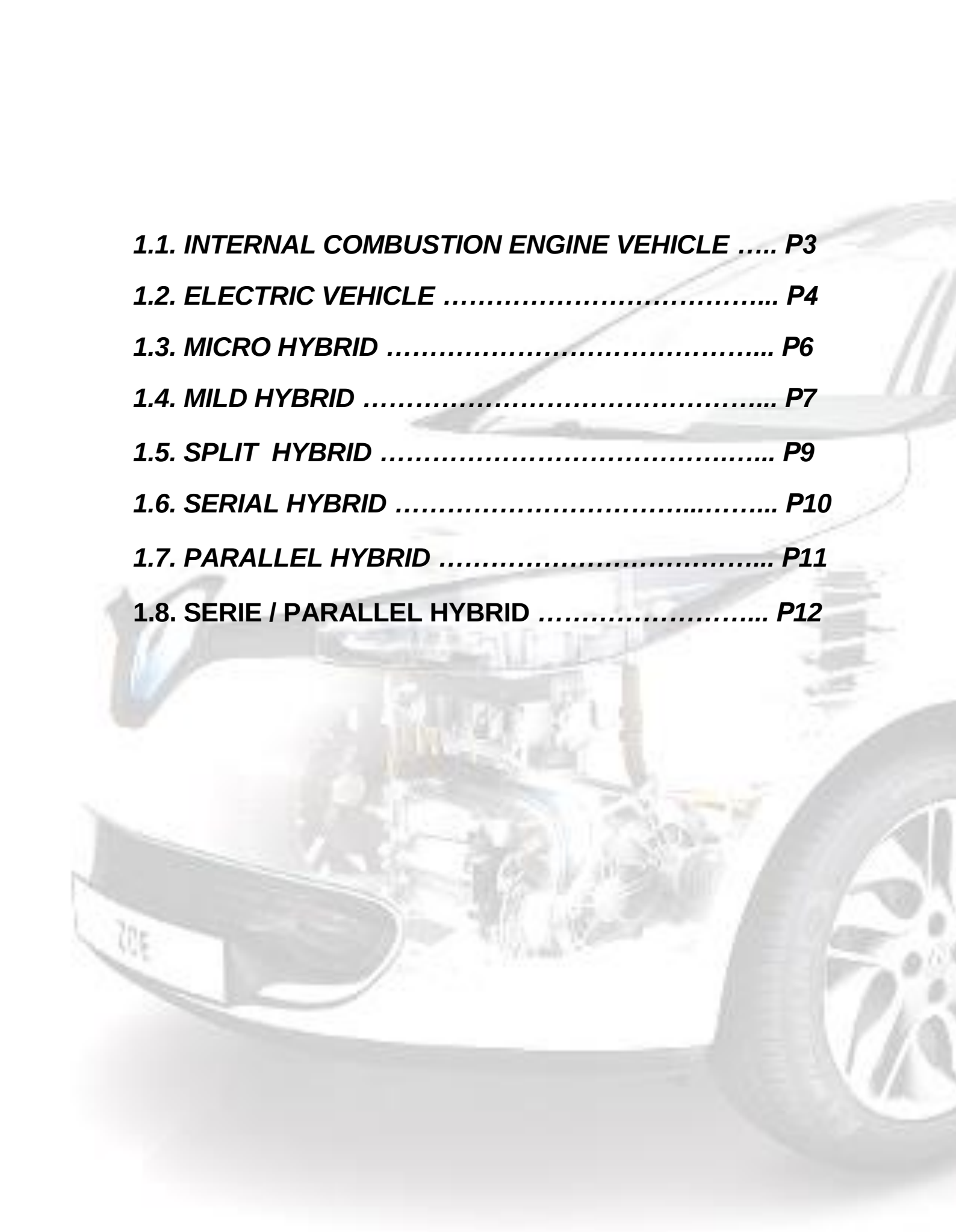
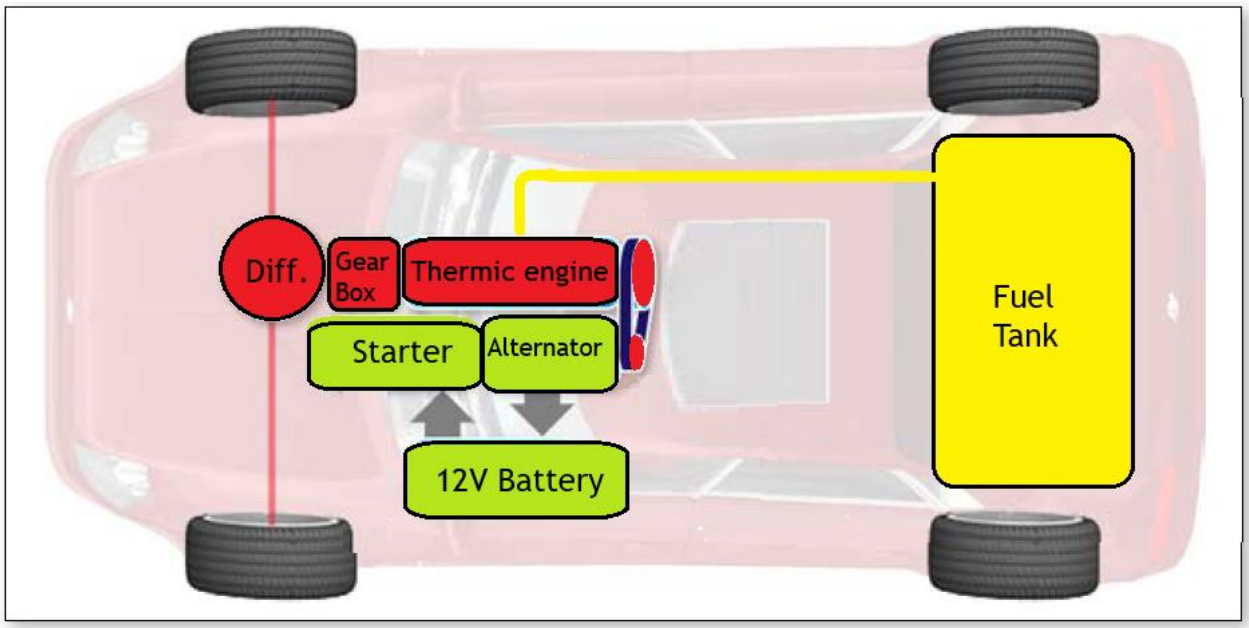

# Electric & hybrid cars training

***Denis Leclerc – FR meeting***

***March 10th to 15th 2016***



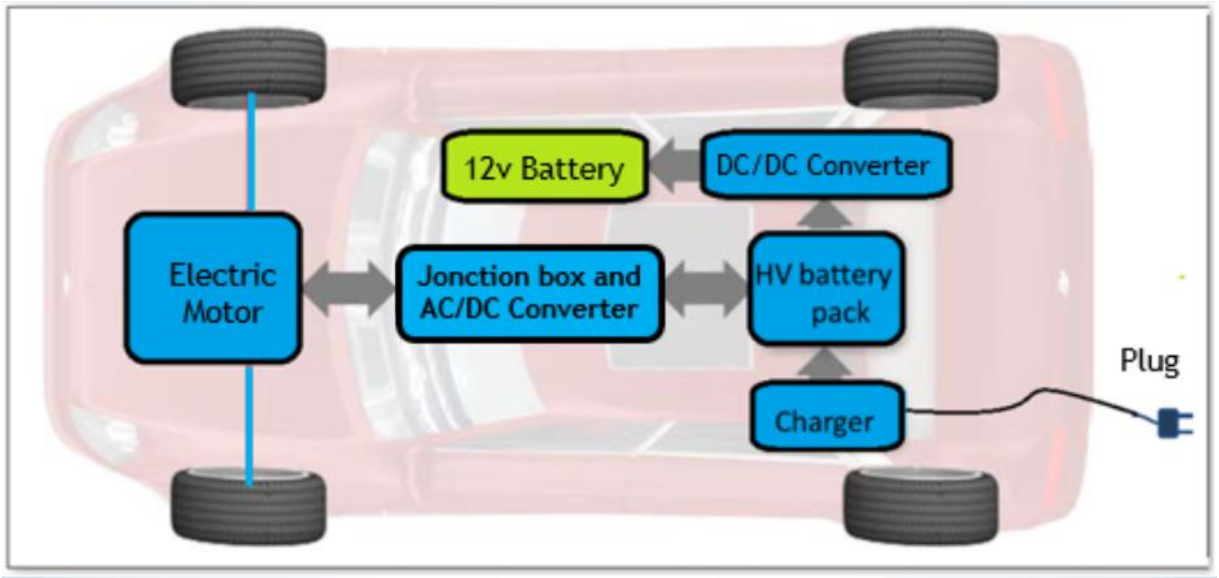
# *1. 1. INTERNAL COMBUSTION ENGINE VEHICLE*




**An internal combustion engine (ICE) is an engine where the combustion of a fuel (petrol or diesel) applies direct force to pistons of the engine.**

**This force moves the component over a distance, transforming chemical energy into useful mechanical energy.**

## *1.2. ELECTRIC VEHICLE*




**Electric vehicles use electric motor(s) to propel the vehicle.**

**The electric motor is connected to the drive wheels.**

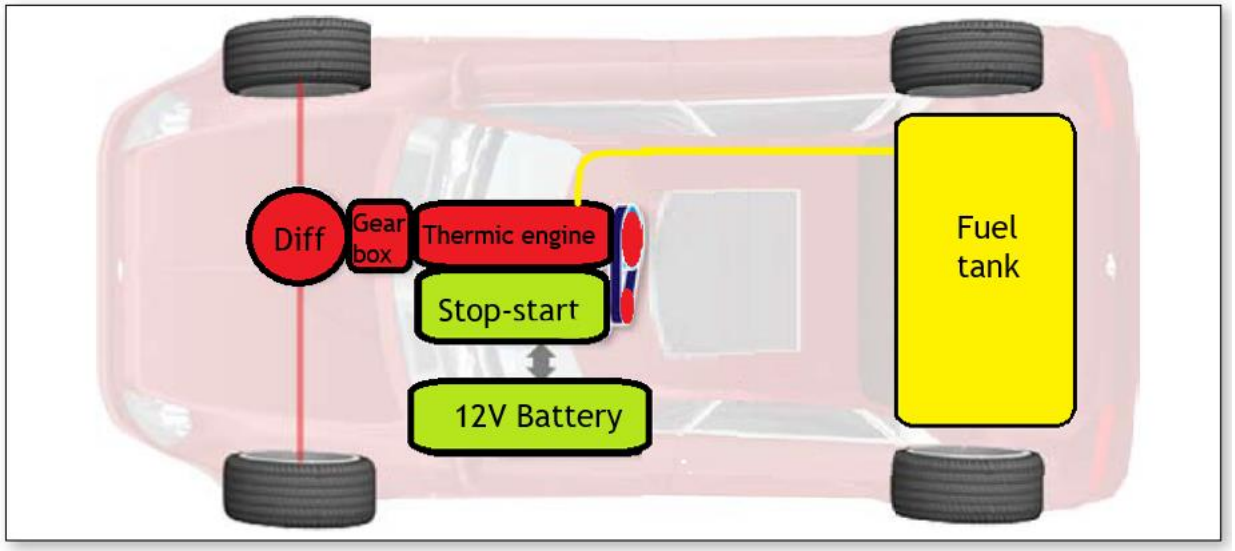
**A high-voltage battery pack is used to supply the electric motor.**

**[Plug-in] means that the high voltage batteries can be charged when the vehicle is not used (i.e.: the vehicle is parked and is connected to a power outlet that supplies the on-board high voltage battery charger).**

# HYBRIDES VEHICLES

| Famille | Puissance du moteur électrique | Plage de tension | Fonctions possibles | Économie de carburant |
|---|---|---|---|---|
| Micro-hybride | 2 à 3 kW | 12 V | - Fonction démarrage/arrêt | < 10 % |
| Mild-hybride | 10 à 15 kW | 42 à 150 V | - Fonction démarrage/arrêt<br>- Fonction Boost *<br>- Récupération d'énergie | < 20 % |
| Full-hybride | > à 15 kW | ≈ 400V | - Fonction démarrage/arrêt<br>- Fonction Boost *<br>- Récupération d'énergie<br>- Conduite électrique | > 20 % |

## *1.3. MICRO HYBRID*



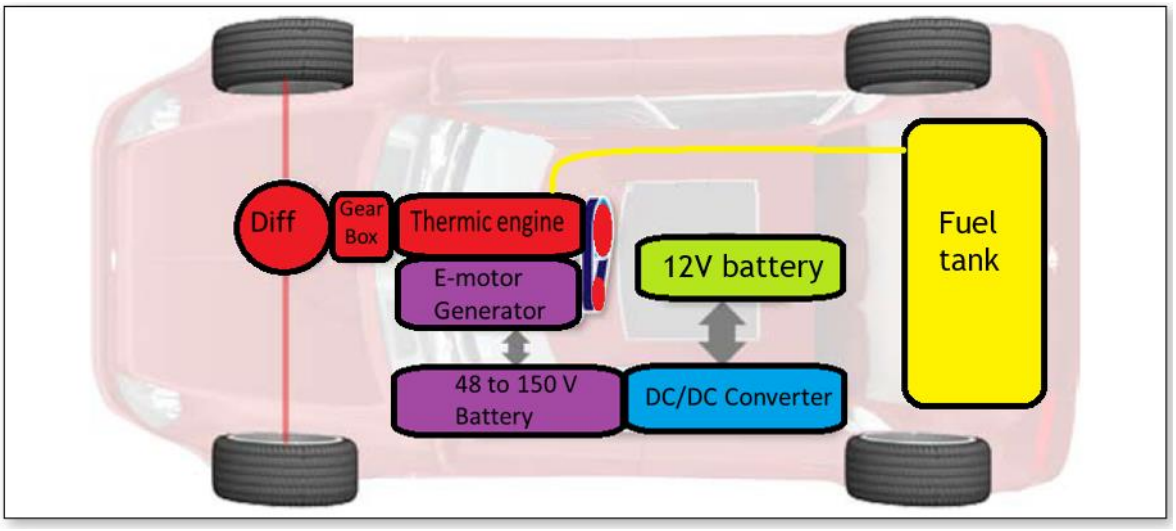

**A stop-start hybrid is the simplest form of hybridization, if one wants to classify it as a "hybrid" at all, or merely an aid to efficiency.**

**Automakers are putting this technology not only on gas-electric hybrids, but even straight internal combustion vehicles to save fuel.**

**The engine does not need to run at a stop, and the engines are engineered so restart does not adversely affect their lifespan.**

**Stop-start hybrids might be called "Micro hybrid" if the alternator is used to produce electricity (to charge the battery) when the car pulls to a stop (this is known as "regenerative braking").**

## *1.4. MILD HYBRID*




**Mild hybrids are primarily powered by a gasoline engine and assisted by an electric motor, allowing the internal combustion engine to be turned off whenever the car is stopped, yet restarted quickly.**

**The electric motor isn't capable of powering the car on its own.**

**The gasoline engine in a mild hybrid does all the heavy lifting that goes into propelling the vehicle. The electric motor is only there to assist, acting as a kind of power booster.**

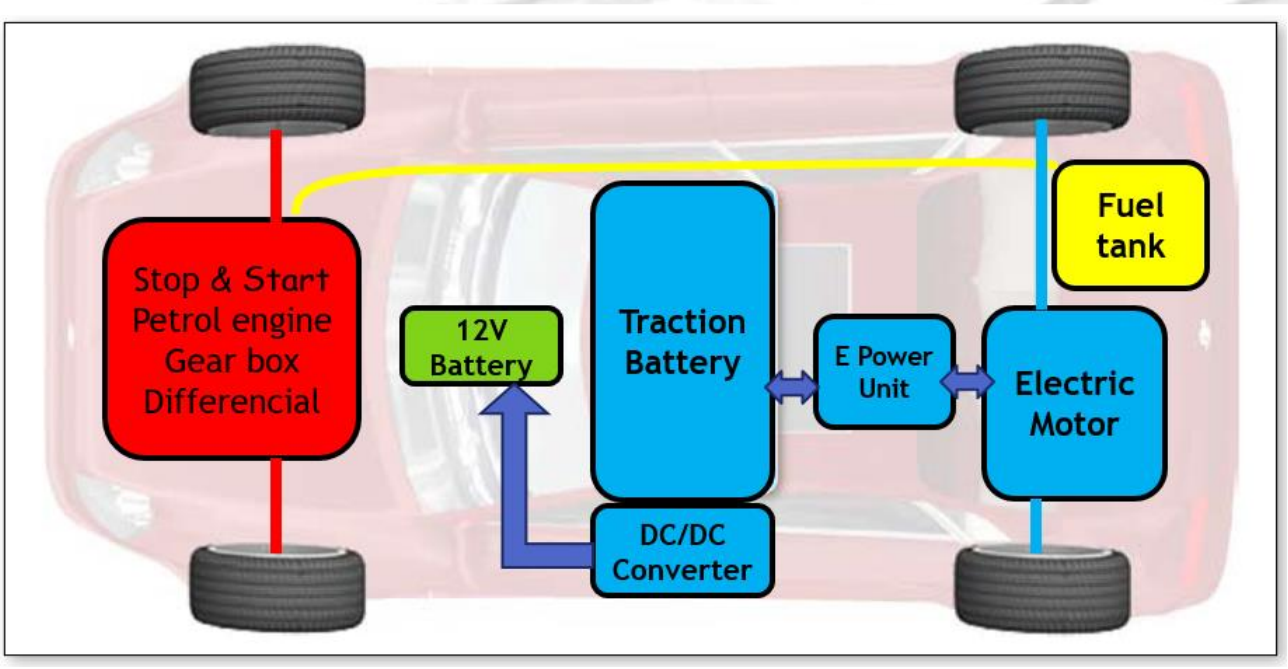
# *FULL HYBRID*

**A full hybrid car has the hability to propel the vehicle on electric motor only. But there is many conceptions :**

- ☑ Split Hybrid
- ☑ Serial Hybrid
- ☑ Parallel Hybrid
- ☑ Serial/Parallel Hybrid

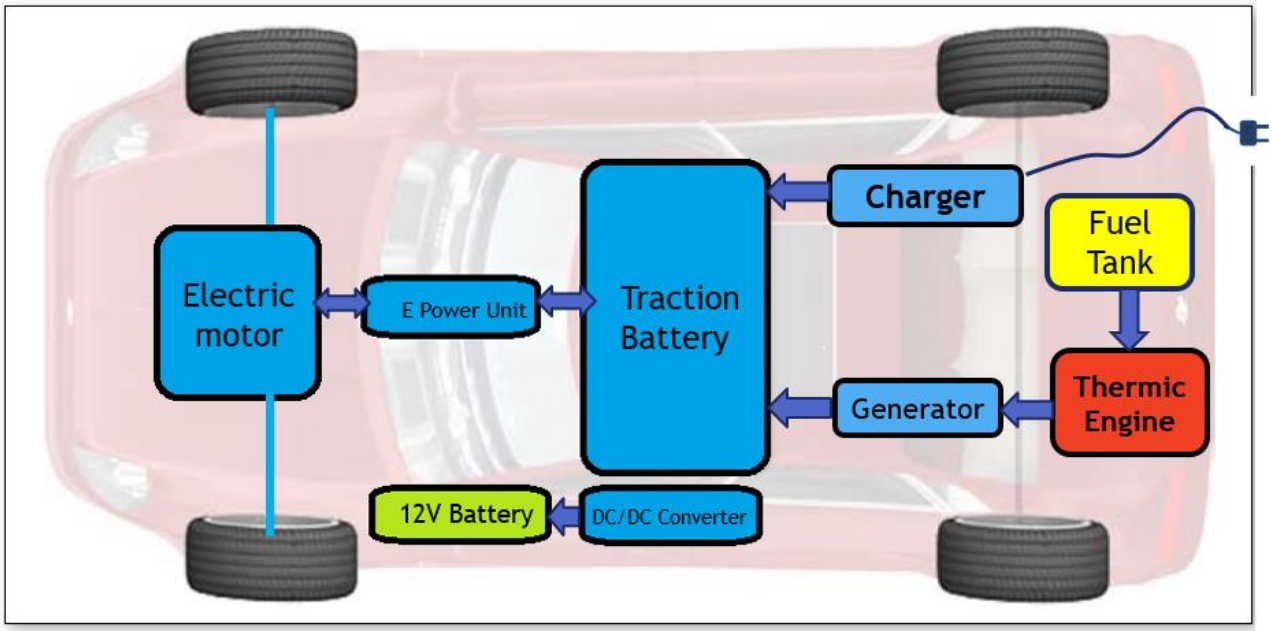
"combined"

## *1.5. SPLIT HYBRID*




**The thermic engine moves a rolling train (ex: front) while the electric engine moves another one (ex: rear).**

## *1.6. SERIAL HYBRID and plug IN*

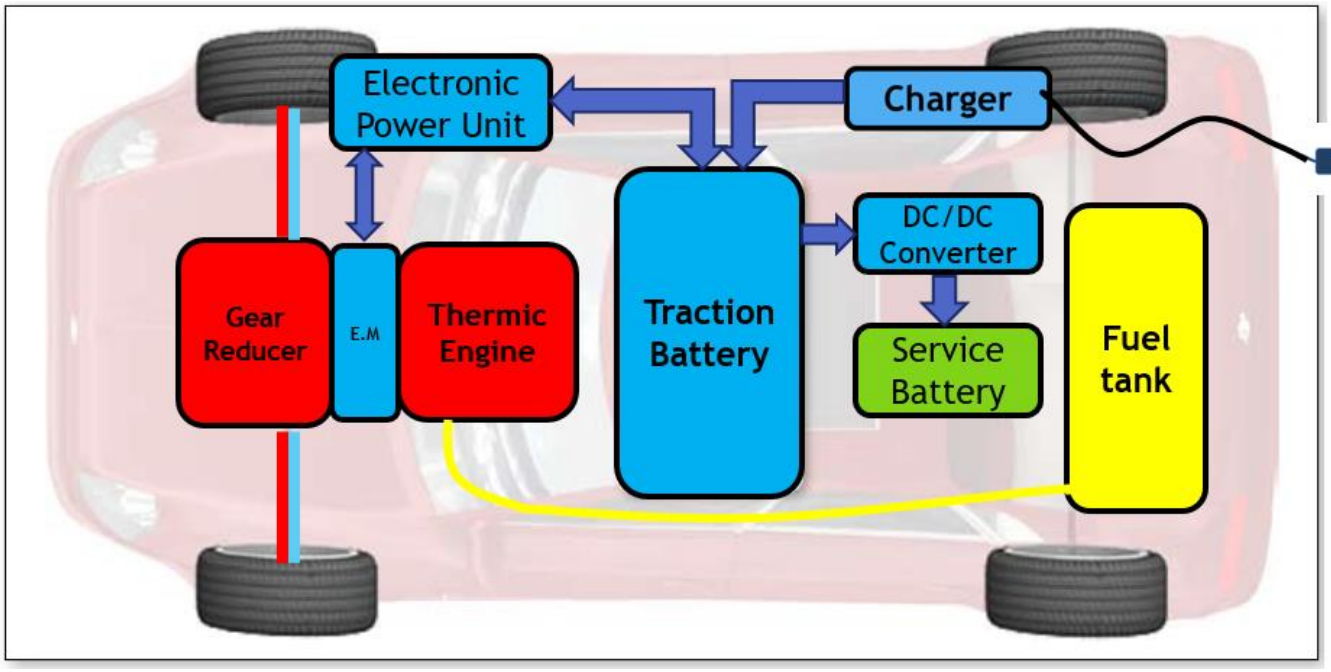



**The serial HEV concept is characterized for the exclusive purpose of electric driving.**

**This electric vehicle equipped with an internal combustion engine is used to drive an on-board generator that comes in when the battery pack is depleted. After recharging the battery pack, the car's wheels are driven solely by the electric.**

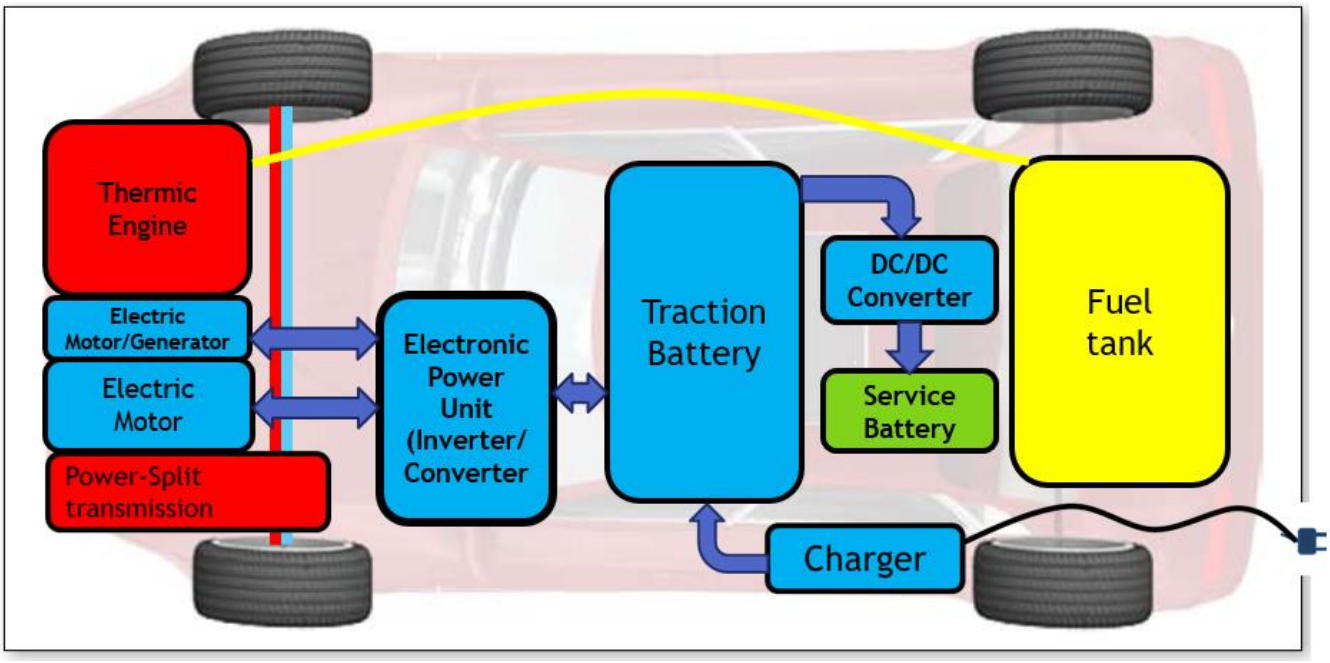
**The gasoline-powered engine (range extender) is used only to recharge the battery pack once it runs out of power**

# 1.7. PARALLEL HYBRID




**Parallel HEV drivetrain, allow the vehicle to be powered by both the electric motor and/or the internal combustion engine (separately or in combination).**

# 1.8. SERIE / PARALLEL HYBRID




**This hybrid cars drivetrains combine the serial and parallel systems.**

**The internal combustion engine would be used for both wheels and generator drive.**