



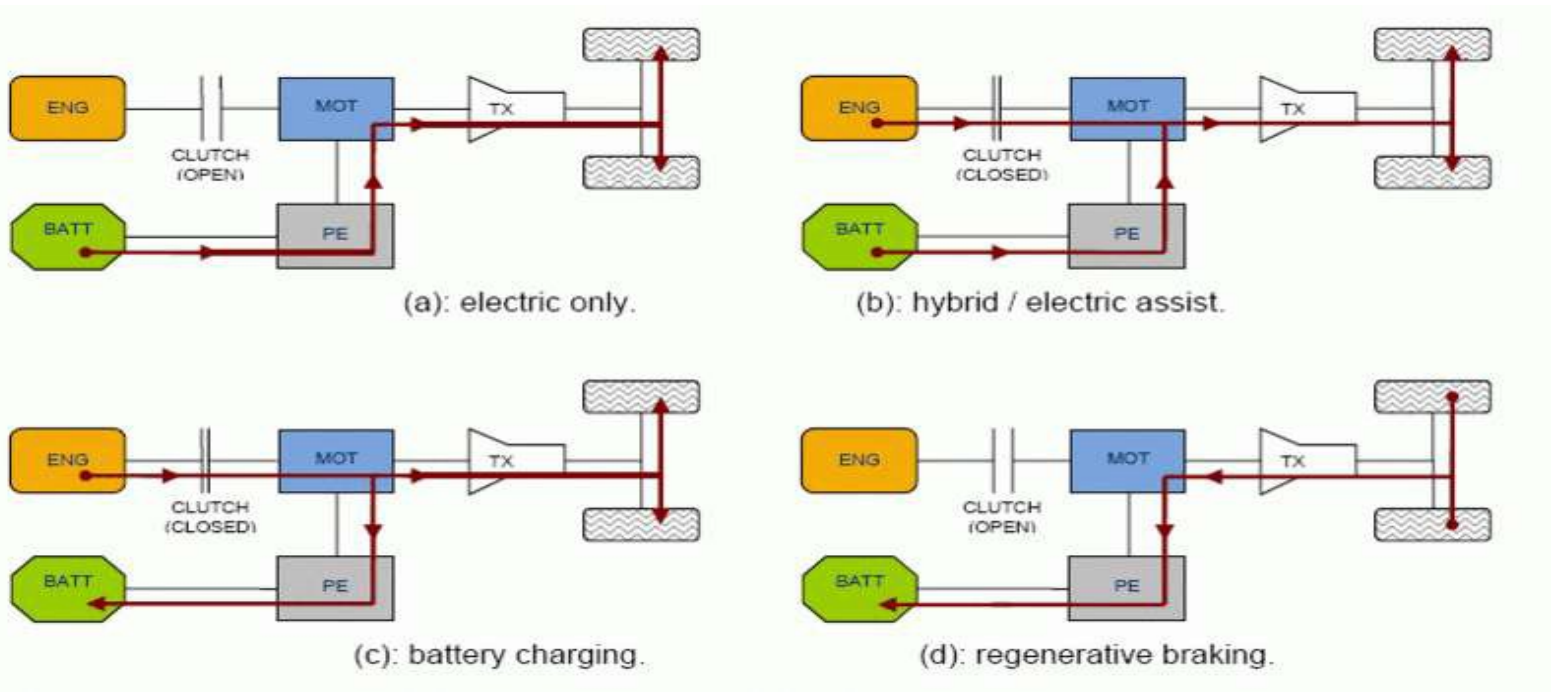
HYBRID VEHICLE

BY JDK

Introduction

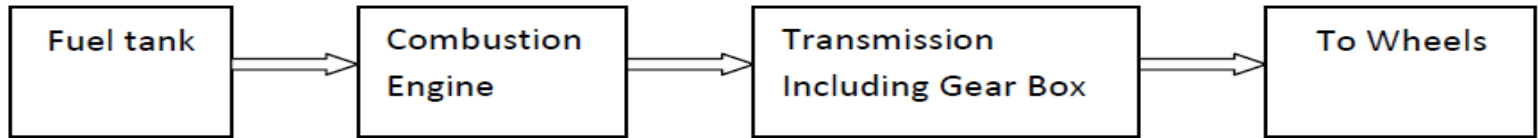
- IC engine invented by Nicholas Otto in 1861
- Automobile Technology in 20th Century
Focus on Petrol and Diesel Engine.
- Automobile Technology in 21st Century
Focus on Hybrid Electric Vehicle, Hybrid Solar Vehicle and Plug-In Hybrid Electric Vehicle.

Working Principle of Hybrid Vehicle

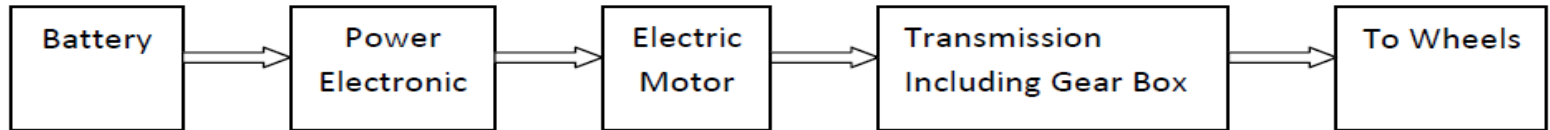


Hybrid Electric Vehicle

A type of technology which indulges both mechanical drive train and electric vehicle.

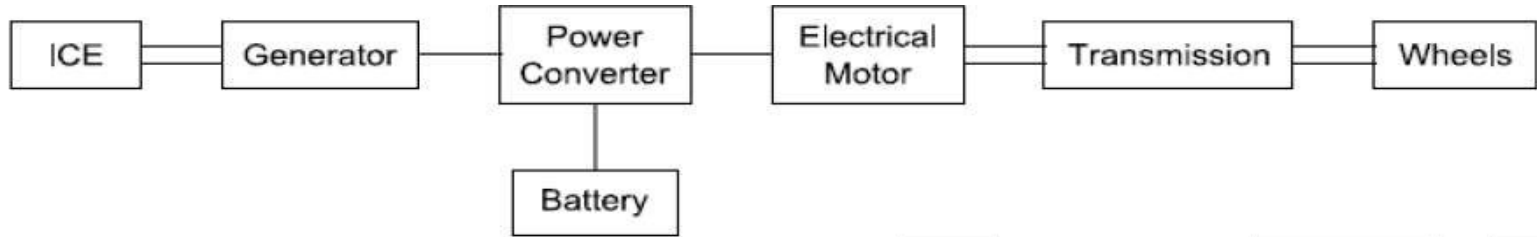


The Arrow depicts flow of Energy within a mechanical drive train

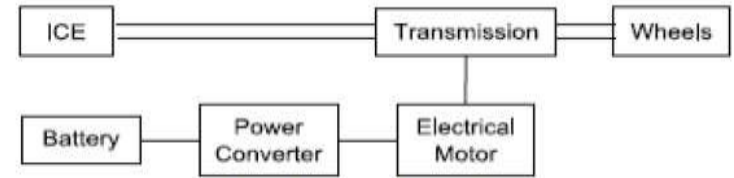


The Arrow depicts flow of Energy within an electric drive train

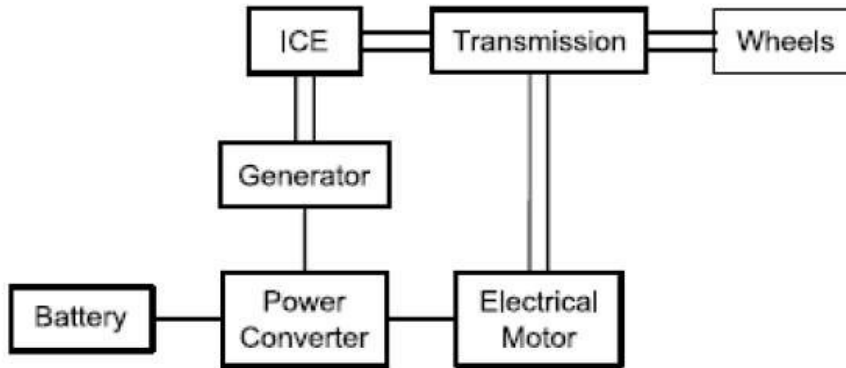
Classification of HEV



Series Hybrid Architecture



Architecture of Paralled Hybrid

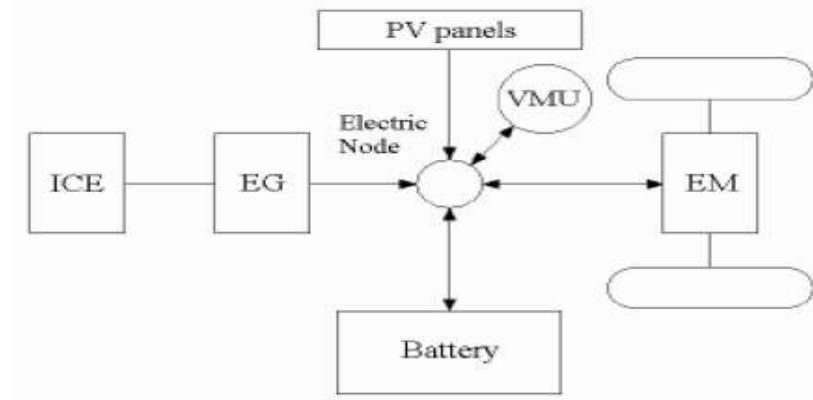


Architecture of Series-Parallel Hybrid

Complex Hybrid: There are two separate mechanical links obtaining a light transmission system and a flexible mounting.

Hybrid Solar Vehicle

- An integration of Hybrid Electric Vehicle and Photo-Voltic Panels.
- This technology is also classified into four types: - Series hybrid, Parallel Hybrid, Parallel-Series Hybrid and Complex Hybrid.



Basic Diagram of Series HSV

Plug-In Hybrid Electric Vehicle

- Next Version of Hybrid Electric Vehicle
 - 1) it can be plugged in to an electrical outlet to be charged and
 - 2) has some range that can be travelled on the energy it stored while plugged in
 - 3) gasoline-independent for daily commuting
 - 4) can also be multi-fuel supplemented by diesel, biodiesel or hydrogen



CASE STUDY OF TOYOTA PRIUS SERIES

Why Prius?

- Came out too early (1997), much before environmental awareness became a mainstream issue.
- Till now the most successful hybrid car ever made (Highest sales and best mileage).
- Has inculcated an intelligent Hybrid Synergy Drive (HSD) rather than going on mainstream functioning directly.

First Generation Prius

Challenges while making the first generation Prius.

- Life of Battery (7-10 years)
- Need for hybrid system
- High Performance engine for charging the battery.



Solutions:-

- The battery pack is always charged between 40%-60% for maximum efficiency.
- The introduction of the “Toyota Hybrid System”.
- Introduction of the Double Overhead Cam-Shaft (DOHC) engine in the vehicle.



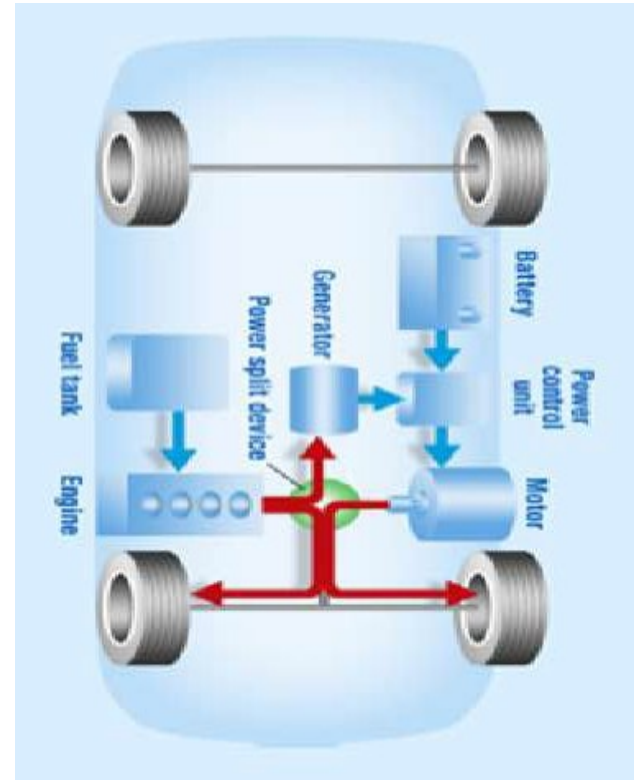
Benefits of DOHC engine

- DOHC stands for Double Overhead Cam shaft engine.
- DOHC allows the engine to have four valves per cylinder. Hence higher power is produced as more air can be sucked and exhaust can be removed at higher rate resulting in decrease in cycle completion time.

Working of Toyota Hybrid System

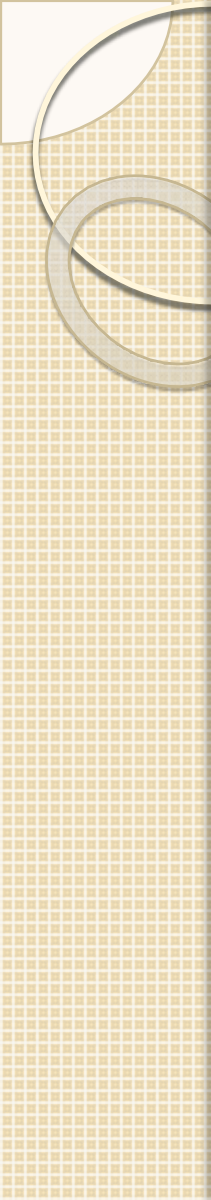
Components

- Petrol Engine
- Two Motor Generators (MG1 & MG2).
- Power Control Unit (PCU).
- Power Split Device
- Battery



Working

- When the car starts it solely runs on Electric Motor (MG2).
- When the car achieve higher speed the petrol engine comes into play.
- The engine also operates a generator with the help of a power split device which in turn drives the electric motor MG2.
- This power splitting is controlled by the power control unit which manages the power for the maximum efficiency.

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- During braking the motor acts as a generator and the energy recovered is stored in the battery.
 - The battery doesn't need any external charging.
 - If the battery is drained, the car is run on the petrol engine in “stand mode” which charges the battery.

Advantages

- Very less noise pollution at low speeds.
- Lower level of CO₂ emissions.
- High mileage

City driving 5.6 L/100 km (17.8km/L)

Highway driving 5.7 L/100 km (17.5km/L)

Combined driving 5.7 L/100 km (17.5km/L)

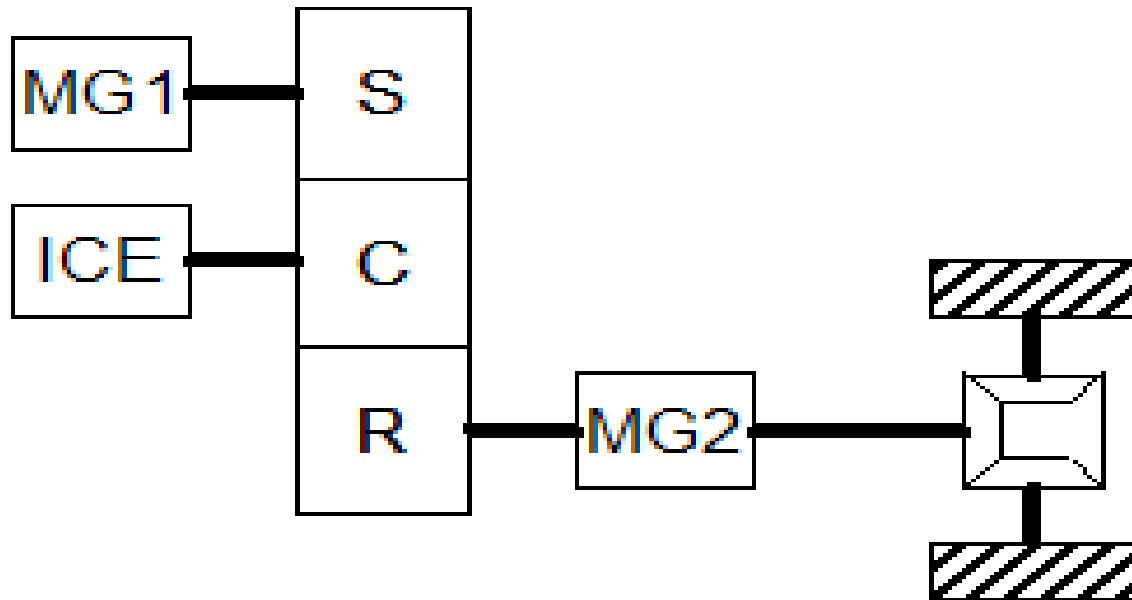
Drawbacks

- The reversing of the car was difficult at steeps.
- The rides where jerky at times.

Second generation: Hybrid Synergy Drive (HSD)

- It has an all electric Air conditioner. Hence the engine can be turned off during standby cooling.
- Torque of electrical motor is increased up to 14 % .
- Inferior electrical losses.
- Improved charge capacity of the generator (500V).
- New HV battery with superior power density and 14% weight reduction.

- Planetary Gear set is introduced



Advantages

- Increase in mileage

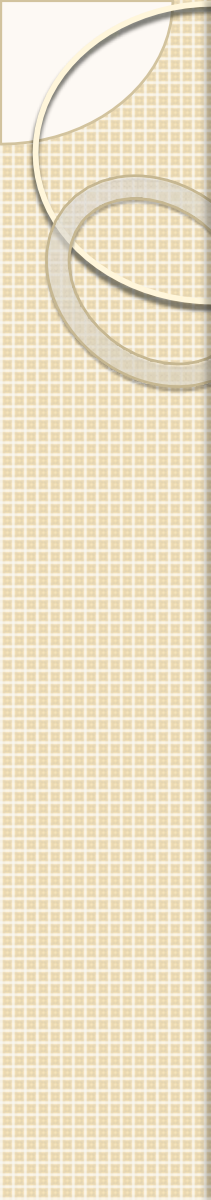
City driving 4.9 L/100 km (20.4km/L)

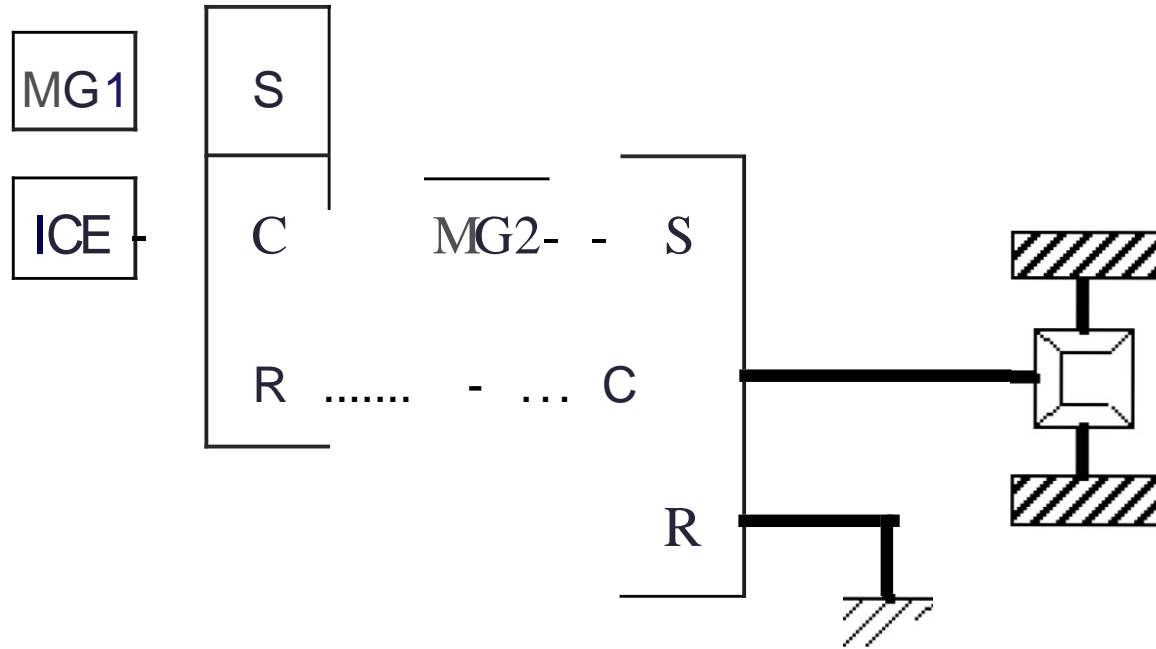
Highway driving 5.2 L/100 km (19.23km/L)

Combined driving 5.1 L/100km (19.60km/L)

Third generation: Hybrid synergy drive (HSD)

- The internal combustion engine is a new more powerful 1.8-litre VVT-i Atkinson cycle petrol engine.
- The electric motor MG2 is 20% more powerful (60kW vs. 50 kW) and 33% smaller.
- The Ni-MH battery power has been increased to a maximum 27kW (+2kW), and has reduced size.

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- The PCU is 36% lighter, faster switching and cooling is employed for improved efficiency.
 - The Ni-MH battery power has been increased to a maximum 27kW (+2kW), and has reduced size.
 - The third generation Prius also has a planetary gear set called the „motor speed gear reduction“ for the MGI.



Advantages

- Very low CO₂ emissions (89g/km).
- Very low noise level at low speeds.
- Mileage was overwhelming

City driving 3.70 L/100 km (27.0km/L)

Highway driving 3.90 L/100 km (25.6km/L)

Combined driving 3.90 L/100 km (25.6km/L)

Drawback

- Too less noise level at low speed caused accidents. This however was corrected by installing a noise producing device in the car.

Plug-In Hybrid Electric Vehicle

- The PHEV has a 4.4Kwh Lithium ion battery which allows an all-electric range of 23 km.
- The lithium-ion battery pack can be charged in 180 minutes at 120 volts or in 90 minutes at 240 volts.

Advantages

- The Prius plug-in releases only 49gm CO₂ emissions.
- Same mileage as that of 3rd generation Prius.
- It has an all electric efficiency of 2.5L/100km (40km/L).
- The Battery can be charges at any outlet.

Advantages of Hybrid Vehicles

- Hybrid cars use no energy during idle state, they turn off and use less than petrol engines at low speeds.
- At lower speeds i.e. in traffic no smog is emitted maintaining its sustainable advantage.
- Hybrid cars offers greater mileage than other cars.
- Noise pollution and emission of CO₂ are considerably reduced.



Drawbacks of Hybrid Vehicles

- Hybrid cars are more expensive than normal cars.
- Hybrid cars are much more complex in construction and working than the IC engine cars.
- Hybrid cars offer larger repair bills.
- Batteries are not yet much advanced so as the car could run for a larger distance on batteries itself.

(Toyota is researching on making higher capacity Li-ion batteries)



Its not about what you want.....

Its about how bad you want it

THANKYOU

LEAN BURN ENGINE

LEAN BURN ENGINE

- Lean burn mode is a way to reduce throttling losses
- burning of fuel with an excess of air in an IC engine
- air fuel ratio may be much lean
- Have higher compression ratios

LEAN BURN ENGINE

- Due to high compression ratio:
 - Lean burn engine shows better performance
 - Fuel is efficiently used in case of lean burn engines
 - Low exhaust hydrocarbon emission

Working of lean burn engine

- Any air/fuel reaction requires an energy source to initiate compression
- In natural gas engines, the spark plug is the energy source to initiate combustion
- In lean burn engines, the combustion process is enhanced by premixing the air and fuel upstream of the turbo charger before introduction into the cylinder

- This creates a more homogeneous mixture in combustion chamber and reduces the occurrence of knocking or detonation
- To prevent knocking, the combustion process must be controlled within a narrow operating window
- Charge air temperatures and volume, together with air to fuel ratio, are constantly monitored
- The microprocessor based engine controller regulates the fuel flow and air/gas mixture and ignition timing

MERITS


- Excess air reduces the temperature of combustion process and this reduces the amount of NO_x produces by nearly half.
- Combustion process is more efficient due to the excess availability of oxygen
- More power is produced from same amount of fuel.
- Lean burn engine can operate on gas with a wide range of quality

DEMERITS

- Complex catalytic converter is required to reduce NOx emissions
- Such engine do not work well with modern 3-way catalytic converter



HYDROGEN ENGINE

- 
- Need of Hydrogen engine
 - Introduction
 - Working principal of hydrogen engine
 - Fuel cell
 - Fuel
 - Electrolysis in Fuel cell
 - Advantages of fuel cell
 - Disadvantages of fuel cell

NEED OF HYDROGEN ENGINE


- Now days due to pollution people have to find the alternative of fuels,that reduce the pollution.
- People find many ways to reduce the pollution like CNG,PNG,electric and hydrogen car.






INTRODUCTION

- Hydrogen vehicle converts the chemical energy of hydrogen to mechanical energy either by burning hydrogen in an internal combustion engine or by reacting hydrogen with oxygen in fuel cell to run electric motor.
- Alternative fuels not only burn but some are renewable ,unlike fossil fuels , which means we could develop a continuous supply of them,

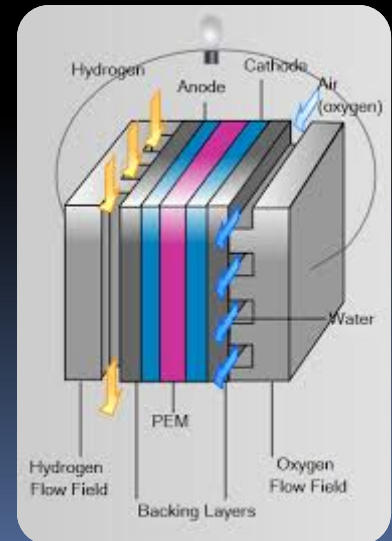
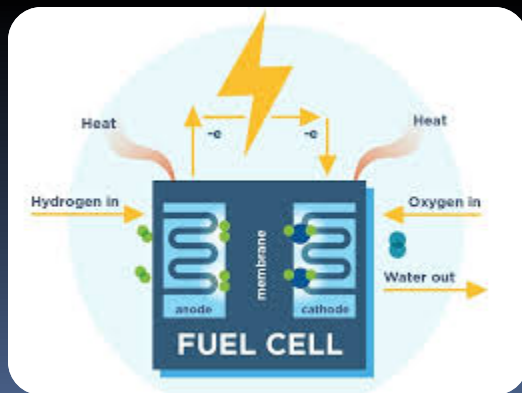


Working principal of hydrogen engine:

- Hydrogen engines are considered by many people to be an excellent alternative to fossil fuel engines.
 - A Hydrogen fuel cell engine works by mixing hydrogen and oxygen, generating electricity during the electrolysis.
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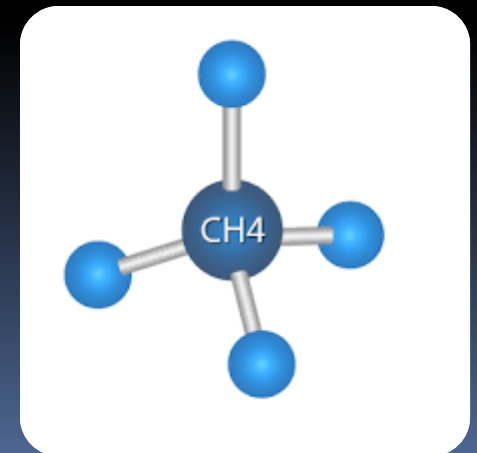
Fuel cell

- Chemical energy to Electricity.
- Needs Fuels and Oxygen are supplied.
- Efficiency of 40-60% + Heat.
- First made in 1838.

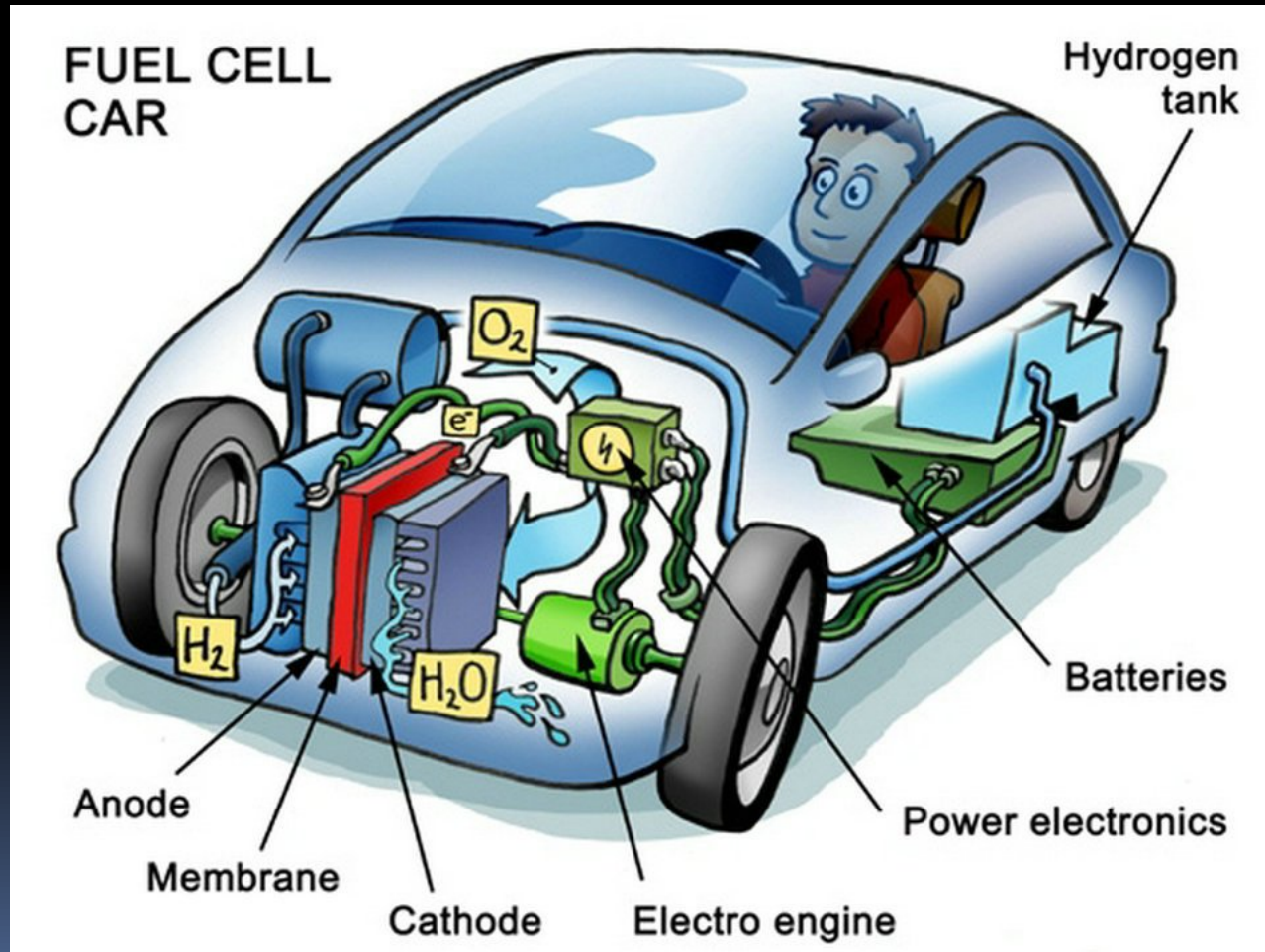


Fuel

- Clean Hydrogen
- Methane
- Natural Gas
- Ethanol



Electrolysis in cell



Advantages of fuel cell:

- Higher efficiency
- Emission from hydrogen fuel cell is zero.
- It can achieve a better fuel economy rating.
- Neutral cost as compare to electric cars.



Disadvantages of fuel cell:

- It can't work in every situations.
- Cost to store hydrogen is high.
- Leakage problems may occur
- It is not widely available right now.



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Hydrogen car as modern vehicle

- Many country starts pilot projects like Japan, USA, europe countries.
- Tata hybrid buses are also use in india.
- Toyota, hyundai, honda



