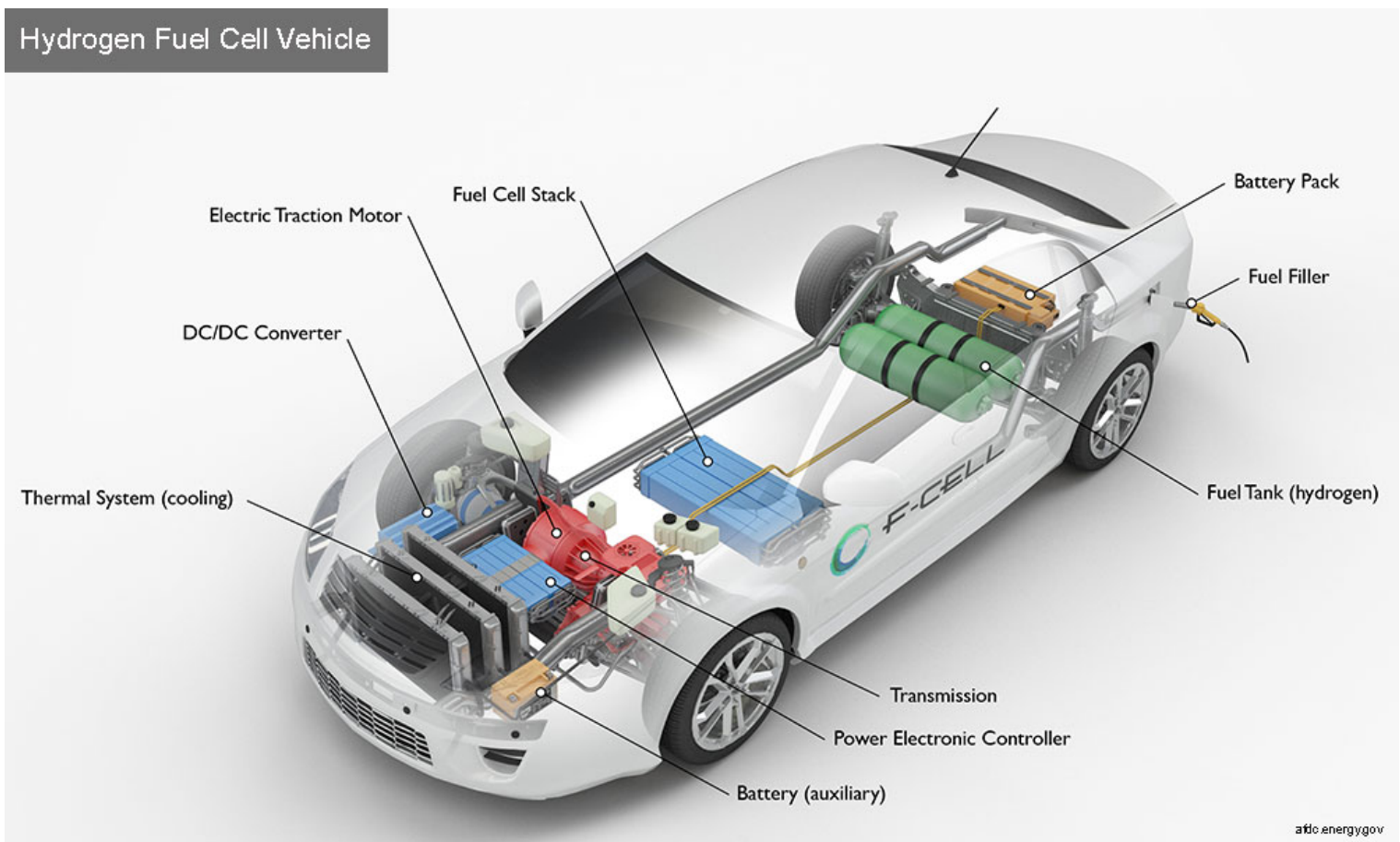


**U.S. Department of Energy - Energy Efficiency and Renewable Energy**  
**Alternative Fuels Data Center**

## How Do Fuel Cell Electric Vehicles Work Using Hydrogen?

Like [all-electric vehicles \(/vehicles/electric\\_basics\\_ev.html\)](/vehicles/electric_basics_ev.html), fuel cell electric vehicles (FCEVs) use electricity to power an electric motor. In contrast to other electric vehicles, FCEVs produce electricity using a [fuel cell \(/vehicles/fuel\\_cell.html\)](/vehicles/fuel_cell.html) powered by hydrogen, rather than drawing electricity from only a battery. During the vehicle design process, the vehicle manufacturer defines the power of the vehicle by the size of the electric motor(s) that receive electric power from the appropriately sized fuel cell and battery combination. Although automakers could design an FCEV with plug-in capabilities to charge the battery, most FCEVs today use the battery for recapturing braking energy, providing extra power during short acceleration events and to smooth out the power delivered from the fuel cell with the option to idle or turn off the fuel cell during low power needs. The amount of energy stored onboard is determined by the size of the hydrogen fuel tank. This is different from an all-electric vehicle, where the amount of power and energy available are both closely related to the battery's size. [Learn more about fuel cell electric vehicles \(/vehicles/fuel\\_cell.html\)](/vehicles/fuel_cell.html).



(/sp/assets/car\_pages/hydrogen-0aacbc9eac63d67ed50249f85bcde662a9c4d43be59c39bc5e194bf42902199e.jpg)

[High-res image \(/files/vehicles/hydrogen-high-res.jpg\)](/files/vehicles/hydrogen-high-res.jpg)

### Key Components of a Hydrogen Fuel Cell Electric Car

**Battery (auxiliary):** In an electric drive vehicle, the auxiliary battery provides electricity to start the car before the traction battery is engaged and also powers vehicle accessories.

**Battery pack:** This battery stores energy generated from regenerative braking and provides supplemental power to the electric traction motor.

**DC/DC converter:** This device converts higher-voltage DC power from the traction battery pack to the lower-voltage DC power needed to run vehicle accessories and recharge the auxiliary battery.

**Electric traction motor (FCEV):** Using power from the fuel cell and the traction battery pack, this motor drives the vehicle's wheels. Some vehicles use motor generators that perform both the drive and regeneration functions.

<https://afdc.energy.gov/vehicles/how-do-fuel-cell-electric-cars-work>

**Fuel cell stack:** An assembly of individual membrane electrodes that use hydrogen and oxygen to produce electricity.

**Fuel filler:** A nozzle from a fuel dispenser attaches to the receptacle on the vehicle to fill the tank.

**Fuel tank (hydrogen):** Stores hydrogen gas onboard the vehicle until it's needed by the fuel cell.

**Power electronics controller (FCEV):** This unit manages the flow of electrical energy delivered by the fuel cell and the traction battery, controlling the speed of the electric traction motor and the torque it produces.

**Thermal system (cooling) - (FCEV):** This system maintains a proper operating temperature range of the fuel cell, electric motor, power electronics, and other components.

**Transmission (electric):** The transmission transfers mechanical power from the electric traction motor to drive the wheels.

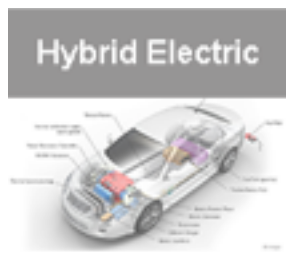
**COMPARE WITH**



[\(/vehicles/how-do-all-electric-cars-work\)](/vehicles/how-do-all-electric-cars-work)



[\(/vehicles/how-do-plug-in-hybrid-electric-cars-work\)](/vehicles/how-do-plug-in-hybrid-electric-cars-work)



[\(/vehicles/how-do-hybrid-electric-cars-work\)](/vehicles/how-do-hybrid-electric-cars-work)



[\(/vehicles/how-do-gasoline-cars-work\)](/vehicles/how-do-gasoline-cars-work)



(mailto:technicalresponse@icf.com) **Need project assistance?**  
 Email the [Technical Response Service \(mailto:technicalresponse@icf.com\)](mailto:technicalresponse@icf.com) or call [800-254-6735 \(tel:800-254-6735\)](tel:800-254-6735)

The AFDC is a resource of the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy's [Vehicle Technologies Office \(https://energy.gov/eere/vehicles/technology-integration\)](https://energy.gov/eere/vehicles/technology-integration).

Contacts [\(/contacts.html\)](/contacts.html) | Web Site Policies  [\(https://energy.gov/about-us/web-policies\)](https://energy.gov/about-us/web-policies) | U.S. Department of Energy  [\(https://energy.gov\)](https://energy.gov) | USA.gov  [\(https://www.usa.gov\)](https://www.usa.gov)