

## Electric motor

In electric vehicles, the electric motor replaces the internal combustion engine used in conventionally powered vehicles. The electric motor converts electric energy into mechanical force and uses it to drive the vehicle.

### The various types of electric motors

Electric motors generally fall into one of the following categories:

- Direct-current motors
- Three-phase motors
  - Asynchronous motors
  - Synchronous motors

**The type of motor now almost always used in modern electric vehicles is the three-phase motor.**

### How electric motors work

In both direct-current motors and three-phase motors, the torque is generated by the attraction force between two magnetic fields. One of these magnetic fields is generated electromagnetically. One magnet is in a stationary position and is called a “stator”. The other is a rotating component and is called the “rotor”. It is also possible for both magnetic fields to be generated electromagnetically. For example, the rotor can be magnetised by what is known as an excitation winding (special coils/wire windings that generate a magnetic field when an electric current passes through them).

### Advantages of electric motors

Electric motors have a broad speed and torque range, and this makes them almost ideal – at least in this respect – as vehicle motors. This is why with most electric motors in electric cars, you don’t need multiple gears or a manual transmission. They also offer high efficiency. Efficiency is the ratio between the provided energy and the energy that is available for propulsion. Electric motors achieve an efficiency of around 80 to 90 percent, petrol engines around 33 percent and diesel engines around 45 percent. In addition, the maximum torque of an electric motor is already available at a standstill and the motors make hardly any noise. Other advantages include their simple, compact design, their low weight, being low-maintenance, and the ability to use the motor as a generator during the deceleration phase.

### Three-phase motor operation in electric cars

To use three-phase motors to the best effect, they are operated with high-voltage three-phase current

---

with around 400 volts. To be able to implement the various velocities, speeds and torques that the driver needs, the frequency and power of the three-phase current have to be varied. This is performed by power electronics with an inverter, or converter, responsible for converting the direct current supplied by the battery into alternating current.

The ideal place to install an electric motor is right next to the axle that it is supposed to power. There are different ways to mechanically couple an electric motor with the wheels. Most of the time this is done with a reduction gear and drive shafts, or by integrating the motor into the wheel as a wheel hub motor.

## **Protection of the environment**

Given that electric motors don't emit any emissions, at least at a local level, they are considered more environmentally friendly than internal combustion engines. However, the production of the electrical power itself may produce harmful substances. The most environmentally friendly solution is when 100% renewable energy sources are used to generate power.

Source: <https://www.my-cardictionary.com/dictionary/drive-system-bev/electric-motor-bev>