SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF AUTOMOBILE ENGINEEIRNG

19AUT202 – HYBRID ELECTRIC AND FUEL CELL VEHICLE

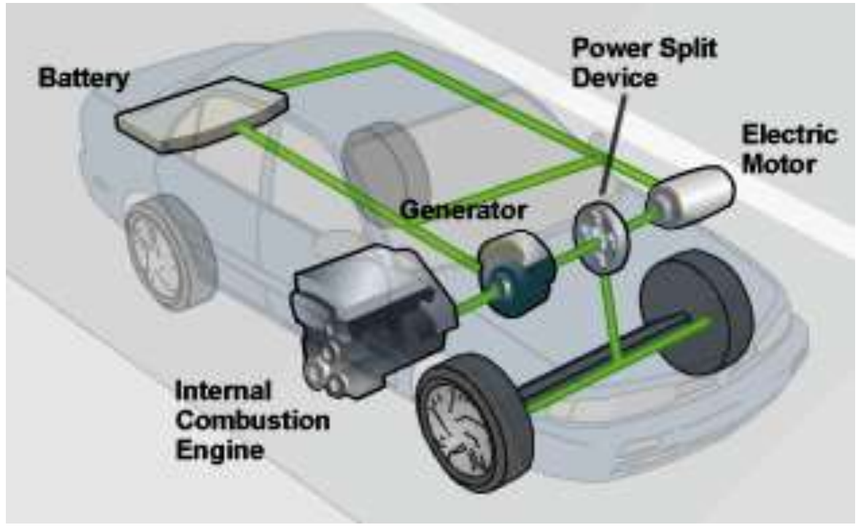
II YEAR / III SEM

UNIT 1 – HYBRID VEHICLE

TOPIC – HYBRID ELECTRIC VEHICLE HISTORY

INTRODUCTION

- Hybrid – Mixed together from two things
- Hybrid Electric Vehicle – combination of the IC Engine of a Conventional Vehicle with battery and electric motor of an electric vehicle.



BACKGROUND

- Unlike the gas powered automobile, the electric automobile did not easily develop into viable mean of transportation
- The easily mass produced gasoline – powered automobile squelched interest in the project
- Technologies that support a reliable battery and the weight of the needed number of batteries elevated the prices of making an electric vehicle.
- Research decreased from 1920 – 1960 and worries about environmental issues of pollution and diminishing natural resources reawakened the need of a more environmentally friendly means of transportation.

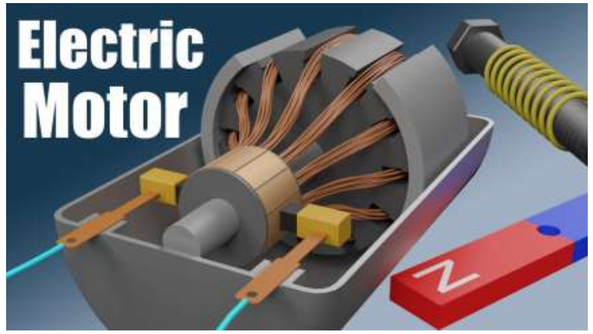
HISTORY

- In 1837, Robert Davidson of Scotland appears to have been the builder of the first electric car.
- During the late 1890s, United States roads were populated by more electric automobiles than those with IC Engine Vehicles.
- The History of the electric car is related with the history of the development of the battery .
- They were clean, quiet and easy to operate.

HISTORY

- In the 1960s, interest in the electric car rose again due to the escalating cost and diminishing the supply oil and concern about pollution generated by internal combustion engine.
- The resurgence of the electric car in the last part of the 20th century has, however been fraught with technical problems.
- Nowadays, Automotive electronics have become so sophisticated and small that they are ideal for electric vehicle applications.
- Batteries are more efficient and capable so every car firm has its own line of electric cars.

COMPONENTS

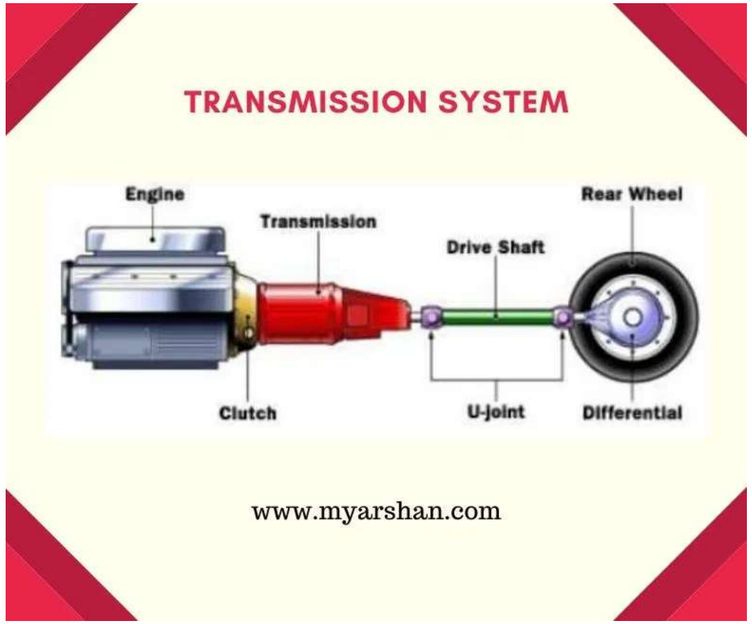

Electric
Motor
N

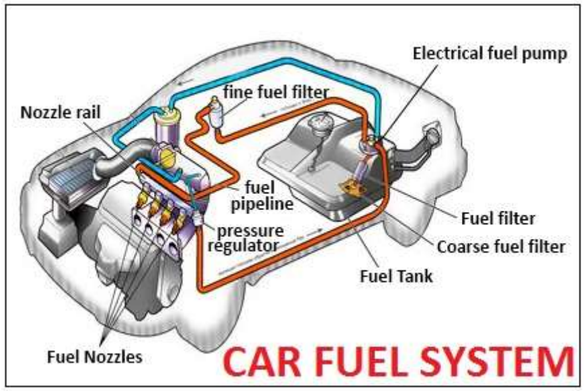

DAKOTA LITHIUM
12V 10Ah
120 Wh • LiFePO4 BATTERY
DAKOTALITHIUM.COM


INDUSTRY 4.0
MOBILITY
ISO 9001 2015
CERTIFIED
ELECTRIC VEHICLE
MOTOR
CONTROLLER DESIGN
CERTIFICATION
COURSE
DG
DIYGURU.ORG

COMPONENTS


Autolite


TRANSMISSION SYSTEM
Engine
Transmission
Drive Shaft
Rear Wheel
Clutch
U-joint
Differential
www.myarshan.com


Electrical fuel pump
fine fuel filter
Nozzle rail
fuel pipeline
Fuel filter
pressure regulator
Coarse fuel filter
Fuel Tank
Fuel Nozzles
CAR FUEL SYSTEM

WORKING

- Two energy sources such as an energy conversion unit such as combustion engine and fuel cell used.
- Energy storage device such as batteries or capacitors are used.
- The energy conversion unit is powered by gasoline, methanol compressed natural gas etc.
- There are different three different types of design in the Hybrid vehicle.

1. Parallel design
2. Series Design
3. Combination of both

NEED FOR ELECTRIC AND HYBRID ELECTRIC VEHICLES

ENVIRONMENTAL CONCERNS:

Current use of heat-combustion engine is a major source of air pollution and may be a cause of global warming.

PRACTICAL CONCERNS:

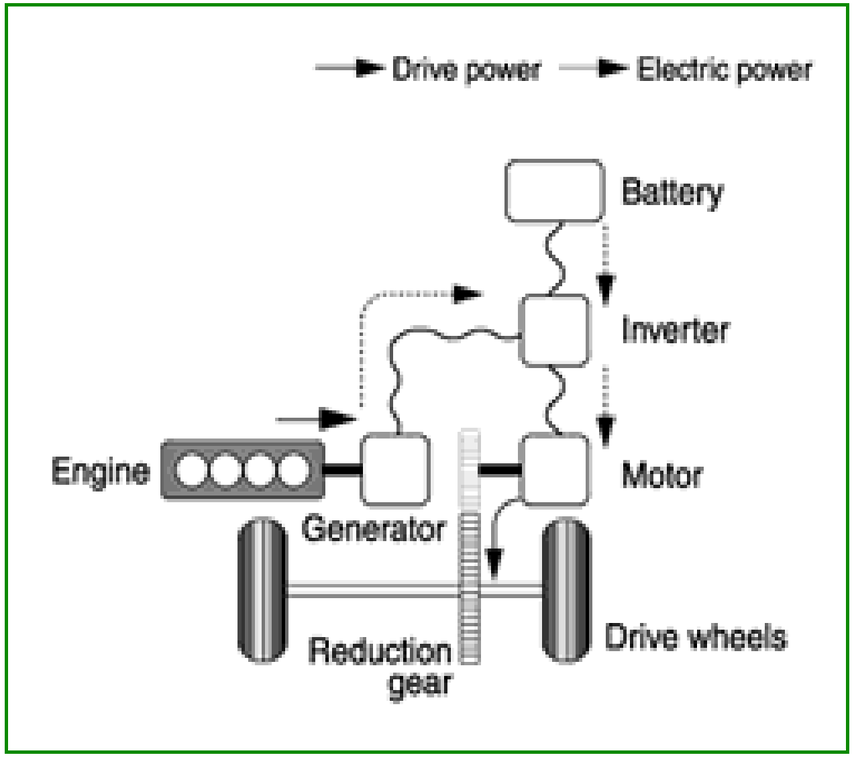
Current conventional cars use a quickly decreasing source of fossil fuel. Although no one knows exactly how long the world's supply of oil will last, most agree that it isn't too far in the future that our current supply will be used up.

BENEFITS

- The electric motor is far more efficient (70%-85% efficiency) than the heat engine (need some numbers).
- EV’s can use regenerative stopping (regain 30% of energy used, theoretically).
- As mentioned already, HEV’s are more environmentally friendly and the oil supplies for conventional vehicles are being depleted.

SERIES STRUCTURE

- Uses the heat engine or fuel cell with a generator to produce the electricity for the battery pack and electric motor
- Motor power is transferred from chemical energy to mechanical energy to electrical energy and back to mechanical energy to drive the wheel.



ADVANTAGES

- Does not need transmission
- Design allows the variety of operation when mounting of engine and vehicle components.
- Engine drive generator to run at optimum performance
- Reduce the emission

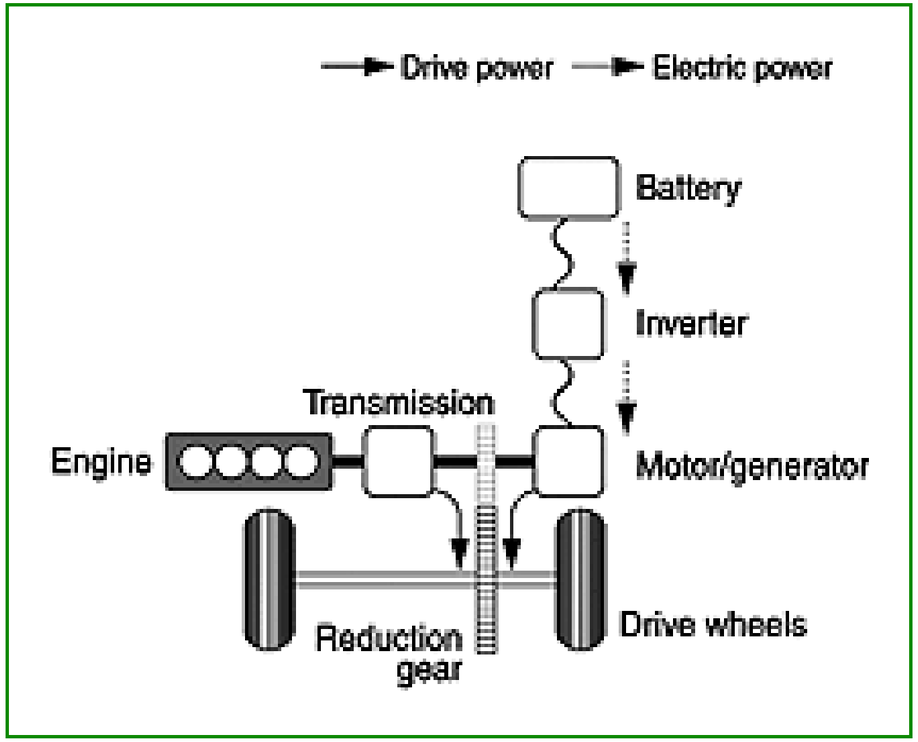
DISADVANTAGES

- Heavier battery pack than the parallel Vehicles.
- Engine must work hard to maintain battery charge because the system is not operating in the parallel.
- In efficiency to convert the chemical energy to mechanical energy to Electrical energy and back to mechanical energy.

PARALLEL STRUCTURE

Direct Mechanical connection between the hybrid power unit and the wheel as in a conventional vehicle but also has an electric motor that drives the wheels.

It uses the power generated by the IC engines in the Highways driving while using both engine and electric motor power accelerating



ADVANTAGES

- Better Fuel Economy.
- The vehicle has more power because both the engine and the motor supply power.
- Does not requires the generator because the motor regenerates the batteries.

HYBRID CARS IN FORD

FORD ESCAPE

FORD FUSION

HYBRID CARS IN TOYATO

TOYATO YARIS

TOYATO CAMY

HYBRID CARS IN HONDA

HONDA INSIGHT

HONDA CIVIC

SERIES HYBRID VEHICLE

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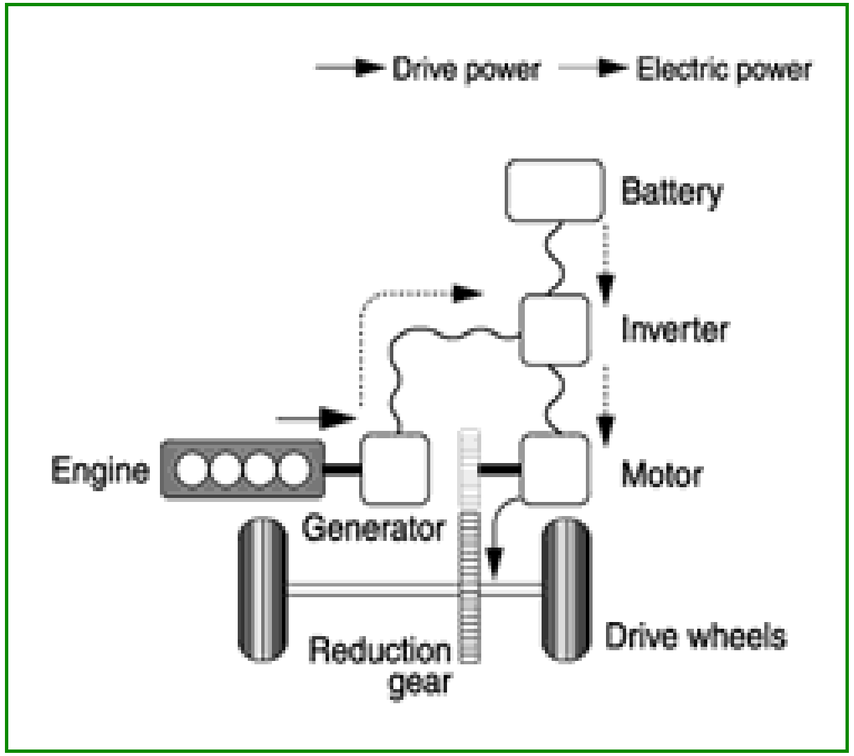
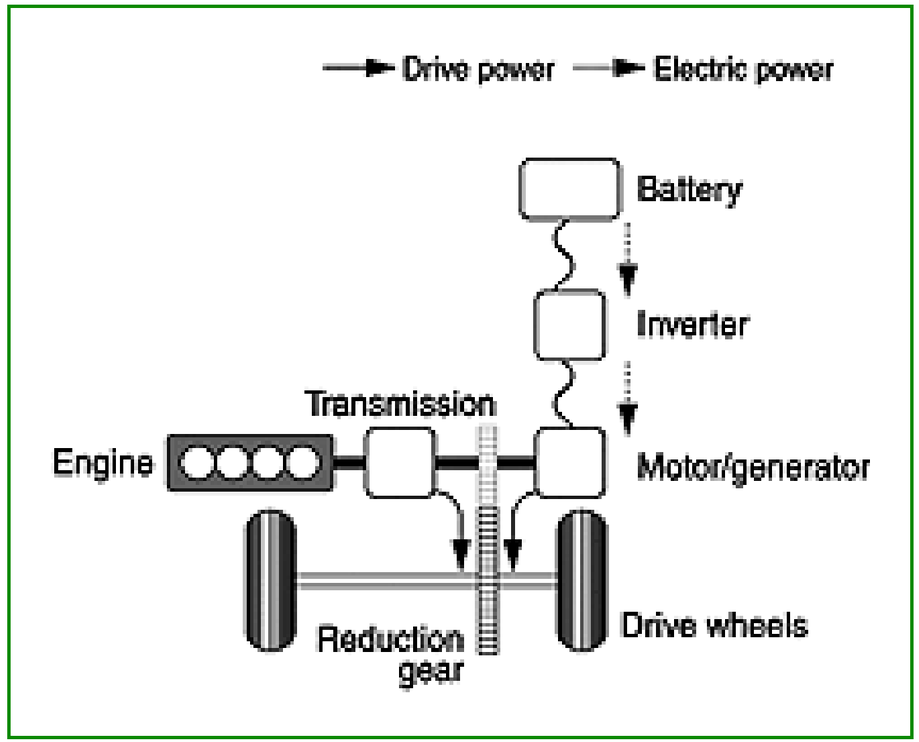
- Motor power is transferred from chemical energy to mechanical energy to electrical energy and back to mechanical energy to drive the wheel.



PARALLEL HYBRID VEHICLE



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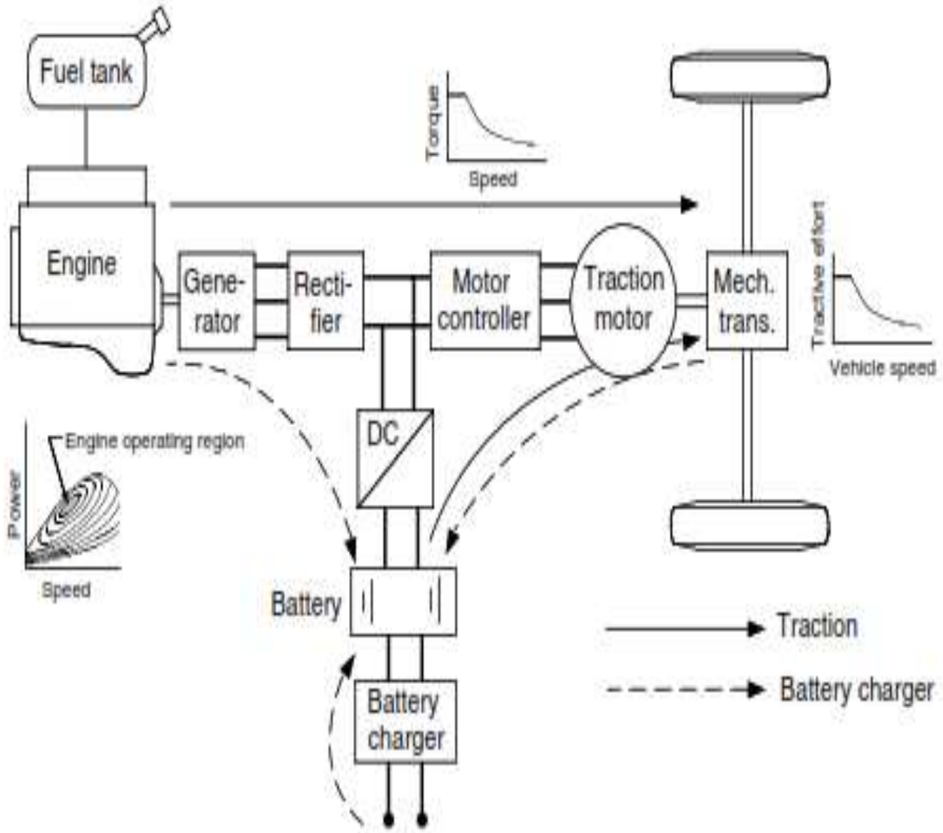
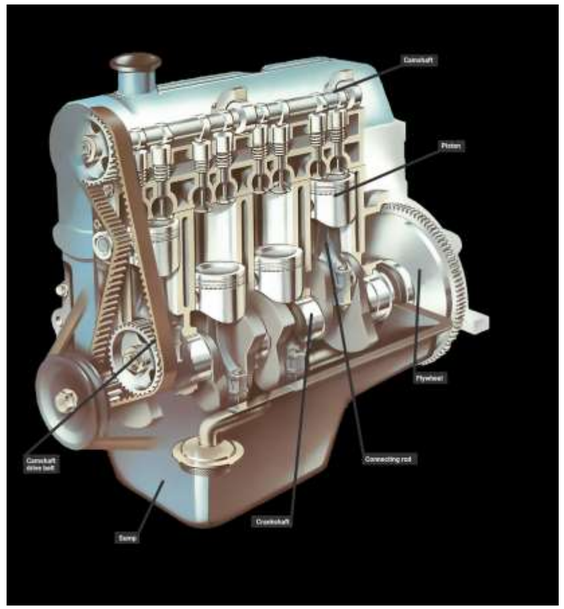
ARCHITECTURE – SERIES HEV



- A series hybrid drive train uses two power sources feed a single power plant (electric motor) that propels the vehicle.
- The unidirectional energy source is a fuel tank and the unidirectional energy converter is an engine coupled to an electric generator.
- The output of the electric generator is connected to an electric power bus through an electronic converter (rectifier).
- The bidirectional energy source is an electrochemical battery pack, connected to the bus by means of a power electronic converter (DC / DC)

HEV – POWER TRAIN

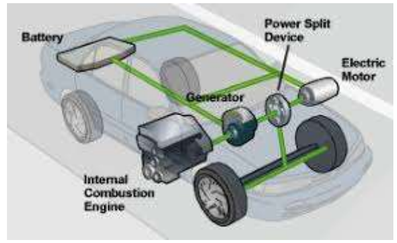
- The electric power bus is also connected to the controller of the electric traction motor.
- The traction motor can be controlled either as a motor or a generator, and in forward or reverse motion.
- This drive train may need a battery charger to charge the batteries by a wall plug-in from the power network.



DIFFERENT MODES – SERIES HEV

1. **Pure electric mode:** The engine is turned off and the vehicle is propelled only by the batteries.

2. **Pure engine mode:** The vehicle traction power only comes from the engine-generator, while the batteries neither supply nor draw any power from the drive train. The electric machines serve as an electric transmission from the engine to the driven wheels.



3. **Hybrid mode:** The traction power is drawn from both the engine generator and the batteries.

4. **Engine traction and battery charging mode:** The engine-generator supplies power to charge the batteries and to propel the vehicle.

5. **Regenerative braking mode:** The engine-generator is turned off and the traction motor is operated as a generator. The power generated is used to charge the batteries.

DIFFERENT MODES – SERIES HEV

6. **Battery charging mode**: The traction motor receives no power and the engine-generator charges the batteries.

7. **Hybrid battery charging mode**: Both the engine-generator and the traction motor operate as generators to charge the batteries.

ADVANTAGES – SERIES HEV

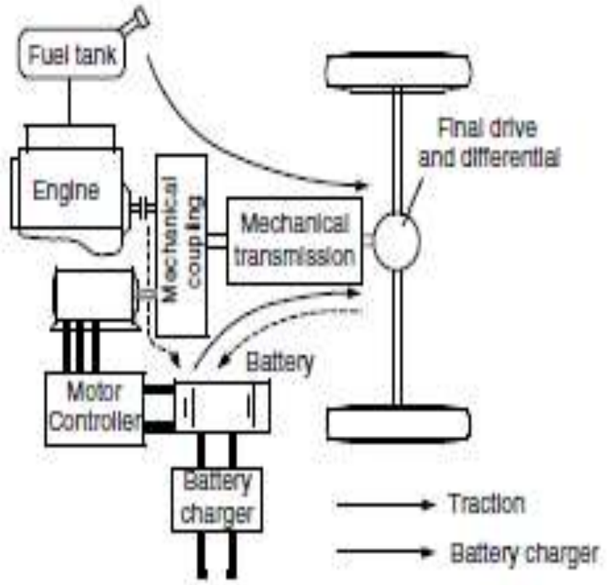
- Does not need transmission
- Design allows the variety of operation when mounting of engine and vehicle components.
- Engine drive generator to run at optimum performance
- Reduce the emission

DISADVANTAGES – SERIES HEV

- Heavier battery pack than the parallel Vehicles.
- Engine must work hard to maintain battery charge because the system is not operating in the parallel.
- In efficiency to convert the chemical energy to mechanical energy to Electrical energy and back to mechanical energy.

ARCHITECTURE - PARALLEL HEV

- A parallel hybrid drive train is a drive train in which the engine supplies its power mechanically to the wheels like in a conventional ICE-powered vehicle.
- It is assisted by an electric motor that is mechanically coupled to the transmission.
- The powers of the engine and electric motor are coupled together by mechanical coupling.
- The mechanical combination of the engine and electric motor power leaves room for several different configurations

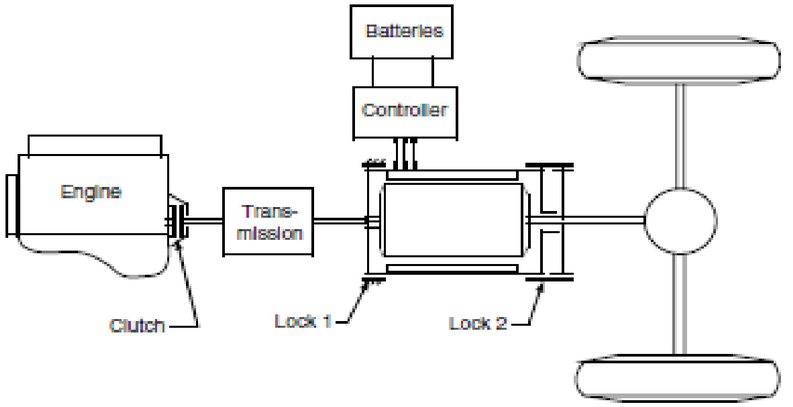


POWER MODES – PARALLEL HEV

1. Hybrid traction: When locks 1 and 2 are released the sun gear and ring gear can rotate and both the engine and electric machine supply positive speed and torque (positive power) to the driven wheels.

2. Engine-alone traction: When lock 2 locks the ring gear to the vehicle frame and lock 1 is released only the engine supplies power to the driven wheels.

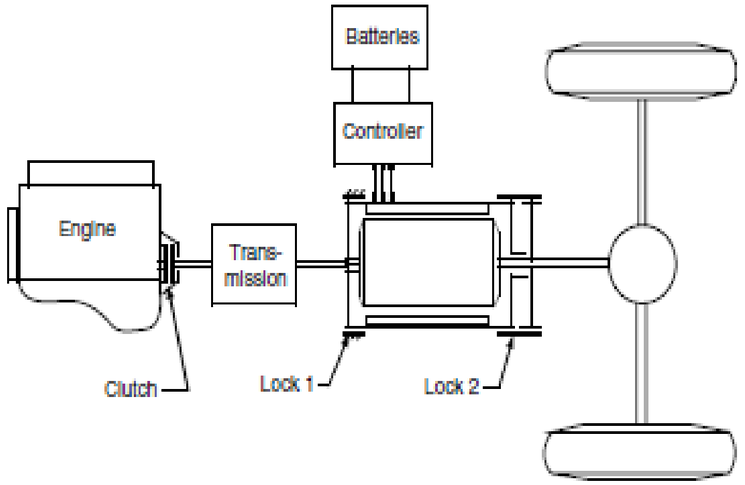
3. Motor-alone traction: When lock 1 locks the sun gear to the vehicle frame (engine is shut off or clutch is disengaged) and lock 2 is released only the electric motor supplies its power to the driven wheels.



POWER MODES – PARALLEL HEV

4. **Regenerative braking:** Lock 1 is set in locking state, the engine is shut off or clutch is disengaged, and the electric machine is controlled in regenerating operation (negative torque). The kinetic or potential energy of the vehicle can be absorbed by the electric system.

5. **Battery charging from the engine:** When the controller sets a negative speed for the electric machine, the electric machine absorbs energy from the engine.



ADVANTAGES – PARALLEL HEV

- Better Fuel Economy.
- The vehicle has more power because both the engine and the motor supply power.
- Does not requires the generator because the motor regenerates the batteries.

VIDEO

SERIES AND PARALLEL HYBRID ANIMATION.

HYBRID ELECTRIC VEHICLE - SERIES

REFERENCE

- Electric and Hybrid – Electric Vehicles” - Ronald K Jurgen,, SAE International, 2011.
- Electric and Hybrid Vehicles- Design Fundamentals” - Iqbal Husain, CRC Press, 2011.
- Electric Vehicle Technology Explained” - James Larminie, John Lowry, Wiley, 2012.

Thank You !!!!!!