

**ZERO
EMISSION
PRODUCTION
HYDROGEN
REFUELLING**



**THE HYDROGEN
HIGHWAY.
BUILDING OUR FUTURE.**

HYDROGEN SYSTEMS INTEGRATION EXPERTS

RHizome2 specialises in on-site hydrogen production and refuelling equipment. Our ZEPHYR station is compliant with the latest international codes and standards to guarantee safety and performance. The green energy transition can only be achieved one step at a time. RHizome2 aims to provide vehicle fleet operators with the tools they need to make that step.



QUALITY ENGINEERING

All designs are checked for quality and third-party verification.



GREEN HYDROGEN

Integrated green hydrogen solutions optimised to applications & demand.



CONSTANT INNOVATION

Ongoing research dedicated to improving RHizome2's systems.



CODE COMPLIANCE

ISO 9001, ISO 14687, ISO 19880, ISO 22734, ASME B31.12, BS EN 1127, SAE J2601, RR 715

ACHIEVING #NETZERO2050

Green hydrogen has a big part to play in the drive to reduce GHG emissions, as the use of fossil fuels inevitably declines and is perhaps already past its peak.

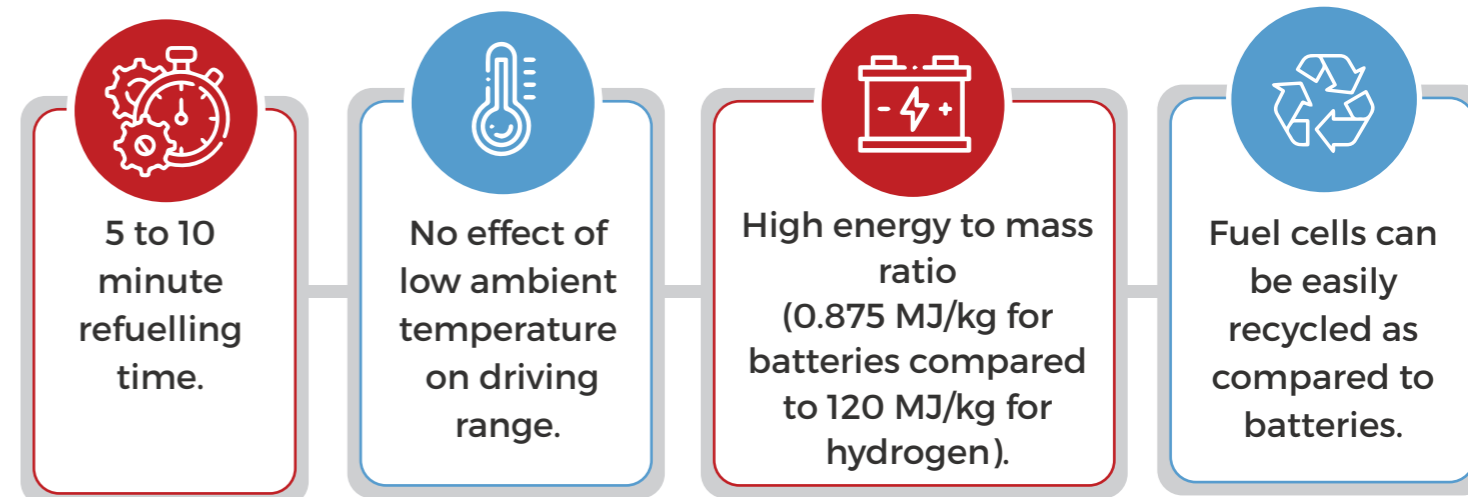
In an effort to meet its zero-emission target by 2050, the UK is turning towards alternative sources of energy to reduce its carbon emissions in all sectors, including the transportation sector. For the longest time, vehicles have operated on fossil fuels, but new opportunities in the form of BEV (Battery Electric Vehicles) and FCEV (Fuel Cell Electric Vehicles) have arisen in the past decade, with new technologies still emerging for road transport such as HICE (Hydrogen Internal Combustion Engine).



Batteries, although well suited for smaller sized vehicles and for shorter range trips, do have a range of problems when it comes to freight vehicles:

High recharge time, range anxiety, dependency on strategic resources (lithium and cobalt) together with low energy to mass ratio. This means that trucks fitted with batteries would spend a significant amount of energy carrying their battery around, and not actual freight.

HYDROGEN CAN OVERCOME THESE PROBLEMS:



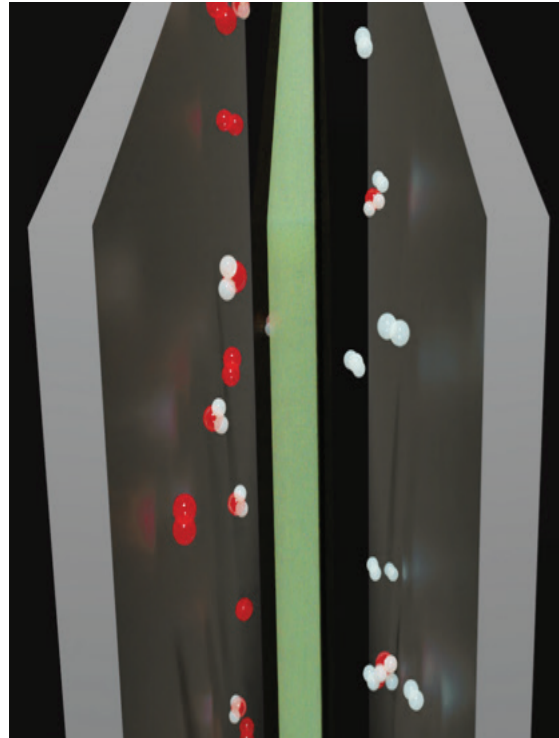
In this context, hydrogen makes for an attractive green fuel to operate freight vehicles. This can only be achieved with the appropriate refuelling infrastructure.

With ZEPHYR, hydrogen can be produced on-site, ready for the refuelling of FCEV fleets.



ON-SITE PRODUCTION

RHizome2's standard station design features on-site production via water electrolysis, using our proprietary PEM stacks design. The only inputs are water and electricity to produce hydrogen and oxygen



PEM Stacks

Proton Exchange Membrane (PEM) technology allows electrolysis of water to produce hydrogen and oxygen in assemblies called "PEM stacks". They are manufactured in a series of cells stacked on top of each other. The more cells are used in a stack assembly, the higher the hydrogen output.

The electrolysis process takes place in each of these cells, where purified water reacts on the surface of the membrane. In the cell, hydrogen travels through the membrane and is separated from the water and oxygen. This increases both hydrogen purity but also inherent safety of the process, by removing the risk of a volatile hydrogen/oxygen mixture formation.

Unlocking Renewable Energy

PEM stacks operate at high current densities and can ramp up to maximum power in a matter of seconds.

PEM electrolyzers are valuable assets for balancing the grid, as they offer the possibility to produce hydrogen from electricity that would otherwise be disposed of.

On-site production removes the need and dependence on hydrogen supply chain logistics. Instead, the hydrogen fuel is directly produced and stored at the refuelling station, for instant or later use.

RHizome2 strives to provide the smartest designs, offering maximum efficiency, availability and reliability, while also producing hydrogen with cheap off-peak renewable electricity, reducing OPEX costs to a minimum.



HYDROGEN REFUELLING STATION

Fuel cells are power generation devices that recombine hydrogen and oxygen into water, resulting in the production of electricity.

With a high power output coupled with hydrogen's unmatched energy density per kg, fuel cells make for an extremely attractive zero-emission solution. This is particularly true for HGV and articulated truck operators in the long-range freight sector, as fuel cells offer a light-weight, zero-emission solution to maximise freight capacity.

Currently, long-range fuel-cell HGVs are refuelled at H35 (350 bar) stations and dispensers. They require high-purity hydrogen in order to preserve fuel-cell longevity. RHizome2 guarantees the fuel quality is compliant with ISO 14687 - Hydrogen Fuel Quality standard.

Our hydrogen is purified fully deoxidised, compressed and stored at pressures of 500 bar (and up to 1000bar subject to fuelling requirements) to be later dispensed safely to vehicles, following SAE J2601 compliant fuelling protocols.

The entirety of the plant can be monitored remotely and operated automatically, following seamless integration at your site location, as a complete plug and play system. The addition of a high-pressure hydrogen ground storage module, allows for maximum station availability and guarantees the fuelling of all your fleet vehicles.

In the unlikely event of anomalous operation, built-in automated shutdown systems will trigger and safely power the station down. Ventilation and sensing is designed to ensure safe operation at all times. ZEPHYR is engineered to meet your specific needs, based on fleet size and refuelling patterns. In all applications, RHizome2 will support you and supply a tailor-made, reliable and safe design.



ZEPHYR™

RHizome2 designs, manufactures and installs best-in-class Hydrogen Refuelling Stations (HRS) for your zero-emission freight vehicles. With on-site hydrogen production as a core feature, there is no dependence on a third-party hydrogen supply chain network. PEM technology along with our purification module allow for N5.0 (99.999%) gas purity and ensure high fuel-cell longevity.

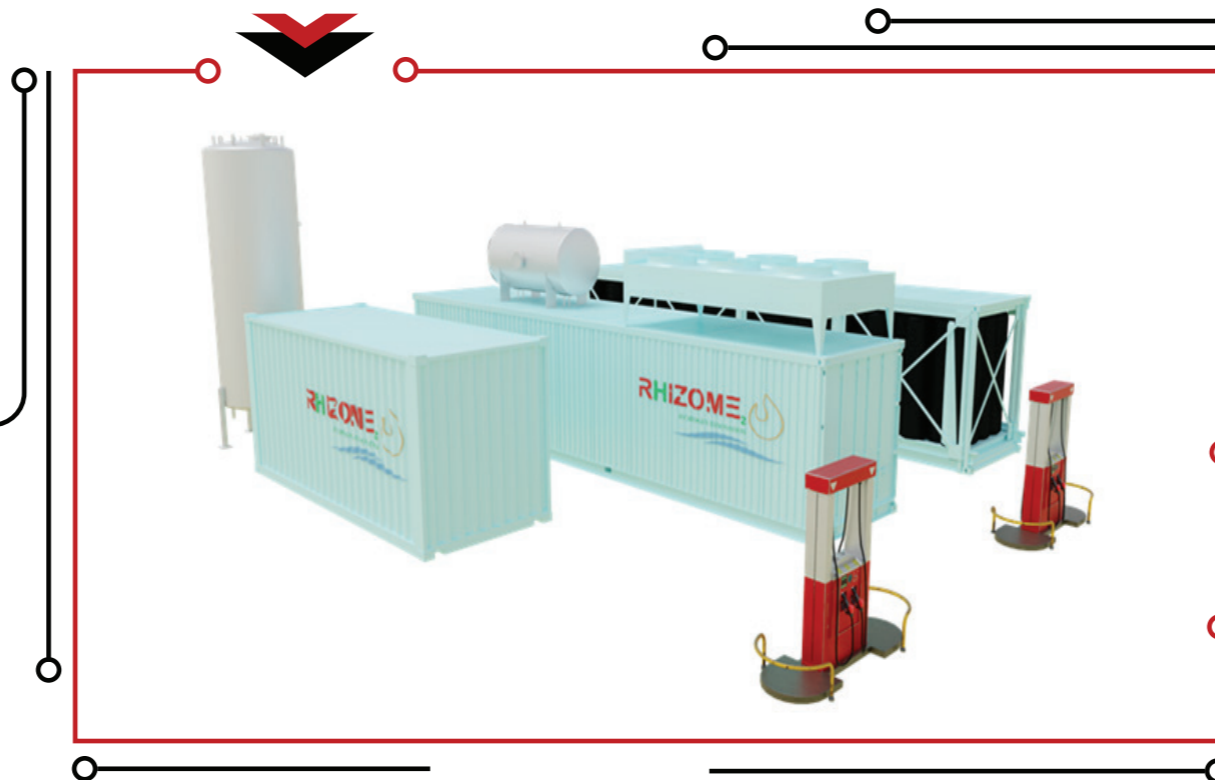
The entirety of our equipment is engineered from a holistic point of view. Hydrogen production, compression, storage and dispensing, as a single solution, which allows for the most compact installations available.

ZEPHYR is supplied as a standalone, autonomous product which can be operated in efficiency or performance mode. In efficiency mode, our integrated smart software tracks in real-time the most ideal hydrogen production windows based on grid electricity demand or renewable production capacity, to offer the cheapest hydrogen possible. Performance mode lets you ramp up to maximum production output, thus matching a possible increase in freight traffic.

Water Purification System is included as a standard supply to ensure correct water quality for electrolysis. Hence, typical tap water is suitable as input to produce hydrogen. System can also be specifically optimised to handle other input water qualities.

Highest Reliability Highest Availability For YOUR Fleet needs

- 100% AUTOMATED**
Station production is fully automated and operates with minimal intervention
- HIGH PURITY HYDROGEN**
Purifier and deoxidiser along with dry discharge compressor for high purity output
- SMALL FOOTPRINT**
All production and refuelling components are integrated in a single compact product



- FAST FUELLING, ANYTIME**
Ground storage and cascade system for numerous consecutive fuellings
- ECONOMICAL**
Short response time to better utilise cheap off-peak renewable energy
- SCALABLE**
Station size can easily be tuned to your specific fleet demands

ZERO-EMISSION PRODUCTION HYDROGEN REFUELLING

PRODUCT	Nominal Daily Production (kg/day)	System Efficiency ¹ (kWh/kg)	Size ²
ZEPHYR-200	200	< 70	1 x 40ft + 1 x 20ft
ZEPHYR-650	650	< 69	1 x 40ft + 2 x 20ft
ZEPHYR-1000	1000	< 67	2 x 40ft + 1 x 20ft

1: EFFICIENCY SCOPE INCLUDES COMPRESSION AND PRE-COOLING FOR FUELLING EVENTS
2: DEPENDANT ON GROUND STORAGE CAPACITY. THE ZEPHYR PRODUCTS IN THIS TABLE INCLUDE 500KG NOMINAL GROUND STORAGE CAPACITY

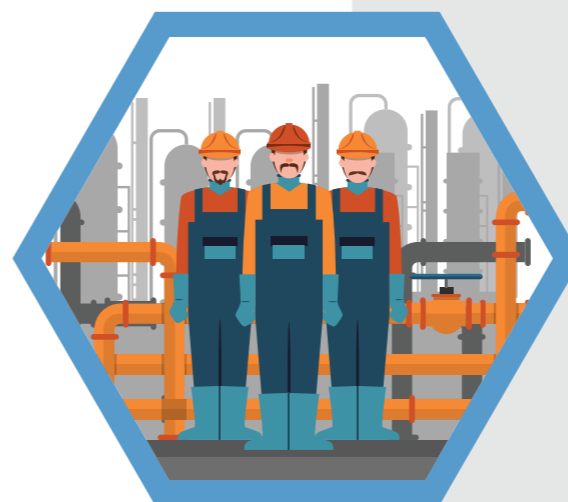
Our on-site production HRS, ZEPHYR , lets you take charge of the fuel supply for your FCEV fleet. As a standard, our dispensers come equipped with fast flow (120g/s) H35 refuelling nozzles to ensure the shortest fuelling times. PEM technology along with a ground storage capacity of more than 1000kg provide the highest reliability and availability levels, for a guaranteed 24/7 fuel supply.

THE RHIZOME APPROACH



CUSTOMISED SOLUTIONS

Hydrogen installations are not one-size-fits-all. RHizome2 is devoted to supplying a solution that best fits your requirements. With a mix of modular technology and smart engineering practice, we can provide a seamlessly integrated installation at your site, which can meet exactly what your vehicle fleet needs.



DECADES OF EXPERTISE

Our team of senior engineers has accumulated years of experience designing low-space, compact process modules in the challenging offshore and marine sector. We were involved in all the engineering and supervisory steps of projects ranging from small, to large-scale. Designs with high pressure explosive gases and hazardous zones are not new to engineers at RHizome2. We bring engineering excellence.



A PATH TOWARDS SUSTAINABILITY

It is RHizome2's goal to guide you through the green transition. As the UK has set clear sustainability targets for the coming decades, we can help you tackle them head on, without worrying about ever harsher penalties from using fossil fuels. Such a shift is better started sooner than later, and we can give you the confidence necessary for it.

**JOIN THE HYDROGEN
REVOLUTION TODAY**

**Learn more
rhizome2.com**

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