BOEM BUREAU OF OCEAN ENERGY MANAGEMENT

Green Hydrogen

Overview

Hydrogen is an abundant element and critical for the formation of molecules like water. With only one proton, hydrogen is the lightest element. Despite its small mass, hydrogen can pack a punch, carrying up to three times the energy content of gasoline. Green hydrogen is fuel produced using renewable energy, such as offshore wind. It is *green* because no greenhouse emissions, such as carbon dioxide, are emitted in the process of hydrogen fuel production.

Green hydrogen (H_2) fuel is produced from water (H_2O) through the process of electrolysis, a chemical reaction where an electric current passes through a substance and splits molecules apart. Electrolyzers are devices that, through the process of electrolysis, use electricity to split water molecules apart (Figure 1).

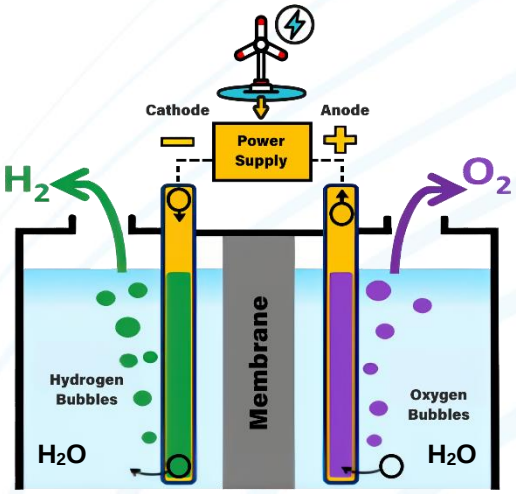

Figure 1. An electrolyzer separating water molecules into hydrogen and oxygen. (*Figure: DOE*)

What are the byproducts of green hydrogen production and fuel?
The hydrogen produced during electrolysis is used for fuel and other energetic purposes. Byproducts include oxygen, water, and brine discharge. The oxygen produced can be used for critical applications like medical care. The water goes back into the water cycle, while byproducts, such as the brine, could be sold as salt.

Why is green hydrogen important?
Green hydrogen can be used as an energy source in hard-to-decarbonize sectors. Hydrogen can provide a fuel source for vehicles like trucks, trains, and ships. Hydrogen can also be stored in fuel cells for long-term energy storage (Figure 2), or as a source of backup power for critical infrastructure like public transportation.

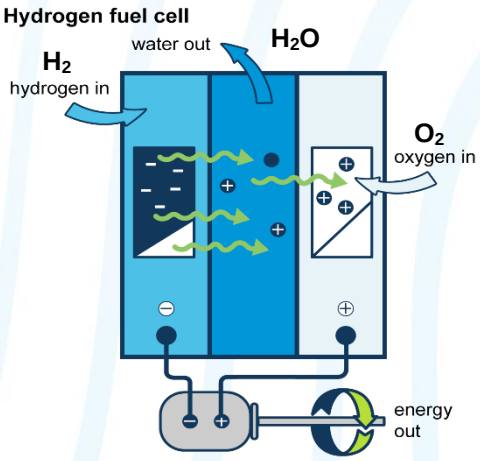

Figure 2. A fuel cell makes electricity using hydrogen. (*Figure: EIA*)

Safety and Community Benefits

Hydrogen is highly flammable, but when green hydrogen production is carried out in a safe and secure environment, it poses little threat to communities. Research and development projects are underway to find the safest methods for green hydrogen production.

Green hydrogen production from offshore wind has great potential in the Gulf of Mexico, where existing port and pipeline infrastructure could be utilized and innovated to grow local economies, create new jobs, and support a just transition to clean energy.