**Hybrid electric vehicle**

Any vehicle that combines two or more sources of power that can directly or indirectly provide propulsion power is a hybrid. A hybrid electric vehicle (HEV) is a hybrid vehicle which combines a conventional propulsion system with rechargeable energy storage system (RESS) to achieve better fuel economy than a conventional vehicle.

Modern mass \_ product HEVs prolongs the charge on their batteries by capturing kinetic energy via regenerative braking.

**Gasoline Power vs. Electric Power**

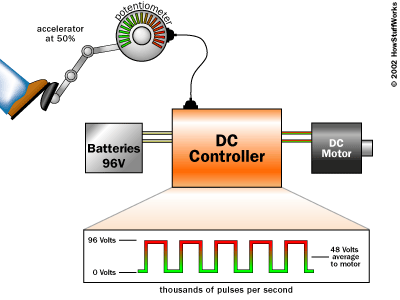
The gasoline-electric hybrid car is just what it sounds like -- a cross between a gasoline-powered car and an electric car.

**gas-powered car**

A gas-powered car has a fuel tank, which supplies gasoline to the engine. The engine then turns a transmission, which turns the wheels.

Electric car

An electric car, on the other hand, has a set of batteries that provides electricity to an electric motor. The motor turns a transmission, and the transmission turns the wheels.

**Inside an Electric Car**

The heart of an electric car is the combination of:

* The **electric motor**
* The motor's **controller**
* The **batteries**

The controller takes power from the batteries and delivers it to the motor. The accelerator pedal hooks to a pair of **potentiometers** (variable resistors), and these potentiometers provide the signal that tells the controller how much power it is supposed to deliver. The controller can deliver zero power (when the car is stopped), full power (when the driver floors the accelerator pedal), or any power level in between.

A simple DC controller connected to the batteries

The very simplest DC controller would be a big on/off switch wired to the accelerator pedal. When you push the pedal, it would turn the switch on, and when you take your foot off the pedal, it would turn it off. As the driver, you would have to push and release the accelerator to pulse the motor on and off to maintain a given speed.

Obviously, that sort of on/off approach would work but it would be a pain to drive, so the controller does the **pulsing** for you. The controller reads the setting of the accelerator pedal from the potentiometers and regulates the power accordingly.

Most controllers pulse the power more than 15,000 times per second, in order to keep the pulsation outside the range of humam hearing. The pulsed current causes the motor housing to vibrate at that frequency, so by pulsing at more than 15,000 cycles per second, the controller and motor are silent to human ears.

In an AC controller, the job is a little more complicated, but it is the same idea. The controller creates three pseudo-sine waves. It does this by taking the DC voltage from the batteries and pulsing it on and off. In an AC controller, there is the additional need to **reverse the polarity** of the voltage 60 times a second.

The hybrid is a compromise. It attempts to significantly increase the mileage and reduce the emissions of a gas-powered car while overcoming the shortcomings of an electric car.

To be useful to you or me,a car must meet certain minimum requirements. The car should be able to:

* Drive at least 300 miles (482 km) before re-fueling
* Be refueled quickly and easily
* Keep up with the other traffic on the road

A gasoline car meets these requirements but produces a relatively large amount of pollution and generally gets poor gas mileage. An electric car, however, produces almost no pollution, but it can only go 50 to 100 miles (80 to 161 km) between charges. And the problem has been that the electric car is very slow and inconvenient to recharge.A gasoline-electric car combines these two setups into one system that leverages both gas power and electric power.

**Gasoline-electric Hybrid Structure**

Gasoline-electric hybrid cars contain the following parts:

**Gasoline engine** - The hybrid car has a gasoline engine much like the one you will find on most cars.

**Fuel tank** – The fuel tank in a hybrid is the energy storage device for the gasoline engine.

**Electric motor** - The electric motor on a hybrid car is very sophisticated. Advanced electronics allow it to act as a motor as well as a generator. For example, when it needs to, it can draw energy from the batteries to accelerate the car. But acting as a generator, it can slow the car down and return energy to the batteries.

**Generator** - The generator is similar to an electric motor, but it acts only to produce electrical power. It is used mostly on series hybrids.

**Batteries** - 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.

**Transmission** - The transmission on a hybrid car performs the same basic function as the transmission on a conventional car.

You can combine the two power sources found in a hybrid car in different ways.Thus there are two types of gasoline-electric hybrid cars; the parallel hybrid, and the series hybrid. Both use gasoline-electric hybrid technology, but in radically different ways. One way, known as a **parallel hybrid** .In a parallel hybrid car, a gasoline engine and an electric motor work together to move the car forward , . Both the engine and the electric motor can turn the transmission at the same time, and independently and the transmission then turns the wheels. By contrast, in a **series hybrid**, the gasoline engine turns a generator, and the generator can either charge the batteries or power an electric motor that drives the transmission. Thus, the gasoline engine never directly powers the vehicle. Both types of hybrids also use a process called regenerative braking to store the kinetic energy generated by brake use in the batteries, which will in turn power the electric motor.

**Improving Fuel Economy**

**Recover energy and store it in the battery** - Whenever you step on the brake pedal in your car, you are removing energy from the car. The faster a car is going, the more **kinetic** energy it has. The brakes of a car remove this energy and dissipate it in the form of heat. A hybrid car can capture some of this energy and store it in the battery to use later. It does this by using "regenerative braking." That is, instead of just using the brakes to stop the car, the electric motor that drives the hybrid can also slow the car. In this mode, the electric motor acts as a generator and charges the batteries while the car is slowing down.