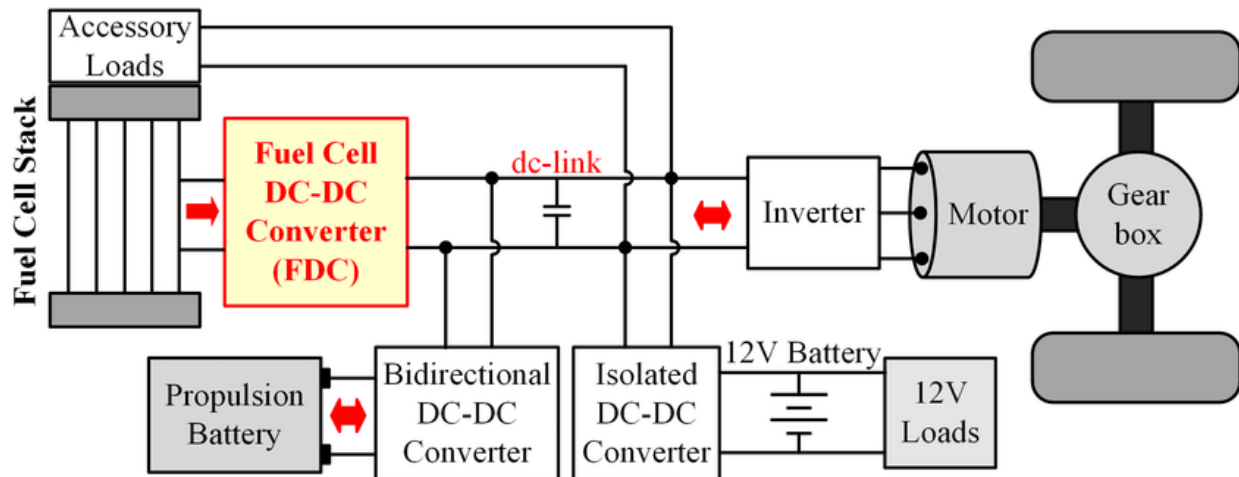


Types: There are different types of electronic ignition systems, including distributor-based systems, distributorless systems, and coil-on-plug systems. Each has its own advantages and applications.

Overall, electronic ignition systems have become standard in modern vehicles due to their improved performance and reliability compared to traditional mechanical systems. They play a crucial role in ensuring the efficient operation of internal combustion engines.

### Fuel cell Electric vehicle

A fuel cell electric vehicle (FCEV) is a type of electric vehicle (EV) that uses a fuel cell to generate electricity on-board for powering an electric motor, which propels the vehicle. Unlike battery electric vehicles (BEVs) that store electricity in a battery pack, FCEVs generate electricity through a chemical reaction between hydrogen and oxygen. Here's how they work and some key points about FCEVs:



1. Hydrogen Fuel Cell: The heart of an FCEV is the hydrogen fuel cell stack. It consists of multiple individual fuel cells that work together to produce electricity. The chemical reaction that takes place in the fuel cell is as follows:

Hydrogen ( $H_2$ ) is supplied to the anode side of the fuel cell.

Oxygen (usually from the air) is supplied to the cathode side of the fuel cell.

At the anode, hydrogen molecules are split into protons ( $H^+$ ) and electrons ( $e^-$ ).

Protons migrate through an electrolyte membrane to the cathode, while electrons are forced to flow through an external circuit, generating an electrical current.

At the cathode, oxygen and protons combine to form water (H<sub>2</sub>O) as a byproduct.

2. Electric Motor: The electricity generated by the fuel cell is used to power an electric motor that drives the vehicle's wheels. This electric motor is similar to the motors used in battery electric vehicles.

3. Hydrogen Storage: FCEVs store hydrogen in high-pressure tanks on board. These tanks must be strong and lightweight to safely contain the hydrogen gas. The hydrogen is typically stored at pressures ranging from 350 to 700 bar.

4. Zero Emissions: One of the significant advantages of FCEVs is that they produce zero tailpipe emissions. The only byproduct of the fuel cell's operation is water vapor, making FCEVs environmentally friendly.

5. Refueling: Refueling an FCEV is similar to refueling a gasoline or diesel vehicle. It takes just a few minutes to fill the hydrogen tanks, whereas charging an electric vehicle with a battery can take significantly longer. However, hydrogen refueling infrastructure is currently less widespread than charging stations for battery EVs.

6. Range: FCEVs typically have a longer driving range compared to many battery electric vehicles. They can go several hundred miles on a single tank of hydrogen, making them suitable for long-distance travel.

7. Challenges: Despite their advantages, FCEVs face several challenges, including the limited availability of hydrogen refueling infrastructure, the energy-intensive process of producing, transporting, and storing hydrogen, and the overall efficiency of the hydrogen production and conversion process.

8. Applications: FCEVs are used in various applications, including passenger cars, buses, trucks, and even some trains. They are particularly suitable for applications where long-range and rapid refueling are essential.

Overall, fuel cell electric vehicles are a promising technology that offers zero-emission transportation and the potential to reduce our reliance on fossil fuels, but their widespread adoption depends on the development of a robust hydrogen infrastructure and addressing some of the technology's challenges.

## **Compressed Natural Gas (CNG) Electric Hybrid Vehicles**

### Introduction

Compressed Natural Gas (CNG) electric hybrid vehicles represent a fusion of two environmentally friendly technologies: CNG propulsion and electric hybrid systems. These vehicles aim to combine the benefits of cleaner-burning CNG with the energy efficiency and reduced emissions of electric hybrid drivetrains. In this brief overview, we will explore the key components, advantages, challenges, and potential applications of CNG electric hybrid vehicles.