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Hydrogen: The fuel of the future?

Some scientists contend it's the perfect solution to the nation's energy needs — hydrogen. It's No. 1, the most abundant element in the universe. There is an endless supply.

Hydrogen fuel cells could be used on a widespread scale to power vehicles, homes, cell phone tower generators, businesses and more. The byproduct of using hydrogen to produce energy is pure water.

But don't cash in your retirement to invest in hydrogen energy production just yet. Not all researchers and energy policy experts concur that it's viable — or clean. At

best, they contend, hydrogen is a bridge technology.

An energy carrier

Hydrogen is an energy carrier, not an energy producer, which means it's expensive to exploit. Energy researchers and producers can't obtain hydrogen in pure form, so they make it. There are three processes, but none compares with gasoline cost-per-

gallon. The U.S. Department of Energy (DOE) is investing mightily in research for better, cost-effective hydrogen fuel technology.

Photolytic process

Researchers are using microorganisms (green algae and bacteria) and/or sunlight to fuel this process. The research is preliminary but desirable; it's sustainable with minimal environmental impact.

Oregon State University wants to perfect a process to create energy from sewage. It's enlisting the aid of microbes, which produce hydrogen from sewage AND clean the water. In July, the university announced a breakthrough, increasing electricity output by 20x. The goal is create treatment that produces more energy than it consumes.

Electrolytic process

Electrolytic processes require electricity and typically a membrane. They split water into hydrogen and oxygen to produce energy. The drawback is that most United States — and Oregon — electricity is produced by coal-fired power plants. There is interest in tying electrolysis to wind power to eliminate greenhouse gas emissions.

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Port of Coos Bay

Will we see the day when fuel cell motors replace traditional diesel and gas powered engines?

Thermal process

These processes require high heat and steam to produce energy. They are energy intensive.

The most common thermal process is steam-methane, which, the U.S. DOE says produces 95 percent of the nation's hydrogen. Here's how it works. The process creates hydrogen by burning methane mixed with steam. It results in carbon monoxide and hydrogen. Think back to high school chemistry ... $CH_4 + H_2O (+heat) \rightarrow CO + 3H_2$. The U.S. DOE sees this as only a near-term option, since it doesn't resolve the greenhouse gas emission or national security issues.

Other thermal processes include coal gasification and biomass gasification or liquid fuel, and the proposed splitting of water molecules through focused solar or nuclear power use.

Storage and transport

Currently, hydrogen is produced in large, central facilities. The challenge then is transporting it for fuel cell use by vehicles, in remote locations or even for military operations. It must be liquefied or compressed for transport in tanks or potentially through pipelines.



© GM Corp.
General Motors produced the Chevrolet Equinox fuel cell vehicle as part of its "Project Driveway" to have people in Washington, D.C., Los Angeles and New York test them.

Safety

Hydrogen gas can be explosive when mixed with oxygen. It leaks easily and can cause metals to become brittle. The U.S. DOE oversees a training/education program on production, storage, distribution and use.

What's next

Car and truck manufacturers, such as GM, Honda and Vision Industries have produced hydrogen fuel cell vehicles. California-based Vision In-

dustry is partnering with the Port of Los Angeles to test its zero emission hydrogen fuel cell trucks. It's part of the port's effort to meet the state's requirement to cut greenhouse gas emissions to 1990's level by 2020.

But for hydrogen energy to be viable, it must be affordable. Analysts say the cost of hydrogen energy production must drop, with estimates for the cost to users as low as \$2 to \$3 gas gallon equivalent. The Department of Energy, which is expected to invest \$1 billion in hydrogen fuel research, recently moved the target year to 2020 to decide whether commercialization of the industry is possible.

FEEDBACK

Emerging Technology is a quarterly educational newsletter. It's part of the Oregon International Port of Coos Bay's ongoing efforts to analyze trends and prospects for emerging industrial opportunity.

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