



fact sheet

Where Do We Get Hydrogen?

For a fuel cell to operate, it needs hydrogen as fuel. When hydrogen (H_2) and oxygen (O_2) are supplied, the fuel cell generates electricity to power the vehicle's electric motor.

Fuel cells use oxygen found in the air around us. Oxygen makes up about 20% of the air we breathe.

Getting hydrogen is more complicated. Hydrogen is the most abundant element in the universe. However, it is not found alone in nature. Instead, it bonds readily with other elements, forming commonly known molecules, such as water, and a host of substances like gasoline, natural gas and biomass (cellulose). We can get hydrogen by unlocking the chemical bonds in the molecules that form these substances.

Hydrogen from Water

Water (H_2O) is made of two hydrogen atoms bonded with an oxygen atom. One way to produce hydrogen is through electrolysis. This process uses electricity and a catalyst to separate the hydrogen from the oxygen in water.

Hydrogen released from water by electrolysis can be captured and stored as fuel. The hydrogen can be compressed and stored as a gas, or cooled and stored as a liquid. The oxygen is either captured or released into the air.

Hydrogen from Hydrocarbon Fuels

Currently, most hydrogen is produced by steam reforming natural gas. In the U.S. alone, about nine million tons of hydrogen are produced every year for industrial uses, like refining gasoline and making silicon chips or food products.

Steam reforming combines natural gas (CH_4), methanol (CH_3OH) or ethanol (C_2H_5OH) with super-heated steam to release the hydrogen from both the hydrocarbon and water molecules. As with electrolysis, the resulting hydrogen can be stored as a compressed gas or a liquid.

“Where will I fill up my fuel cell car?”

Gas stations are a familiar sight for our conventional, internal combustion engine vehicles and are located nearly everywhere we drive. For fuel cell vehicles to be successful, they will also need a convenient, safe fueling system.

Today, more than 20 hydrogen fueling stations are in operation in California. Members of the California Fuel Cell Partnership continue to plan and build more stations for fuel



3300 Industrial Blvd.
Suite 1000
West Sacramento, CA
95691
(916) 371-2870
www.cafcp.org

cell vehicles.

In the future, when you drive your fuel cell vehicle, the gas station you currently use may be the place where you'll get hydrogen. You may even be able to refuel your fuel cell vehicle at home while you sleep!

Developing the infrastructure for producing and distributing the fuel for fuel cell vehicles is a major task, and there are many questions and challenges to be addressed. Through the CaFCP, the auto companies, energy suppliers, technology companies and government agencies are working together to thoroughly investigate all the fueling options, and to test them in real-world conditions.

Through the Hydrogen Highway Network, the State of California has a goal of having 50-100 hydrogen fueling stations accessible to fuel cell vehicles by 2010, and producing at least 33 percent of the hydrogen from renewable sources. Please visit www.hydrogenhighway.ca.gov for more information.

A Few of the Basics...

Fuel cells generate electricity in an electrochemical process that uses hydrogen from fuel tanks and oxygen from the air. The electricity powers an electric motor to drive the vehicle with water and heat being the only tailpipe emissions.

When the hydrogen is generated from renewable resources, like solar or wind-generated electricity for use in electrolysis, the entire "well-to-wheels" cycle is virtually pollution-free.

When producing hydrogen from natural gas, there are some pollutants, including carbon dioxide (CO₂). However, because fuel cell vehicles have zero-tailpipe emissions, the net effect in the "well-to-wheels" cycle is a significant reduction in smog-forming pollutants and at least a 40% reduction in CO₂ and other greenhouse gas emissions.

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