H_2REF-DEMO

HYDRAULIC COMPRESSION FOR HIGH CAPACITY HYDROGEN REFUELLING STATION DEMONSTRATION

Project ID	101101517
PRR 2025	Pillar 2 – H_2 storage and distribution
Call topic	HORIZON-JTI-CLEANH$_2$-2022-02-08
Project total cost	EUR 5 786 712.50
Clean H_2 JU max. contribution	EUR 4 617 384.88
Project period	01-01-2023 - 30-06-2026
Coordinator Beneficiary	CENTRE TECHNIQUE DES INDUSTRIES MECANIQUES, FR
Beneficiaries	FABER INDUSTRIE SPA, HYDAC TECHNOLOGY GMBH, HYDROGEN-REFUELING-SOLUTIONS, H2NOVA, UNIVERSITA DEGLI STUDI DI MODENA E REGGIO EMILIA, UNIVERSITE DE TECHNOLOGIE DE COMPIEGNE

https://heavy-v.h2ref.eu/

PROJECT AND GENERAL OBJECTIVES

H_2REF-DEMO aims to further develop and quintuple the innovative compression concept developed in H_2REF, in order to address large vehicle refuelling applications requiring hydrogen to be dispensed at rates of hundreds of kg/h, such as refuelling bus fleets every evening at bus depots and refuelling trucks and trains. The concept is particularly well-suited for scaling up, thanks to the scalability of fluid power and composite pressure vessel technologies. As it incorporates the intrinsic modularity of fluid power technology together with that of pressure vessel technology, this disruptive solution will allow the different expected hydrogen supply to be addressed in a cost effective and reliable manner, in particular those that are the most suitable for large-scale refuelling applications where daily consumptions exceed one tone.

- On-site production.
- Road-delivery with high pressure trailers (e.g. 500 bar, in carbon composite), as these have an effective payload of around one tone.

Large-scale hydrogen refuelling involves two distinct types of compression:

- **Compression of hydrogen production for storage**. As production is the supply chain function with the highest cost, it tends to be performed through continuous (24/7) operation of production devices sized on the basis of daily consumption. Storage of the hydrogen produced requires compression at the same rate in order to keep storage size and footprint within acceptable limits.
- **Compression of stored hydrogen for high-capacity dispensing**. This compression function brings hydrogen from storage – that is a fixed vessel storing hydrogen produced on-site, a fixed vessel into which hydrogen has been delivered by trailer, or a trailer - maintaining the pressure required for dispensing at the rate required when dispensing takes place, for example at the rate required when dispensing takes place, for example at any time of the day when vehicles pull-in to refuel, or almost continuously during a certain time frame (e.g. 4-6 hours per day at a bus depot). The feed pressure of compression for dispensing is typically higher than that of compression for storage, however the required throughput is also higher (as dispensing takes place only part of the time).

NON-QUANTITATIVE OBJECTIVES

The main goal of the project is to develop and test at full scale a high-capacity compression module (HCCM) capable of either hydrogen compression for storage prior to dispensing (1.2 tons/day) or hydrogen compression for high-capacity (35 MPa) dispensing (150 kg/h 2.5 kg/min), with 1 year's demonstration of use for high-capacity refuelling of heavy-duty vehicles in a commercially operated refuelling station. Particular attention will be given to design optimisation to minimise costs.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTSMULTIPHYSICAL MODELLING AND SIMULATION OF THE HCCM PROCESS AND INITIAL SIZING AND ESTIMATION OF POTENTIAL PERFORMANCE.

- Functional specification of the HCCM based on a bladder accumulator and an elementary compression unit.
- Functional specification and material selection for bladder and tests on material.
- Design of the accumulator's shell.
- Development of an initial safety plan.
- Specification and simulation of the global refuelling system.
- Specification and simulation of the hydraulic power pack.
- Review of existing regulations, codes and standards and identification of gaps within the project activities.

FUTURE STEPS AND PLANS

- Selection of bladder material and manufacturing of bladders.
- Manufacturing of shells.
- Development of the accumulator and performance of the first tests.
- Develop the hydraulic power pack.
- Start gas skid development.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?	SoA result achieved to date (by others)	Year for reported SoA result
Project's own objectives	CAPEX	k€/(kg/day)	1.2		2.2	2024
	Bladder durability	cycles	20 000		N/A	N/A

Clean Hydrogen Partnership
Co-funded by the European Union