



Skilling-up for Hydrogen Mobility

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Hydrogen mobility has a special aura; it is enjoying tremendous attention and few industrial sectors are growing with a similar pace. California, Germany, Japan, the Netherlands and South Korea have committed to invest in hydrogen fuelling station infrastructure. As the sector grows, which industries have the right skills to migrate into the business of making hydrogen fuelling stations? Industrial gas companies are coming from a base in hydrogen production and distribution, international energy majors have historically invested in roadside filling stations for liquid fuels and automotive OEMs may also have a role. There are also several new players popping up in the space, proving that there is room for market entrants with the right mix of capabilities to compete.



Copyright Resato International - Hydrogen Fleet Owner Station

Handling the pressure in hydrogen fuelling stations

To ensure a high energy density in the fuel tank, Hydrogen filling stations compress hydrogen to pressures up to 700 bar. Companies with high-pressure technology may be able to expand to support the manufacture of hydrogen filling stations, either with components or complete units. The hydraulic system on a construction site digger operates at around 350 bar – in the right ballpark. The hydraulic system in an autofrettage machine can produce 20,000 bar - that leaves the 700 bar pressure in a hydrogen filling station far behind.

Beyond high-pressure technologies, the skills that people will need to work in this field are like any other emerging technology. An entrepreneurial spirit, market insight, cross-functional working, creativity, vision and passion will all help. Furthermore, a safety mindset coupled with deep technical and engineering competences are also required to underpin some of the supply chain, production and research roles.



Steel plate cut by a water jet

Resato International, with their base in the Netherlands, is an example of a company that has an established position in ultra-high-pressure technologies. Their established products are high pressure water jet cutting machines and high-pressure test systems. With this background, they are well placed to move into the adjacent space of high-pressure hydrogen fuelling stations and this is indeed what they have done in recent years.

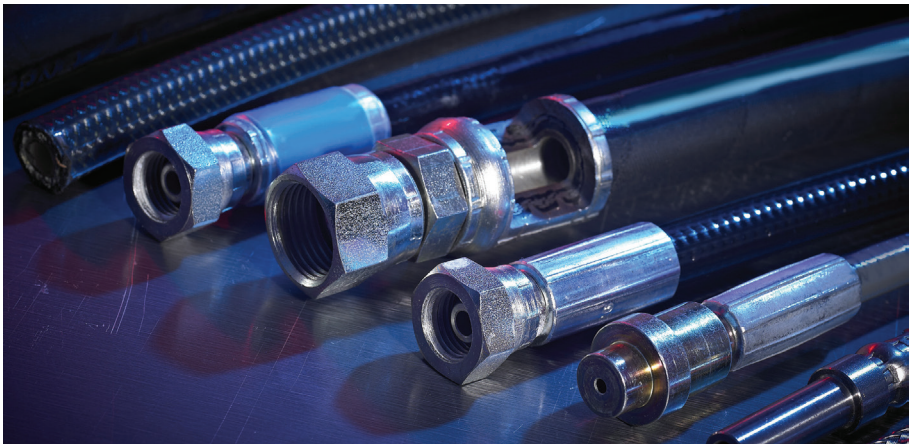
The hydrogen fuelling stations produced by Resato incorporate a hydraulic driven piston compressor. There is a high degree of complexity involved in compressing hydrogen gas to 700 bar and it is equally as challenging to create seals, which can contain the hydrogen effectively. Resato's experience with high-pressure testing systems extends up to 14,000 bar. To put that into the context of hydrogen fuelling station, imagine standing on the ground looking up at the 700m tall Burj Khalifa tower in Dubai: it would seem like a long way up. But, from a Jumbo Jet flying at its regular cruising altitude of 14,000m, the skyscraper 13,300m below disappears into a dot on the landscape. To say 'high-pressure' is relative. Of course, hydrogen gas, hydraulic oils and water all behave differently but it is likely that companies working in these adjacent high-pressure spaces will have the required respect for pressure, an appropriate safety mindset and the technical expertise to move into hydrogen fuelling systems or components.

With the twin goals of growth and diversification, Resato began to work in hydrogen in 2016. Since then they have developed two types of filling stations. A smaller fleet-owner station (FOS) and a larger public station. One of their public stations will open in The Hague in a few weeks and another will follow in Germany in 2021. For the FOS range, several have already been installed and several more will follow this year.

The FOS is used where small fleets of hydrogen powered cars operate from a fixed location such as city centre taxis or company car fleets. When the vehicles operate close to the FOS and return to base regularly, they can be sure that a top up of hydrogen will always be at hand. The FOS costs only a fraction of the larger public stations, so many fleet operators are likely to find the conversion to hydrogen is more affordable than they might have imagined.



High pressure hydraulics



High pressure hydraulics

Greening up the energy mix

As the hydrogen mobility topic develops, there could also be good potential for hydrogen filling stations in other mobility applications, for example, fork-lift trucks which operate inside warehouses could be converted to zero emission fuel cell vehicles. It would be an environmental win in addition to a health benefit because nobody wants toxic exhaust gas fumes from internal combustion engines polluting the enclosed workplace.

The technology used in hydrogen fuelling stations is agnostic to where the hydrogen has been sourced. Brown, blue, or green can all work equally well. Most can generally be fed with hydrogen from high pressure gas cylinders, or bundles, which are readily available from many industrial gas suppliers or they can be coupled to a hydrogen electrolyser. Whether the hydrogen in the gas cylinder is green or not, and whether the electrolyser runs on green power or not is really a decision for the operator. However, the idea of locally produced wind or solar power feeding an electrolyser which feeds hydrogen to a high-pressure storage vessel for subsequent compression into the vehicles is a highly appealing route to green energy and sustainable mobility.