Plug Power partnership with Burckhardt Compression yields successful hydrogen liquefaction

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Making green hydrogen a readily available fuel relies on rapidly building production facilities. Companies like Plug Power are leading the way, creating an end-to-end green hydrogen ecosystem. In this environment, effectively delivering sufficient hydrogen relies on large reciprocating compressors, which is why Plug Power has partnered with Burckhardt Compression, a leading supplier of compression solutions for sustainable applications, to provide specialized equipment for new projects.

Green hydrogen is produced from water by splitting the hydrogen and oxygen molecules using electrolysis. This process is powered by renewable energy sources such as solar, wind or hydro, and when the resulting gas is utilized in a fuel cell system, the only emission is water. Consequently, green hydrogen promises to decarbonize industry, vehicles, and the way we produce fuel. There is a catch though - hydrogen is an incredibly light gas which makes it challenging to deliver it in required quantities to the consumer. Therefore, it must be compressed, or like in this case, even liquefied before transport to filling stations.

Big efficiency for large equipment

Oliver Franz, Sales Manager H_2 for Mobility & Energy at Burckhardt Compression, explains the best approach: “To move large quantities of hydrogen efficiently, ring type compressors are a better choice than centrifugal. Our designs offer industry leading efficiency, which is an advantage especially in a renewable energy project where maximizing production output versus power consumed is crucial.”

Considering this, Plug Power approached Burckhardt Compression to deliver a large quantity of H_2 piston compressors in a phased order to support the construction of multiple new hydrogen liquefaction facilities. The first phase of compressors required the Burckhardt Compression team in the US to quickly grow its capacity.

“We have operated a facility in Waller, Texas, for eight years now, and assembling the piston compressors required for the project on-site meant we had to expand. Each compressor weighs more than 200,000 pounds (91 tons), which exceeded the capacity of our cranage. Beyond equipment upgrades, we also needed to bolster our team,” says Michael Ciambella, Compressor Engineering and Manufacturing Manager.

Increasing capacity and expertise

The expectations from Plug Power were high and Burckhardt Compression planned to exceed them. Ramping up assembly was dependent on the ability to move around a fully built compressor to enable assemblies to be executed in parallel. Burckhardt Compression invested in a hydraulic gantry crane system with a 1-million-pound (450 ton) lifting capacity, which would allow the safe, slow movement of the compressors across the workshop. The company worked with experts to install and supervise all lifts during the project.

The investments paid dividends, as Michael confirms: “We were able to grow our assembly capacity at Waller by 50%, which allowed us to effectively meet the first phase of compressors and any afterwards. The assembly turnaround time for each compressor was reduced from six weeks down to four, and sometimes we delivered even faster than that! We managed to complete the first phase three days ahead of schedule with zero safety incidents."

Eleven new personnel joined the team too, including a consultant and a project lead with 20-years’ experience in compressor projects. As a global company, the US

team also received training from a Burckhardt Compression expert from Switzerland, who joined the company for six weeks to ensure transfer of know-how for the assembly work. Components for the compressors would be manufactured in Switzerland and delivered to the team in the US.

Specifically designed for hydrogen

Burckhardt Compression was able to design a dry running piston compressor with a highly variable turndown arrangement to exactly meet customer needs. This will allow operators to match the compressor's performance to the process requirements without any wasted energy.

Michael continues: "This is a dry design to ensure that no lubrication oil can contaminate the hydrogen and reduce fuel quality. With large diameter pistons for the first stage, there is a lot of heat from frictional forces, so the rider band must be able to withstand this and provide a long service life. We use proprietary polymer materials we have developed in-house. This enables over a year of operation before maintenance is required, which is unsurpassed in terms of uptime."

The minimal weight pistons were designed with energy saving in mind, while still ensuring enough strength to compress the hydrogen. Compressor chambers are fitted with a fixed pocket, which can expand to increase internal space. Specially developed pressure packing further contributes to an extended service life. Ultimately, the design philosophy is to find the sweet spot in terms of gas temperature and required production output for the customer.

A monitoring solution from Burckhardt Compression's digital experts PROGNOST Systems is also included. A suite of sensors constantly delivers data regarding the performance of suction and discharge valves, bearing temperatures and rod drop. Consequently, operators can monitor equipment condition and predict any preventative maintenance measures steps needed, improving uptime.

Great expertise for a new market

As of Q1 2024, Burckhardt Compression has successfully delivered the first order and has more projects underway. Following the expansion of its team and facilities, this partnership has let Burckhardt Compression lead the way in hydrogen production.

A significant factor in the success of this partnership has been the readiness of Burckhardt Compression's service and its flexibility to operate both within and outside the country, thanks to the extensive setup in the US. This ability instilled confidence in Plug Power to opt for the ‘new’ technical solution. Burckhardt Compression's ability to provide reliable and efficient services, coupled with the commitment to customer satisfaction, has played a crucial role in the successful implementation of these projects.

Michael adds: “We have 175 years of knowledge in compressors and over 50 years’ experience in hydrogen, so we can bring great expertise to a relatively young market. Our products support the entire hydrogen value chain, from production operations all the way to the forecourt. Burckhardt Compression even supports third-party compressors with modernization solutions, tailored services and high-speed replicated parts. We are certain that the quality of our work speaks for itself, and that we can continue to support landmark renewable projects such as this.”

"Although the energy transition brings forth exciting opportunities, the challenges that it presents can be daunting to our customers. With a customer intimacy culture within Burckhardt Compression (US), Inc. we are committed to delivering the best business solutions for our partners such as Plug Power. Our successful completion of the first phase of units is an excellent testimony to Burckhardt Compression's customer collaboration, product leadership, technical expertise and project capacity. We are super excited about our proven products and services supporting a sustainable energy future," concludes Annie Savarimuthu, VP Systems Division, Burckhardt Compression (US) Inc.

Burckhardt Compression has released an exclusive timelapse video of the compressor lifting process at its facility, which can be viewed here: https://youtu.be/2JORdJLask8

About Plug Power

Plug is building an end-to-end green hydrogen ecosystem, from production, storage, and delivery to energy generation, to help its customers meet their business goals and decarbonize the economy. In creating the first commercially viable market for hydrogen fuel cell technology, the company has deployed more than 69,000 fuel cell systems and over 250 fueling stations, more than anyone else in the world, and is the largest buyer of liquid hydrogen.

With plans to operate a green hydrogen highway across North America and Europe, Plug built a state-of-the-art Gigafactory to produce electrolyzers and fuel cells and is developing multiple green hydrogen production plants targeting commercial operation by year-end 2028. Plug delivers its green hydrogen solutions directly to its customers and through joint venture partners into multiple environments, including material handling, e-mobility, power generation, and industrial applications.

For more information, visit www.plugpower.com.

Image captions:

Image 1: Burckhardt Compression was able to design a dry running piston compressor with a highly variable turndown arrangement to exactly meet customer needs.

Image 2: Burckhardt Compression was able to design a dry running piston compressor with a highly variable turndown arrangement to exactly meet customer needs.

Image 3: The minimal weight pistons were designed with energy saving in mind, while still en-suring enough strength to compress the hydrogen.

Image 4: Burckhardt Compression invested in a hydraulic gantry crane system with a 1-million-pound (450 ton) lifting capacity, which would allow the safe, slow movement of the compressors across the workshop.

About Burckhardt Compression

Burckhardt Compression is the worldwide market leader for reciprocating compressor systems and the only manufacturer and service provider that covers a full range of reciprocating compressor technologies and services. Its customized compressor systems are used in the gas gathering and processing, gas transport and storage, refinery, chemical, petrochemical as well as in the industrial gas and hydrogen mobility and energy sectors. Burckhardt Compression's leading technology, broad portfolio of compressor components and the full range of services help customers around the world to find the optimized solution for their reciprocating compressor systems. Since 1844, its highly skilled workforce has crafted superior solutions and set the benchmark in the gas compression industry.

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