Resources:

Increase your H2IQ — www.hydrogen.energy.gov

Fuel Cell Standards — www.fuelcellstandards.com

Hydrogen Installation Permitting Guide — www.hydrogen.energy.gov/permitting/

Produced by the National Renewable Energy Laboratory (NREL)

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DOE Hydrogen Program

Hydrogen Data

- Hydrogen is colorless and odorless — Detectors are needed
- Hydrogen flames are virtually invisible in daylight — Detectors are needed
- Hydrogen disperses 3.8 times as fast as natural gas.
- 1 kg of hydrogen has the same energy content as 1 gallon (3.2 kg) of gasoline.

U.S. Department of Energy
Hydrogen Program
www.hydrogen.energy.gov

	Hydrogen	Natural Gas	Gasoline	No. 2 Diesel
physical state	compressed gas or liquid	compressed gas	liquid	liquid
flammability range in air	4.1%–74%	5.3%–15%	1.4%–7.6%	1.0%–6.0%
lower heating value (btu/lb)	52,217	20,263	18,676	18,394
boiling temperature (°F)	-423	-259	80–437	356–644
specific gravity (60°F)	0.07	0.424	0.72–0.78	0.85
energy content per gallon	gas: 6,500 Btu at 3,000 psi	gas: 33,000–38,000 Btu at 3,000 psi	109,000–125,000 Btu	128,000–130,000 Btu
autoignition temperature (°F)	1,085	900–1170	495	600
latent heat of vaporization (Btu/lb at 60°F)	192.1	219	150	100
freezing point (°F)	-435	-296	-40	-30 to -40

Source: U.S. DOE Office of Energy Efficiency and Renewable Energy; www.eere.energy.gov/afdc/pdfs/fueltable.pdf; www.eere.energy.gov/afdc/pdfs/afv_info.pdf

Conversion Factors

Pressure

1 bar = 0.1 megaPascal (MPa) = 14.5 lbf/square inch (PSI)
5,000 psi = 345 bars = 34.5 MPa
10,000 psi = 689 bar = 68.9 MPa

Volume

1 standard cubic foot = 28.3 liters
[standard conditions are atmospheric pressure and 60°F (16°C)]

Mass

1 kilogram = 2.2 pounds

Energy

1 British thermal unit (Btu) = 1,055.05585262 joules (J)

1 calorie (cal) = 4.1868 joules (J)

1 kilowatthour (kWh) = 3.6 megajoules(MJ)

Temperature

$°C = (°F-32) \times {}^{5}/_{9}$