

COSMHYC XL

COMBINED HYBRID SOLUTION OF METAL HYDRIDE AND MECHANICAL COMPRESSORS FOR EXTRA-LARGE SCALE HYDROGEN REFUELLING STATIONS



COSMHYC XL
INNOVATIVE H2 COMPRESSION

Project ID:	826182
PRD 2023:	Panel 2 – H2 storage and distribution
Call topic:	FCH-01-7-2018: Improvement of innovative compression concepts for large scale transport applications
Project total costs:	EUR 2 749 613.75
Clean H₂ JU max. contribution:	EUR 2 749 613.75
Project period:	1.1.2019–30.06.2023
Coordinator:	Europäisches Institut für Energieforschung EDF-KIT EWIV, Germany
Beneficiaries:	Ludwig-Bölkow-Systemtechnik GmbH, Mahytec SARL, Nel Hydrogen AS, Steinbeis 2i GmbH

<https://cosmhye.eu/cosmhye-xl-project>

PROJECT AND OBJECTIVES

Hydrogen mobility is one of the most promising solutions for a sustainable energy transition in large-scale transport modes, including trucks, buses, trains and professional vehicle fleets. For these applications, a well-functioning hydrogen refuelling infrastructure is necessary, including hydrogen compressors able to meet challenging constraints in terms of flow rate and availability. COSMHYC XL aims to develop an innovative compression solution for extra-large hydrogen refuelling stations, based on the combination of a metal hydride compressor and a mechanical compressor.

NON-QUANTITATIVE OBJECTIVES

- The project aims to create a hybrid system allowing for different configurations. Ludwig-Bölkow-Systemtechnik will show that only small adaptations for different refuelling applications and intermediate storage capacities are required to minimise total costs.
- The project aims to increase reliability. The results of COSMHYC and the preliminary results of COSMHYC XL show that reliability can be strongly improved compared with that of SoA mechanical compressors.
- The project aims to undertake a cost-of-ownership assessment. Activities dedicated to this are ongoing. The results of the previous COSMHYC project show that the target total cost of ownership can be achieved.

PROGRESS AND MAIN ACHIEVEMENTS

- A prototype of a dual-head mechanical compressor has been assembled and is operational; the compressor reaches 120 kg/h in two-stage configuration and 240 kg/h in duplex configuration (listed in the European Commission's Innovation Radar).
- Metal hydrides without rare-earth elements were produced for all three compression stages (listed in the Innovation Radar).
- The metal hydride compressor prototype is assembled in a 20-foot container, including all subsystems (e.g. thermal integration, control and monitoring system) (listed in the Innovation Radar).
- The test site has been in commission for the metal hydride compressor prototype. All risk assessments were successfully performed, and pre-certification is complete. The long-term test started in Q4 2022.

FUTURE STEPS AND PLANS

- The project is conducting long-term tests of the prototypes. The tests of the mechanical compressor are complete; the metal hydride compressor tests started in late 2022. The testing protocol validates the combination of the compression technologies.
- The consortium is collecting and analysing all data generated during the tests. Based on these data, a techno-economic analysis will be conducted and the project's final exploitation roadmap will be set.

QUANTITATIVE TARGETS AND STATUS

Target source	Parameter	Unit	Target	Target achieved?	SoA result achieved to date (by others)	Year of SoA target
Project's own objectives	Energy consumption	kWh/kg	6.18		8	2018
	Degradation	%/1 000 h	0.8	⚙️	N/A	N/A
	Specific costs	k€/kg*day	1.47		3.7	2021
	Noise levels	dB	< 60		53.9	2021