HYDROGEN: EARTH'S NEXT GREAT ENERGY SOURCE?

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The quest for a sustainable global energy source is well-documented, with the search for inexpensive "green energy" ongoing for decades. In recent years, hydrogen has emerged as a promising solution, with the potential to provide a steady supply of sustainable, clean-burning fuel. As a global leader in the design and manufacture of pressure control products, BelGAS is invested in energy's future. Our engineering and R&D teams are working on the solutions of tomorrow, and our entire company stands ready to provide guidance to customers as the world navigates these changes.

Other investment is following the promise of hydrogen. According to the Hydrogen Council, investment in hydrogen projects by 2030 will total $500 billion. Some studies have shown that hydrogen is capable of supporting one-quarter of the world's energy needs by 2050. Greater investment will lower its cost and create more opportunities. As these different opportunities are explored, we will truly find out the potential of hydrogen and how it can help us decarbonize the world.

For nations to meet their emissions reduction goals, hydrogen must play a major role in the world's energy future.

BURNS CLEAN … EXPENSIVE TO CLEANLY PRODUCE

Hydrogen comes with many benefits as an energy source, not the least of which is that its only byproduct is water. It burns much cleaner than fossil fuels and leaves virtually no carbon footprint. Another plus is that hydrogen is plentiful throughout the planet; in fact, it's the most common element on earth.

However, it is always bound to another substance, meaning it must be separated before it's viable to use. This is why hydrogen is defined as an energy vector, not an energy source.

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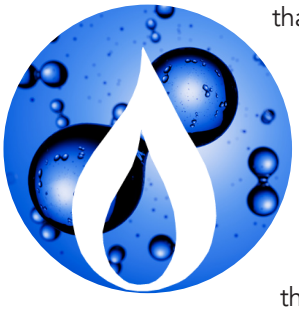
There are many methods for processing hydrogen, each with their own pros and cons, but most require the use of an energy source that does create carbon. Those that don't are prohibitively expensive (although the recently passed US Inflation Reduction Act does provide for tax credits that will make American green hydrogen the cheapest in the world, as low as $0.73 USD per kilogram). So separating hydrogen becomes a matter of compromise. Choose a production method that creates greenhouse gasses or choose a cleaner method that will likely be so expensive consumers won't be willing to pay for it.

The most common current method for hydrogen production is Steam Methane Reforming (SMR), where steam and methane are combined with heat to yield hydrogen. However, carbon dioxide is produced in the reaction and needs to be captured to reduce environmental impact. The production method of electrolysis uses electricity to produce hydrogen and can have a low environmental impact if the electricity is generated from renewable energy source like solar and wind.

Selecting the best hydrogen-producing technology often depends on the application. Incorporating carbon capture, utilization and storage (CCUS) can reduce or eliminate the carbon footprint of hydrogen derived from separation powered by fossil fuels. In CCUS, carbon expended during the process is collected instead of being released. It can be used for a variety of purposes including as an additive to plastics and concrete, as plant food, as a refrigerant, or for injection into wells for oil and gas recovery. It can also be stored in underground and above-ground facilities and in abandoned oil and gas reservoirs.

SMALLER MOLECULE, BIGGER CHALLENGE

The energy sector has been accustomed to the combustion engine and conventional gas transmission for decades now, which may provide something of a head start on hydrogen transmission in that we already understand certain fundamentals about energy derived from gaseous substances. Hydrogen presents an opportunity to help decarbonize our world without a major shift in infrastructure. We will be able to blend hydrogen with natural gas safely and reduce carbon emissions. However, we must also be aware of the limitations of the current infrastructure has as it pertains to hydrogen transmission.



The reason for these limitations is that the hydrogen molecule is significantly smaller than the molecule for natural gas. Attempting a straight transferal of hydrogen into the existing natural gas infrastructure will result in excessive leaking and inefficient delivery. So, it is important that regulators are sealed tightly so that the hydrogen gas does not leak. Hydrogen is also known to embrittle certain metallic materials under stress. So applications must be sensitive to material compatibility.

PLAYING THE PERCENTAGES

A key question that needs to be answered is what concentration level of hydrogen will be most viable for conversion into consumer energy. Hydrogen produces less energy than the same volume of natural gas, so maximizing the percentage of hydrogen in any fuel blends becomes paramount.

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Current studies show that up to 20% hydrogen can be blended in existing natural gas infrastructure without any issues affecting end users' appliances. Globally, there are utilities currently experimenting with blends in which anywhere from 5% to 30% hydrogen is mixed into conventional gas.

It's worth mentioning that, in 2016, Northern Gas Networks of Leeds, England, carried out a feasibility study that found a conversion to 100% hydrogen using the current gas network was technically possible and economically realistic. It is believed to be the first time standard gas operational procedures were tested under 100% hydrogen conditions on an existing network.

The differing proposed hydrogen percentages to blend into the current natural gas supply illustrates a challenge facing makers of energy transmission equipment. We've already established the hydrogen molecule is smaller and prone to escape from fittings and fixtures made for standard gas. Now we know the new standard has to accommodate hydrogen at concentration levels somewhere between 5% and 100%. Which is to say, nothing has really been determined at all.

HYDROGEN FUEL CELLS

Some of these new horizons have already arrived, such as the hydrogen fuel cell. It does not combust hydrogen, but instead uses a membrane fuel cell to generate electricity from the hydrogen gas passing through the cell. This electricity is used to power an electric motor in a multitude of applications. It is already powering vehicles around the world

Hydrogen fuel cells are becoming more popular for passenger vehicles than even battery-powered electric motors. Particularly when it comes to commercial transport, hydrogen fuel cells have an advantage. Lithium batteries are extremely heavy and have an energy density that is 284 times lower than hydrogen. These heavy batteries limit cargo capacity due to weight restrictions typical for tractor trailers, aircraft, and ships. Refueling is also an advantage for the fuel cell, as it can be "filled up" like a normal diesel-operated vehicle.

THE PATH TO HYDROGEN

The goal of BelGAS is to engineer and produce pressure regulation products impervious to hydrogen leakage at the highest concentrations, to maximize energy delivery for end users and service management for energy providers.

At BelGAS, we already have a proven track record of success in the design and manufacture of pressure, flow, and other transmission regulation and management products for the oil and gas industry. As the hydrogen fuel industry has continued to grow, we've been there in lockstep with the latest developments, assisting hydrogen leaders in creating the pressure and flow solutions for tomorrow.

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Investment from governments and private sources continually pour into the market, changing the landscape on an almost daily basis. As the list of global players grows, strategic partners need to source suppliers who are expert in this rapidly evolving industry. Suppliers in the energy sector with a proven history of innovation, deep knowledge base, and a reputation for collaboration and high customer service values provide an edge in the market.

The scalability of hydrogen fuel solutions will require a strict adherence to high standards of hydrogen protection and safe operation; that the material transmits with no leakage and arrives at its destination with no incidents anywhere along the way. BelGAS is committed to partnering with premier energy leaders and policy makers to provide safe, scalable solutions for hydrogen transmission.

It's an exciting time to be in the energy field, as most everyone agrees we are on the cusp of the next great energy source in hydrogen. But there is little consensus on how we make it viable, leaving it up to individuals and collectives to forge their own paths. In many ways, we are writing the rules of the next energy dawn as we go. The processes we experiment with and refine now may very well define energy protocols for generations.