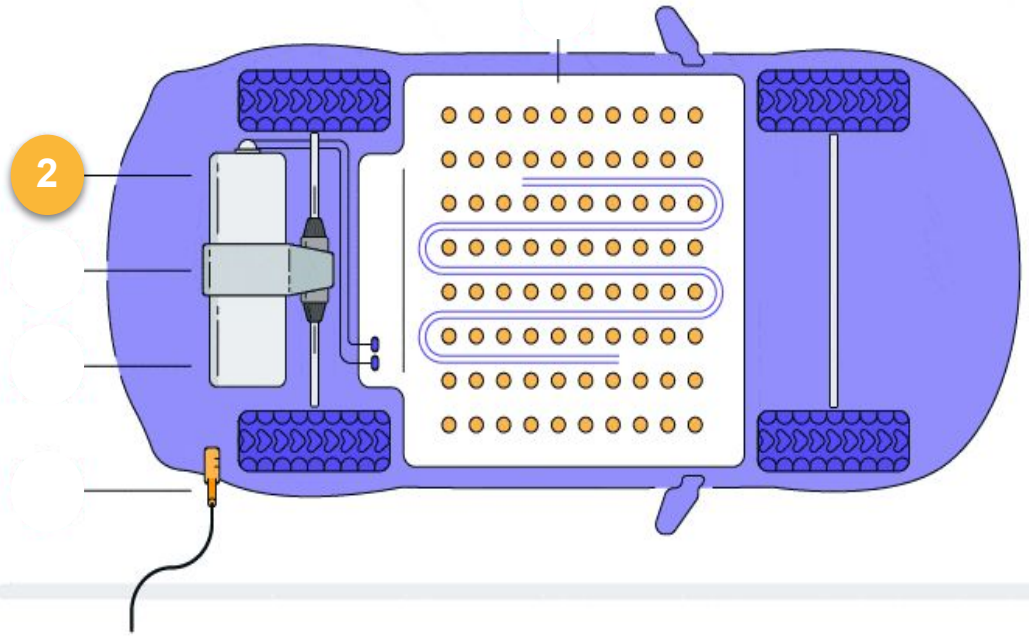
How does a battery electric car work?

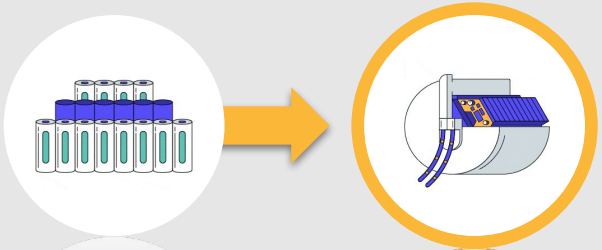
The **battery pack** is made up of lithium ion cell batteries with coolant running through the pack to keep it from overheating



How does a battery electric car work?

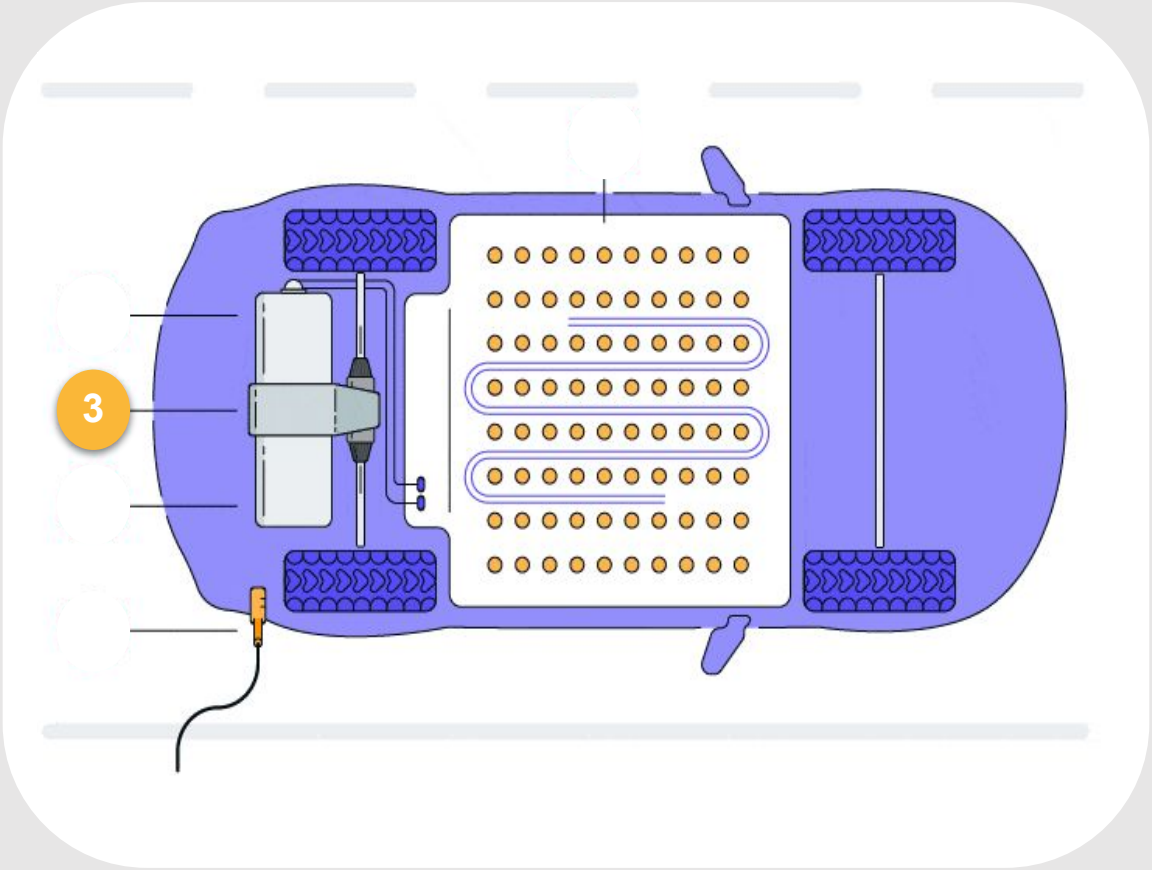
The **inverter** converts the power from direct current to alternating current to power the motor

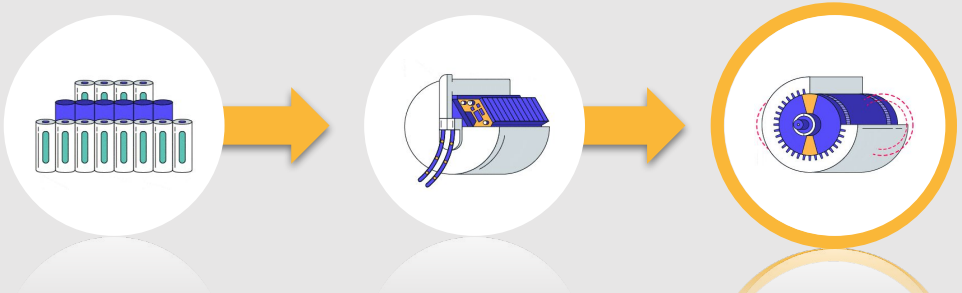




How does a battery electric car work?

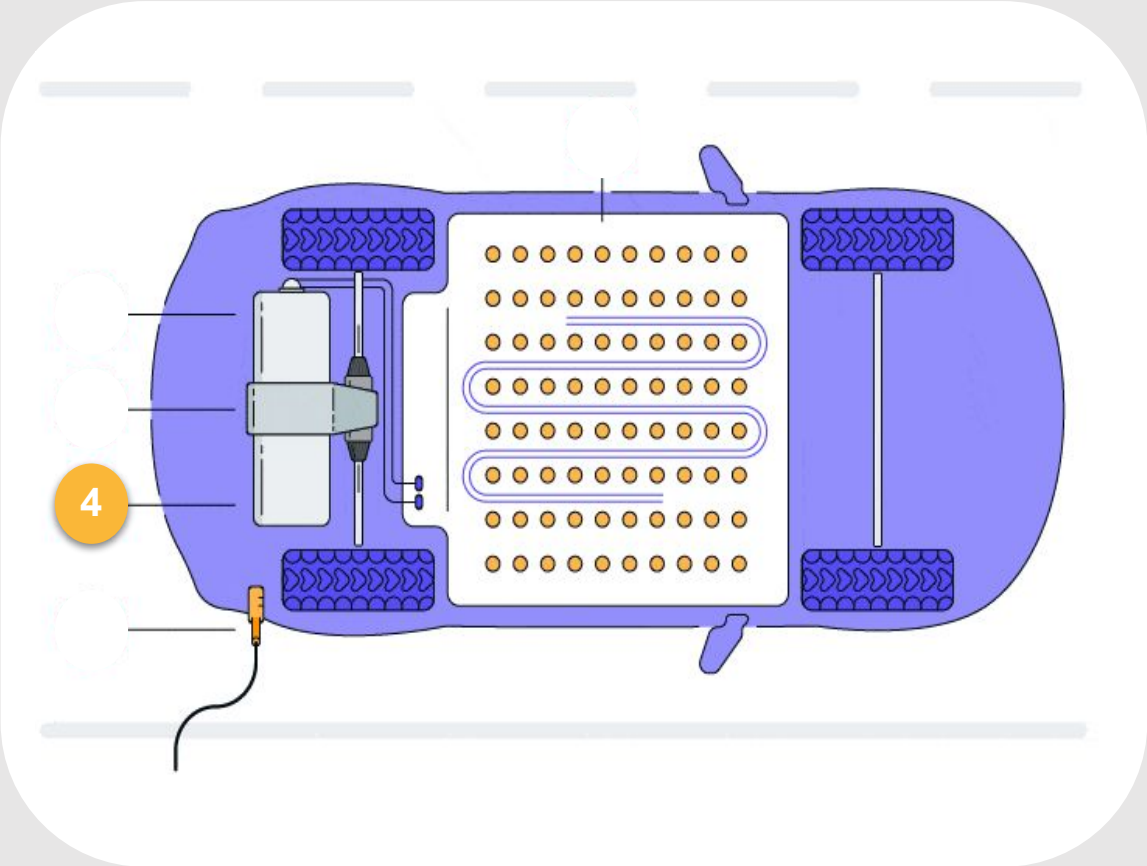
The **induction motor** uses the alternating current to produce a rotating magnetic field causing it to turn

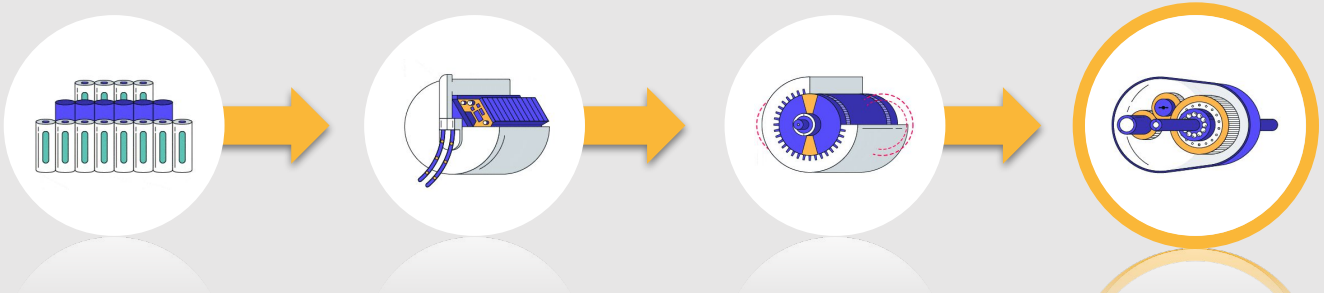




How does a battery electric car work?

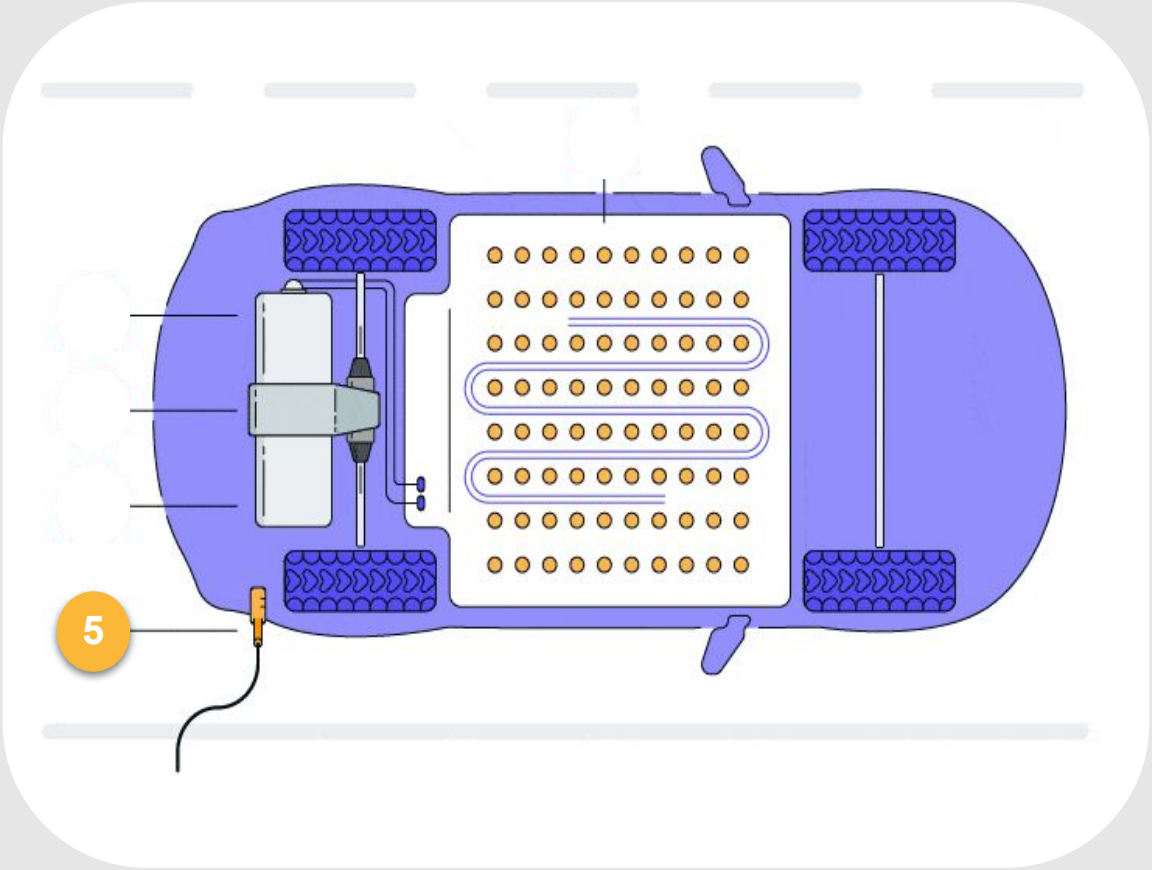
The **drivetrain** distributes power from the motor to the wheels.

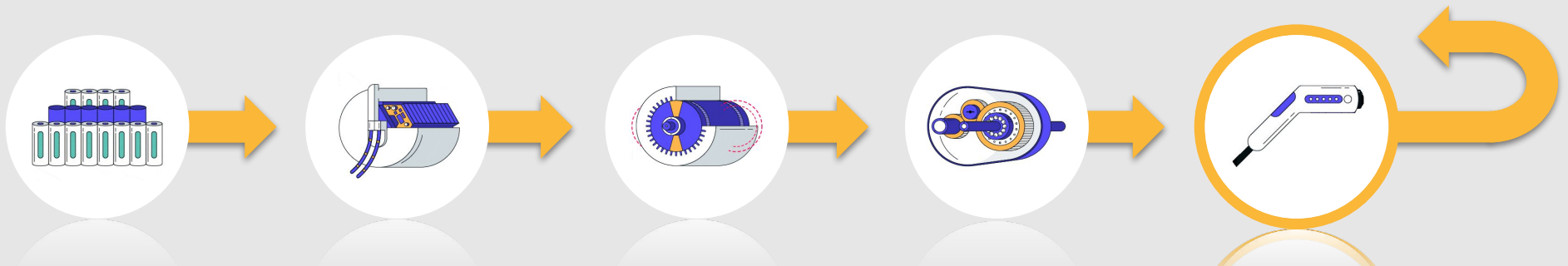




How does a battery electric car work?

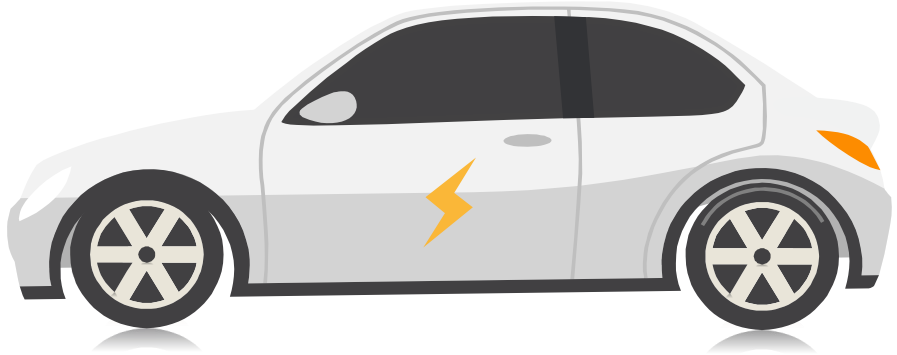
The **charging system** allows you to transfer energy from the grid to the battery pack





What else do these vehicles offer?

Regenerative Braking



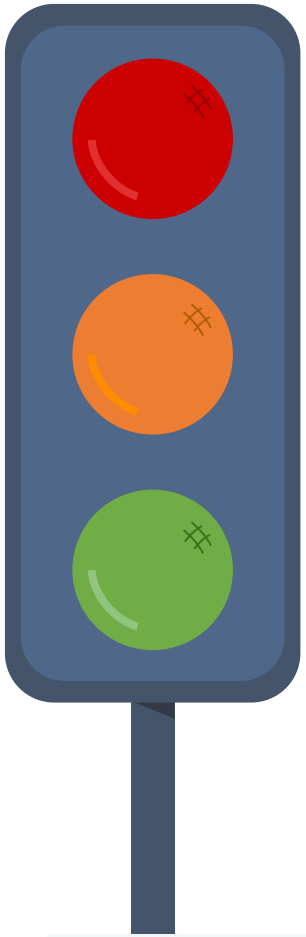
When you take your foot off the accelerator or press on the brakes the electric motor is operated in reverse

This recaptures some of the vehicle's kinetic energy and recharges the battery

Regenerative braking increases efficiency, but should not take the place of charging at a station

Regenerative braking modes vary with each vehicle make and model

One-pedal Driving



Brake — press the brake pedal to stop quickly

Slow Down — release the accelerator*

→ regenerative braking

Speed Up — press the accelerator

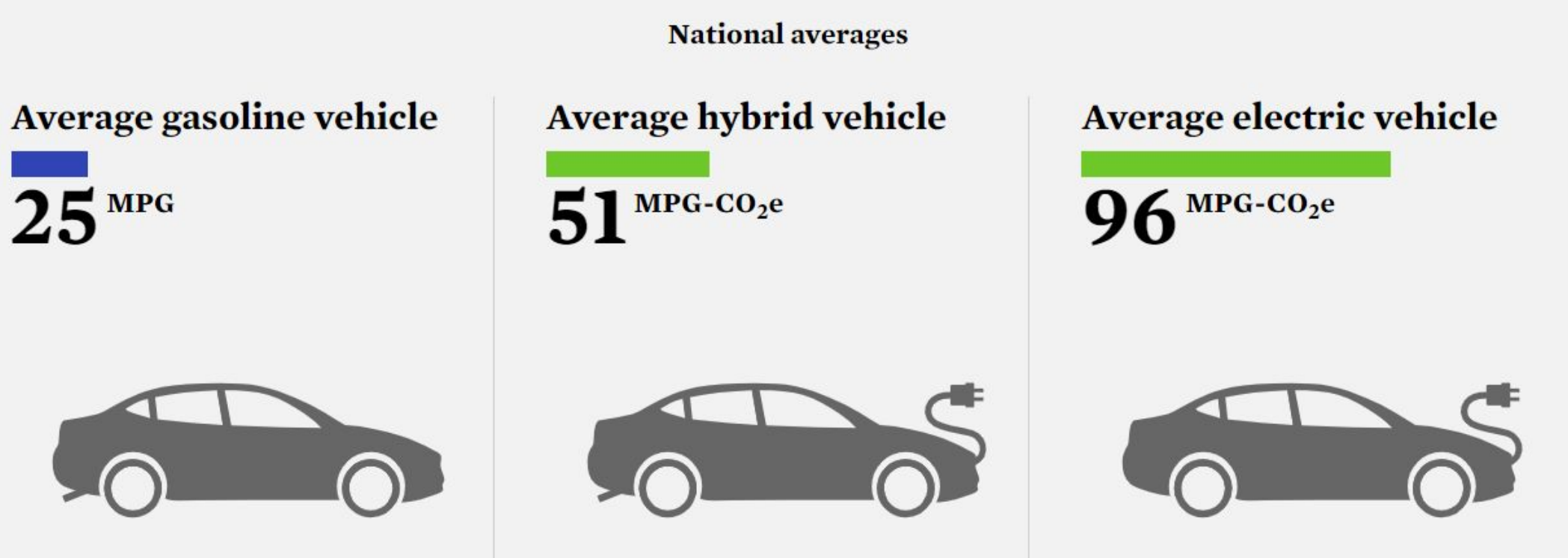
*depending on vehicle model, when you release the accelerator the brake light may or may not activate.

Dashboard Displays & Other Features

What are the Benefits?

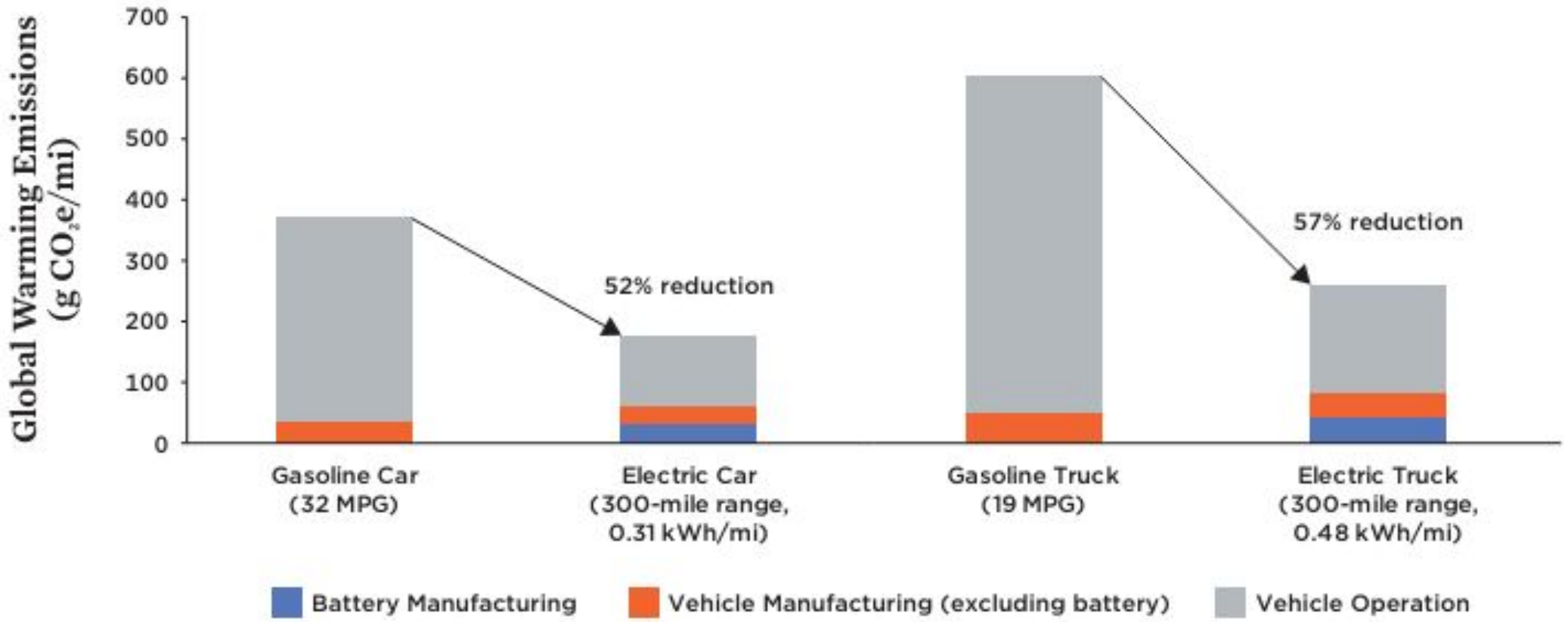
- Zero Emissions (potential)
- More Efficient
- Less Maintenance
- Fuel Savings
- Enhanced Performance
- Helps Meet Mandates

Emissions by Type



Miles-per-gallon carbon dioxide equivalent or MPG-CO_2e is a standard way to understand and compare emissions from electric vehicles

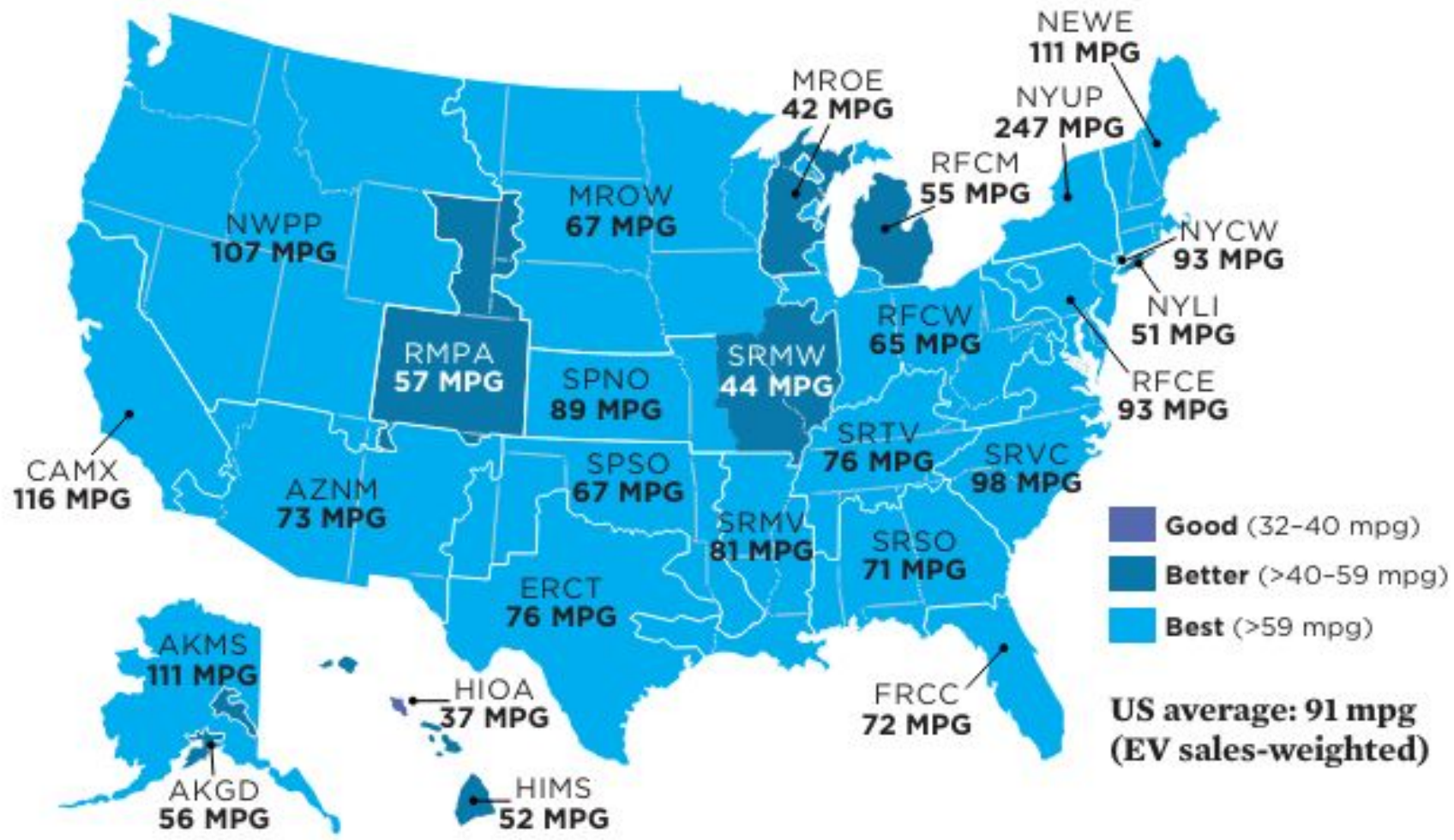
FIGURE ES-2. Life Cycle Global Warming Emissions, EVs vs. Gasoline Cars and Trucks



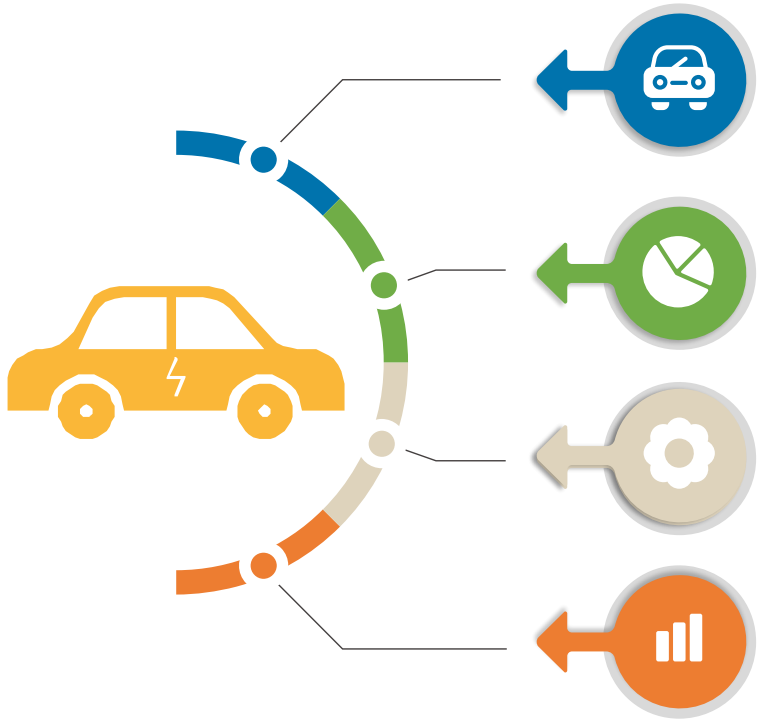
Life cycle global warming emissions are significantly lower for EVs than for gasoline cars or trucks when considering manufacturing and usage, despite higher battery-manufacturing emissions for the EV.

Note: Emissions are measured in grams of carbon dioxide–equivalent per mile, averaged over the life of the vehicle.

The Miles per Gallon Equivalent of the Average EV



ZEV Market Trends



U.S. laws & regulations promote and mandate ZEV Market Development

Investment & mass production ramp up for all classes of electric vehicles; longer ranges; More technology improvements improving ranges & availability

More public charging & fleet card acceptance is coming! More compatibility between plugs/connector types

Supply chain disruptions relating to microchips have mostly recovered since 2022 but the automotive industry hasn't fully recovered

Maintenance

- Each vehicle has an 8-year, 100,000 mile battery pack warranty

- BEVs don’t require oil changes
  - They do, however, require regular tire pressure testing, tire rotation, and the owner must routinely flush any corrosive materials, replace the cabin air filter and wiper blades, and top off the washer fluid

- Maintenance requirements will vary depending on the climate

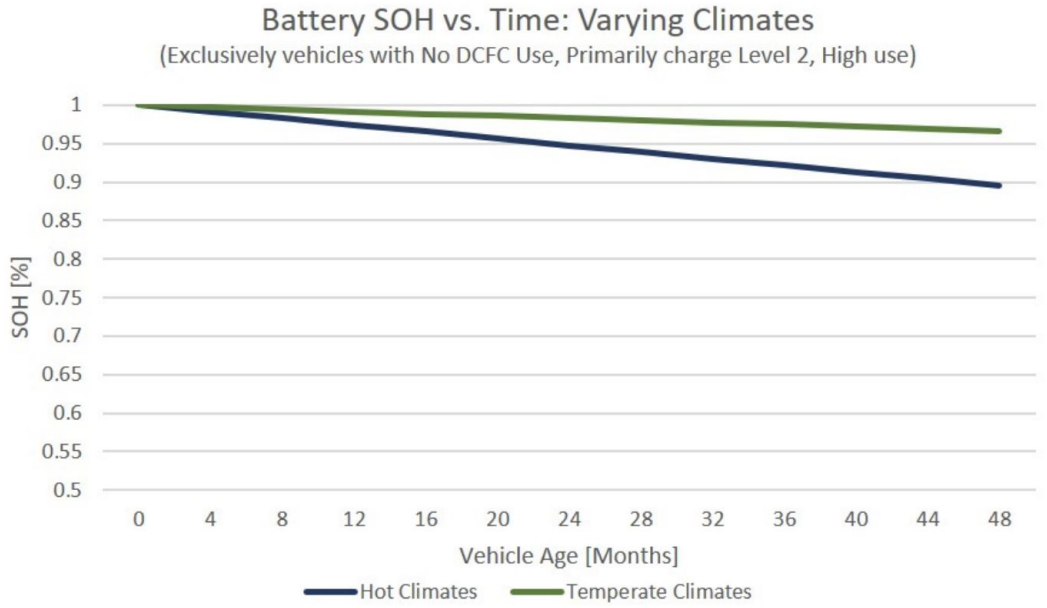
- Work with GSA to schedule Tesla appointments

Common Factors Impacting Battery Life and Driving Range

Source: DOE NREL

Anything Extreme:

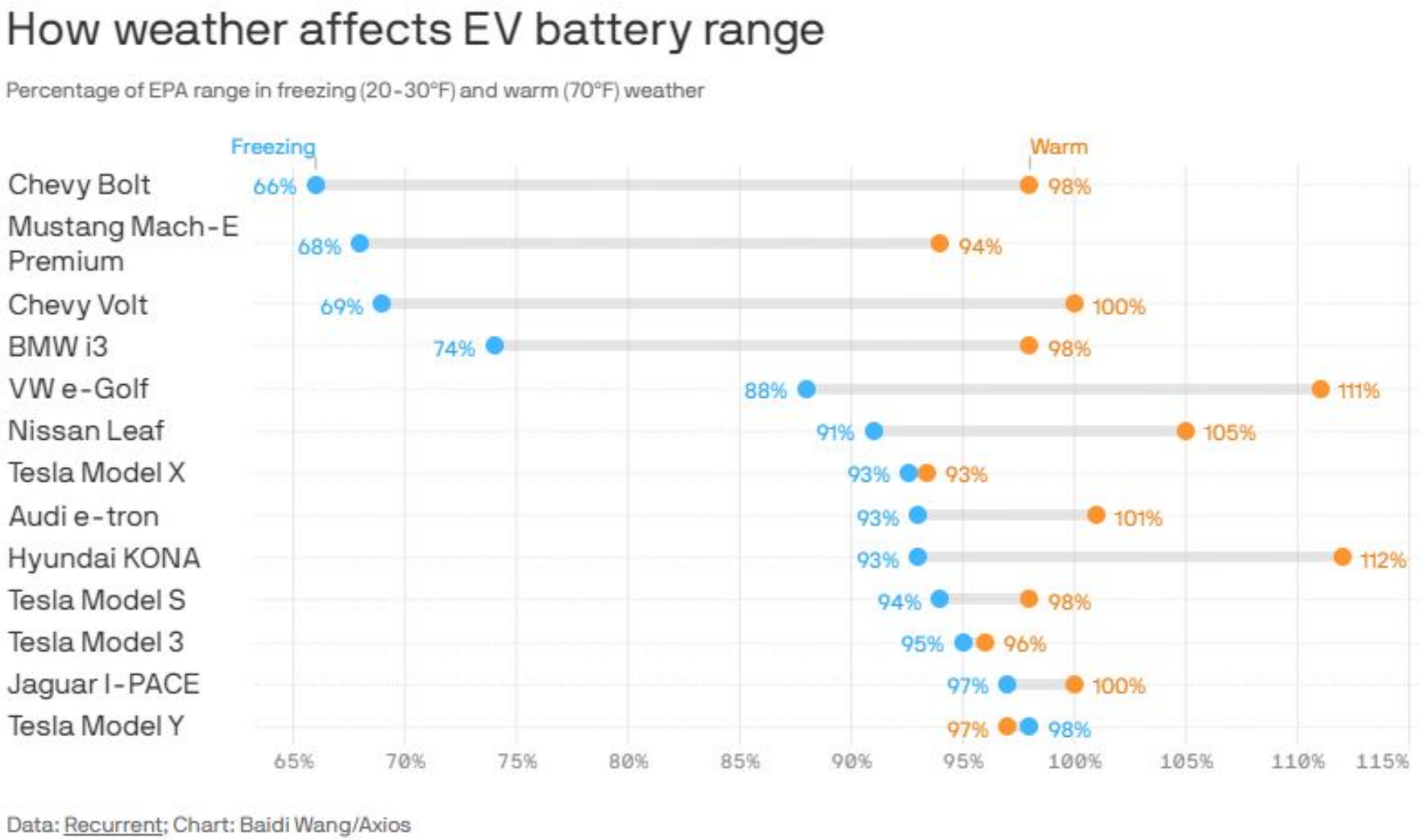
- Temperatures
- Terrain



- Temperate (fewer than 5 days per year over 80°F (27°C) or under 23°F (-5°C))
- Hot (more than 5 days per year over 80°F (27°C))

Source: DOE NREL and https://www.geotab.com/uk/blog/ev-battery-health/

Effects of Temperature



Tips to Minimize Range Loss

1. Park your car in a garage.
2. Heat the passenger, not the car.
3. If you need to heat or cool the bain, make time to “pre-heat” or cool down the inside of the vehicle while still connected to the charger.
4. Inflate your tires.
5. Activate the “eco” mode.
6. Smooth driving habits.

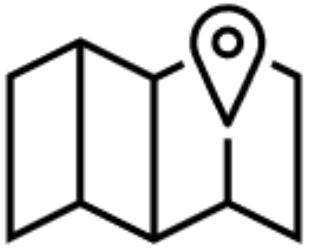
Remember:

- High vehicle use does not equal higher battery degradation.
- EVs on average lose 20% of their range in colder climate.
- EVs charge more slowly in cold temperatures.
- Lower-power charging methods promote longer battery health.

Zero Emission Vehicle Selection Considerations

Duty & Power Requirements
Typical vehicle uses (moving people, moving items)

Vehicle Type
Vehicle type required (light-, medium-, or heavy-duty)



Driver & Route
Specific driver requirements, route consistency

EVSE

Charging Levels

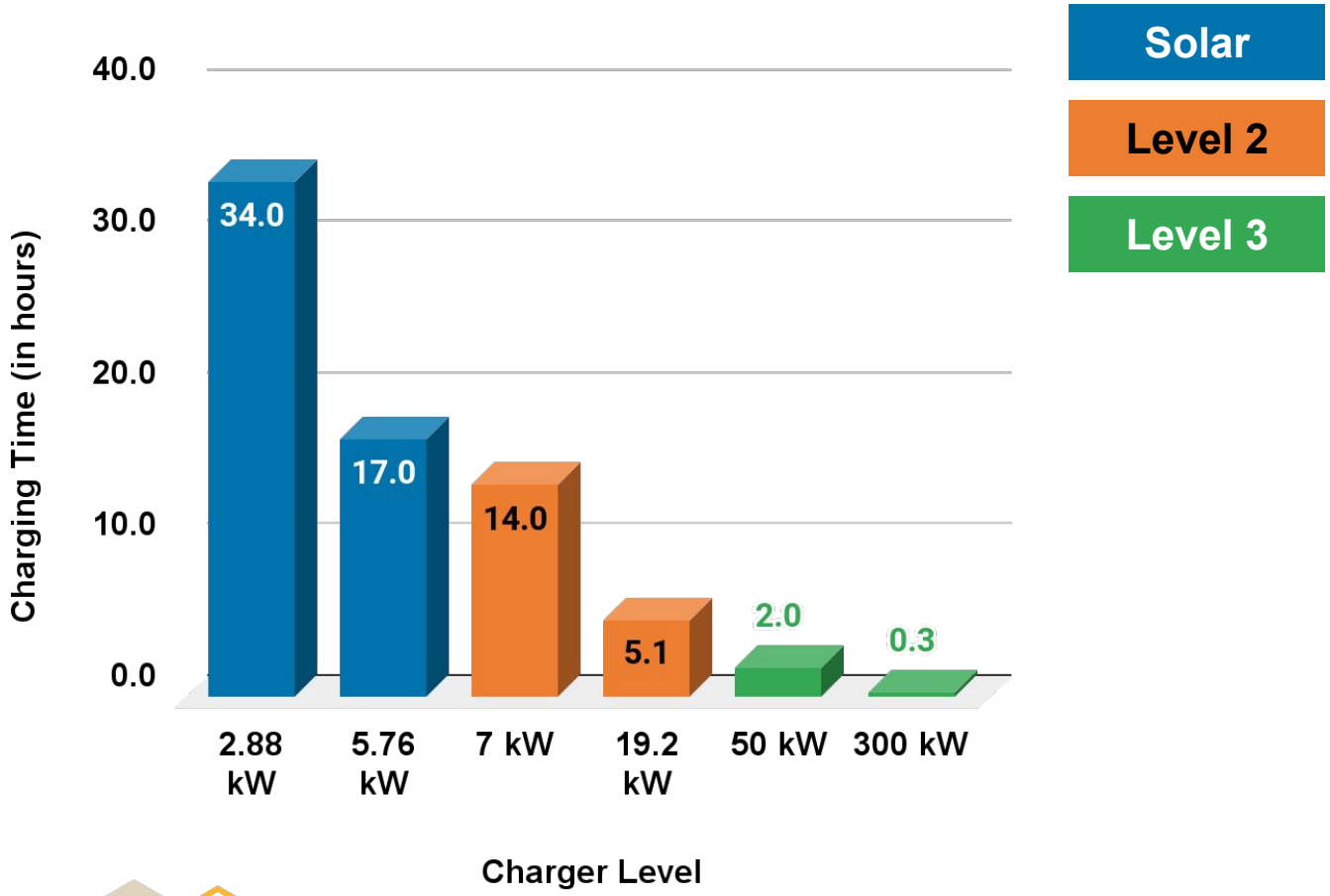
Level 1 charging	Level 2 charging	Level 3 charging
		
Voltage: 120V Charge Time: 3 - 5 miles per hour Locations: Home	Voltage: 240V Charge Time: 12 - 40 miles per hour Locations: Home, Public	Voltage: 480V Charge Time: 80% charge in 20-30 mins Locations: Public

ZEVs by Recharging Time

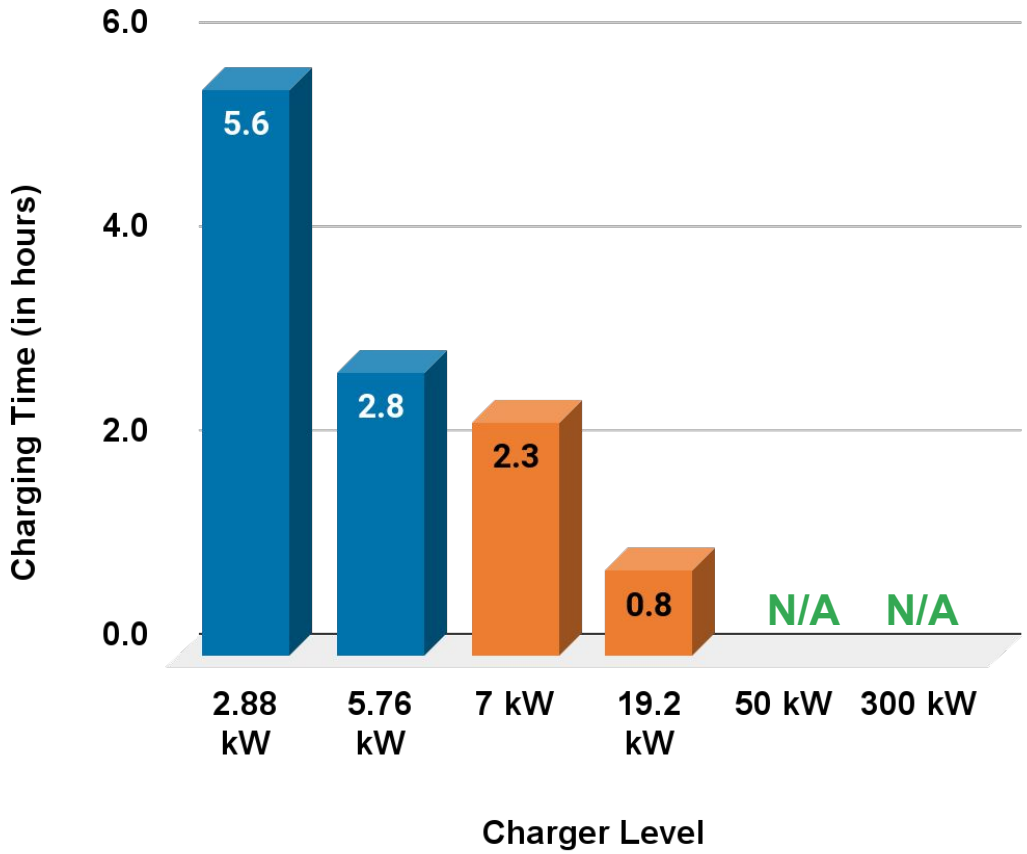
MY2024 Electric Vehicle	KW	All Electric Range/Total Range/Mile	Level 1/120V Recharge Time (hrs) $	Level 2/240V Recharge Time (hrs) $$	DC FAST (50-150 kW) Recharge Time (hrs) $$$
			4-6 miles of range per hour. *Charging cord provided. Plug into existing outlet or station*	***10-20 miles of range per hour****.2-10 hours for full charge. Stations can collect data.*	***50-90 miles of range per 30 mins****. Full charge in 30 minutes-1 hour.*
Nissan Leaf (base)	40 kWh	149	30	7.5	1.8
Chevy Bolt	66 kWh	259	64	9	1.4
Chrysler Pacifica PHEV	16 kWh	32/520	14	2	N/A
F150 Lightning	98 kWh	230-320	72+	10-14	41-122 minutes
Mustang Mach-E	70 kWh	211-300	95+	14	1 hour
Hyundai Kona	49 kWh	258	50+	9.5	1 hour
Ford Escape PHEV	14 kWh	37/530	10	3.5	N/A
Model 3	82 kWh	XXXX	XX	2.4	N/A

How long does it take to charge my vehicle?

Ford F150 Lightning



Chrysler Pacifica-P



How to find a Charger?

- Finding a charger plugshare.com or DOE Alternative Fueling Station Locator
- Sites like abetterrouteplanner.com help you plan for charging on trips

EV Charging: More Networks Accept WEX

- ChargePoint roaming agreements mean more pay-for use or free public charging -
  - **Available at ChargePoint, EVBox, evconnect, EVgo, and Flo connected Stations**
  - Reporting in gsafleet.gov
- GSA Fleet Leased Teslas can charge via plug and charge
- FY25 Costs for charging will be passed through
- Request a WEX connected ChargePoint card at GSAFleetAFVTeam@gsa.gov
- **WEX RFID Cards coming in FY25!**
  - **Use at** ChargePoint, EvConnect, EVGo, Flo, Blink, Revel and AmpUp. Several more should be coming on here in the next months or so.

Find a station on https://www.plugshare.com/

EVSE Safety

Charging an EV is safe and easy!

Just make sure you:

- Use the appropriate equipment for charging your EV
- Look for approved safety certifications
- Choose reputable manufacturers
- Stay grounded
- Don’t leave out cords
- Use proper signage
- And leave installation to the professionals!

If your station won’t be networked, ensure it is in a secure/gated location

Smart Charging 101

Leidy Boyce, NREL

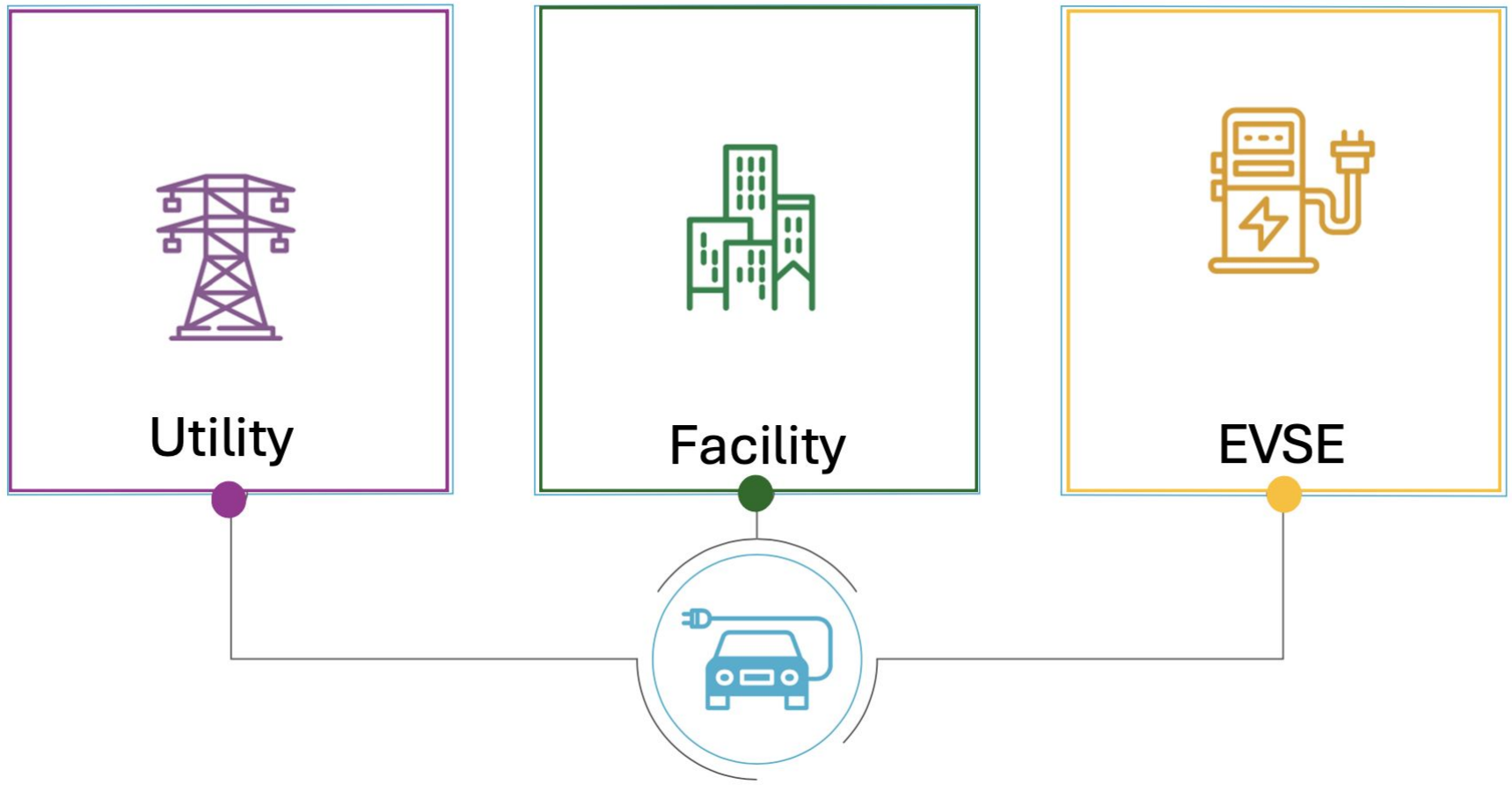
What is Smart Charging?

Smart Charging additional Expenses

- Installation, Maintenance Management of Service.
- Cloud Services.
- Network Connectivity

Fleet Operations

- End user training
- Fleet logistic and policy might change
- EVSE feature and compliance with industry standard are important.



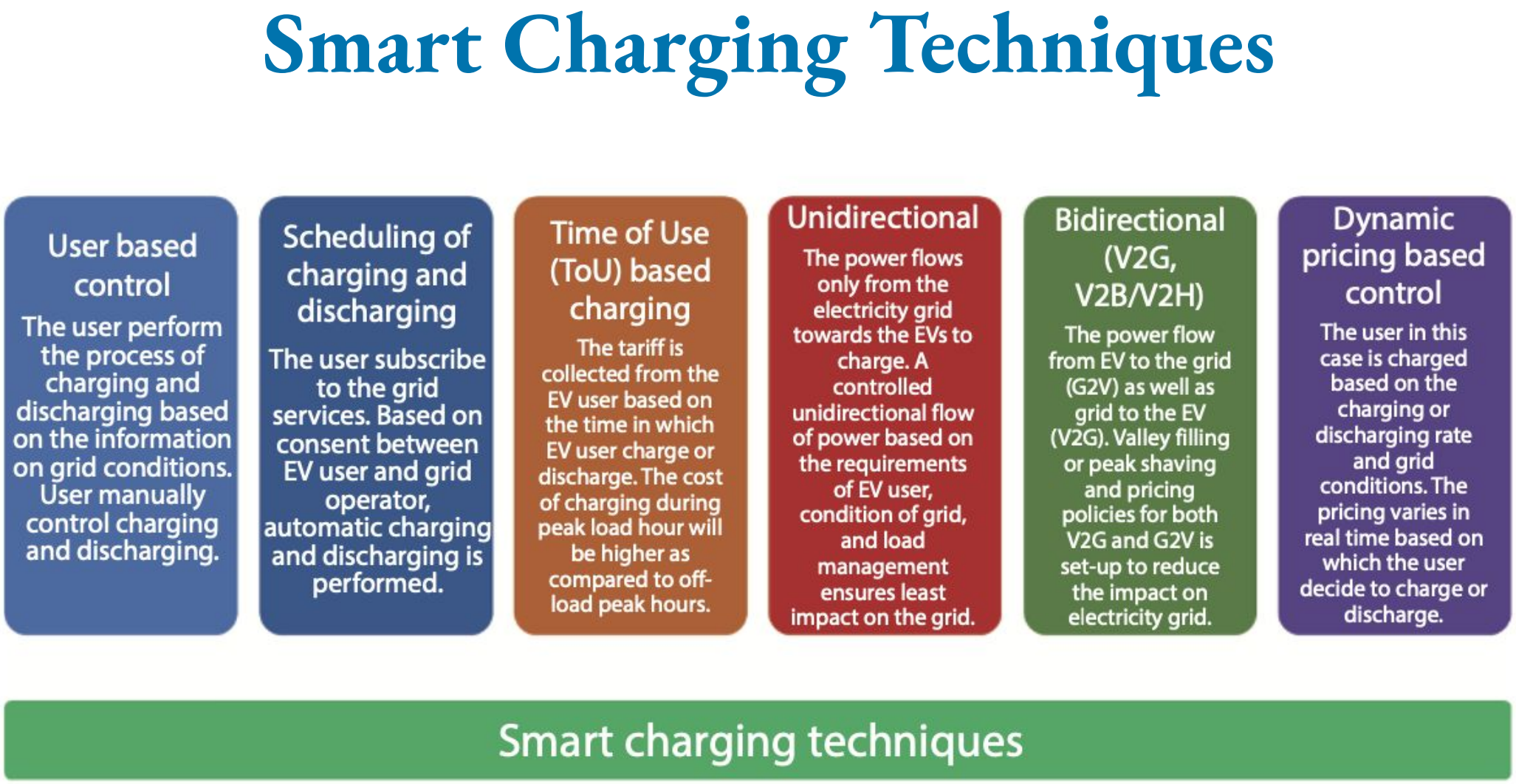
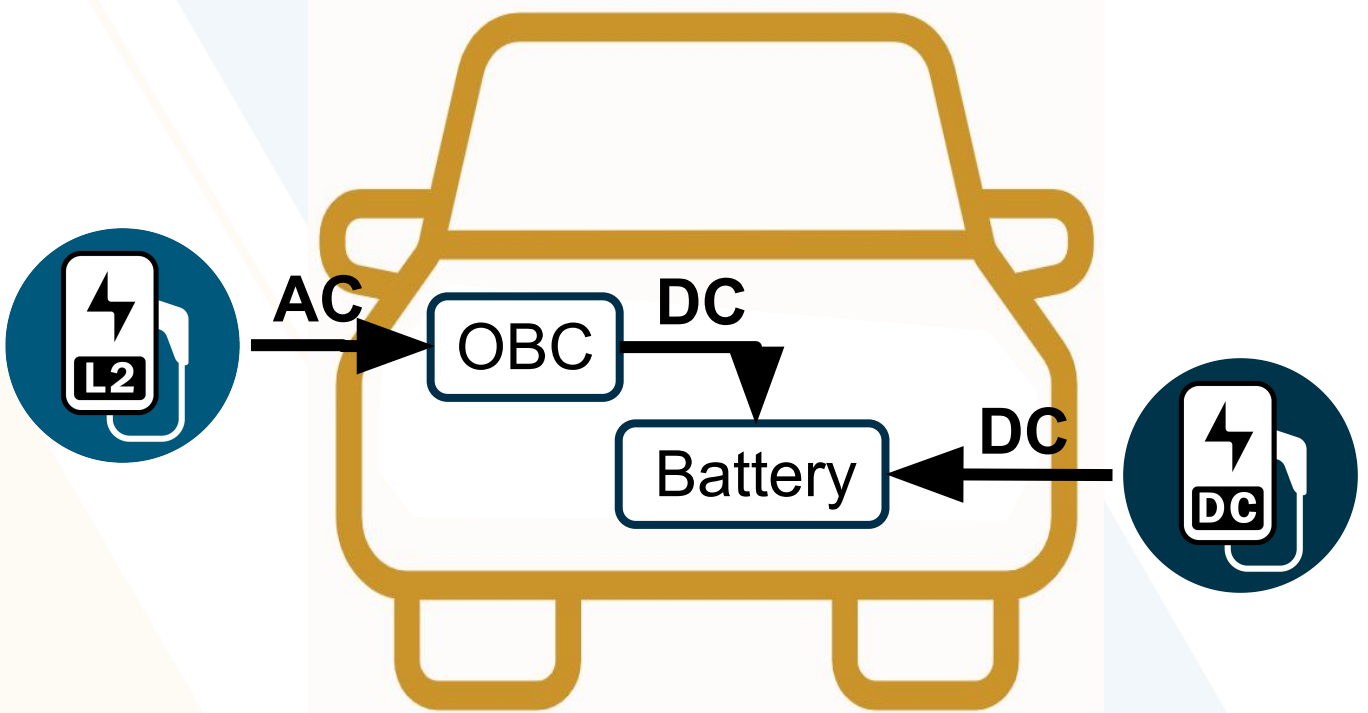


Figure 1.2 . A brief on different approaches to smart charging techniques, Smart Charging Solutions for Hybrid and Electric Vehicles. **Pag 10.**

Onboard Chargers (OBC)

OBC takes the incoming AC electricity supplied via the charge port and converts it to DC power for charging the traction battery.



The most important function of the on-board charger is to control the speed and efficiency of the charging process.

EVs cannot charge faster than the capability of its onboard charger

EV	AC Onboard charger size (kW)	DC Acceptance Rate (kW)
Chevy Bolt	7.2 or 11.5	50
Tesla	7.7 or 11.5	250
Ford Mustang Mach-E	11	150
Volkswagen ID.4	11	125
Audi e-tron	9.6 or 11	150
Nissan LEAF	6.6	50
F-150 Lightnings	11.5 or 19.2	100 or 150

Your Choices Matter

Not as Flexible

FLEXIBLE

EV

Battery Size
On-board
Charger Capacity

Fleet driving needs?

Connector Type

Max power
(kW)

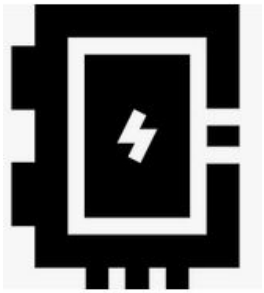
Breaker size?

Charging Station

Level 1, 2, or 3

Charging times?

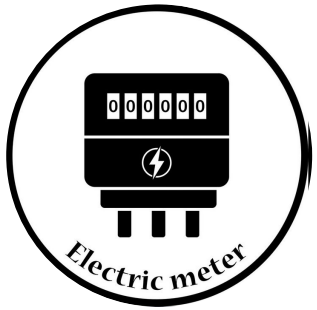
Service Panel



Electrical
Capacity

Is it sufficient? Panel Rating

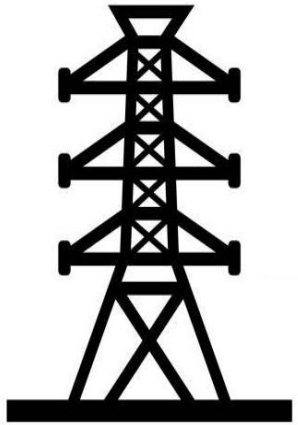
Meter



Electricity Cost

How much and when? kWh

Energy Source



Electrical Upgrades?

Energy Requirement Considerations

Vehicle Key Parameters		Building/Facility Key Parameters
Number of trip per day, miles driven per trip, and trip time hours		Distance from service panel to vehicle parking area.
On-board charger capacity (kW) and DC acceptance rate, and battery size (kWh)		Service panel capacity and number of spare brakers
EV's energy consumption rate in kWh/miles		Energy Consumption
Vehicle location and typically dwelling period length		Utility bill rate structure

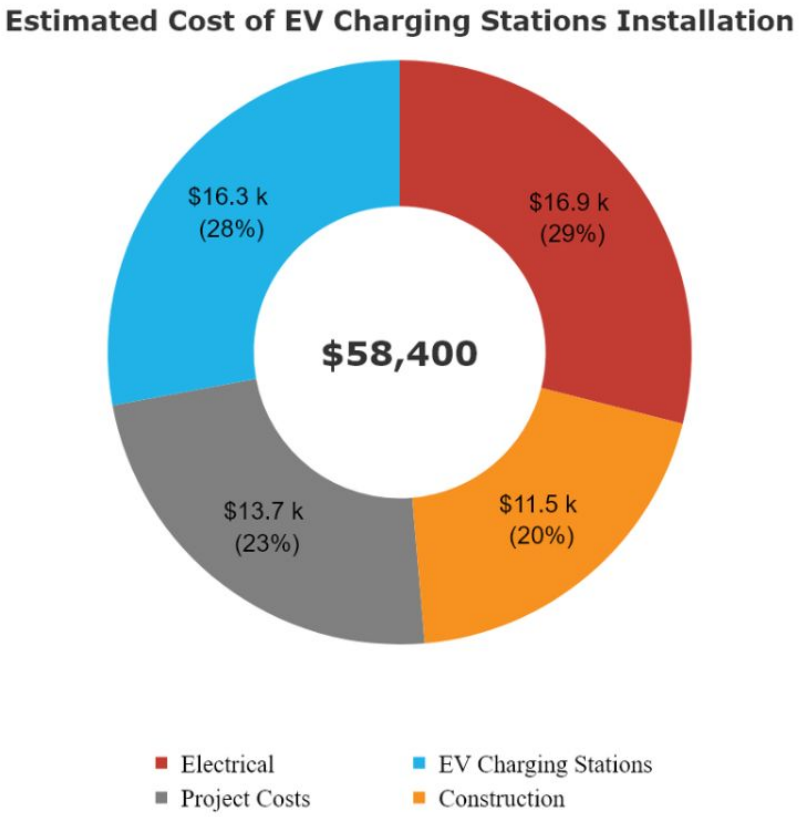
EVI-LOCATE

(Electric Vehicle Infrastructure – Locally Optimized Charging Assessment Tool and Estimator)

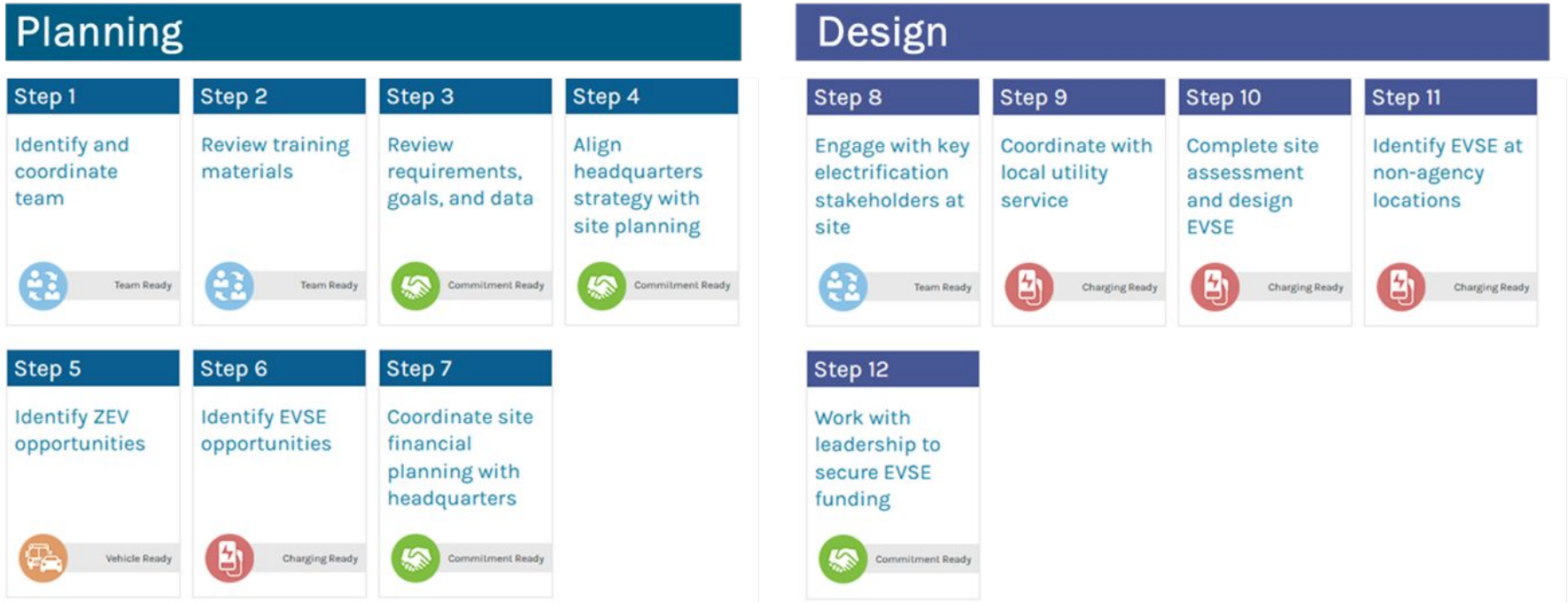
Plan charging station deployments

Assess site-specific electrical needs

Calculate local project costs



ZEV Ready Federal Fleet Electrification Process



https://www.energy.gov/femp/overview-zev-ready-federal-fleet-electrification-process

Questions & Answers

Contact us:

gsafleetafvteam@gsa.gov

federal.fleets@nrel.gov

Federal Fleet Electrification Support

Download the **FY24 ZEV Fact Sheet** at [gsa.gov/afv](gsa.gov/afv) to see all of the current ZEV offerings

Make, Model, Offeror	Toyota Prius Prime (PHEV) (Global Auto) Closed –Anticipated Reopen	Chevy Bolt (BEV) Closed –Anticipated Reopen	Nissan Leaf (BEV) (U.S. Fleet Source)	Tesla Model 3 RWD (BEV) (U.S. Fleet Source) Closed –Anticipated Reopen
SIN & Vehicle Type	8P Subcompact Sedan	8E Subcompact Sedan	8E Subcompact Sedan	9E Compact Sedan
Passengers	5	5	5	5
Pass. Volume (cu. ft.)	111.3	94.4	92.4	97
Rear Legroom (inches)	33.4	36.5	33.5	35.2
Cargo Capacity (cu ft.)[1]	19.8	16.9	23.6	19.8
Acquisition Price	$28,641	$28,910	$22,293 (base) $27,388 (extended range)	$48,423 (base) $58,423 (extended range & AWD)
Incremental Cost	$11,169	$11,435	$4,883	$28,821
GSA Lease Rate (base)	$227/mo. & $0.095/mile	$242/mo. & $0.029/mile	$242/mo. & $0.029/mile (base) $317/mo. & $0.029/mile (extended range)	$253/mo. & $0.056/mile (base) $397/mo. & $0.056/mile (ext. range Option AFI & AWD)
Total Range (miles)	640 miles	259 miles	149 miles (base) 226 miles (extended range)	263 miles (base) 353 miles (extended range & AWD)
All-Electric Range (miles)	25 miles	259 miles	149 miles (base) 226 (extended range Option IB1)	263 miles (base) 353 miles (extended range & AWD)
Recharge Times[3]	120V: 5 hrs & 30 minutes 240V: 2 hrs & 10 minutes Fast Charge: N/A	120V=64.75 hrs 240V=10 hrs Fast Charge: ~1.4 hrs	120V: 30 hrs 220V: 7.5 hrs Fast Charge: ~1 hr	120V: 24-36 hrs 240V: 8 hrs Fast Charge: 20-60 mins
MPGe and MPG (city/highway/combined)	MPGe: -/-/133 MPG: -/-/54	MPGe: 131/109/120	MPGe: 123/99/111 (base) 118/97/108 (extended range)	MPGe: 150/133/142 (base) 141/127/134 (extended range)
Grams of CO2 Per Mile	78 grams/mile	0 grams/mile	0 grams/mile	0 grams/mile

[1] Total cargo includes with total cargo area and total cargo space with seats folded down.
[2] All vehicles (except Tesla models) come with a Level 1 (120V) charger capable of plugging into 3 prong electrical wall outlets. All vehicles are capable of Level 2 (240V) charging. J1772 adapter is standard with Tesla Models and a CCS Adapter (for use at DC Fast Chargers), as is a L2 wall station (install required).
[3] DC Fast Charge capability is standard on the 8E Leaf and Bolt; 9E Model 3; 162E/34E/95E E-Transit; 98E Kona and Bolt EUV; 55E Kona; 91E Mach-E; 96E Mach-E, 96P Outlander and Model Y; 55E F150 Lightning & Hummer.

LD & MD SINs Available

+1,000 Allocation / No Limit

SIN	Make/Model
9E/91E	Tesla Model 3/Y
100E/105E	Hyundai Ioniq 5
10E	Hyundai Ioniq 6
100E/105E	VW ID.4 Pro
105E/105G	Chevy Blazer (+SSV)
57E	Chevy Silverado EV
55E	Ford F150 Lightning
91E/96E	Ford Mustang Mach-E
34E	Ford E-Transit

BEV **PHEV**

Going Fast!

SIN	Make/Model	Allocation
96P	Mitsubishi Outlander	<400
96P	Kia Sorento	<250
98P	Ford Escape	<200
105P	Jeep Grand Cherokee	<120
112P	Jeep Wrangler Rubicon	<50

Find more resources and information:

- One stop shop: **gsa.gov/ElectrifyTheFleet**
- Browse or purchase: **GSAFleet.gov!**
- ZEV Fact Sheet: **gsa.gov/AFV**

Available HD & Specialty Vehicles

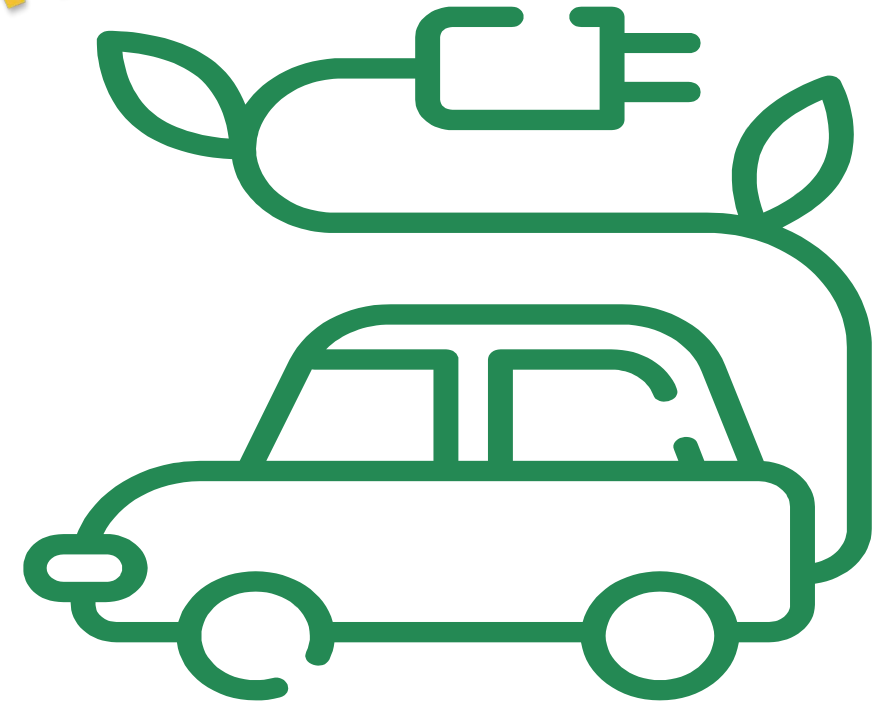
SINs	Vehicle Types
524E, 624E	Electric Tractor
531E, 533E	Electric Stake/Flatbed Truck
571E, 573E	Electric Dry Van
281E	Electric Wheelchair Van
320E-323E, 338E-339E	Electric School & Adult Work Buses
397E-399E	Electric Intercity Motorcoaches
377D-377L	Electric HD Low Floor Transit Buses

Find more resources and information at **gsa.gov/ElectrifyTheFleet and browse or purchase in GSAFleet.gov!**

Federal Support for ZEV Deployment

Offerings Match Commercial Marketplace	Charging Station Offerings & Install Support	RFID Cards
Unique Financing Options	Training (GSA Fleet & DOE EV Champion Training coming in October!)	Resources & Assistance (ZEV Ready Center, EVI Locate, EV U Finder, Contact NREL for ZPAC)

GSA EVSE Empower Week



Plug Into the Future: Energize Your Skills!

Multiple 1 Hour sessions the week of August 5th

Recordings & presentations will be posted to gsa.gov/gsa-fleet-training

Registration open soon!

Jam-packed week of EVSE sessions!

Session dates/times will be sent out soon and include:

- ➔ GSA's EVSE Offerings & Considerations
- ➔ EVSE FAQs
- ➔ Public Charging & Paying to Charge
- ➔ Site Planning
- ➔ EVSE/ZEV FAST Reporting

Reach out to GSAFleetAFVTeam@gsa.gov with questions

Fleet®