



Hydrogen: An Overview

Overview

Hydrogen is the most abundant gas in the universe and the simplest element, consisting of one proton and one electron. As a gas, hydrogen does not exist in a natural state on earth. It is always mixed with other elements. Combined with oxygen, it creates water. Combined with carbon, it makes different compounds such as methane, coal, and petroleum – today’s major fuels.

Hydrogen Production

Because hydrogen does not exist in a natural state it must be manufactured in an energy intensive process. The energy needed to produce hydrogen can be obtained from many sources, including traditional fossil fuels, nuclear energy and renewable energy sources.

Today, the most common method to produce hydrogen is to employ steam to separate it from carbon found in petroleum and natural gas. When combined with carbon capture and storage technologies designed to reduce carbon dioxide emissions, hydrogen production holds the promise of a plentiful fuel that will help safeguard the world’s climate system.

Hydrogen can also be produced by using electricity to separate it from oxygen in water through a process known as electrolysis. The electricity for the electrolysis process can be produced from a variety of energy sources such as oil, coal, natural gas, nuclear energy, and renewable energy sources such as wind power, hydroelectricity, biomass, geothermal, and solar energy. Other less developed and applied methods include thermo and biochemical processes.

The Hydrogen Transformation

Hydrogen can be utilized to store clean energy that is produced both from traditional fuels using carbon capture and storage technology and from renewable

energy sources. Stored as hydrogen or one of its compounds, this clean energy can be moved to where it is needed.

As an energy carrier, hydrogen holds the potential to dramatically transform the ways in which we use energy. It may be utilized to fuel hydrogen-powered vehicles, eventually allowing us to replace traditional automobiles with a clean hydrogen alternative. And, because hydrogen can be stored and transported to where it is needed, it may be used in combination with fuel cells to provide energy in locations not served by the electric power grid and, for stationary applications that require very reliable sources of electricity, such as the information technology industry and medical applications.

Most importantly, because hydrogen can be produced from a variety of energy sources found in most countries, it holds the potential for reducing dependence on imported energy. When produced with clean technologies, it can reduce the emission of carbon dioxide, an important greenhouse gas.

The Challenges

Before hydrogen can take its place in the global energy picture, many new systems must be built. How will we lower the cost of producing, storing, and transporting hydrogen? How will we increase the durability and reliability, while at the same time, reduce the cost of fuel cells used in transportation and stationary applications? How will consumers access affordable, reliable and safe end use technologies? What international codes and standards will have to be developed to rationalize technology development and ensure its safe deployment? And, how can we educate local officials and emergency response personnel on the potential for, and special requirements of, this technology?

The IPHE partners are collaborating to address the challenges associated with the development of the hydrogen economy. For or more information, please visit the IPHE website at www.iphe.net