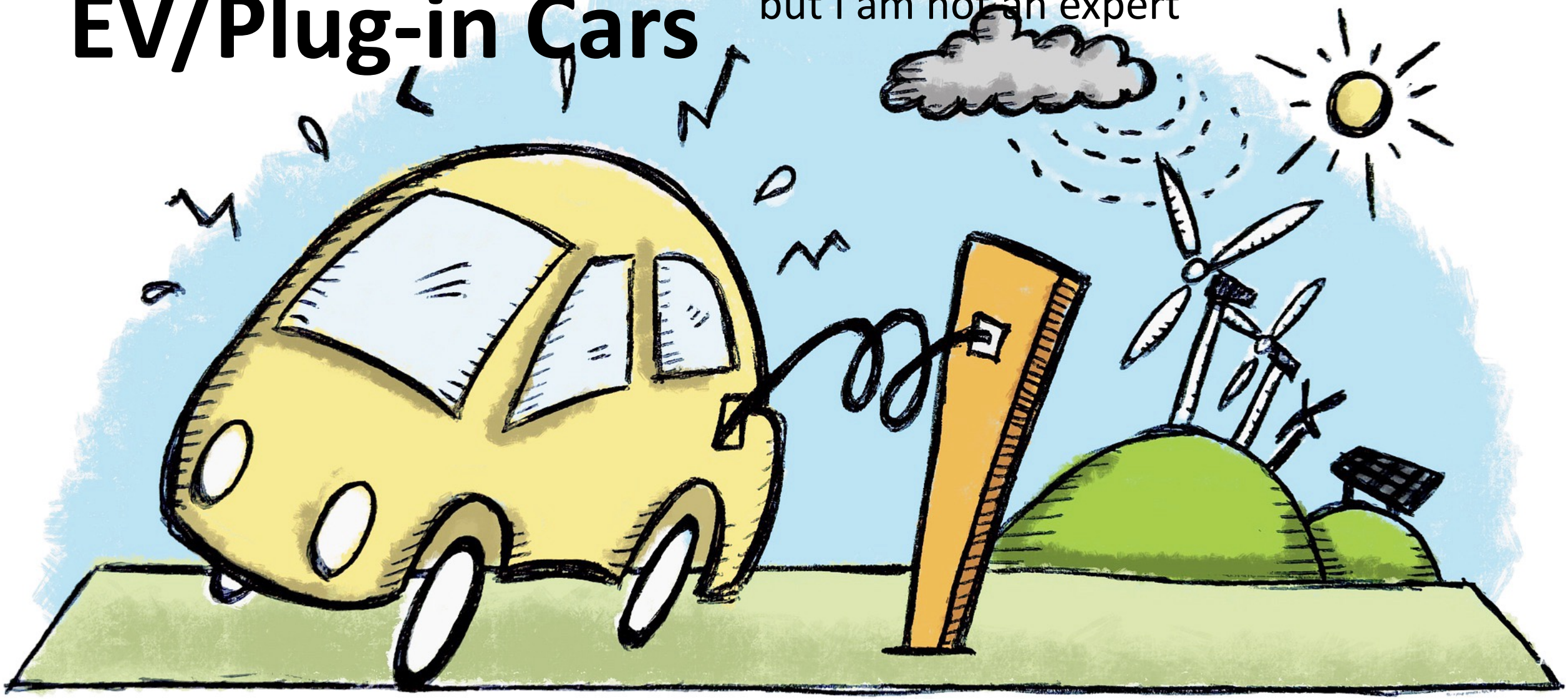
EV/Plug-in Cars

- I strive to present accurate information, but I am not an expert



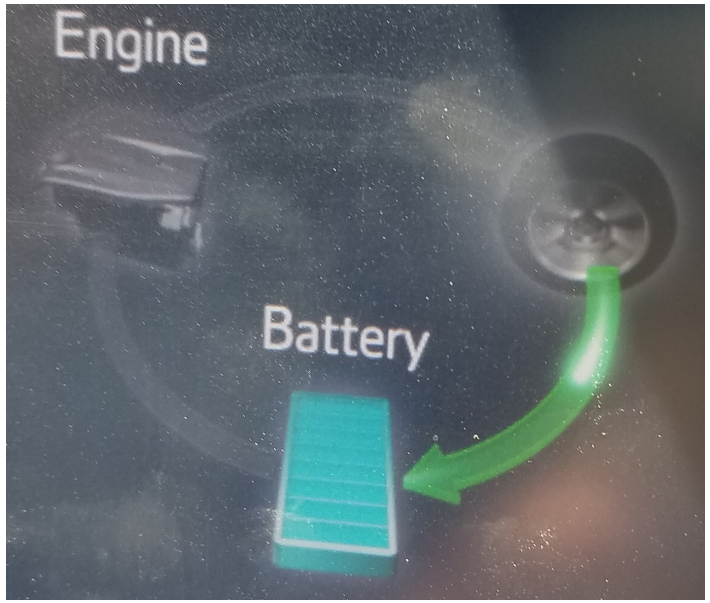
Our 2022 journey

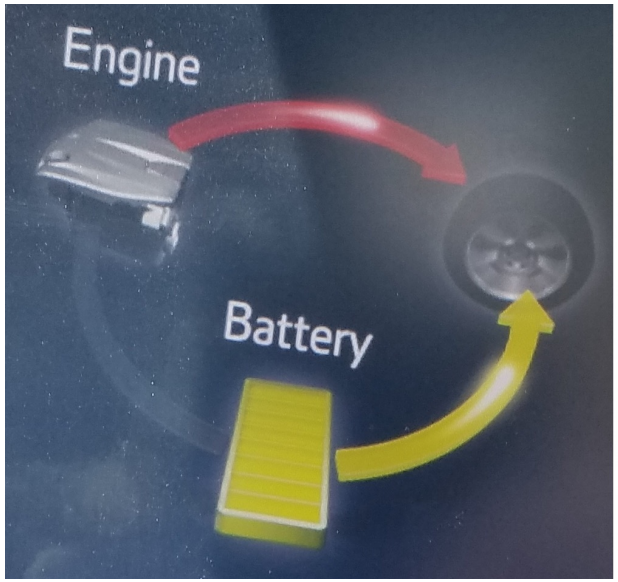
What I have learned

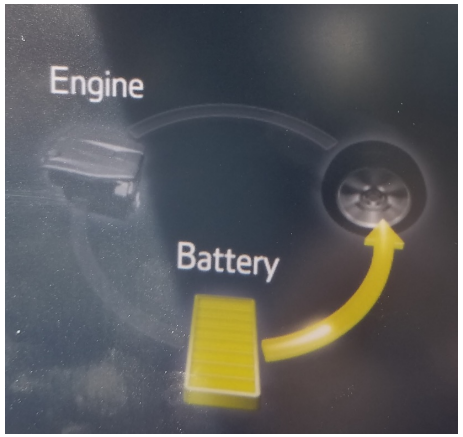
Hybrid car

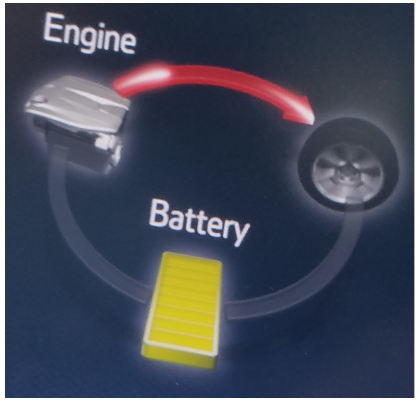
Hybrid cars use gas and electric motors together to maximize fuel efficiency.

- Left/top
  Slowing/braking/charging battery
- Right/top
  gas/electric BOTH powering car (max power)
- Left/bottom
  Electric ONLY
- Left/middle
  Gas driving AND charging battery
- Right/bottom
  Gas ONLY







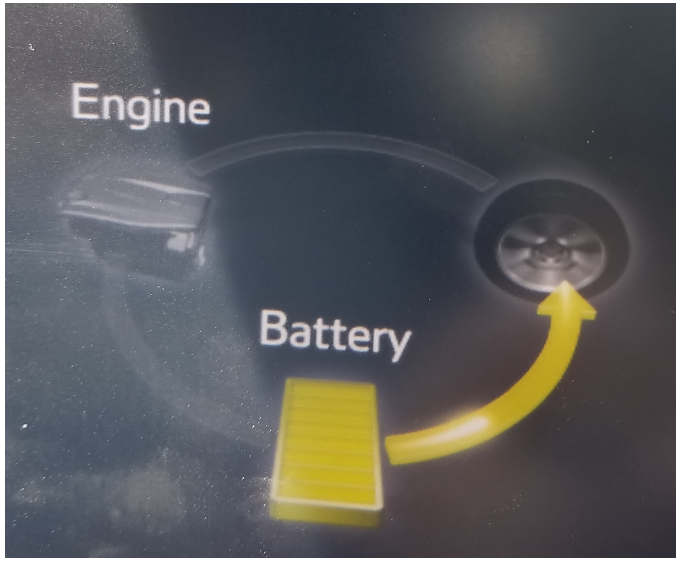


Plug-in Hybrid

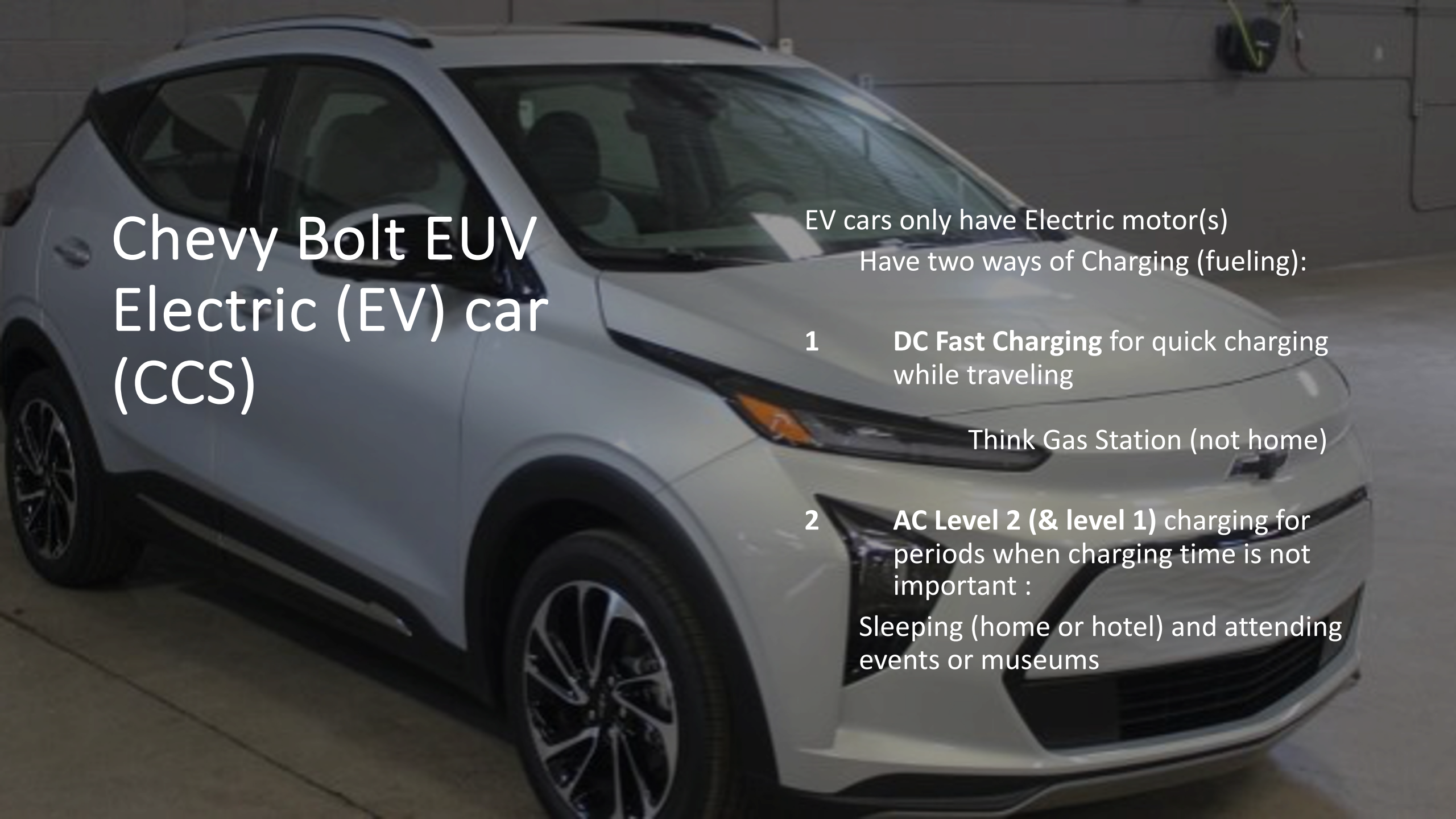
- Plug-in Hybrids can run ONLY using the electric motors for an extended period
  Toyota RAV4 Prime – EPA 42 miles

- When the Battery charge reaches a specific level of discharge, it starts running exactly like a regular Hybrid (like the prior slide)

- Note: Plug-in Hybrid Charging:
  - Use AC Level 1 and Level 2 Chargers
  - Do not use DC Fast Chargers*



Chevy Bolt EUV Electric (EV) car (CCS)



EV cars only have Electric motor(s)

Have two ways of Charging (fueling):

1 **DC Fast Charging** for quick charging while traveling

Think Gas Station (not home)

2 **AC Level 2 (& level 1)** charging for periods when charging time is not important :

Sleeping (home or hotel) and attending events or museums

AC Level 1 and 2 Charging

Plug-in Hybrids and EVs

J1772

Level 1 and Level 2 Chargers use AC power (120 or 240 v outlets):

Can be used at your home (picture – level 1)

- **Level 1** Chargers use a 120-household outlet

  Toyota RAV4 charges in 12 hours

  Chevy Bolt 29.33 hours (home)

- **Level 2** Chargers use different 240 V outlets

  Toyota RAV4 charges in 4 ½ hours

  Chevy Bolt 10 hours (home) – 6 hours*

My RAV4 has a 3.3 kW Charger; optional 6.6 kW Charger reduces time ~1/2

Level 2 Charging Stations
Plug-in Hybrids and EVs

Locations

Town parking lots, Hotels, Churches, Museums, Malls, ski areas, Movie theaters, etc.

- Some are free, and others require you to pay
- I have used a few Charging Stations and they were FREE
  - Norman Rockwell museum
  - Madison CT (lunch and Movie)
  - Deep River CT (lunch and short walk)
  - Savannah GA (visiting a park)

The DC Charger built into the car will determine your fastest charging times

Speed of Charging

DC Charger

- Chevy Bolt EV 55 kW 80% full in 1 hour
- VW ID4 135 kW 80% full in 38 mins
- Ford F150 Lightning 150 kW
- Mach E 110 kW
- Mach E 150 kW
- Chevy Silverado EV 300 or 350kW??

- Other cars have even higher DC Chargers for faster charging

Barriers to EV adoption

- 1. Price of EV cars
  - EVs are becoming competitive
    Some $30K or less
- 2. Driving Range of EV cars
  - Most now travel 250 miles or more.
- 3. Speed of Charging
  - Speed varies by car, but 20 min charging is now possible
- 4. Charging Infrastructure (DC Fast Charging stations)
  - This is currently the most challenging barrier.
  - Tesla or NACS (North American Charging Standard) is the most extensive system
  - The CCS Charging infrastructure faces many challenges from reliability and availably.
    - With planning, you can travel almost anywhere

Range Anxiety

My view on Range Anxiety

Causes of Range Anxiety:

1. Whole new approach to fueling your car
2. Range
3. Speed of Charging
4. Charging Infrastructure

Three Types of car usage and Anxiety:

(How I categorized usage)

- 1. **Local travel** (No Range Anxiety) 200 miles
  Perhaps 80% of travel
  Many people will primarily charge at home
- 2. **Range of car travel** (some Range Anxiety)
  Perhaps a trip to Cape Cod
- 3. **Long Distance Driving**(Higher Range Anxiety)
  Perhaps a trip to Washington DC or Florida

Toyota RAV4 Prime – Plug-in Hybrid

Toyota RAV4 Prime Charging/fueling:

- This is primarily my car
- We do all our long-distance driving in this car
- Only Charge at home
  80%
- Long Distance driving
  20%

- I have gone 6 weeks or more without using any gasoline.

How we use our Chevy Bolt EUV

- This is primarily my wife's car
- When we travel together locally, we also use this car

Types of EV Charging: (how WE use it)

- 1. Only Charge at home (Local) 99%
- 2. Driving Car's Range (247 miles) 1%
  - i.e. Trip to Cape Cod is within range
- 3. Long Distance Driving 0%
  - i.e. Trip to Maine that would require multiple stops

- Over 100 years ago, we had to learn about Gasoline cars.
- Now we are learning about Electric cars