



19MEE402 Hybrid Technology

UNIT 3-REQUIREMENTS IN HYBRID AND ELECTRIC VEHICLES

Electric Propulsion unit

Electric propulsion units in hybrid vehicles consist of electric motors, power electronics, and a battery. Here's a brief overview of how they work and their types:

Parallel Hybrid System:

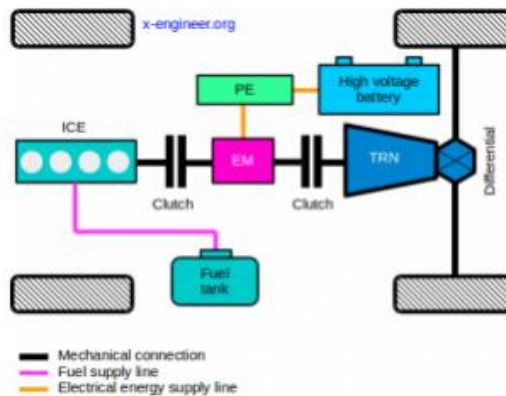


Image: Parallel hybrid powertrain with two clutches

where:

ICE – internal combustion engine

EM – electric machine

TRN – transmission

PE – power electronics

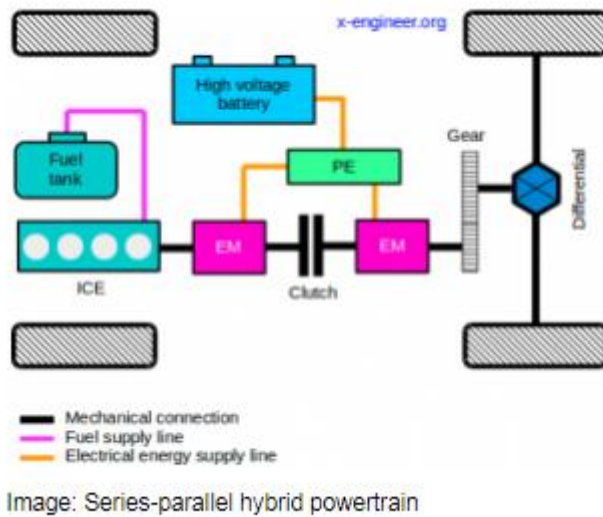
In this type, both the internal combustion engine (ICE) and electric motor can independently propel the vehicle.

The vehicle can operate on either the gasoline engine, electric motor, or a combination of both.

Series Hybrid System:
The internal combustion engine (ICE) is used solely to generate electricity.

The electric motor drives the wheels, and the generator charges the battery or directly powers the electric motor.

Power Split or Series-Parallel Hybrid System:



Combines features of both parallel and series hybrid systems, offering flexibility in power sources.

Allows the vehicle to operate in different modes depending on driving conditions.

Working:

During low-speed or stop-and-go situations, the electric motor is often used for propulsion, saving fuel and reducing emissions.

The internal combustion engine kicks in during higher speeds or when additional power is needed.

Regenerative braking captures energy during deceleration, converting it into electricity to recharge the battery.

Series hybrid power train

In a series hybrid powertrain, the internal combustion engine is not providing torque directly to the drive wheels. Instead, the engine is powering an electrical generator which provides electrical energy to the traction electric motor. A series hybrid is using two electric machines:

- an electric generator (connected to the engine)
- an electric motor (connected to the wheels through a single step gearbox and a differential)

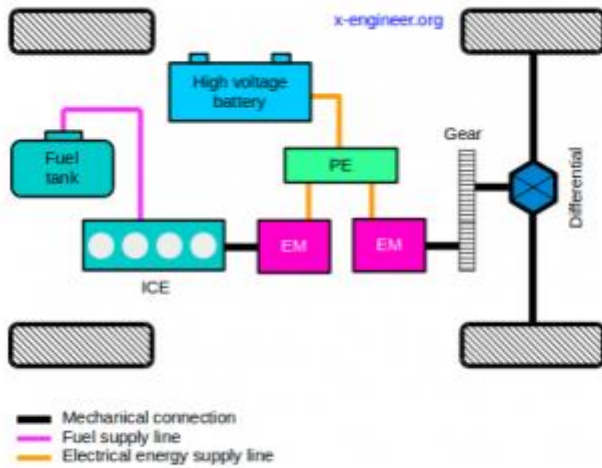


Image: Series hybrid powertrain

Power-split hybrid powertrain

A hybrid vehicle with a power-split architecture combines the characteristics of a parallel hybrid with those of a series hybrid. A power-split hybrid powertrain mechanically links an internal combustion engine and two electric machines using a **power split device (PSD)**. The power-split device is usually a single **planetary gear set (PSG)** or multiple PSGs.

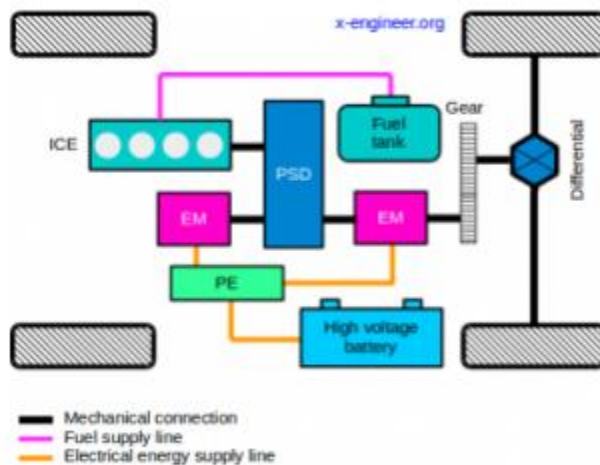


Image: Power-split hybrid powertrain