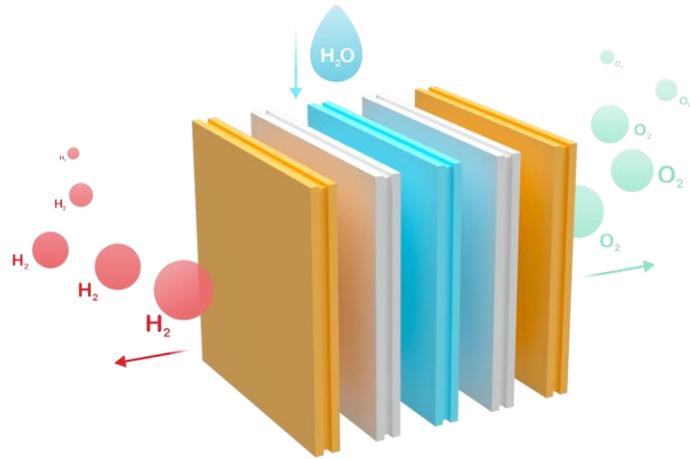


Next Generation Alkaline Membrane Water Electrolysers with Improved Components and Materials



Next Generation Alkaline Membrane Water Electrolysers with Improved Components and Materials

Aldo Gago

German Aerospace Genter (DLR)

Aldo.Gago@dlr.de



This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 875118. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation program, Hydrogen Europe and Hydrogen Europe Research



Short summary about NEWELY



- Starting date: 1st January 2020
- Duration: 42 months
- Budget: 2,597,414 €
- FCH-JU contribution: 2,204,846 €
- Call topic: FCH-02-4-2019 New Anion Exchange Membrane Electrolysers

Objectives

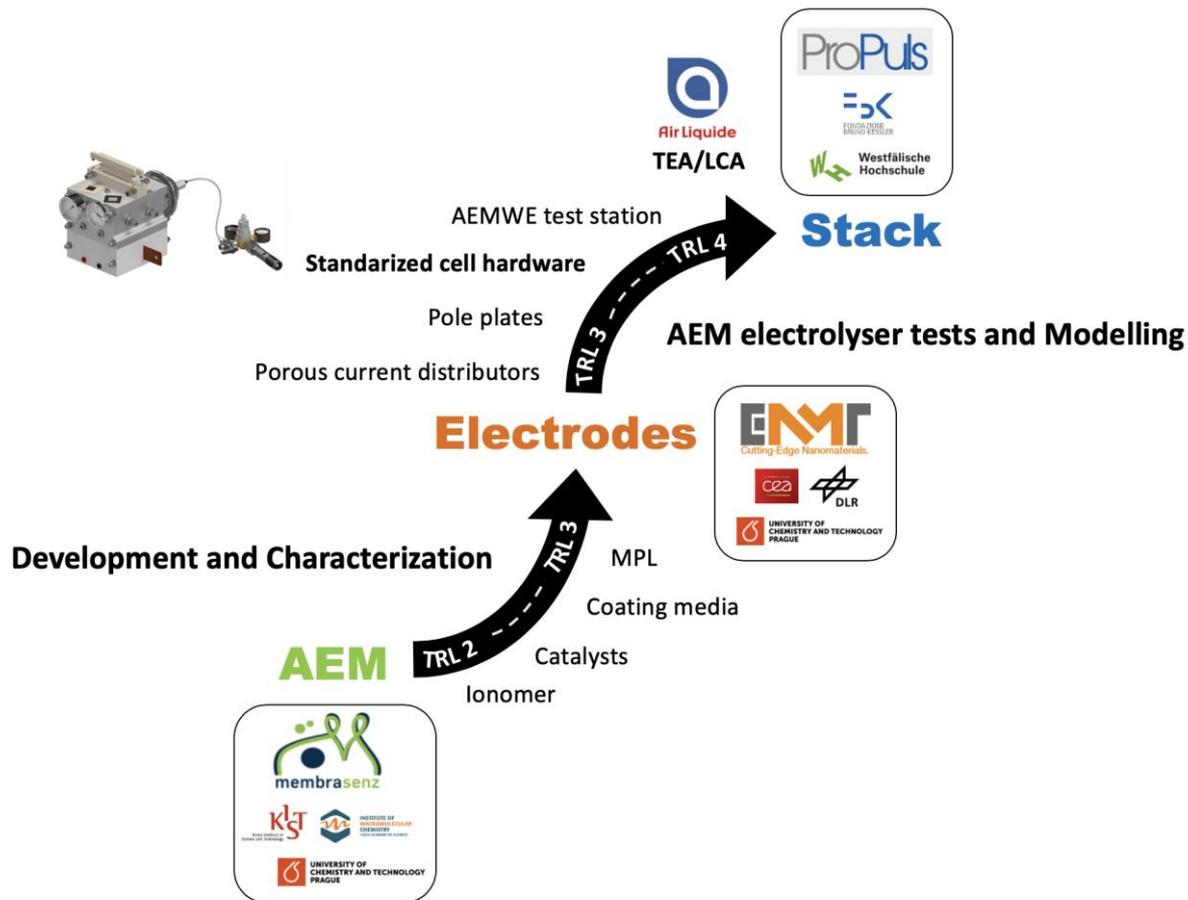


- NEWELY project aims to redefine AEMWE, surpassing the current state of AWE and bringing it one step closer to PEMWE in terms of efficiency but at lower cost. The main developments include:
 - Stable AEMs and ionomers with ionic conductivity of at least 50 mS cm^{-1} in pure water
 - Highly active non-PGM nanostructured oxygen evolution reaction (OER) and hydrogen evolution reaction (HER) catalysts
 - MEAs based with pore-gradient catalytic layers with open structure
 - Thermal sprayed pore-graded macroporous layers (MPL) on low-cost mesh-type stainless steel PTLs, to decrease cell overpotential
 - 200 cm^2 active area AEMWE 5-cell stack with hydraulic compression technology and output hydrogen pressure up to 40 bar.
- The stack will reach $2 \text{ V @ } 1 \text{ A cm}^{-2}$ with pure water feedstock only or diluted KOH. The targeted performance of the NEWELY prototype will be validated in a 2,000 hours endurance test with $< 50 \text{ mV}$ degradation.

Partners and their roles in the project

Participant	Participant organisation name	Country	Role
	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	Germany	Coordinator, PTL, MEA
	Westfälische Hochschule Gelsenkirchen, Bocholt, Recklinghausen (WHS)	Germany	Stack testing, stack development
	Commissariat à l'énergie atomique et aux énergies alternatives (CEA)	France	MEA, testing
	ProPuls GmbH (ProPuls)	Germany	Stack, test cell
	Air Liquide (Air Liquide)	France	TEA, LCA
	Fondazione Bruno Kessler (FBK)	Italy	Testing, communication, dissemination and exploitation
	Cutting-Edge Nanomaterials UG (CENmat)	Germany	Catalysts
	MEMBRASENZ GmbH Sàrl (Membrasenz)	Switzerland	Membrane
	Vysoká škola chemicko-technologická (UCTP)	Czech republic	Membrane testing, analytics
	Ústav makromolekulární chemie AV ČR v.v.i. (IMC-CAS)	Czech republic	Ionomer, membrane
	Korea Institute of Science and Technology (KIST)	South Korea	Membrane

Concept of NEWELY



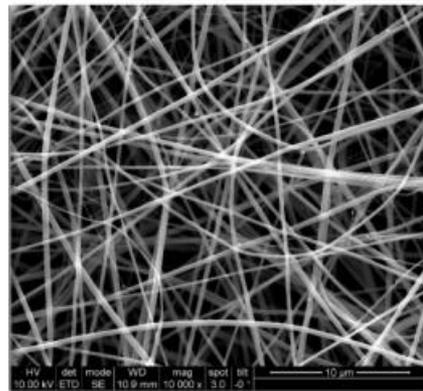
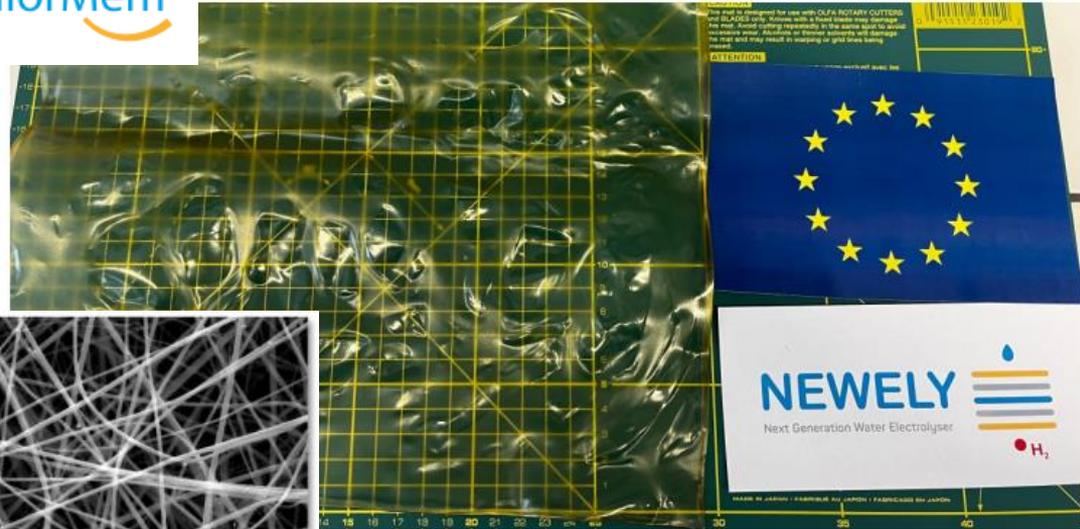
Quantitative objectives



Project Target	Target value	Achieved
AEMWE stack	2 kW, \leq 40 bar	Max. power not yet determined , 0 bar since operation change from pure water to 0,1 M KOH
Cell voltage @ current	2 V @ 1 A/cm ²	2 V @ 2 A/cm ²
Stable operation for 2000 h, cell voltage gap after 2000 h	50 mV	Test of 385 h, voltage gap \ll 20 mV
Chemically, thermally and mechanically stable AEM membrane with conductivity ... Area Specific Resistance	\geq 50 mS/cm ... \leq 0.07 Ω cm ²	62 mS/cm ... 0.065 Ω cm ²
Non-PGM catalyst added overpotential Anode + cathode @ 1 A cm ⁻²	415 mV @ 1 A cm ⁻²	232 mV @ 1 A cm ⁻²
TEA and LCA demonstrate reduction of CAPEX and OPEX relative AWE and PEMWE	Analysis study	Study finalised

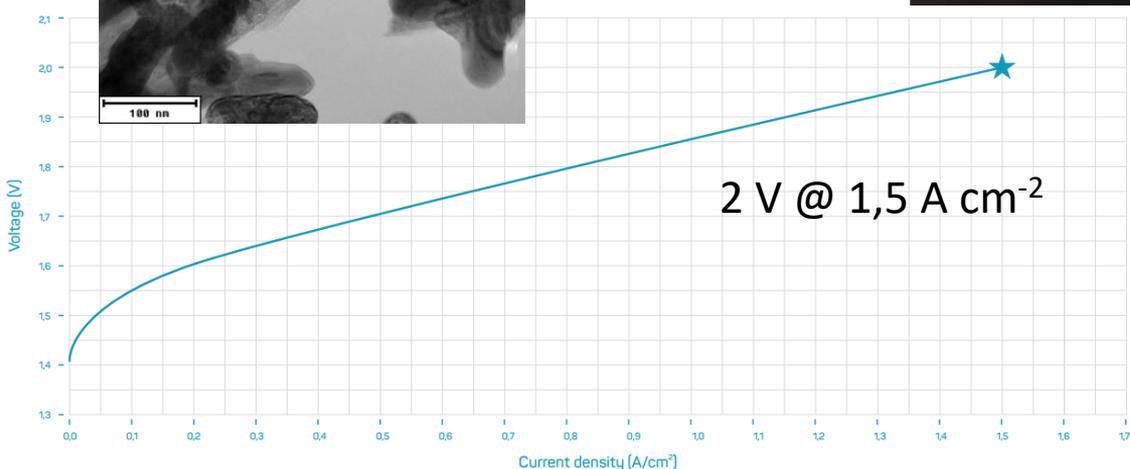
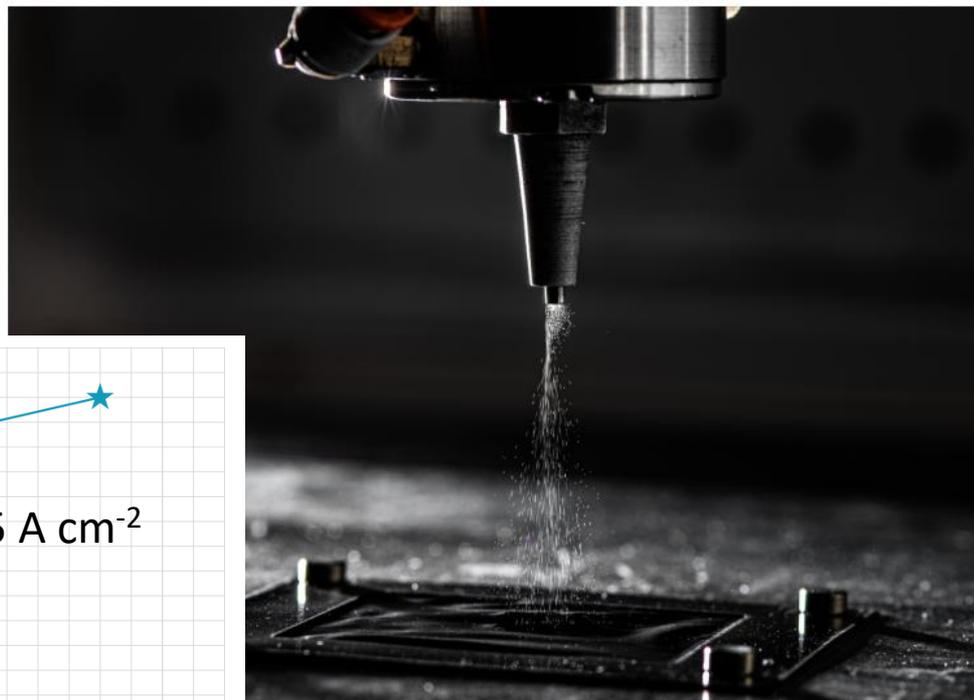
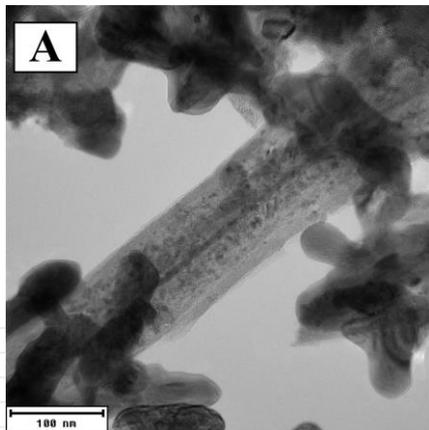
Achievements - Highlights

- Membranes: high conductivity, reinforcement, upscaling and stability. Commercialization of project membrane started via start-up company of project partner IMC-CAS:



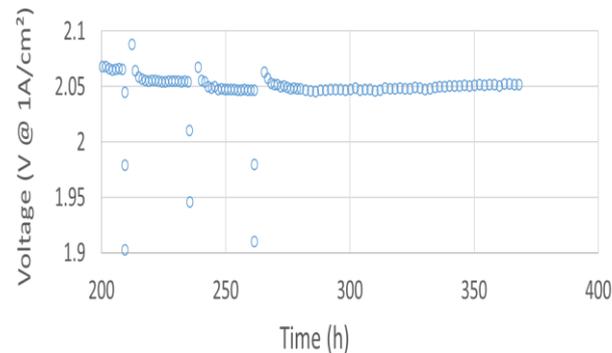
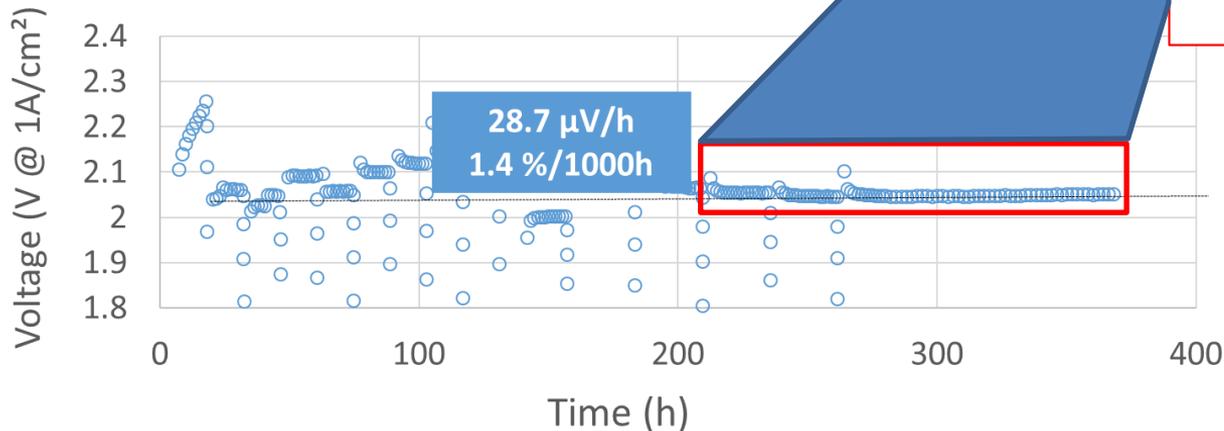
Achievements - Highlights

- Catalyst and Electrodes: Non-PGM, low overpotential, Catalyst coated substrates



Achievements - Highlights

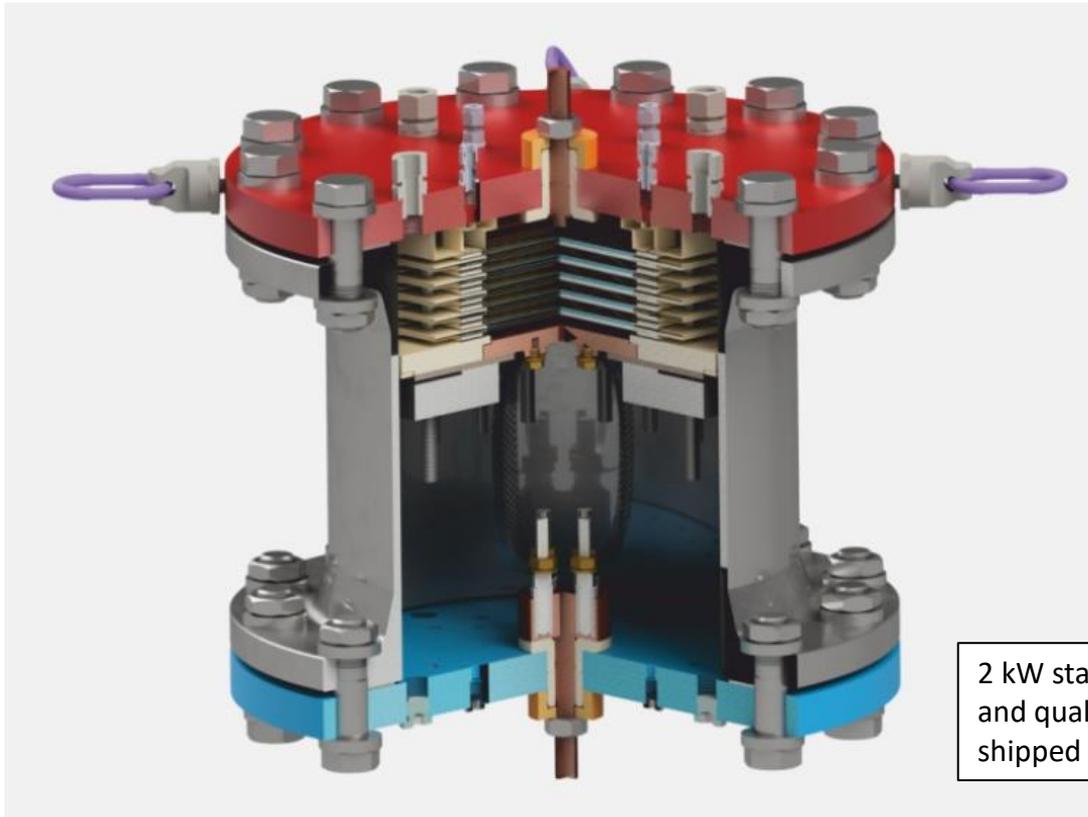
- Single cell long term stability
- The test validates the test cell hardware from the company ProPuls for its use in AEMWE



ProPuls

Achievements - Highlights

- Stack with hydraulic compression technology



2 kW stack fully manufactured, tested and quality control completed. shipped and installed at FBK

Achievements - Highlights

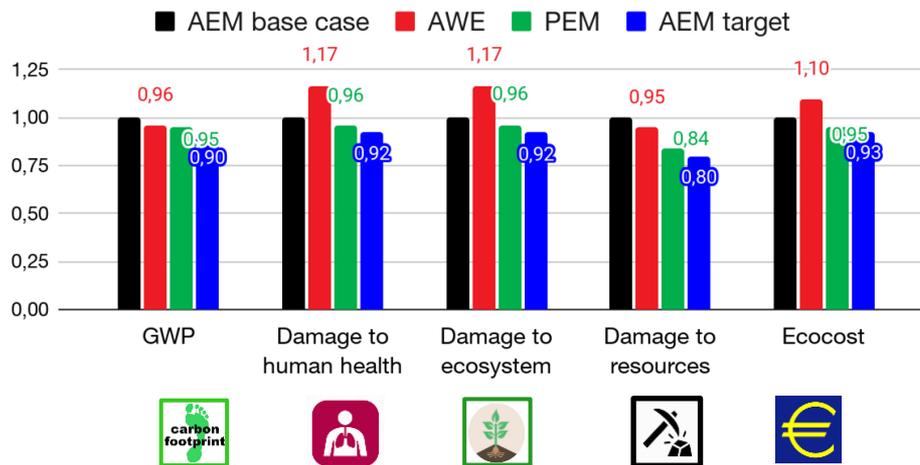
- Test bench designed and constructed for project AEM measurements



Achievements - Highlights

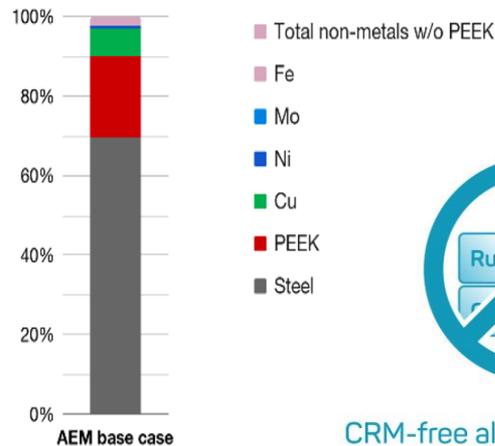
- LCA result

LCA relative results - Case DE wind, 50% availability



Materials amounts in AEM NEWELY stacks

percentage total materials/kg H₂ produced, case DE wind offshore 50%



CRM-free alkaline technology



Disclaimer

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Clean Hydrogen Partnership. Neither the European Union nor the granting authority can be held responsible for them.



This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 875118. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation program, Hydrogen Europe and Hydrogen Europe Research





Aldo Gago
German Aerospace Center (DLR)
Aldo.Gago@dlr.de

www.newely.eu



This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 875118. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation program, Hydrogen Europe and Hydrogen Europe Research



THANK YOU