NYC DCAS
Citywide Administrative Services

Let’s Talk About Electric Vehicles

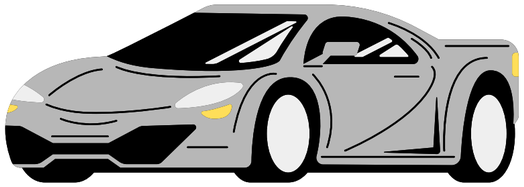
Understanding and Using Your EV

March 2024

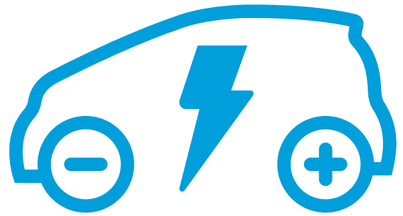
Internal Combustion Engines (ICE) vs. Electric Vehicles (EV)

- refuel with gasoline/petroleum
  - sometimes diesel
- average 400 miles in range
- oil changes, regular maintenance
- common, familiar, comfortable

- refuel with electricity
  - e.g. from grid, solar, renewable source
- range varies from 100 to 500
- no oil changes, little-to-no maintenance
- new, becoming more common, unfamiliar and seemingly complicated



let's familiarize and uncomplicate it



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Internal Combustion Engines

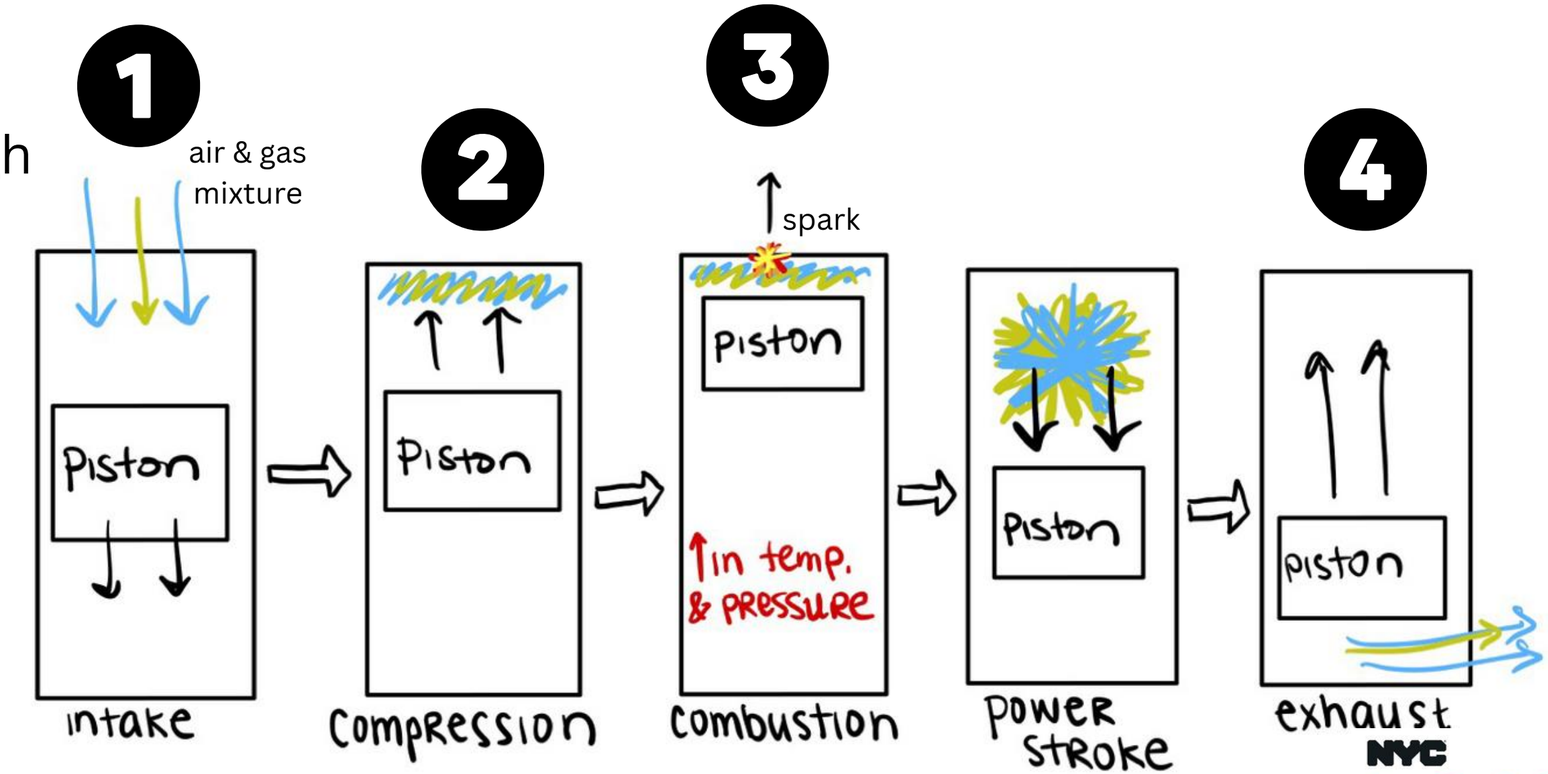
Spark Ignition

Torque is a measure of **rotational force** or the ability to cause an object to rotate around an axis, usually measured in newton-meters (Nm) or pound-feet (lb-ft).

In ICE vehicles, torque is **created through a set of mechanical processes** that involve combustion of a gas-air mixture (hence “internal combustion engine”):

4 steps:

1. Mix of air and fuel enters through intake valve
2. Air and fuel are compressed
3. Spark ignites air-fuel mixture
   - Explosion (i.e., expansion of the gases) sends piston downwards with significant force - *this turns the wheels*
4. Remaining gases are expelled through exhaust valve



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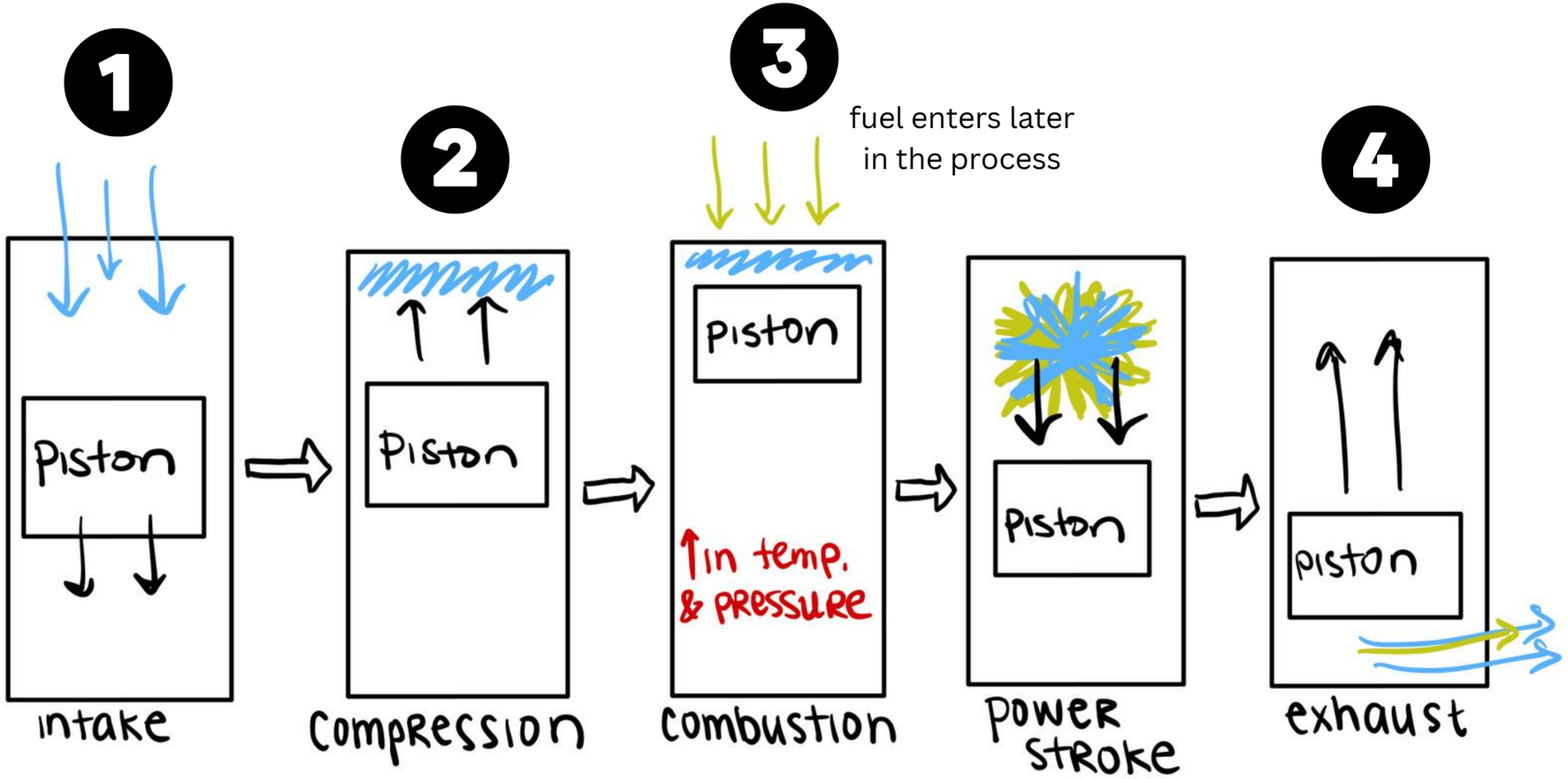
Diesel Engines

Compression Ignition

Diesel engines are similar to petroleum cars, but the mechanical process does not include a spark. Instead, air alone is compressed, and then the diesel fuel is let in, which instantly ignites when it meets the highly pressurized hot air.



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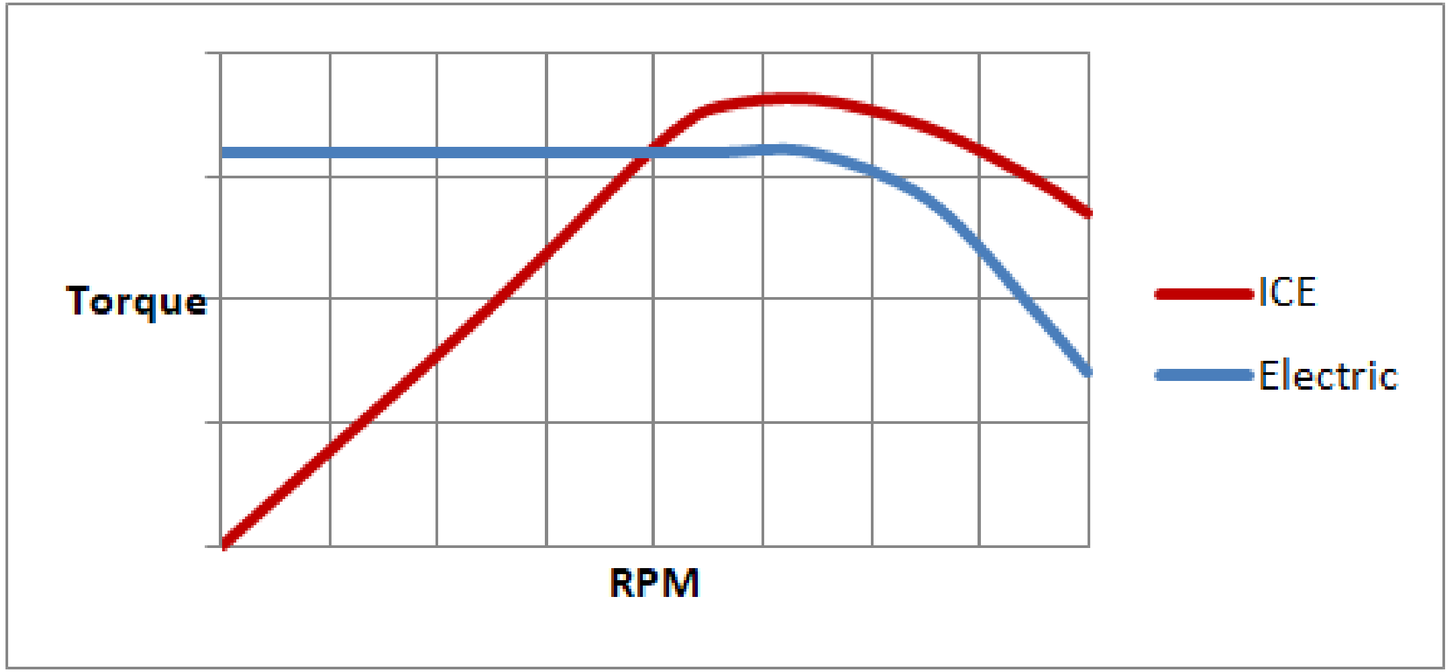
Electric Vehicles

In EVs, the electric motor **directly converts electrical energy into mechanical torque** (no combustion needed).

This direct conversion means the **maximum available rotation force** is immediately available, known as **instant torque.**



This is why **EVs outperform ICE vehicles** in the 0-60mph acceleration category.

Practically, it means that there is a **much smaller lag time** between pressing the accelerator pedal and acceleration. (i.e., **smaller changes in pedal position** are required when driving an EV)

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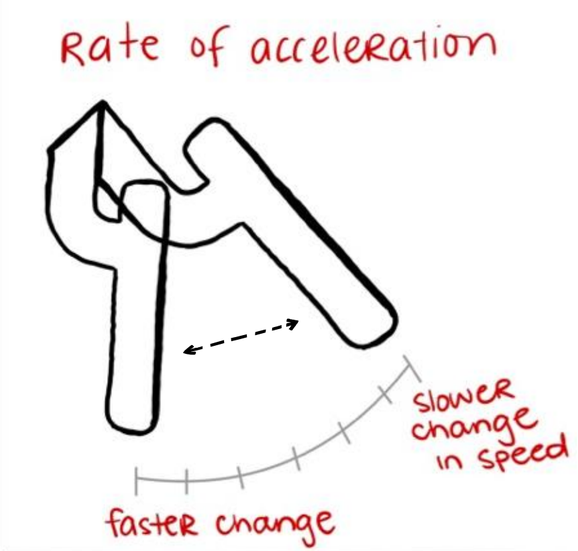
Electric Vehicles

Single-pedal driving, or regenerative braking, is a function of electric vehicles that allows the driver to maximize efficiency.

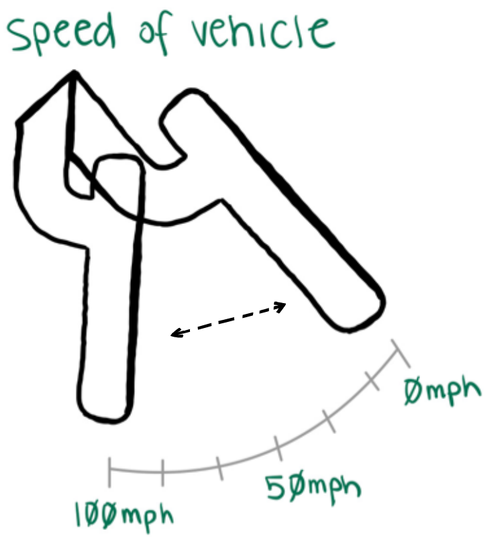
The regenerative braking capability will **increase your car's range,** but it means getting used to the fact that **taking your foot off the "accelerator" will slow the car down very quickly**--like putting your foot on the brake would

pedal angle differences

ICE



EV



Since pedal angle is correlated with speed instead of acceleration rate...

→

push pedal down **= speed up**
keep still **= stay at current speed**
lift up slightly **= slow down**
take foot off completely **= slow to stop**

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EVs are Low Maintenance

No gas engine, no fuel lines, no exhaust system, no catalytic converter to break or be stolen.

EVs are a lot simpler than gas and diesel vehicles and less prone to breakdowns and costly repairs.

DCAS has already published on this based on over a decade of experience with EVs.

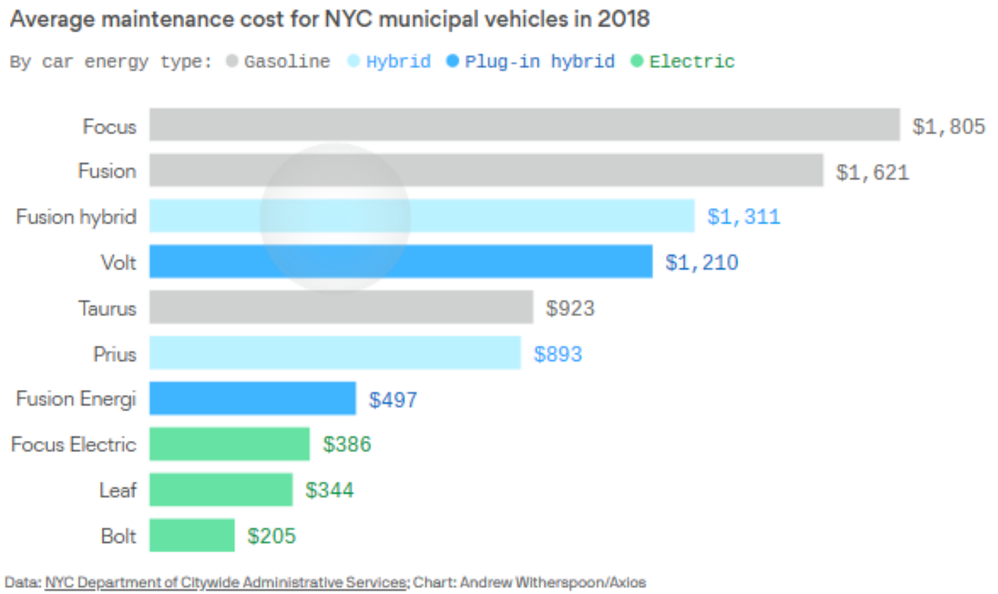
All electric vehicles can achieve over 50% reduced maintenance. This is not as true of plug-in hybrids.

HERE

EV maintenance costs in NYC run lower than gas-powered cars

Ben Geman, author of Axios Generate

The New York City government's maintenance costs for its electric vehicle fleet were much less per automobile than its gasoline-powered cars, city data released this month shows.



Data: NYC Department of Citywide Administrative Services; Chart: Andrew Witherspoon/Axios

Why it matters: Municipal and corporate vehicle fleets are a growth area for EVs, and not just for environmental reasons. That's the upshot of the latest edition of a newsletter I'd never seen until yesterday: the NYC Fleet Newsletter from Citywide Administrative Services.

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Battery Fire Risk is Low, but You Need to Know

The good news: fires with EV batteries on cars and trucks are very uncommon. Most vehicle fires are with gas and diesel units.

If a fire does happen though, it will burn quickly, very hot, and can even re-ignite after first being put out.

If your EV battery is ruptured in a crash or begins to catch on fire, stay far away and keep others away. Call 911 and let FDNY handle the fire. Don't try to put it out yourself.

See below for more safety tips from DCAS.

HERE

City of New York Fleet
Reported Vehicle Fire Incidents Since 2012

Vehicle Type	Number	Percent
Diesel	175	83%
Diesel, Hopper Fires	6	3%
Diesel Hybrid	1	<1%
Hybrid Gas Electric	9	4%
Plug-in Electric (PHEV)	1	<1%
Plug-in Electric, Underground Explosion	2	1%
Gas	17	8%
All-Electric Vehicle (BEV)	0	0%
Off-Road	1	<1%
Total	212	100%

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Electric Vehicles

DSNY Electric Garbage Truck

NYPD Electric Patrol Cars

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Learning about Charging

Charger Types

Tesla / NACS

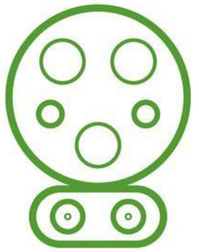
Cars that take NACS (e.g., Teslas) use this for all charging levels

LEVEL 1	LEVEL 2	LEVEL 3 (DC FAST)
110V outlet - AC	240V - AC	400 - 1000V - DC
12 - 16 Amps	12 - 80 Amps	< 125 Amps
1.4 - 1.9 kW	2.5 - 19.2 kW	50 - 350 kW
3 - 5 miles of range per hour	10 - 20 miles of range per hour	80% charge in 30-50 minutes

TYPE 1 J1772

TYPE 1 J1772

CCS COMBO TYPE 1



CHAdeMO

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Level 2 Charging

Charging a battery from empty to 80% usually takes 8-10 hours

Batteries require DC power, but standard outlets are AC

- Electric vehicles (EVs) equipped with an on-board charger
- Performs AC to DC conversion before delivering charge to the battery

Connector Types

TYPE 1 J1772

Tesla / NACS

NACS (North American Charging Standard) is currently only compatible with Teslas, but that might change in the coming years as the US shifts away from other connector types and standardizes charging cables.

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Level 3 Charging

Also called Direct Current Fast Charging (DCFC or DC Fast)

AC to DC conversion happens in the charging unit

- Allows current to bypass the vehicle's onboard charger
- Results in a much faster, higher-powered charge

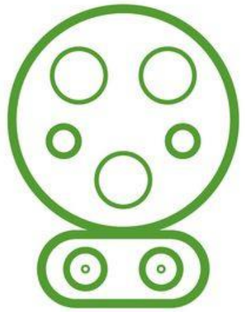
Connector Types

CHAdeMO

Mitsubishi Outlander

Nissan Leaf

CCS COMBO TYPE 1



all others

Tesla / NACS

Teslas only, for now

CHAdeMO

CCS 1

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Level 3 Charging

ChargePoint Express 250

- draws significant energy from the grid, is expensive to install (can require rewiring)
- delivers a maximum of 62.5 kW
- can deliver up to 125 kW when paired with another L3 charger
    - provides CCS1 and CHAdeMO cables, but *only one works at a time*
    - always functional, as long as it is tied to the grid
    - Heavy electric draw during peak load periods.

Freewire Boost 150

- draws the same amount of energy from the grid as a L2 charger but uses a battery to supply DC Fast-level power.
- can deliver up to 150 kW with CCS1 cable and 100 with CHAdeMO
- has two cables, *can charge two vehicles simultaneously*
    - when two vehicles are charging, each vehicle receives half of the power output (up to 75 kW)
- functional when the battery is charged with or without grid. Would work directly after a power outage.
- Helps with peak load management.

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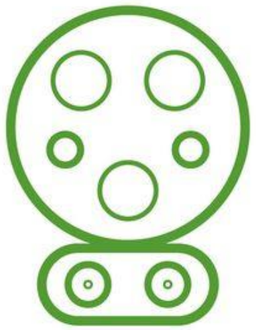
Level 3 Charging

Charging a battery from empty to 80% usually takes less than an hour

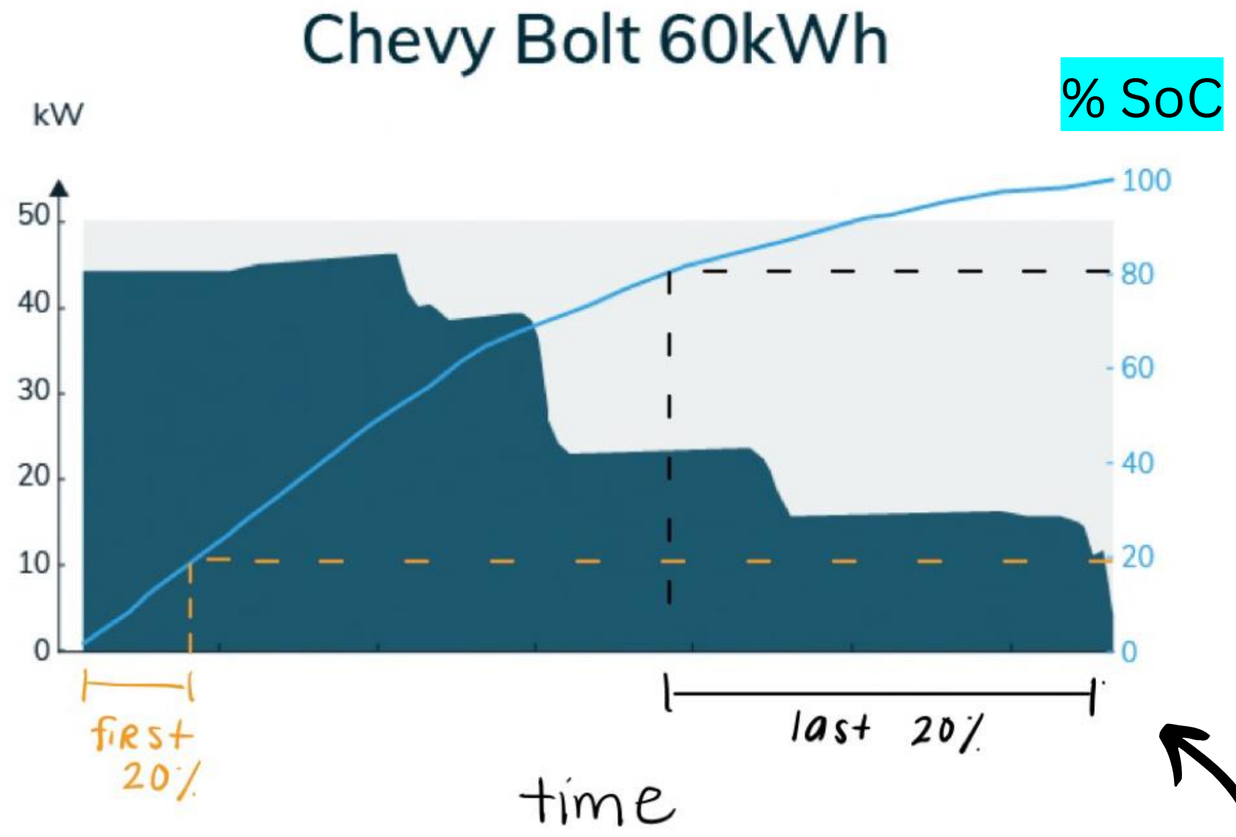
Connector Types

CHAdeMO

CCS COMBO TYPE 1



Tesla / NACS



Charging from 80% to 100% takes another hour or more. ***This is generally a waste of your time*** unless you know you'll need the extra mileage.

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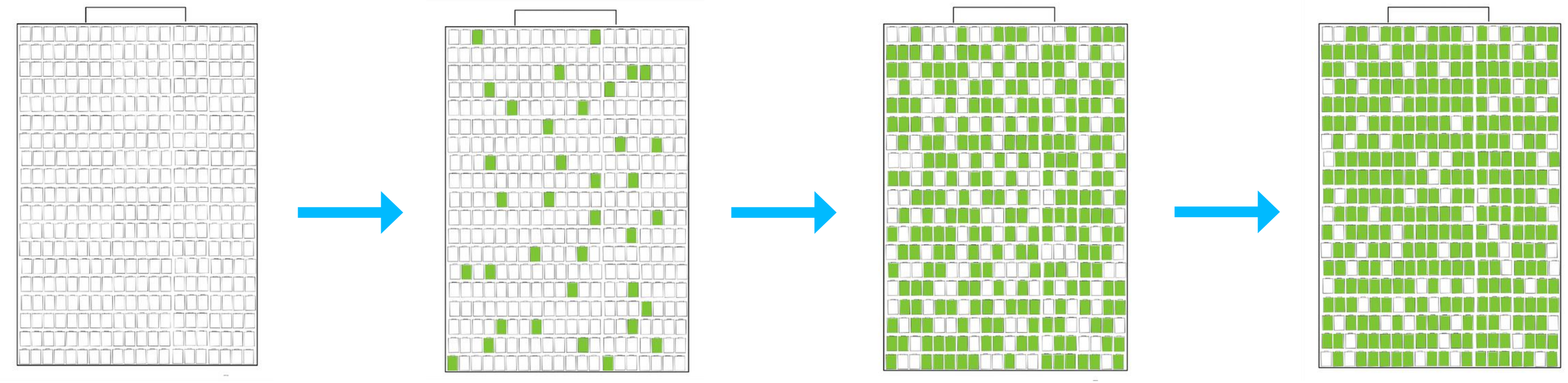
DC Fast Charging Rates

Think of the battery as a movie theater: each seat represents a battery cell.



1. At first, finding a seat (i.e., filling a cell) is easy because most are empty.

2. As the theater gets more crowded, it becomes harder to find an empty seat.

3. Rather than sitting wherever you want, you have to spend time finding a seat and then moving past those who are already seated.

4. Once an EV's battery hits 80%, the DC Fast charger decreases the power output to avoid overloading the battery. Because these chargers provide energy at such a high rate, this ability to adjust power output is critical; without it, the battery runs the risk of overheating. This is why it takes so much longer for an EV battery to charge the last 20%.

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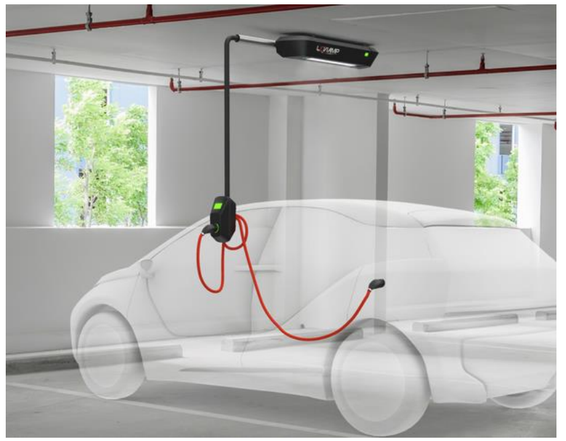
Charger Mounting Styles

pedestal
Level 3

bollard Level 2

wall-mounted
Level 2

solar Level 2



ceiling-mounted Level 2

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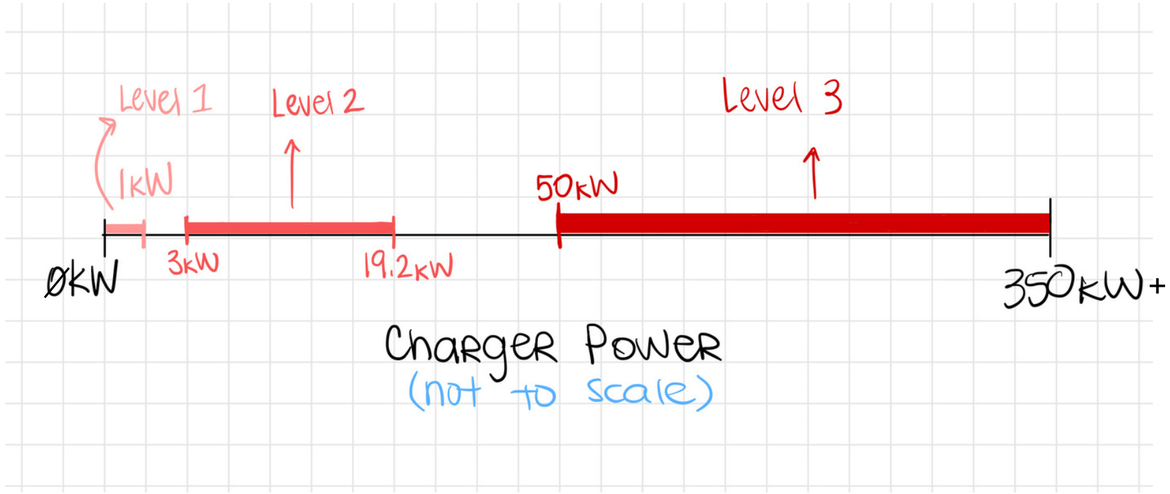
Charger Power & Charging Time

- EV battery sizes differ among make and model
- Charge time depends on battery size and max power intake



advertised power ≠ guaranteed power output

Make/Model	DCFC Max Power Intake	Battery Size
2018 Mitsubishi Outlander	22 kW	12 kWh
2018 Nissan Leaf	46 kW	40 kWh
2018 Chevrolet Bolt EV	55 kW	60 kWh
2021 Ford F-150 Lightning	107 kW	98 kWh
2021 Ford Mustang Mach-E	115 kW	68 kWh
Electric Garbage Truck	150 kW	115 kWh

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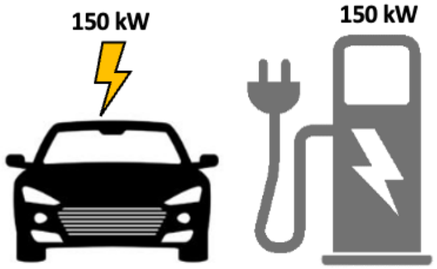
Simultaneous Charging

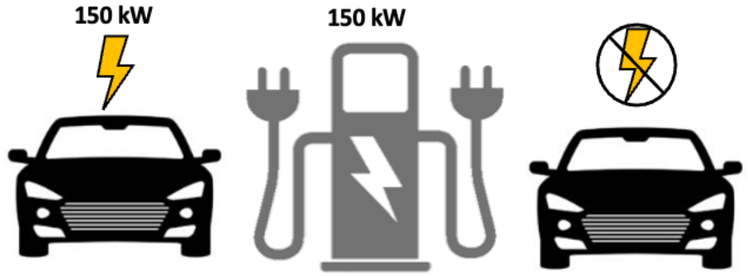
- BEAM solar charger



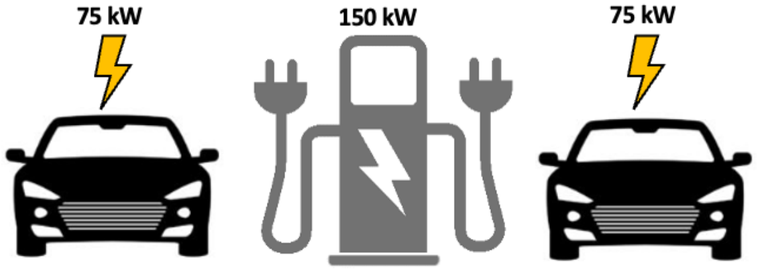
One charging port = maximum power for every charging sequence

- Chargepoint CPE 250
- most DCAS Level 3 chargers fall into this category

Two charging ports ≠ simultaneous charging



- most Level 2 chargers
- some Level 3 (e.g., Freewire Boost)



Two charging ports and simultaneous charging = two vehicles charging at once, each with a reduced maximum power.

- Most dual-port Level 2 chargers have simultaneous charging capabilities.
- Some L3 chargers do, and some don't.
- **Just because there are multiple cables on a L3 charger does NOT guarantee simultaneous charging abilities**

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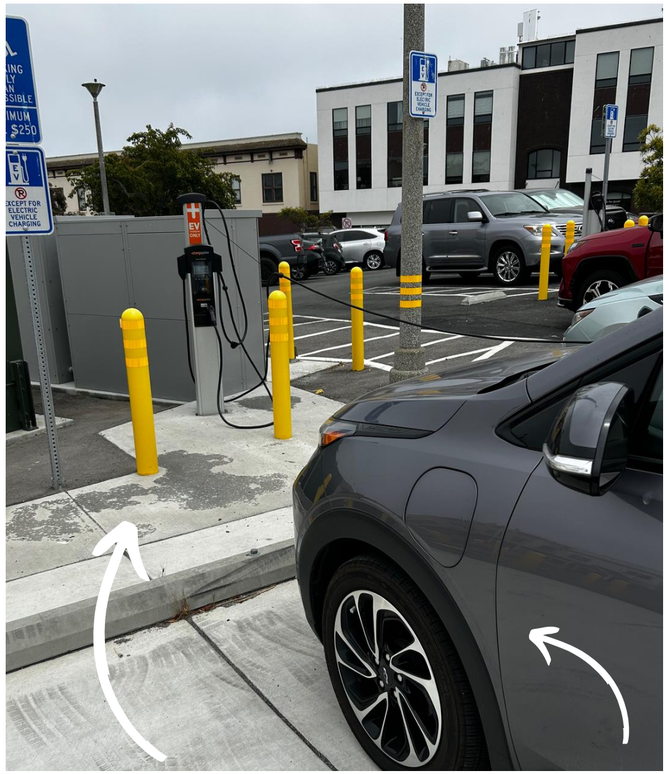
How to Charge



Step 1: Park the vehicle in the spot that places your charging inlet as close as possible to the charger. This may mean backing into the space if the inlet is at the rear of the vehicle.

Step 2: Open the charging inlet door. Walk up to the charger and swipe RFID card/follow the onscreen instructions to unlock the charging cord.

sample WEX card

swipe here

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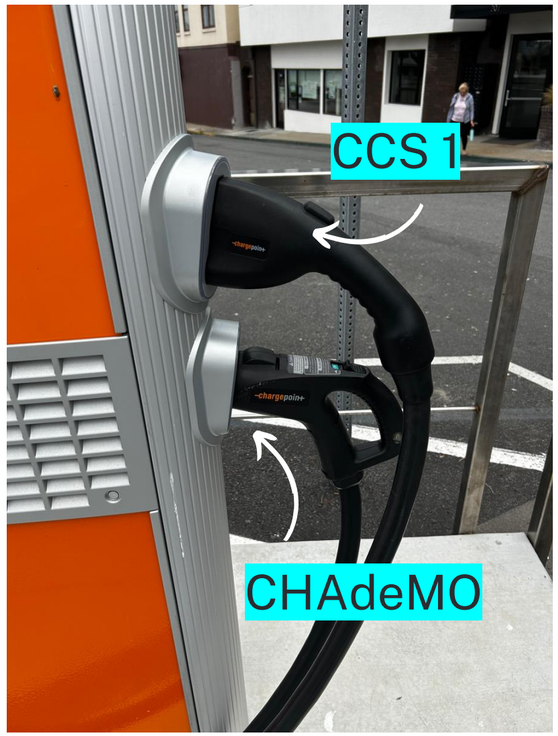
How to Charge

Step 3: Take charging cable from the charger and plug it into your vehicle. If using a DC Fast charger, there may be two cable configurations. Your car likely takes the CCS1 configuration, but it's possible you'll need to choose the CHAdeMO one.

Level 2

Level 3



There may be a covering that you have to open in order to fit the Level 3 charger into the charging port

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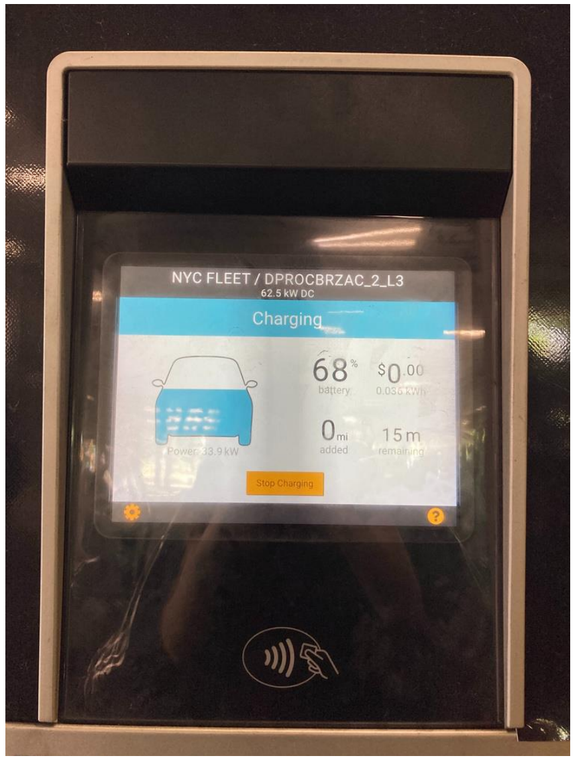
How to Charge

Step 4: Upon plugging the charging cable into your car, ensure it's securely in place. You should hear a click indicating that the charger has successfully connected to the car. Your car, the charger, or both will indicate that charging has started. *It's important to ensure the charging session has started before walking away. If it hasn't, unplug and start again.*

Step 5: The car should be charging now. You are free to leave it until the charging session is over. The charger, the car, or both will indicate the charging session progress and should show when charging is finished. When finished, unplug the cord from the car's charging inlet. *Remember, unplugging at 80% will save you time!*



Step 6: Plug the charging cable back into the charger. Remember to close the door of your car's charging inlet. You should be all set!

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Cold Weather Tips for EVs

- ✓ Maintain 20-80% charge to optimize battery performance.
- ✓ Plug in your EV and run the heating system for 20-30 minutes before hitting the road to increase range.
- ✓ In a traffic jam, use the onboard console to manage your battery usage. Allow for 20% variance in your available range when planning your route.
- ✓ Keep in mind, seat heaters are a more energy-efficient method to stay warm.
- ✓ Whenever possible, park your car indoors to protect your battery from the cold.

Source:
Optimizing Electric Vehicles for Cold Weather Driving - ZETA (zeta2030.org)
Other links:
Electric car battery life in winter (caaquebec.com)
Safety:
Winter Weather Driving Tips: Prepare Your Vehicle | NHTSA

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NYC Fleet
EV Charging Tips

1 CHARGE EARLY CHARGE OFTEN

Don't wait until the battery is low to recharge. Instead, "top off" when you can. Even if it's for 5-10 minutes.

2 UNPLUG WHEN AT 80%

After 80%, the battery starts charging more slowly to protect its lifespan. It's a more efficient use of your time to unplug at 80% and charge slightly more often.

3 STICK TO LEVEL 2 IF POSSIBLE

Especially if you have overnight charging capabilities. Fast charging is great if you're in a hurry, but Level 2 is better for overall battery health.

4 AVOID EXTREME TEMPERATURES

Park in the shade when it's sunny and in the sun when it's cold. The battery's charge will last longer if it avoids extreme temps.

5 REGENERATIVE BRAKING EXTENDS RANGE

Recharge the battery a little every time you slow down!

6 INSTANT TORQUE = LIGHTNING-FAST ACCELERATION

BE CAREFUL. EVs boast faster 0-60 mph times than gas cars; so don't floor it. Drive SLOWLY, stay safe.

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