

## Ensuring hydrogen power plays its part in a ‘Green Industrial Revolution’

A perspective from Luxfer Gas Cylinders

Despite the challenging economic environment of the past year, its 20-year legacy in hydrogen fuel storage has led Luxfer Gas Cylinders to see a five-fold increase in enquiries in 2020, from forward thinking companies exploring the harnessing of hydrogen power for transport projects.

As the world’s largest manufacturer of high-pressure composite and aluminium cylinders, Luxfer Gas Cylinders has unrivalled industry-leading expertise in designing and supplying the storage systems that hold the alternative fuel.

Jim Gregory, European Business Development Manager at Luxfer Gas Cylinders, explains, “In 2019 the demand we saw was primarily for public transport, road freight and some cars. In 2020, the range of applications has expanded significantly – we began working on projects relating to other transport modes including boats, construction equipment, forklift trucks and aerospace projects.”

“We went from a feeling that the focus on hydrogen as a fuel might remain limited to public transport for the next few years, to dealing with a volume of enquiries that has multiplied by a factor of five in 12 months – across sectors even we couldn’t have envisaged only 12 months ago.”

Luxfer recognises how this expansion reflects an international step change in approach to hydrogen. In the UK Government 2020 Spending Review, Prime Minister Boris Johnson envisioned a ‘Green Industrial Revolution’, highlighting hydrogen as a means to help recover from the economic fallout of Covid-19.

With transport one of the highest pollution-emitting sectors, the review prioritises the transition to zero emission vehicles, with £81m dedicated to research and development funding in 2021-22 to launch a programme of investment in low and zero emission transport technologies – including hydrogen.

### Looking ahead – strengthening hydrogen collaborations across Europe

The commitments made in the UK are mirrored across the rest of Europe with almost all European countries announcing clear and

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ambitious programmes for the advancement of hydrogen as a fuel source. The European Commission also sees hydrogen playing a central role in paving the way to a net zero greenhouse gas economy by 2050.

In its recent position paper on sustainable and smart mobility, Hydrogen Europe highlights the need for clear goals and predictable policies to provide a business case for investment in hydrogen. The position paper adds that a broad coalition of stakeholders is needed to identify and enable decarbonisation pathways, to achieve a net-zero emissions future.

Luxfer is at the forefront of this, as a member of Hydrogen Europe and other similar bodies around the world, helping to advance the use of hydrogen by working alongside innovators in every sector that currently relies on fossil fuel.

Gregory said, “We have been making high pressure gas storage for 80 years, and we have been at the forefront of every technological advancement in that time from medical applications to lightweight breathing apparatus, and the use of hydrogen as a way to decarbonisation is no exception.”

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“These include, for example, the advances made by construction equipment OEMs and their first hydrogen-powered construction machinery.” We’re also seeing innovation in the heavy goods lifting and mechanical handling industry across the ports of Europe, with multiple investments going into hydrogen-powered equipment.”

“Rail will also be an important and very visible part of the hydrogen story over the next few years. Orders have already been placed throughout Europe for the first locomotives and we will see those hit the tracks by the end of 2022 in France, Germany, Italy and here in the UK.”

Luxfer played a vital role in developing the UK’s first hydrogen-powered train. Unveiled in June 2019, the HydroFLEX project comprises a former Thameslink electric train retrofitted to run using a hydrogen fuel system. Luxfer’s

alternative fuel experts worked in close collaboration with Porterbrook and the University of Birmingham’s Centre for Railway Research, which won Department for Transport funding to support the concept. The hydrogen storage solution was developed and assembled at Luxfer’s UK alternative fuel facility using its G-Stor® H<sub>2</sub> hydrogen cylinders and in September 2020 the train hit the mainline tracks for the first time.

Gregory continued, “With HydroFLEX, regular testing still continues, and I am sure we will see more advances in its capabilities, while the UK rail industry is waiting for confirmation of the first orders for multiple hydrogen trains for the UK’s railways.”

“Aside from land-based transport, we are seeing a flurry of activity in marine and aerospace applications as well. Based on the number of prototypes we are building and the number of new applications for 2021, we will soon be able to travel on a hydrogen version of almost every kind of transport – something that even we hadn’t envisaged when we made our first hydrogen vehicle systems at the beginning of the 2000s.”

### A track record of working with hydrogen

Luxfer sees huge potential in the future of hydrogen in the global pursuit of low-emission, cleaner and more sustainable energy systems,

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and has been investing every year in its Nottingham, UK site to increase capacity to meet the rising demand – and future potential.

Luxfer has an established reputation for its expertise in alternative fuel, specifically for complete ‘plug and play’ systems featuring its own G-Stor™ H<sub>2</sub> hydrogen cylinders and components. A global footprint, and an 80-year history in the specific engineering and stringent safety standards required for high pressure gas containment, helps cement this reputation.

Dr. Mark Lawday, Sales Director at Luxfer Gas Cylinders, said, “There are many benefits of hydrogen and we are very proud that our technology is being used to effect positive change around the world.”

“Interest in alternative fuels is at an all-time high, thanks to net zero emission targets set by global leaders. Hydrogen provides a very real solution for transport, most recently outlined in the European Commission’s Sustainable and Smart Mobility Strategy (SSMS). Thanks to our heritage and expertise in the sector, we are extremely well placed to help drive programmes on from conception to realisation.”

### A series of ‘world firsts’

As well as HydroFLEX, other pioneering projects that Luxfer has been involved in include:

- The world’s first hydrogen buses. Luxfer has >>



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>> worked with bus partners to make hydrogen-powered buses a reality. From the first 10 zero-emission buses, that hit the roads in Aberdeen, Scotland in 2015 to the recent double-deckers unveiled in late 2020. Companies such as Transport for London (TfL) have committed in hydrogen technology. TfL has announced an order of 20 hydrogen double deckers featuring Luxfer systems, as London launched the world's first low Ultra Low Emissions Zone. By designing a bespoke system to fit each bus, Luxfer works with bus manufacturers to provide the optimum capacity to make sure that the bus can travel for its full shift without the need for refuelling, whilst keeping the weight to a minimum. This year will see the technology deployed across the UK with similar schemes to follow in Birmingham and Brighton.

- **The world's first commercially produced hydrogen trucks.** A multi-million-pound project integrating hydrogen technology into 60 trucks was delivered in 2020, marking the first such green fleet in history. The vehicles, which will transport supermarket deliveries across Switzerland, are equipped with bespoke alternative fuel systems from Luxfer. Each features a rack of seven high-pressure tanks holding around 35kg of hydrogen. This provides a long-distance range of more than 400km before refuelling, which far surpasses the capabilities of battery electric truck technology.
- **The first commercially available hydrogen powered refuse trucks.** In development for the last two years, Luxfer has worked with several refuse truck manufacturers in Europe to design, fit and support 20 vehicles in 2020. With greater range and power than electric systems, a key requirement of heavy loads vehicles like refuse trucks, Luxfer is helping city authorities in these countries to reach their ambitious carbon reduction targets.
- **Pioneering new Dutch 'Dual Power' tractor.** Dutch land and water works firm, Jos Scholman, has unveiled the first New Holland T5.140AC H<sub>2</sub> Dual Power tractors, where hydrogen is mixed with diesel fuel in a modified diesel engine thus reducing emissions by over 80%.

Five hydrogen tanks with a total water capacity of 470 litres are built on the roof of the tractor, which holds sufficient hydrogen for a full day's work, and contains as much energy as 40L of diesel. The correct ratio of hydrogen

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and diesel is regulated by the tractor itself based on the temperature, the load and the speed of the engine. When the tractor/engine is on a lighter load, the engine is running on a mostly hydrogen mixture and when the tractor/engine is loaded more heavily, the ratio of hydrogen will be lower compared to diesel. The dual fuel systems can run on diesel if hydrogen fuel is not available.

- **The world's first self-sufficient hydrogen-powered boat.** Launched in 2017, Energy Observer is a floating laboratory that has been travelling from continent to continent, exploring practical solutions and new innovations in ecological transition. As well as the Luxfer supplied hydrogen system, it also has solar panels and wind turbines and is producing hydrogen itself on board through electrolysis of the salt water.

Gregory concluded, "Luxfer is committed to developing low emission alternative fuel solutions for transportation as these exciting projects illustrate, yet this is only the start."

"It is a realistic alternative fuel source for many transport modes. If the 2020's are the decade of hydrogen, then the next two years will be the crucial proving ground as so many new applications become reality." **H<sub>2</sub>V**

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