

## UNIT-1

### *The Present and Future of Hybrid and Electric Vehicles*

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## *The Present and Future of Hybrid and Electric Vehicles*



## *Presentation Outline*

- Why does society need/want hybrid and electric vehicles?
- Current status of EV's and HEV's.
- The general structure and functionality of HEV's.
- New developments and future technology of HEV's.

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## *The 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.

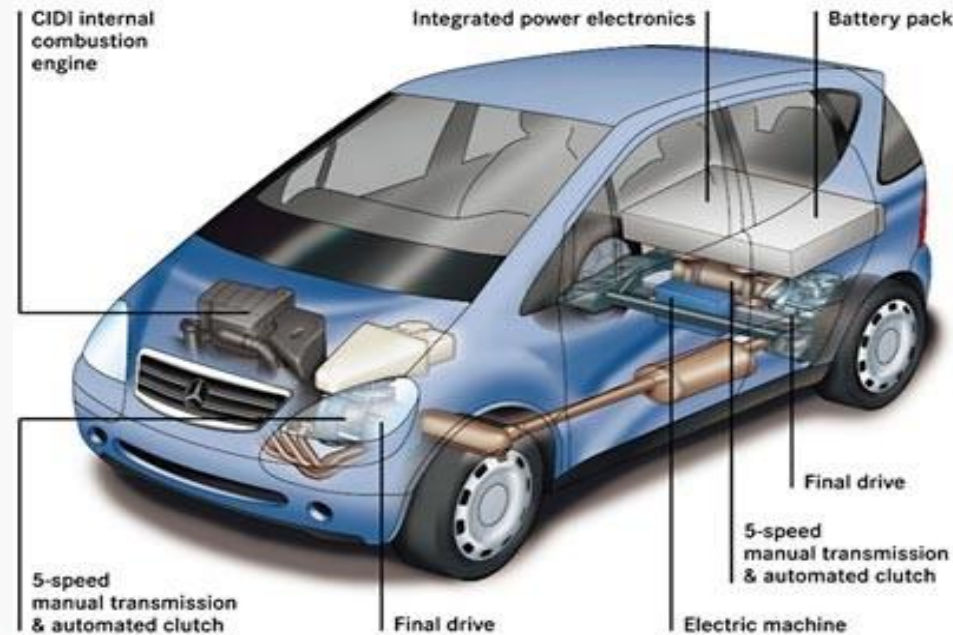
*“In 15 years Americans will be routinely driving hybrid electric cars performing at 80 miles per gallon. Today's internal-combustion-engine-only vehicle will become an artifact of history.” - Dan Doughty*

## *The Benefits of EV's and HEV's compared with conventional vehicles*

- 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.

Source: <http://www.rqriley.com/ev-tech.html>

## *Basic Structure of a Hybrid Vehicle*

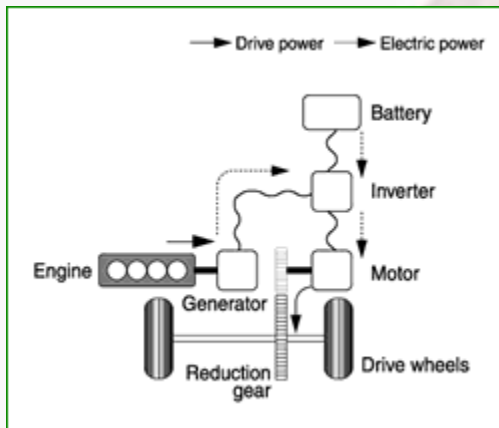


The batteries in a hybrid car are the energy storage device for the electric motor. Unlike the gasoline in the fuel tank, which can only power the gasoline engine, the electric motor on a hybrid car can put energy into the batteries as well as draw energy from them.

Source: [www.howstuffworks.com](http://www.howstuffworks.com)

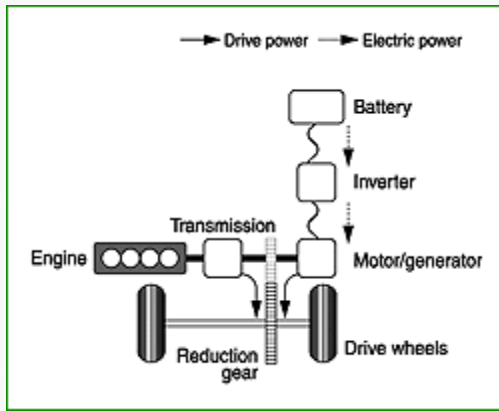


## Structure of the Hybrid Design



### ■ Series

This is called a series hybrid system because the power flows to the wheels in series. A series hybrid system can run a small-output engine in the efficient operating region relatively steadily, generate and supply electricity to the electric motor and efficiently charge the battery. This system is being used in the Coaster Hybrid.

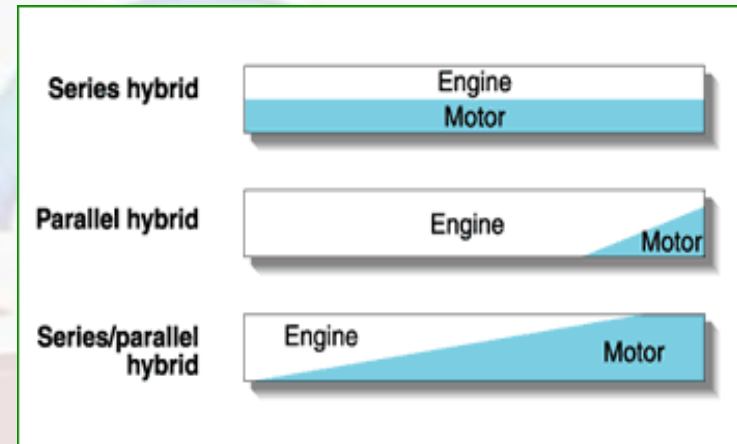
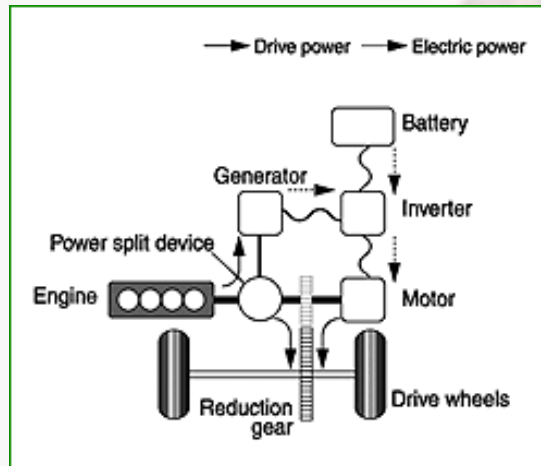


### ■ Parallel

In a parallel hybrid system, both the engine and the electric motor drive the wheels, and the drive power from these two sources can be utilized according to the prevailing conditions. This is called a parallel hybrid system because the power flows to the wheels in parallel.

Source <http://www.toyota.co.jp/en/tech/environment/ths2/what.html>

## Structure of the Hybrid Design



### ■ Series/parallel hybrid system

This maximizes both series and parallel systems, it has two motors, and depending on the driving conditions, uses only the electric motor or the driving power from both the electric motor and the engine, in order to achieve the highest efficiency level. This is the system used in the Prius and the Estima Hybrid.



## Current Areas of Research

- Current research focusing on maximizing the efficiency
  - Reduce Mass.
  - Decrease material and manufacturing costs.
  - Improving the Hardware.
  - Battery – alternatives to/maximizing the nickel-metal hydride currently in use.

## The Nickel Metal Hydride Battery

### The Benefits

- hold twice as much energy as lead batteries
- have a longer life cycle
- require no maintenance
- the materials in them are far less toxic than the materials in regular car batteries.

### The Disadvantages

- they can be heavy and bulky
- High price- as much as \$5000.
- With sudden boom of hybrid cars, there is a supply shortage.

Source: [http://www.usatoday.com/money/autos/2004-11-21-hybrid-batteries\\_x.htm](http://www.usatoday.com/money/autos/2004-11-21-hybrid-batteries_x.htm)

## *The PNGV*

The Partnership for a New Generation of Vehicles was established in 1993, with the following agenda:

PNGV goals must be achieved without sacrificing key vehicle performance, safety, emissions, size, and economic criteria. The primary requirements for the PNGV vehicle are as follows (in abbreviated form):

- A three-fold improvement in vehicle fuel economy to 35 km/l (83 mpg).
- A vehicle range of 612 km (380 miles).
- Acceleration from 0-97 km/h in 12 seconds (0-60 mph in 12 seconds).
- Attain a maximum speed of 137 km/h (85 mph).
- Climb a 6.5% grade at 89 km/h (55 mph) for 20 minutes.
- Achieve drive away power in 5 seconds and full power in 2 minutes.
- Must meet FMVSS safety requirements and EPA Tier II emissions standards.
- Purchase price equivalent to today's family sedan.

Source: <http://www.rqriley.com/ev-tech.html>



## Today's Market

<b>Make/model</b>	<b>MPG</b>	<b>Cost</b>
Honda Civic	48	\$20,650
Honda Insight	57	\$20,380
Honda Accord	37	\$30,000
Toyota Prius	60	\$20,295
Ford Escape SUV	36	\$27,180
GMC Sierra truck	21	\$37,400

Source: [http://www.sfexaminer.com/article/index.cfm/i/112204n\\_autoshow](http://www.sfexaminer.com/article/index.cfm/i/112204n_autoshow)

## The New Cars of Today

