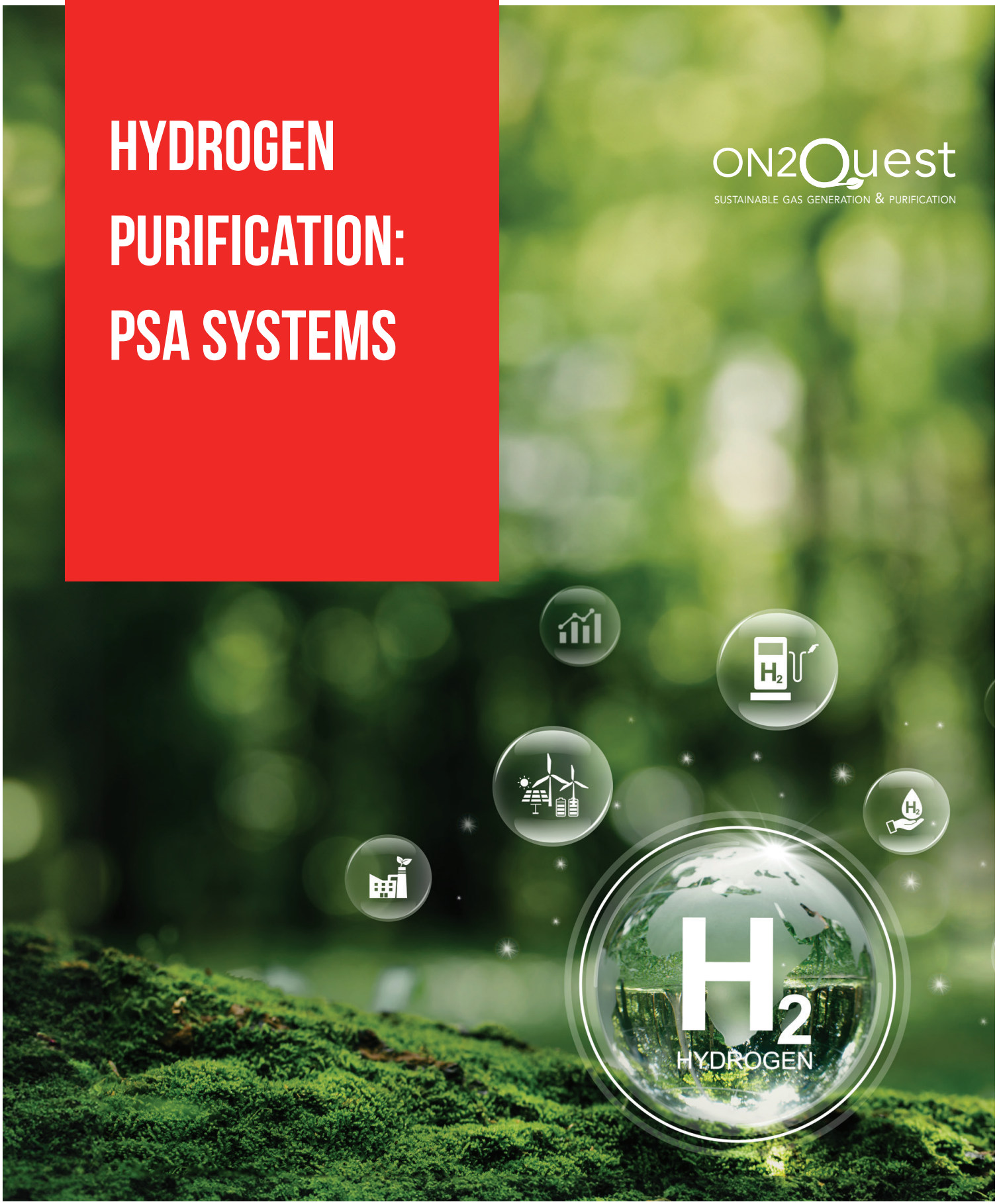
HYDROGEN PURIFICATION: PSA SYSTEMS

ON2Quest
SUSTAINABLE GAS GENERATION & PURIFICATION



MAXIMISE EFFICIENCY: PURIFY EFFECTIVELY

HYDROGEN H_2

HYDROGEN PURIFICATION SYSTEMS

ON2Quest's hydrogen purification systems are equipped with the latest advancements that uses either the pressure swing adsorption (PSA) or vacuum pressure swing adsorption (VPSA) technology. These systems are meticulously designed to effectively enhance hydrogen-containing gas streams to achieve pure and ultra-pure hydrogen as required by the various applications need.

THE EQUIPMENT

Through a carefully calibrated process of adsorption and desorption, impurities such as moisture, hydrocarbons, and other contaminants are efficiently removed from the hydrogen stream, leaving behind higher purity levels of hydrogen.

The PSA systems are based on three distinct technology platforms, each offering unique benefits for different feed gas specifications and flow rates. All systems are designed to allow adjustable hydrogen purity levels of up to 99.9999% and typically achieve recovery rates between 80% and 90%.

All systems can be supplied as modules, to be integrated with other equipment like steam reformers or gas recycling systems. Alternatively, the PSA can be supplied as standalone system, integrated with peripheral equipment such as compressors, storage vessels and electronics.

Standardised systems are skid mounted and pre-tested, allowing minimal downtime for installation at the end user's site.

UNIQUE PROPOSITION

HIGHEST IN-CLASS EFFICIENCY
Optimising gas separation to achieve peak performance for maximum efficiency and reliabilty.

SMALLEST FOOTPRINT
Smaller than conventional PSA with the same capacity due to reduced vessel size and use of proprietary valves.

REDUCED DOWNTIME
Longer intervals of maintenance maximises productivity, ensuring continuous operations.

FEED GAS COMPOSITION
Flexible and adaptable to varying feed gas composition.

ADSORBENT MATERIALS
Proprietary adsorbent materials for maximum efficiency and effectiveness.

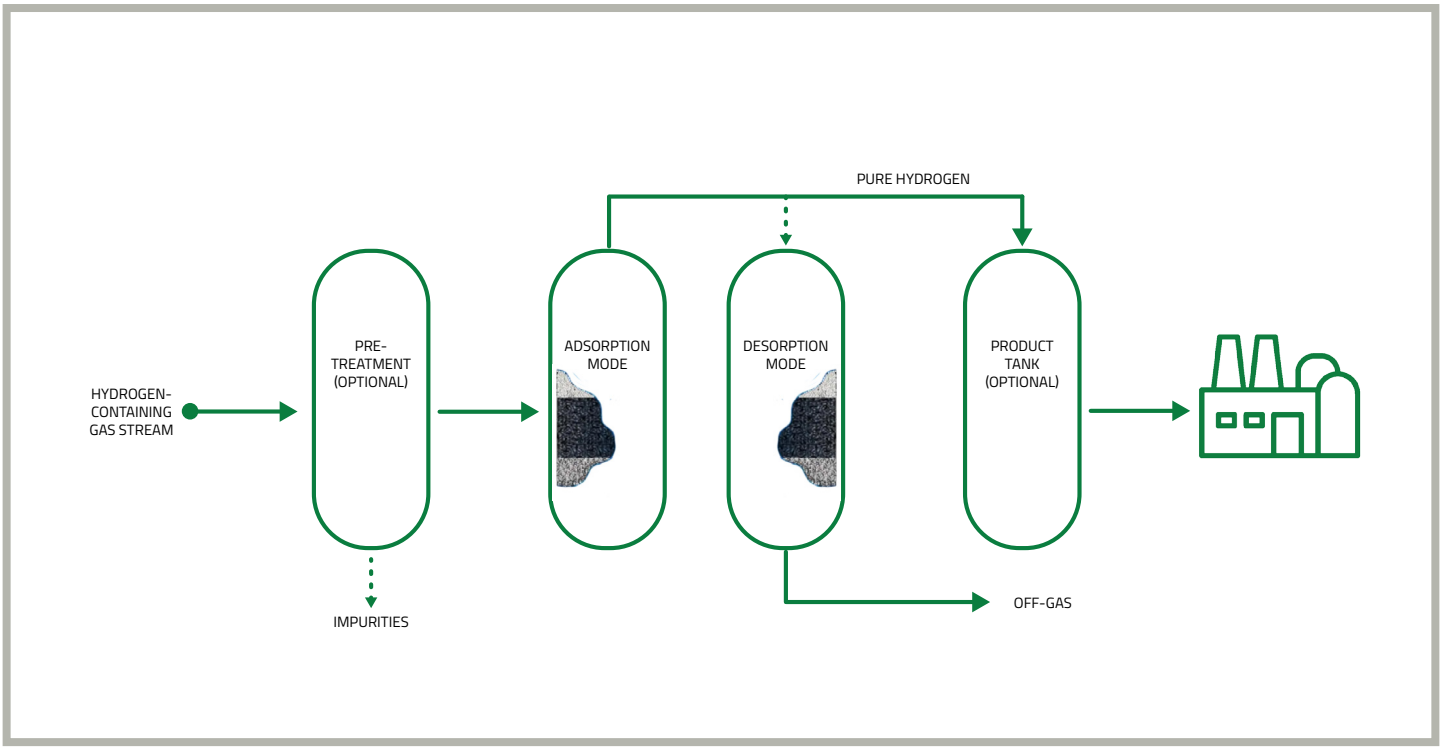
LOW PRESSURE SUITABILITY
Unique low pressure design for varying operating conditions.

WORKING PRINCIPLE

THREE DISTINCT PLATFORMS

HQ-X	The small-scale VPSA technology is optimised for low pressure feed gases up to a maximum flow rate of 250 Nm³/h. Typical applications include the recovery of waste hydrogen and further polishing of relatively high purity hydrogen. The incorporation of a vacuum step in the process enables higher yields to be achieved.
HQ-C	The unique rotating manifold PSA platform is designed for medium pressure hydrogen-containing gas streams with flows of up to 3,000 Nm³/h. The rotating manifold technology contributes to a small footprint, minimal pressure drop, reduced maintenance expenses, and reduced downtime.
HQ-M	The large-scale rotating manifold PSA platform is designed for feed gas streams of up to 15,000 Nm³/h. This preserves the same advantages as achieved with the HQ-C platform, maintaining a limited footprint at higher flow rates due to the increased operating pressure.

HOW IT WORKS



Hydrogen-containing gas streams typically contain undesired components such as carbon dioxide, methane, water vapor, and many other components such as sulfur. Depending on the component and the level of concentration that needs to be removed, several process steps are required to prepare the mixture for the core PSA process.

The PSA consists of multiple vessels filled with proprietary adsorbent materials. At elevated pressure, all the non-desired components are adsorbed by one or more of these adsorbents while the less adsorbable hydrogen flows through the bed.

Once the adsorbent bed reaches its adsorption capacity, the vessel closes off. And another vessel takes over the purification process in such a way that there will always be a continuous feed gas flow, and therefore, resulting in a continuous product flow.

The impurities from the initial vessel goes through a desorption process where it is regenerated by reducing the pressure. The vessel will then go through an equilibration cycle where it will be purged with some of the pure hydrogen product from the product stream, preparing it for the next purification cycle.

For efficiency optimisation, a PSA system is designed with multiple vessels in parallel since the regeneration and repressurisation process takes more time than a production cycle.

SPECIFICATIONS

SPECIFICATIONS

Platform	HQ-X	HQ-C	HQ-M
Technology	VPSA gate valve	PSA rotating manifold	PSA rotating manifold
Design standards	CE, PED, ATEX	ASME, CE, PED, ATEX	ASME, CE, PED, ATEX
Input specifications[1]			
Feed flow rate [Nm³/h]	15 - 250	80 - 3000	800 - 15000
Feed flow pressure [bar(g)]	6 - 12	10 - 21	15 - 30
Feed gas temperature [°C]	4 - 60 (10 - 40 optimal)	4 - 60 (10 - 40 optimal)	4 - 60 (10 - 40 optimal)
Power Consumption [kW]	7 - 15	0.2 - 0.5	0.2 - 0.5
Operational specifications			
Turndown [%]	25 - 100	40 - 100	40 - 100
Max. yield [%]	90	82	84
Product purity [%]	up to 99.9999		
Pressure drop [bar(g)]	<1		

MODELS

Platform	Model	Feed Flow Range[2]	Max. Pressure	Dimensions[3]		
				Width	Depth	Height
		Nm³/hr	barg	meters		
HQ-X	50	15 - 50	12	1.2	1.8	2.2
	100	25 - 100		1.3	1.8	2.2
	250	65 - 250		1.8	2.2	2.2
HQ-C	250	80- 200	21	1.4	1.1	2.3
	450	180 - 450		1.6	1.6	2.9
	1000	400 - 1000		1.9	1.8	2.9
	2000	800 - 2000		5.6	2.6	4.1
	3000	1200 - 3000		5.8	2.7	4.1
HQ-M	2000	800 - 2000	30	3.3	2.8	3.6
	3500	1400 - 3500		3.5	3.0	3.6
	8500	3400 - 8500		4.1	3.6	4.9
	11000	4400 - 11000		4.4	4.0	4.9
	15000	6000 - 15000		4.7	4.3	4.9

Notes:

[1] Specific contaminations in feed gas might lead to the need for additional pre-treatment measures.

[2] The optimal choice for Platform and Model depends on local requirements related to available flow, pressure, feed composition, and desired product specifications (purity/pressure).

[3] Dimensions refer to the skid mounted PSA including vacuum pump, but excluding compressor for feed stream, and buffer vessel for product gas.

KEY BENEFITS

COST SAVINGS

- Higher recovery rate with the use of advanced adsorbents and rotating manifold design.
- Lower electricity consumption due to lower pressure requirements and application of vacuum that reduces upfront compression.
- Lower capital costs due to compact design and limited installation efforts.

ENVIRONMENTALLY FRIENDLY

- Highest in-class recovery efficiency.
- Post treatment modules available for several off-gas components.

RELIABILITY

- One rotating manifold instead of multiple valves per vessel.
- Robust design with the flexibility to temporarily shut down one or more vessels.

ENHANCED SAFETY

- Relatively fast cycling allows the total gas volume to be limited.
- All international certificates and ATEX compliant.

PACKAGED SOLUTIONS

- Skid-mounted and pre-tested at factory for quick deployment.
- No need for on site assembly.

SPACE EFFICIENCY

- Smallest possible footprint with the use of rotating manifold design.
- Skid-mounted or containerised integrated systems.

QUALITY CERTIFICATIONS

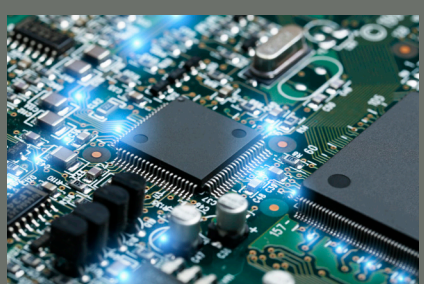
APPLICATIONS

FOOD PROCESSING

FUEL CELL GAS UPGRADING

HYDROGEN PRODUCTION

INDUSTRIAL GAS RECOVERY



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