ECOHYDRO

ECONOMIC MANUFACTURING PROCESS OF RECYCLABLE COMPOSITE MATERIALS FOR DURABLE HYDROGEN STORAGE

Project ID	101138008
PRR 2024	Pillar 8 – Strategic research challenge
Call topic	HORIZON-JTI-CLEANH2-2023-07-01: Advanced materials for hydrogen storage tanks
Project total cost	EUR 9 617 290.00
Clean H_2 JU max. contribution	EUR 9 617 290.00
Project period	1.1.2024–31.12.2027
Coordinator	Institut Mines-Télécom, France
Beneficiaries	Airbus, Arkema France SA, Basaltex NV, Centre Technologique Nouvelle-Aquitaine Composites & Matériaux Avancés, Chemical & Intermodal Logistics, Electra Commercial Vehicles Limited, FEV TR Otomotiv ve Enerji Araştirma ve Mühendislik Limited Sirketi, Katholieke Universiteit Leuven, Luxembourg Institute of Science and Technology, M.D.P. Materials Design & Processing SRL, MAHYTEC SARL, Politechnika Wrocławska, Promat Research and Technology Centre, Temsa Škoda Sabancı Ulaşım Araçları Anonim Şirketi

https://ecohydro-project.eu/

PROJECT AND GENERAL OBJECTIVES

Ecohydro's global objective is to ensure an economic process for manufacturing recyclable composite materials for durable hydrogen tanks through the usage of high-strength carbon fibre, low-viscosity thermoplastic liquid resin and instant *in situ* photopolymerisation for composite pressure vessels.

Ecohydro has six ambitious general objectives:

- identify and develop multifunctional sustainable materials enabling a circular design and reducing the whole-life cost of hydrogen storage solutions;
- develop standardised inspection and repair methods that improve safety aspects of hydrogen storage and increase the lifetime of hydrogen storage solutions;
- develop smart solutions that allow for cross-application uses of hydrogen storage to reduce the total number of storage tanks produced;
- demonstrate increased storage size and reduced capital cost for aboveground storage of hydrogen;
- demonstrate increased tube trailer payload, reduced capital cost and increased operating pressure for road transport of hydrogen;
- demonstrate increased gravimetric capacity, conformability, reduced capital costs and increased tank gravimetric efficiency for onboard storage of H_2 in heavy-duty truck and aviation applications.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Trailer payload	kg	1 500	
	Operating pressure	bar	700	
	Trailer capital cost	€/kg	350	
	Gravimetric capacity	%	7	
	Cost	€/kg	600	
	Tank gravimetric efficiency	wt%	35	
	Storage size	t	20	
	Storage tank capital cost	€/kg H_2	300	

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SUSTAINCELL

DURABLE AND SUSTAINABLE COMPONENT SUPPLY CHAIN FOR HIGH PERFORMANCE FUEL CELLS AND ELECTROLYSERS

Project ID	101101479
PRR 2024	Pillar 8 – Strategic research challenge
Call topic	HORIZON-JTI-CLEANH2-2022-07-01: Addressing the sustainability and criticality of electrolyser and fuel cell materials
Project total cost	EUR 9 993 652.00
Clean H_2 JU max. contribution	EUR 9 993 652.00
Project period	1.1.2023–31.12.2028
Coordinator	SINTEF AS, Norway
Beneficiaries	Centre national de la recherche scientifique, Commissariat à l'énergie atomique et aux énergies alternatives, Danmarks Tekniske Universitet, Deutsches Zentrum für Luft- und Raumfahrt EV, École polytechnique fédérale de Lausanne, Forschungszentrum Jülich GmbH, Fundacion Tecnalia Research and Innovation, Haute école spécialisée de Suisse occidentale, Teknologian tutkimuskeskus VTT Oy, Université de Montpellier

https://sustaincell.eu/

PROJECT AND GENERAL OBJECTIVES

The Sustaincell project aims to support European industry in developing next-generation electrolyser and fuel cell technologies by developing a sustainable European supply chain of materials, components and cells. This will be based on scientific breakthrough innovations, ecodesign guidelines and environmentally friendly manufacturing routes. The project will focus on developing new critical-raw-material (CRM)-lean and/or CRM-free materials and architectures, aiming to maximise functionalities and durability while decreasing CRM content per unit cell. The new flexible and scalable processing routes will exhibit higher productivity, reduced utilities consumption and reduced greenhouse gas emissions. The project will also develop enhanced recovery and treatment processes for optimising recovery and reuse of platinum group metals / CRMs and ionomers extracted from end-of-life stacks and production processes.

The project is led by SINTEF and will involve world-leading experts in the value chain of alkaline, proton-exchange membrane, anion-exchange membrane, solid oxide ion conducting and proton ceramic conducting electrolysers and fuel cells. The open innovation research will be actively communicated to European academia and industry to exploit the results of Sustaincell for the benefit of society.

NON-QUANTITATIVE OBJECTIVES

- Harvesting and expanding European knowledge and know-how on CRM identification, substitution, recovery and recycling strategies and value chains.
- Ensuring the replacement and/or reduction of CRMs per unit cell using eco-friendly processing methods.
- Increasing the yield of ionomers and CRMs recovered from used cells and membrane electrode assemblies, and from scrap and waste, by recycling.
- Contributing to the development of harmonised EU protocols.
- Validating new solutions in terms of gain in performance and durability at the single-cell level.
- Demonstrating the sustainability of at least three innovative solutions for each technology.
- Maximising the impact, uptake and acceptance of Sustaincell results by developing strategies for dissemination to, communication with and exploitation by academia, industries, policymakers, non-governmental organisations and the public.
- Establishing a suitable toolbox for efficient risk management and knowledge sharing between partners.

PROGRESS AND MAIN ACHIEVEMENTS

- Autumn school was co-organised by Sustaincell with four other EU projects (eCOCO2, Winner, Protostack, Single).
- School provided tutorial lectures on design, fabrication, characterisation, testing, and modelling of materials, components, cells, and stacks.
- Two milestones have been partially achieved, with performance targets achieved for several materials, durability needing validation.

FUTURE STEPS AND PLANS

- Prepare a workshop on life-cycle assessment in 2024;
- Continue the development and validation of CRM-free/lean electrocatalysts/ionomers/electrodes for both low- and high-temperature technologies;
- Carry out the round robin test;
- Increase interaction with external stakeholders and dissemination activities.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
SRIA (2021–2027)	CAPEX	€/kW	@ 100 MW: AEL 400, AEMEL 300, PEMEL 500, SOEL 520 @ 500 kWe, PEMFC 900	
	Min. CRMs/PGMs (other than Pt) recycled from scraps and wastes	%	50	
	Ionomers recycled from scrap and waste	wt%	80	
	Pt recycled from scrap and waste	wt%	99	
	Current density at the cell level for AEL, AEMEL, PEMEL, SOEL	A/cm^2 @ *x* V	2030: AEL 1 @ 1.8, AEMEL 1.5 @ 2, PEMEL 3 @ 1.8, SOEL 1.5 @ 1.2	
	CRMs as catalysts in AEL, AEMEL, PEMEL, PEMFC	mg/W	AEL 0.0, AEMEL 0.0, PEMEL 0.25, PEMFC (transport) < 0.25 mg/kW, PEMFC (stationary) 0.01 mg/Wel non-recoverable CRMs	
Project's own objectives	PEMFC electrical efficiency, non-recoverable CRM loading, degradation rate	%	~ 56 % (% lower heating value H_2), 0.01 mg/Wel, 0.2 %/1 000 h	

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