Fact Sheet
California Environmental Protection Agency
Air Resources Board

Fuel Cell Electric Vehicles

Fuel cells have captured worldwide attention as a clean power source for zero emission vehicles (ZEVs). ZEVs powered by fuel cells are being developed by many auto manufacturers, and have generated interest and enthusiasm among industry, environmentalists and consumers.

What are the benefits of fuel cell vehicles?

A fuel cell vehicle, powered by an electric motor, promises the air quality benefits of a battery-powered EV, combined with the driving range and convenience of a conventional gasoline engine. Compared to conventional vehicles, fuel cell EVs can offer:

- zero or near-zero smog-forming emissions,
- lower greenhouse gas emissions (CO_2),
- higher fuel economy,
- greater engine efficiency and
- reduced water pollution from oil leaks,
- much quieter and smoother operation.

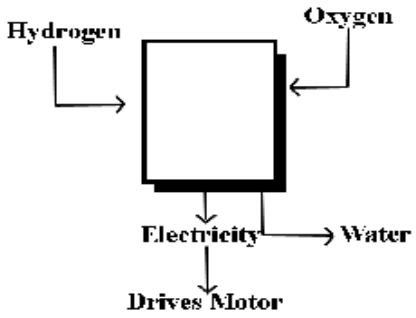
A fuel cell using pure hydrogen produces no tailpipe emissions and is clean to produce when using renewable energy sources.

What is a fuel cell?

In principle, a fuel cell operates like a battery. A fuel cell converts chemical energy directly into electricity by combining oxygen from the air with hydrogen gas. However, unlike a battery, a fuel cell does not require charging. It will produce electricity as long as fuel, in the form of hydrogen, is supplied.

Fuel cells have been a reliable power source for many years. Applications include electrical power supply for space flights as well as conventional electric power generation in buildings and power plants.

A Fuel Cell at Work



How does a fuel cell work?

An individual fuel cell consists of two electrodes, one positively charged (cathode) and one negatively charged (anode), with a substance that conducts electricity (electrolyte) sandwiched between them. Oxygen from the air passes over the cathode and hydrogen over the anode, generating electricity and water.

The hydrogen fuel for a fuel cell vehicle can be supplied in several ways. Some vehicles carry a tank of pure hydrogen. Others could be equipped with a "fuel reformer" that converts hydrocarbon fuels—such as methanol, natural gas, or gasoline—into a hydrogen-rich gas. Individual fuel cells must be combined into groups called fuel cell stacks in order to achieve the necessary power required for motor vehicle applications.

What is the current status of fuel cell electric vehicles?

Impressive advances in fuel cell technology have been made over the last several years. Auto manufacturers such as DaimlerChrysler, Ford, Honda, Toyota and General Motors have announced plans to place fuel cell vehicles into commercial fleet use by 2004. More than 30 prototype passenger vehicles from DaimlerChrysler, Ford, General Motors, Hyudai, Nissan, Toyota and Volkswagen, have been tested at the California Fuel Cell Partnership, based in West Sacramento – all are fueled by hydrogen and are zero-polluting. Transit buses powered by fuel cells have been demonstrated in several California cities, including areas around Palm Springs, Chula Vista, and Oakland.

What is ARB doing to support fuel cell electric vehicles?

Fuel cells are a very promising technology for use in both light-duty and heavy-duty vehicles. ARB is working closely with public and private partners on research and development, vehicle demonstration programs, and the infrastructure and safety requirements needed to support these vehicles. On the regulatory side, the 2003 amendments to the ZEV program allow large volume manufacturers to comply with either a "base compliance path" using percentage ZEV requirements as structured in the 2001 ZEV amendments, or with an "alternative compliance path." The "alternative compliance path" allows advanced technology partial zero emission vehicles (PZEVs) which have near zero tailpipe emissions to meet the pure ZEV obligations, provided that the manufacturer meet fuel cell vehicle production requirements specified in the table below.

Model Years	Manufacturer's Market Share of
2001-2008	250 fuel cell vehicles
2009-2011	2,500 fuel cell vehicles
2012-2014	25,000 fuel cell vehicles
2015-2017	50,000 fuel cell vehicles

What is the California Fuel Cell Partnership?

ARB is a founding member of the California Fuel Cell Partnership, a collaboration of auto manufacturers, fuel providers, fuel cell technology developers and government agencies. Since its formation in 1999, the partnership has demonstrated fuel cell–powered electric vehicles under real day-to-day driving conditions; demonstrated the viability of an alternative fuel infrastructure technology; addressed commercialization issues; and increased public awareness of fuel cell vehicles. The Partnership expects to place up to 60 fuel cell vehicles on the road by the end of 2003, and facilitate placement of up to 300 FCVs by the end of 2007.

Where can I get more information?

For more information on fuel cell vehicles, please visit the California Fuel Cell Partnership web site located at http://www.fuelcellpartnership.org. For information about clean vehicles that you can buy today, visit www.DriveClean.ca.gov.

For general information, please contact the ARB toll-free at (800) END-SMOG/(800) 363-7664 (California only) or (800) 272-4572. You may obtain this document in an alternative format by contacting ARB's Americans with Disabilities Act Coordinator at (916) 322-4505 (voice); (916) 324-9531 (TDD, Sacramento only); or (800) 700-8326 (TDD, outside Sacramento).