Why Selecting The Proper Valve Technology Is Critical To Achieving Success In The Expanding Hydrogen Economy

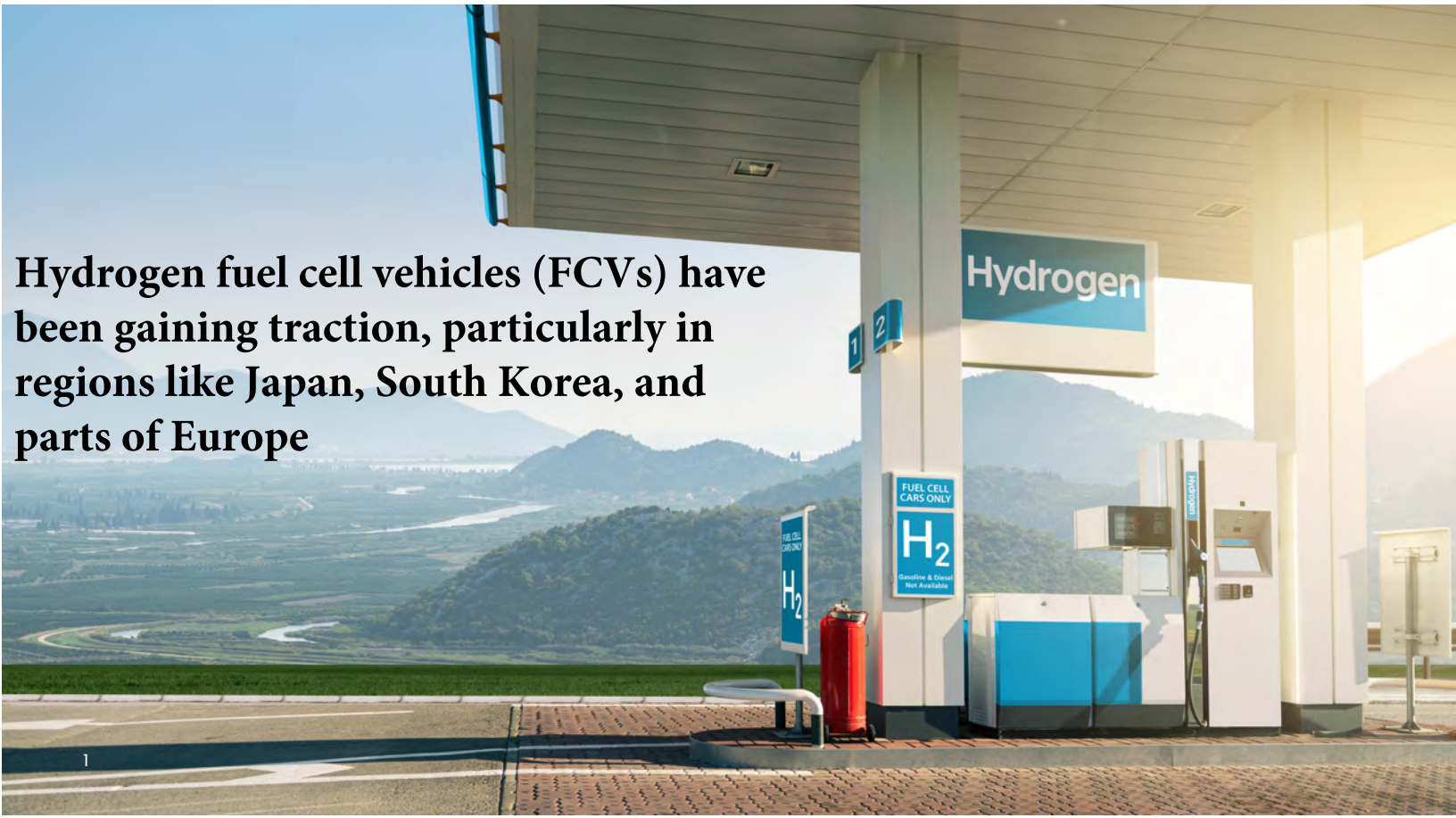
The Case For Globe Valves

REGO ACME CRYOGENICS

Fueling the Future

For many years, hydrogen has been used as a feedstock in the chemical and manufacturing industries in North America, but in a report titled “Hydrogen consumption breakdown in the U.S. 2020, by sector” that was released by Statista in June 2022, it is predicted that by the year 2050, hydrogen may be most commonly used as a transportation fuel in the U.S.

If true, this will contribute greatly to the growth and development of what has been termed the “Hydrogen Economy,” both in North America and around the globe, especially in countries whose governments offer subsidies for hydrogen production and use. So, while North America has led the way in hydrogen production and consumption for the past 30-plus years, the rest of the world is beginning to realize its benefits, with many European countries, along with India beginning to make noteworthy commitments to expanding their hydrogen production, storage, transport and consumption infrastructures.



Hydrogen fuel cell vehicles (FCVs) have been gaining traction, particularly in regions like Japan, South Korea, and parts of Europe

A Clean Energy Solution for Sustainable Development

What's aiding in the attraction of hydrogen as a growing source of energy usage is the fact that it is more environmentally friendly than traditional fossil fuels. For example, hydrogen can be used as a feedstock for a variety of products, from plastics, fertilizers and fuels, without producing greenhouse gases. It can also be used to power an array of industrial equipment, such as furnaces and boilers, while creating lower emission levels than fossil fuels. This helps make hydrogen a key contributor as the world's industrial manufacturers strive to develop more ecologically sensitive processes and techniques.

Powering the growing Hydrogen Economy is an infrastructure that enables the usage of hydrogen as a renewable source of energy for heating homes, schools, hospitals and businesses, facilitating manufacturing, powering vehicles, energy storage and the long-distance transport of energy. At the same time, because of hydrogen's diffusivity, wide flammability range and ultra-low temperature in liquid form (-423°F/-253°C), it has unique handling characteristics that require specialized technologies in order to ensure its safe, reliable and economical production, storage, distribution and use.

How will globe valve technology excels in facilitating the safe and reliable handling of hydrogen, making it an indispensable tool in an optimized hydrogen-specific operation?

Design Of The Hydrogen Infrastructure

When you talk about a hydrogen infrastructure, you are referring to the system of facilities, techniques and equipment that are used to produce, store, distribute and use hydrogen in applications ranging from chemical feedstocks to motor fuels. A properly constructed, outfitted and maintained hydrogen infrastructure will be the engine that drives the Hydrogen Economy, making it responsible for ensuring the safe, efficient and economical production, storage, distribution and use of the fuel in any application.

There are four general areas within the hydrogen infrastructure:

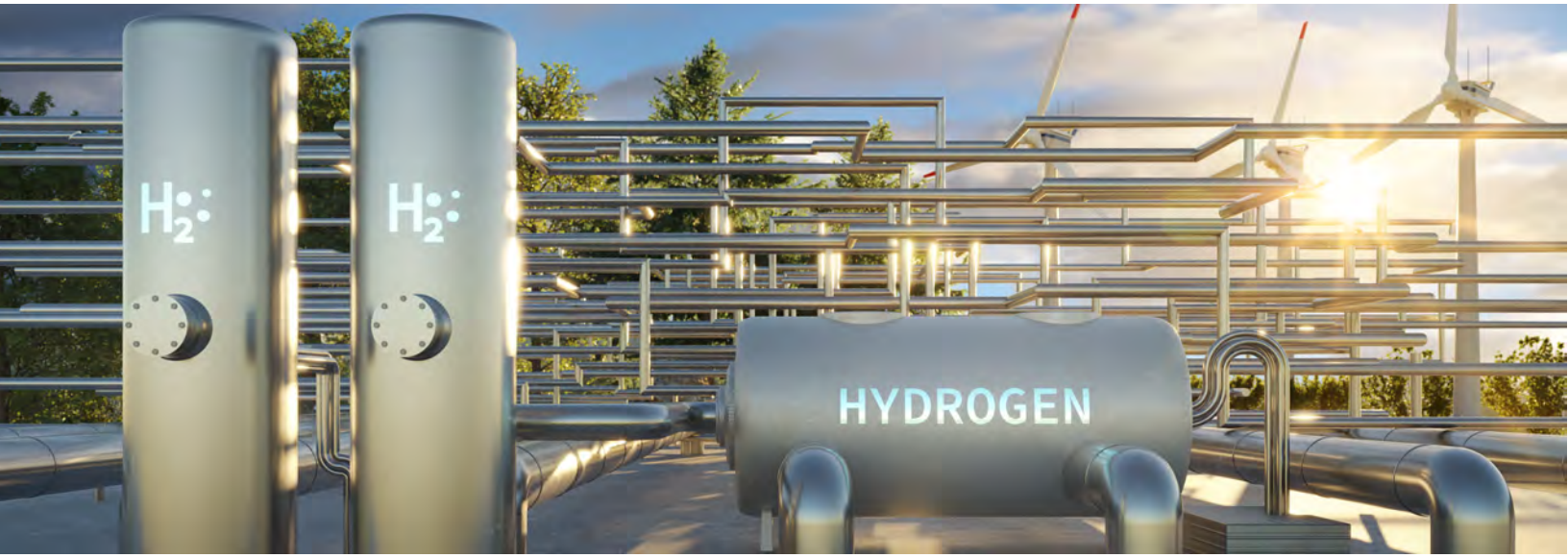
Raw Material Storage and Handling: Hydrogen is produced from natural gas, water or organic biomass, all of which must be stored in a safe and efficient manner, typically through the use of specialized handling equipment and storage tanks.

Hydrogen Production: A variety of processes can be used to produce hydrogen, with the most common being steam-methane reforming, electrolysis and gasification. All of these processes require the use of facilities and equipment that have been designed for this specific purpose, including compressors, reactors and separators.

Hydrogen Storage and Distribution: Hydrogen is stored in bulk as a liquid, which requires the use of specialized storage tanks and pipelines, along with railcars and trucks that are outfitted with dedicated hydrogen containers.

Hydrogen Fueling Stations: As hydrogen begins and subsequently continues to grow in popularity as a motor fuel, fueling stations that cater to hydrogen-powered vehicles will become more prevalent. These stations will require hydrogen-specific storage tanks, dispensers, monitoring and safety equipment.

Within this production-and-supply infrastructure, the use of water and biomass are gaining increased traction, as are manufacturing technologies like electrolysis and gasification because they produce a smaller carbon footprint than legacy processes that rely on the consumption of fossil fuels, such as steam-methane reforming.



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So, as the infrastructure that powers the Hydrogen Economy continues to expand and mature in the coming decades, it will require systems and equipment that will help ensure its safety, from refining and storage to transportation and use. Nothing can be more detrimental to an energy source with a growing reach and reputation than a high-profile industrial accident that causes widespread fear or antipathy toward it.

Therefore, it is imperative that the producers, storers, transporters and suppliers of hydrogen-based products take great pains to ensure that their systems are outfitted with components that have achieved the highest levels of reliable performance and safety, with reduced risk of an attention-grabbing accident occurring. In this realm, the valves that are used to help facilitate the transfer of hydrogen within a production plant, from one storage source to another, onto and off of transport vehicles, and at the consumption point must be able to perform their tasks safely and reliably.

As mentioned, globe valves have emerged as a leading technology for use with cryogenic liquids and gases such as hydrogen due to their ability to be vacuum jacketed. They excel in hydrogen-handling applications because they have a simple design and method of operation, along with easy maintenance, that allows them to perform flawlessly in the field for tens of thousands of open/close cycles.

Globe valves are commonly available in manual and actuated versions, with bellows and non-bellows designs.

Valves that are designed with bellows have gained popularity in hydrogen applications because the stretchable bellows is welded to the stem itself, which means that it doesn't need to slide through any packing during its operation. This allows the seal to stretch with the stem as it moves, resulting in a seal that can be rated to an average of 50,000 usage cycles, but has been tested successfully to 250,000 cycles at the standard pressure rating of 300PSI.

The globe configuration can also fit precisely within standard valve-size envelopes, making it ideal for new installations or as a retrofit into existing system designs. The valve's top-entry design also allows for maintenance without the need to disturb the vacuum space. Globe valves are also be available in check valve and long-stem fire-control configurations, as well as high-purity and ultra-high-purity designs.

As mentioned above, globe valves are compatible with Vacuum Jacketed Pipe (VJP) systems that are tasked with handling hydrogen and other cryogenic liquids. The VJP system consists of a pair of stainless-steel pipes: an inner pipe through which the hydrogen flows and an outer pipe that seals the vacuum space, creating a "vacuum jacket" in the annular space between the two pipes.

The inner pipe is suspended inside the outer pipe by a series of nonconductive supports. The internal support system and Multi-Layer Insulation (MLI) also knows as "super insulation" help prevent heat loss due to conduction and radiation.

The ultimate operational benefit of the VJP system is that it helps prevent liquid loss due to heat transfer as the liquid is moved through the piping, resulting in maximized efficiency and cost savings over time.

All of the Model CV valves have also been fashioned to be compliant with ASME B16.34 and CSA B51 regulations

The Model CV valve possesses all of the design and operational benefits that make it ideal for use when handling hydrogen, while it is compatible with Acme's proprietary VJP system.

The accumulated knowledge and expertise that go into Model CV valve packages enable it to meet the specific and unique needs of the end user, and with 20,000 valves currently in use in the field the technology has come to be known as, simply, the "Acme Hydrogen Valve."

In our brave, new energy world, the Hydrogen Economy stands poised to play a significant role. In order to reach its ultimate level of incorporation, however, the fuel will need to be produced, stored, distributed and consumed in such a way that the safety and reliability of its manufacturers, handlers, transporters and users, along with the environment, is not compromised. Playing a meaningful part in the hydrogen infrastructure are the valves that help facilitate its handling. Since 1996, the Acme Cryogenics Model CV Cryogenic Globe Valves has proven to be the top choice for operators within the Hydrogen Economy who are looking to optimize the safety, reliability and cost-effectiveness of their operations.