

A “hydrogen station” includes, at minimum, above-ground fuel storage tank(s), a compressor and a dispenser typically integrated into an existing gasoline or CNG station. As with natural gas, all the equipment is above ground and may likely have a significant footprint. Unlike CNG, equipment can be distributed on the property to maximize space. In addition, hydrogen stations have multiple designs that include the option of making hydrogen on site.



Most hydrogen is made by steam-reforming natural gas at a central production plant—often at or near an oil refinery. At atmospheric temperature, hydrogen is a gas and can be distributed by a pipeline or in pressurized tubes. Some plants can also liquefy hydrogen by cooling it to a cryogenic temperature (-423°F/-253°C). Stations can also make hydrogen on site by reforming natural gas or electrolyzing water. Compressed gaseous hydrogen is stored above ground in ASME-standard steel pressure vessels. (Composite pressure vessels require individual approval by OSHA.)

Hydrogen is a gaseous fuel that can be dispensed at two different pressures: H35, which is approximately 5,000 psi, and H70, which is 10,000 psi. A hydrogen dispenser looks similar to a retail fuel dispenser and usually has two different hoses and nozzles, one for each pressure. Customers cannot attach the high-pressure nozzle to a lower pressure receptacle, similar to a diesel nozzle not fitting into a gasoline port.

When a customer activates the dispenser, hydrogen flows from the storage tanks to the dispenser and through the nozzle into the vehicle in a closed-loop system. If filling with H70, the hydrogen passes through a booster compressor and chiller before entering the dispenser. If the nozzle is not correctly attached to the vehicle, fuel will not flow. When the tank is full, dispensing stops.

Filling with hydrogen is fast, easy and safe. A full tank of hydrogen—4-6 kilograms—provides range similar to a conventional vehicle on about one-third the amount of energy as gasoline.

Hydrogen is a low-carbon, non-toxic fuel that is domestically produced from local resources. Most hydrogen is made from natural gas, but increasingly it is made from water, biogas and biomass. For more than 75 years, hydrogen has been safely handled, distributed and dispensed. Building codes and technical standards are created around hydrogen’s unique properties: small molecule, lighter-than-air, quick diffusion and gaseous state.



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Delivery Method	Equipment at Station	Advantages	Disadvantages
<b>Liquid Delivery</b>	Liquid storage tank Heat exchanger Compressor Gaseous storage Booster compressor (optional) Chiller Dispenser	<ul style="list-style-type: none"> <li>• Can store more fuel (greater capacity)</li> </ul>	<ul style="list-style-type: none"> <li>• Much larger footprint</li> <li>• Potential for fuel boil off</li> <li>• Expense of two types of storage tanks</li> </ul>
<b>Gaseous Delivery</b>	Gaseous storage Compressor Chiller Dispenser	<ul style="list-style-type: none"> <li>• Smaller footprint than liquid</li> <li>• Equipment can be in various locations</li> </ul>	<ul style="list-style-type: none"> <li>• Least amount of storage capacity without multiple trailers/ storage tubes</li> </ul>
<b>On-site Electrolysis</b>	PV system Water purifier Electrolyzer Compressor Gaseous storage Booster compressor Chiller Dispenser	<ul style="list-style-type: none"> <li>• Make fuel on site</li> <li>• Potential to sell carbon credits</li> </ul>	<ul style="list-style-type: none"> <li>• More equipment</li> <li>• Larger footprint</li> <li>• Can be more expensive</li> </ul>
<b>H2 from pipeline</b>	Scrubber Gaseous storage Booster compressor (optional) Chiller Dispenser	<ul style="list-style-type: none"> <li>• Larger capacity</li> <li>• Can require less storage</li> </ul>	<ul style="list-style-type: none"> <li>• Station must be near pipeline</li> <li>• More equipment</li> <li>• Larger footprint</li> </ul>

## Where does hydrogen come from?

There is not a “right” way to make hydrogen, but ways that are right for every region of the world. Most hydrogen comes from natural gas, but you can also make hydrogen from solar or wind energy and water. A station in Orange County makes hydrogen, electricity and heat from wastewater. Universities and research labs are experimenting with making hydrogen from other forms of biomass, such as almond shells, rice straw, and algae.

## Is hydrogen dangerous?

Hydrogen is as safe as other fuels; just different. It is a lighter-than-air gas that diffuses quickly. It is difficult to concentrate hydrogen enough to make it catch fire, let alone explode. The vehicles and tanks pass all safety tests.



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