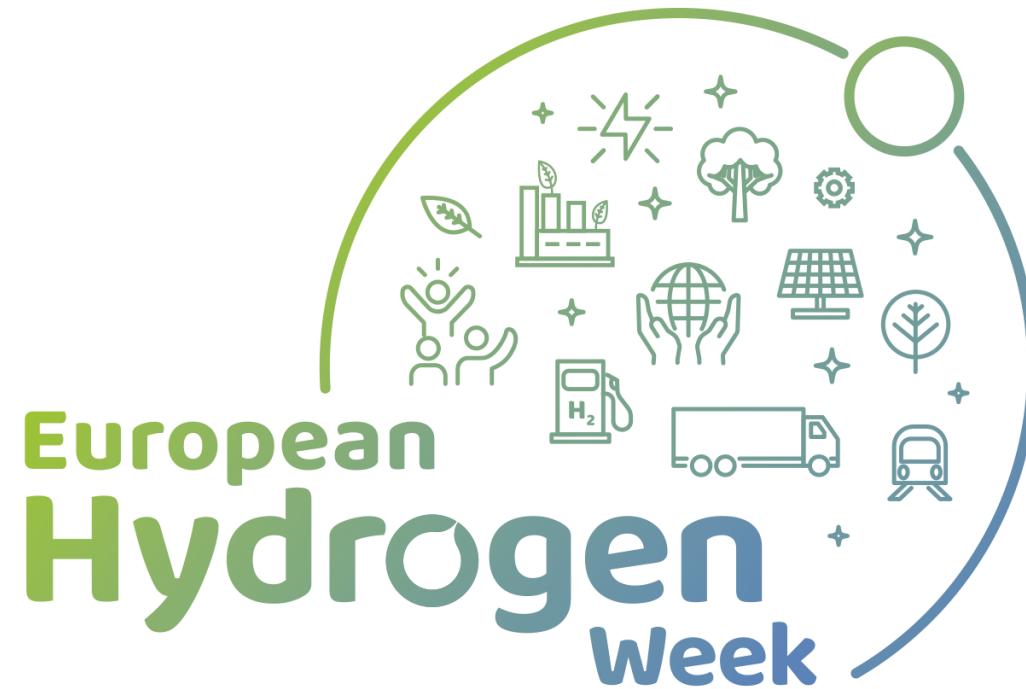


## NEWELY

Next generation alkaline water electrolyzers with improved components and materials



Aldo Gago

DLR

[www.newely.eu](http://www.newely.eu)

[aldo.gago@dlr.de](mailto:aldo.gago@dlr.de)

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# Project Overview

- Call year: 2019
- Call topic: FCH-02-4-2019: New Anion Exchange Membrane Electrolysers
- Project dates: 01/2020 - 12/2022
- % stage of implementation 01/11/2019: 64%
- Total project budget: 2 597 414 €
- FCH JU max. contribution: 2 204 846 €
- Other financial contribution: 392 567 €

Partners:



INSTITUTE OF  
MACROMOLECULAR  
CHEMISTRY  
CZECH ACADEMY OF SCIENCES

Korea Institute of  
Science and Technology



UNIVERSITY OF  
CHEMISTRY AND TECHNOLOGY  
PRAGUE



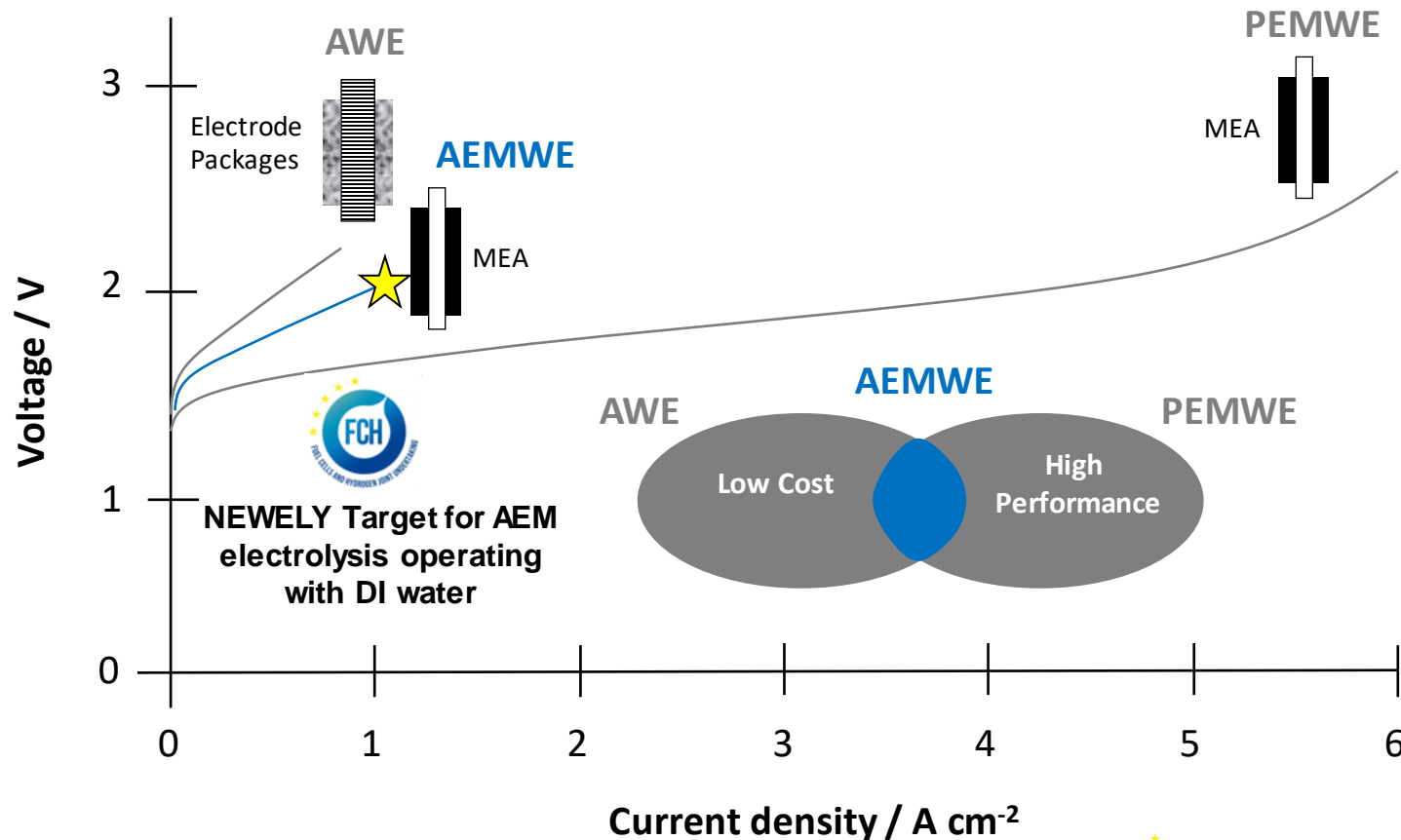
Westfälische  
Hochschule

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European  
Commission

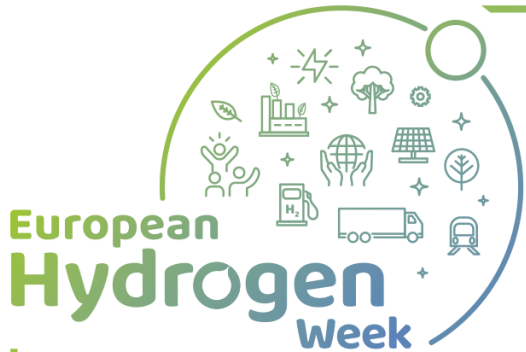
# Project Summary



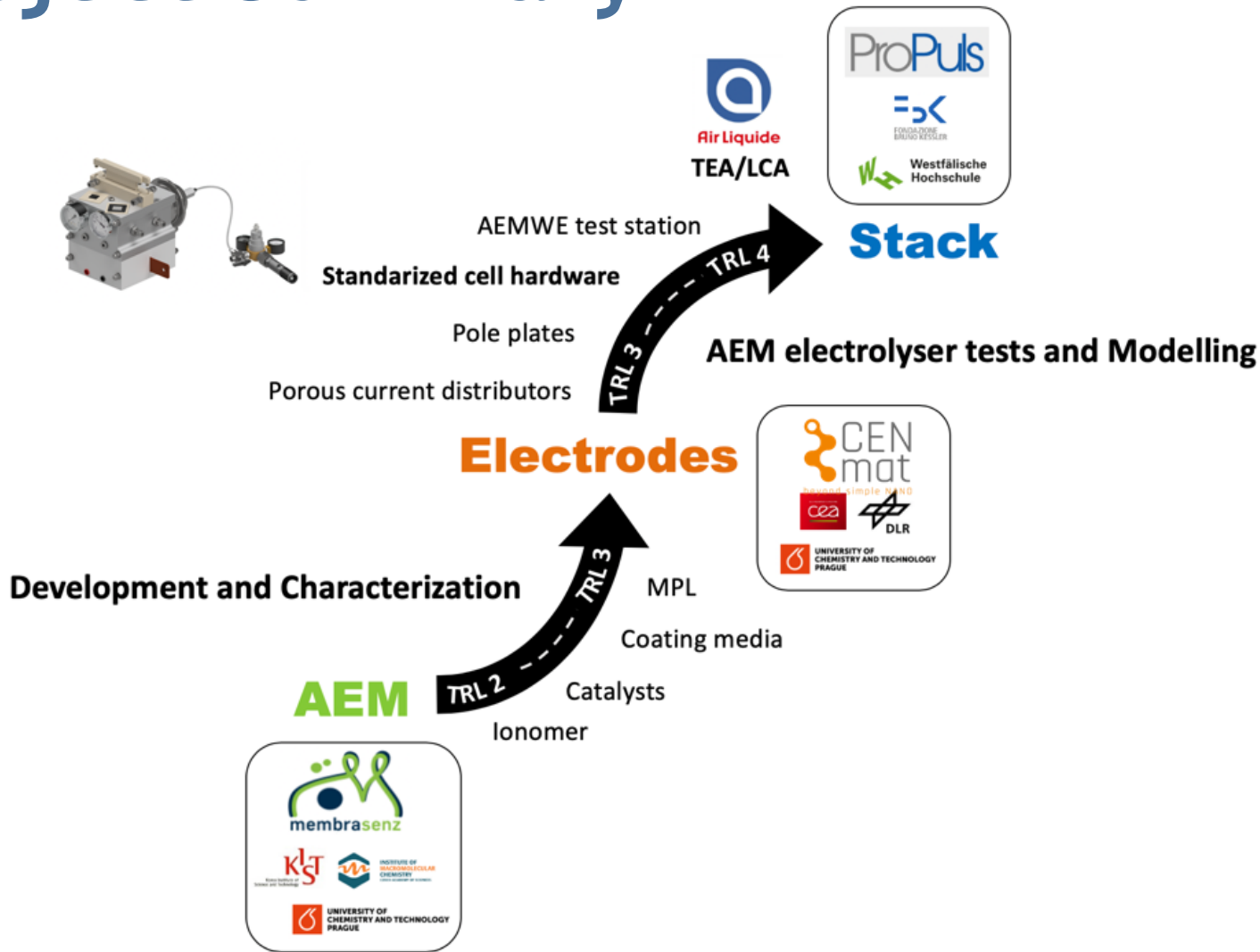
NEWELY project aims to redefine AEMWE, surpassing the current state of AWE and bringing it one step closer to PEMWE in terms of efficiency but at lower cost. The main developments include:

Stable AEMs and ionomers; Highly active non-PGM oxygen evolution reaction (OER) and hydrogen evolution reaction (HER) catalysts; MEAs; low-cost high efficiency Porous Transport Layers (PTLs); 200 cm<sup>2</sup> active area AEMWE 5-cell stack

The stack will reach 2 V @ 1 A cm<sup>-2</sup> with pure water or 0.1 M KOH electrolyte feedstock. The targeted performance of the NEWELY prototype will be validated in a 2,000 hours endurance test with < 50 mV degradation.



# Project Summary



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# Project Progress: Stable Membrane conductivity



**Achievement to-date**

FAA-3-50  
40 mS/cm  
< 2.5  $\Omega$  cm<sup>2</sup>

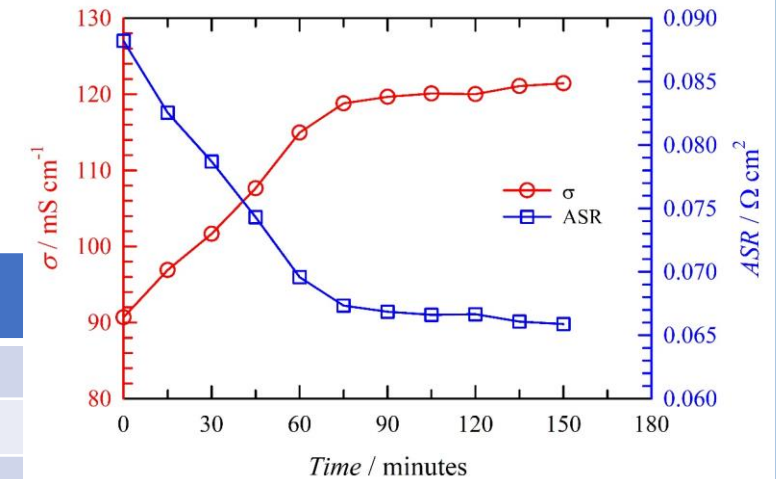


**NEWELY**  
120 mS/cm  
0.065  $\Omega$  cm<sup>2</sup>

Membrane and binder Type 1 - based on hydrocarbon backbone with DABCO functional group

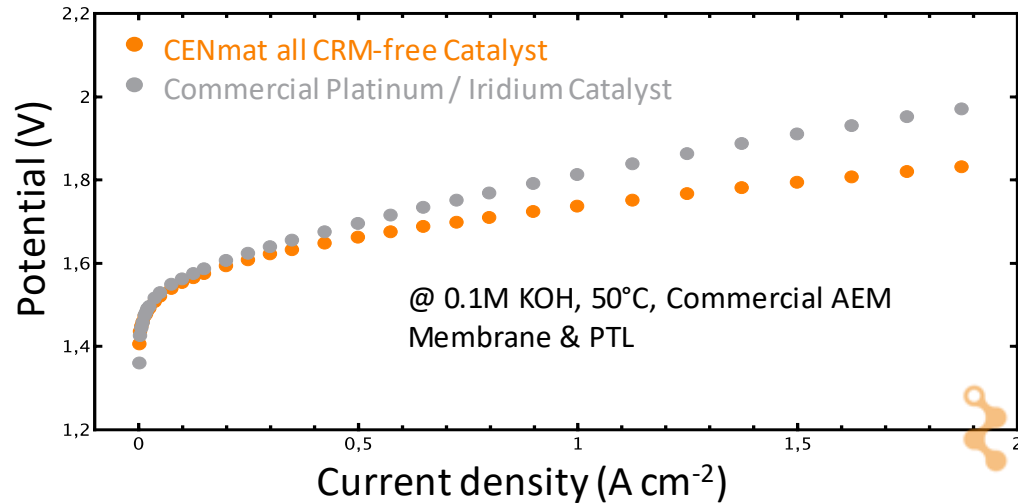
- High OH<sup>-</sup> conductivity,
- good mechanical stability (60  $\mu$ m thickness)
- Stability of functional group in KOH
- Developed active binder based on same chemistry

Membrane parameter	PSEBS CM DABCO	NEWELY target	Comment on the next optimisation steps
Tensile stress at break, MPa	3.4	15	Crosslinking; Reinforcement textile
Tensile strain at break, %	436	100	Target was met
IC, S m <sup>-1</sup>	6.0 <sup>a</sup>	5.0 <sup>a</sup>	Target was met
ASR, $\Omega$ cm <sup>2</sup>	0.27	0.07	Increased degree of chloromethylation; Thickness reduction



IC vs time at 30 °C in demineralised water

# Project Progress: Cell performance



### CENmat's proprietary:

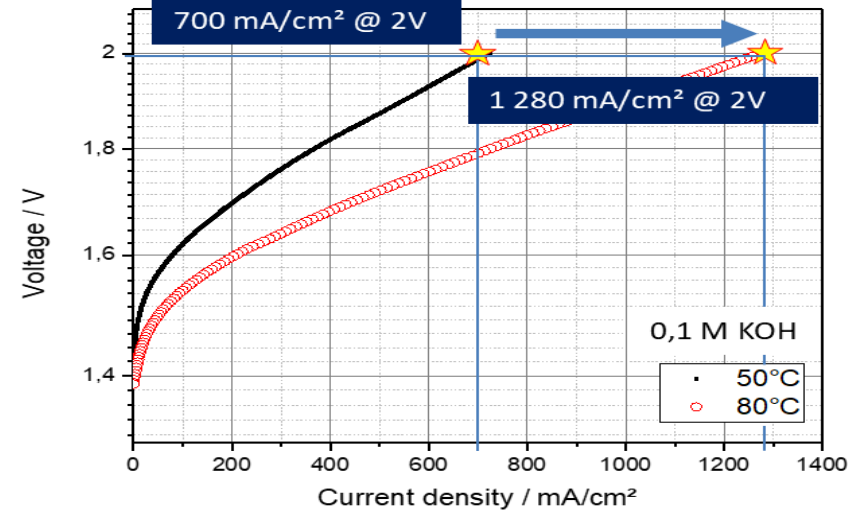
- Highly active and durable CRM-Free catalyst (OER & HER) &
- Low cost component and cell design

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25%

50%

75%

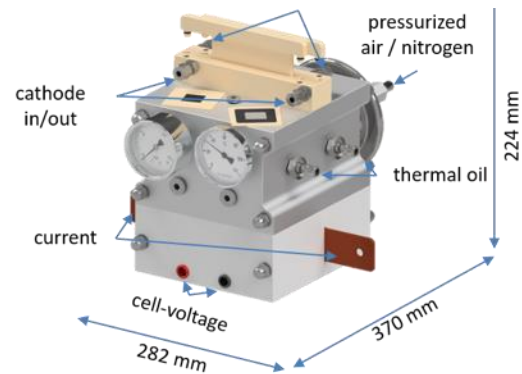


### All project materials:

- Highly active and durable CRM-Free catalyst (OER & HER)
- Project membrane and ionomer

# Project Progress: Demonstrator stack

## Achievement to-date



### Single cell test system

- 25 cm<sup>2</sup> cell size
- ambient pressure
- up to 150 A @ 3 V
- useable for PEM/AEM

New design



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25%

50%

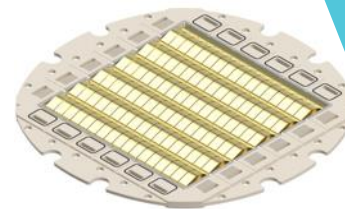
75%

2kW

### Test station for AEMWE

- 25 cm<sup>2</sup> / 200 cm<sup>2</sup>
- resin water / KOH
- option for NEWELY Stack

results



### New AEMWE stack

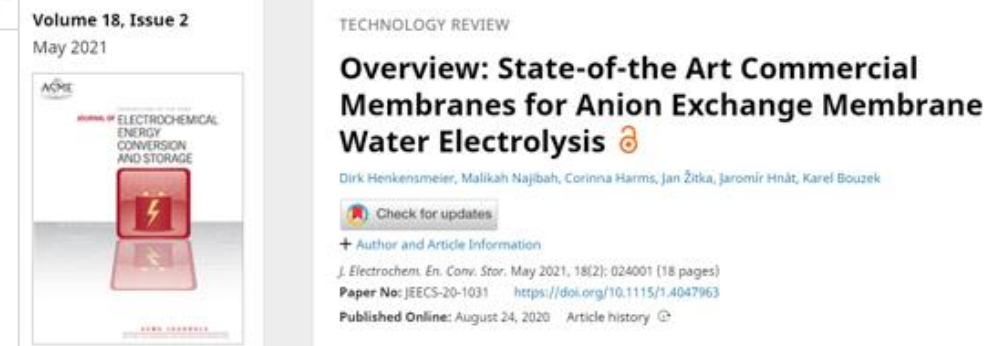
- 5 cells
- 200 cm<sup>2</sup>
- 1 A/cm<sup>2</sup> @ 2 V
- Up to 2 kW
- 40 bar

# Scientific publications

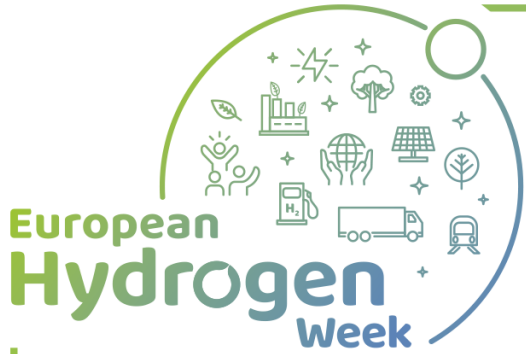
1) Najibah, M., Tsoy, E., Khalid, H., Chen, Y., Li, Q., Bae, C., ... & Henkensmeier, D. (2021). PBI nanofiber mat-reinforced anion exchange membranes with covalently linked interfaces for use in water electrolyzers. *Journal of Membrane Science*, 119832.

2) Henkensmeier, D., Najibah, M., Harms, C., Žitka, J., Hnát, J., & Bouzek, K. (2021). Overview: State-of-the art commercial membranes for anion exchange membrane water electrolysis. *Journal of Electrochemical Energy Conversion and Storage*, 18(2), 024001.

3) Aili, D., Yang, J., Jankova, K., Henkensmeier, D., & Li, Q. (2020). From polybenzimidazoles to polybenzimidazoliums and polybenzimidazolides. *Journal of Materials Chemistry A*, 8(26), 12854-12886.







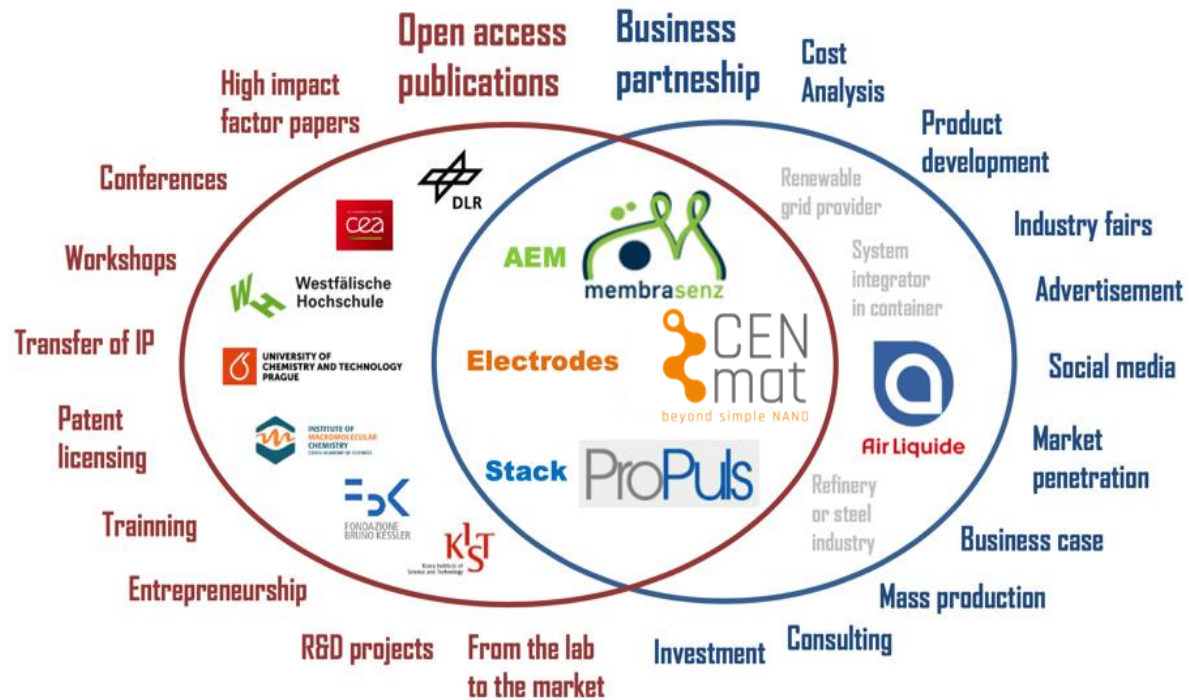
# Risks, Challenges and Lessons Learned

## Major risk for project progress:

- Covid-19 effects with partial laboratory shutdowns, travel restrictions
- Work much less efficient
- However some countries (e.g. Korean partner) less affected

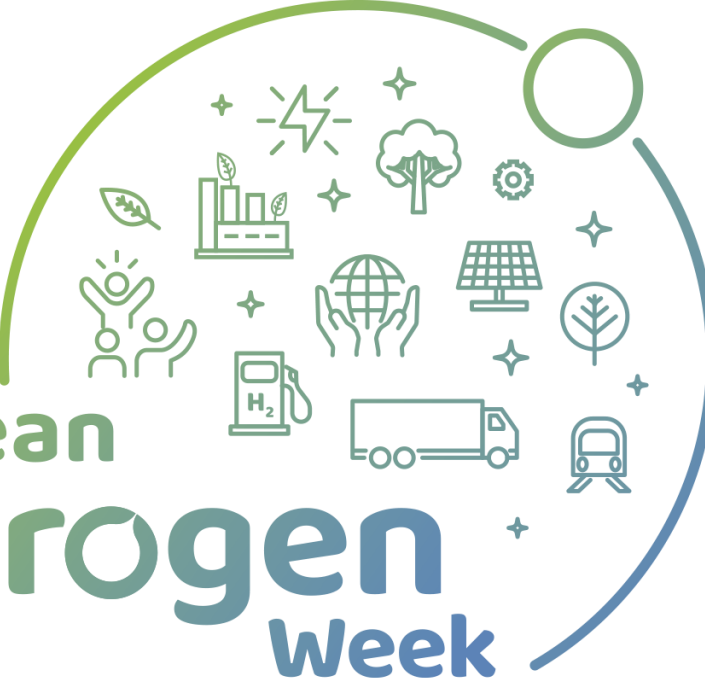
# Exploitation Plan/Expected Impact

## Exploitation



## Impact

- Game-changer electrolyser
- No PGM materials → no supply problems
- Low cost
- Increase EU competitiveness in production of green hydrogen



**European  
Hydrogen  
Week**

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