

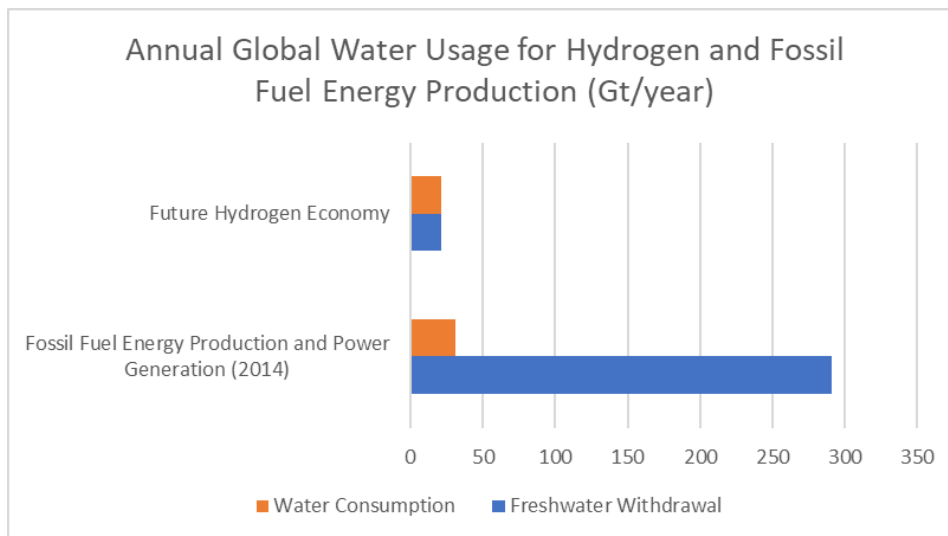
Hydrogen and Water Usage

Producing renewable hydrogen through electrolysis requires only water and electricity. One important consideration for future deployment of electrolyzers is water usage.

A major advantage in the use of hydrogen as a fuel, compared to fossil fuel combustion, is that there is no requirement for water as a coolant in the electrolyzer system or in fuel consumption, drastically reducing the water withdrawn from the local environment for operations.

Production through Electrolysis

- According to recent studies, the global hydrogen demand for a fully developed hydrogen economy would be approximately 2.3 gigatons (Gt) per year.
- A team at the University of Delaware [calculated](#) that producing that total of hydrogen through renewably-generated electricity would require 20.5 Gt of freshwater per year, less than 10% of the water used in incumbent energy production through coal, oil, and natural gas.
- The *Roadmap to a US Hydrogen Economy* forecasts that the US would require 63 million metric tons of hydrogen to account for 14% of US energy demand by 2050, only ~2% of the 2.3 Gt globally mentioned above and represents a fraction of a percent of total water usage today in traditional energy production.



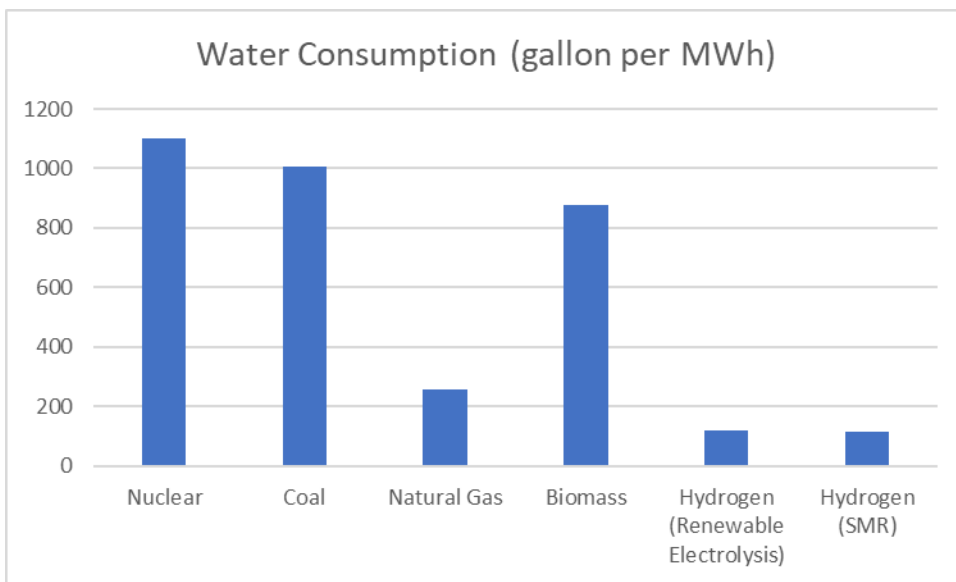
This chart shows a comparison between freshwater withdrawal and consumption of fossil fuel production and a future full-scale, renewably-produced hydrogen economy. (Data Source: University of Delaware)

Hydrogen and Water Usage

Hydrogen represents a reduction in water requirements in other forms of production and consumption as well.

Production through Reformation

- Producing hydrogen through steam methane reformation (SMR) consumes around the same amount of water directly as electrolysis.
- Carbon capture technology does not add significant water usage requirements to the production of hydrogen through SMR, so low-carbon hydrogen offers water usage savings in this method, as well.



This chart shows the amount of water required to produce a megawatt-hour of electricity using a variety of methods. (Data Source: Argonne [National Laboratory](#))

Fuel Cell Operations Help Water Balance

- Fuel cell systems, which generate low or zero emission electricity via hydrogen or hydrogen-rich feedstocks, can significantly lower water usage when compared to fossil fuel combustion for power generation.
- An average U.S. coal plant withdraws 25 gallons of water for each kilowatt-hour of electricity produced, while most fuel cells require a single gallon per megawatt-hour, reducing water consumption by more than 96% compared to coal-based electricity consumption.