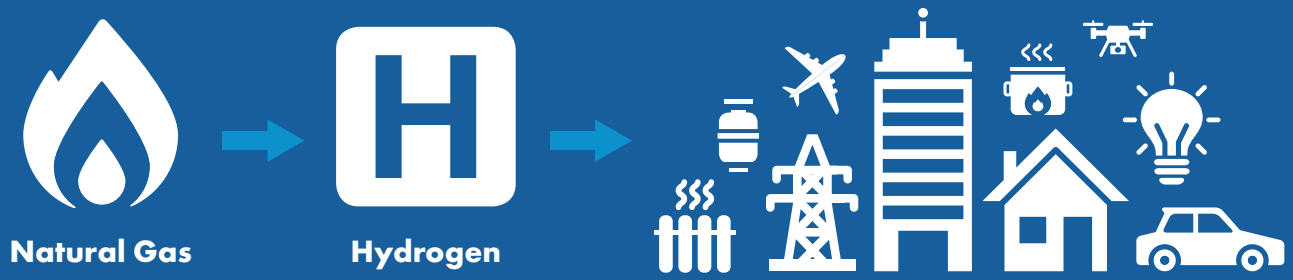
Natural Gas and Hydrogen

Hydrogen can be used in fuel cells to generate power using a chemical reaction rather than combustion, producing water and heat as by-products.

Although not a source of energy itself, Hydrogen can store and deliver usable energy like that produced by natural gas. Once this energy is created it can be used in cars, in houses, for portable power and many many more applications.



Here's how it works:

Step 1

Steam-Methane Reformation:
High-temperature stream (700- 1,000 degrees celcius) is used to produce hydrogen from natural gas.

$CH_4 + H_2O$ (+ heat) → $CO + 3H_2$

OR

Partial Oxidation
The Methane and other hydrocarbons in natural gas react with a limited amount of Oxygen (typically from air) that is not enough to completely oxidize the hydrocarbons to Carbon Dioxide and water.

$CH_4 + ½O_2 \rightarrow CO + 2H_2$ (+ heat)

Step 2

Next a "water gas shift" reaction occurs, meaning the Carbon Monoxide and steam are reacted using a catalyst to produce carbon dioxide and more Hydrogen.

$CH_4 + H_2O$ (+ heat) → $CO + 3H_2$

Step 3

Carbon dioxide and other impurities are removed from the gas stream, leaving essentially pure hydrogen.

Carbon dioxide to storage (CCS).

Step 4

Hydrogen is combined with oxygen in a fuel cell to create water, heat, and electricity that can be used to power electric cars, to light up homes, even to propel spacecraft.

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