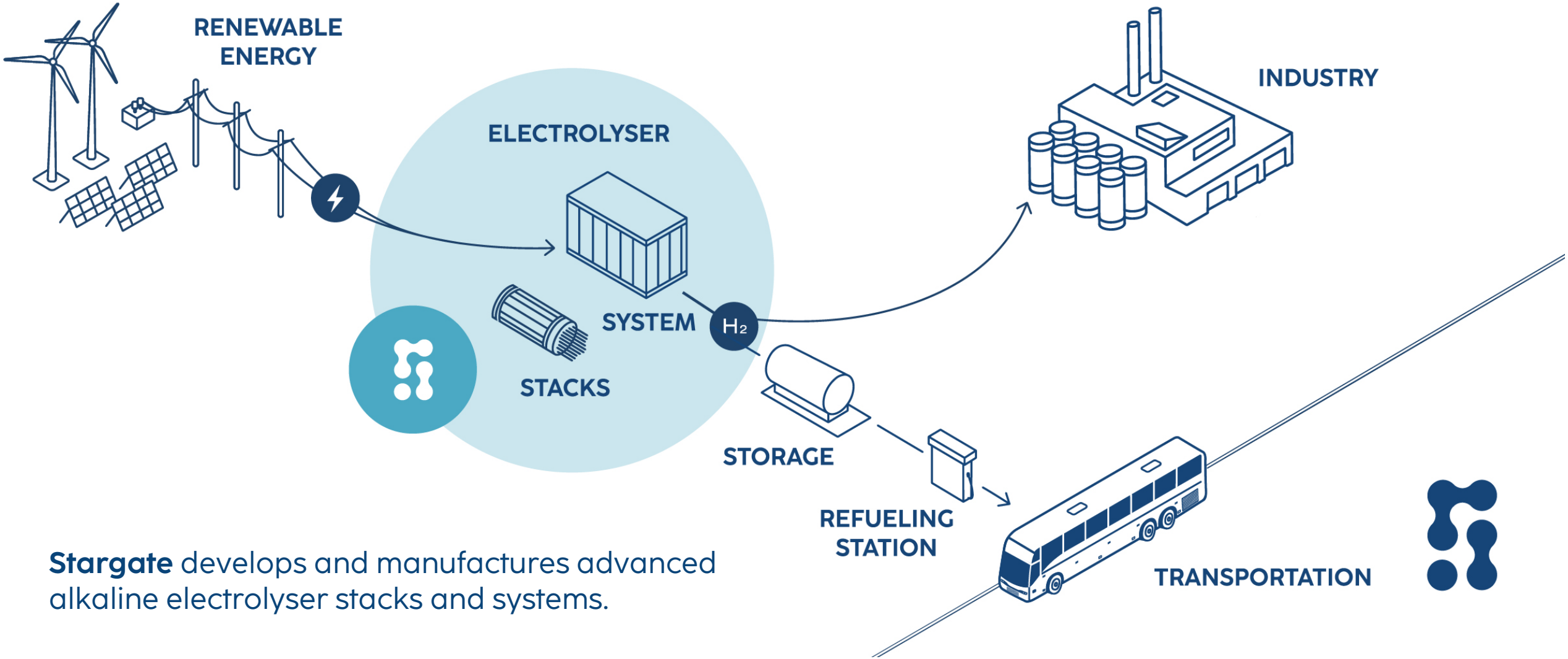
Alkaline electrolysis technology development at **Stargate Hydrogen**

Stargate Hydrogen in brief



Stargate develops and manufactures advanced alkaline electrolyser stacks and systems.

Stargate Hydrogen in brief

Rapidly growing company
with a headcount of **50+** people

Gender balance: **42%-58%**
Nationalities: **14**

Important Project of Common European Interest (IPCEI)
Patents pending: **7**

PhD: **7**
Masters: **31**

Two approaches

Rely on legacy technology

Focus on increasing manufacturing capacity

Two approaches

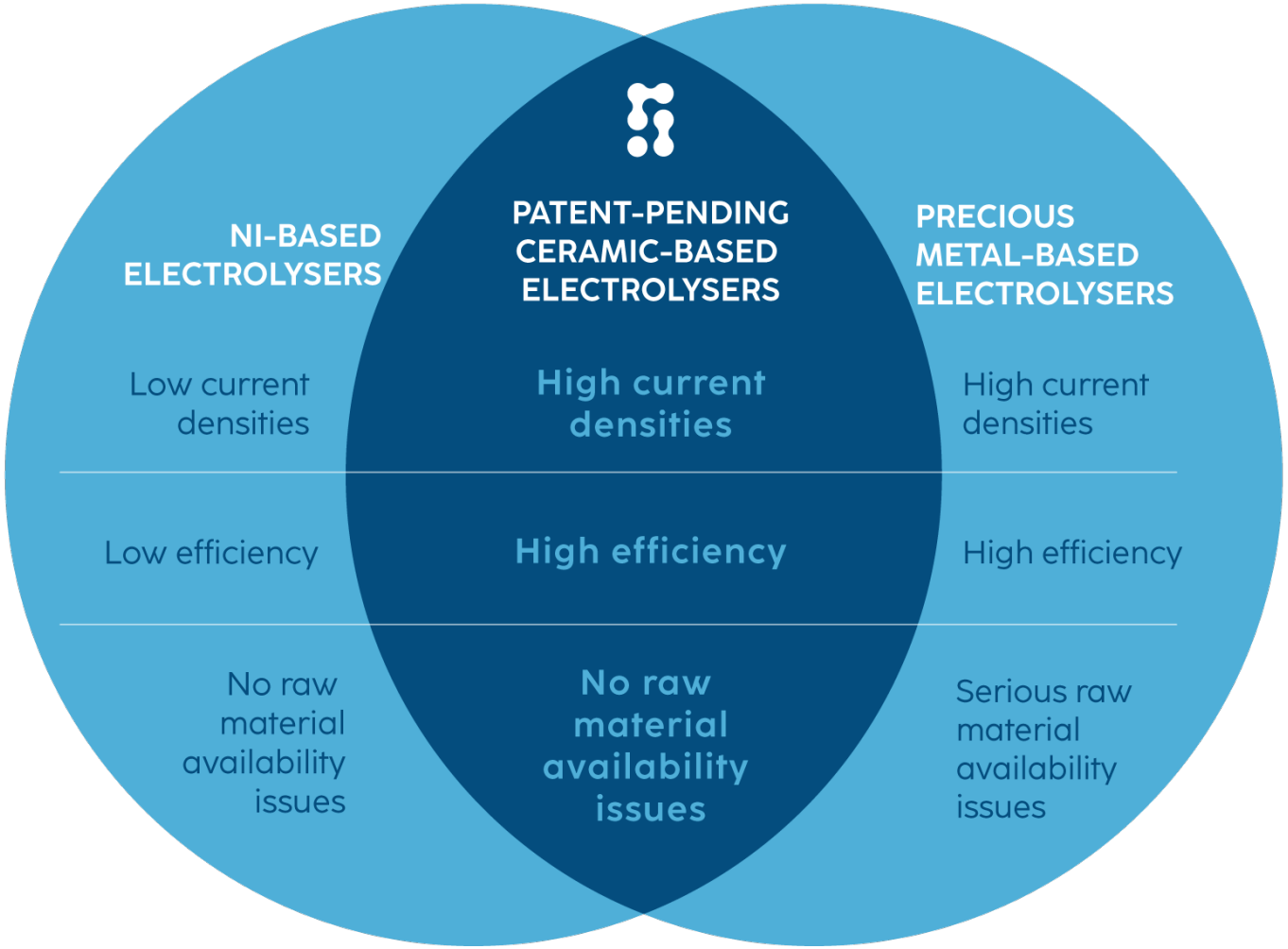
Rely on legacy technology

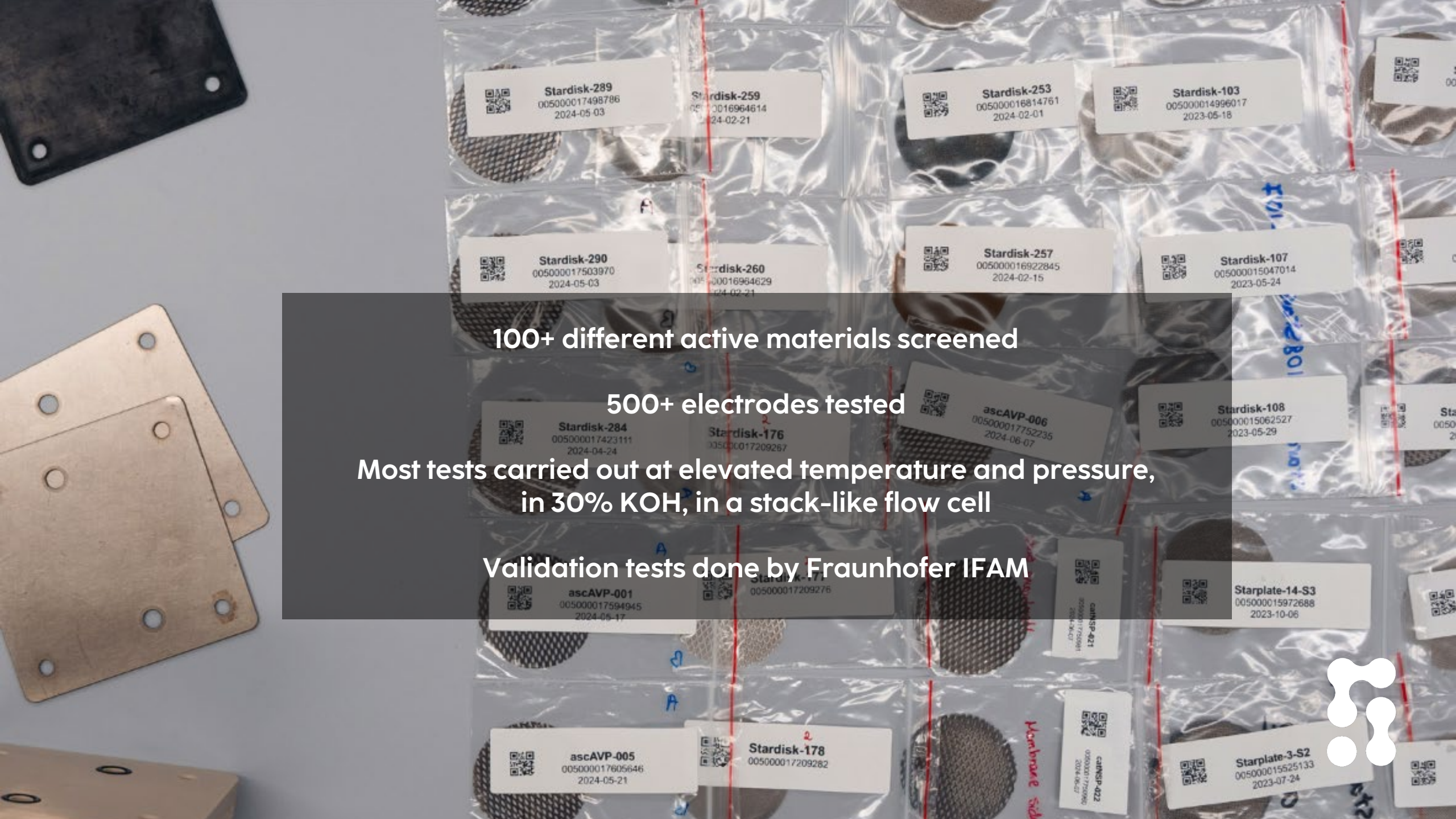
Focus on increasing manufacturing capacity

Develop new solutions relying on recent scientific advances

Focus on improved performance before scale-up

Beyond **state-of-the-art** technology





100+ different active materials screened

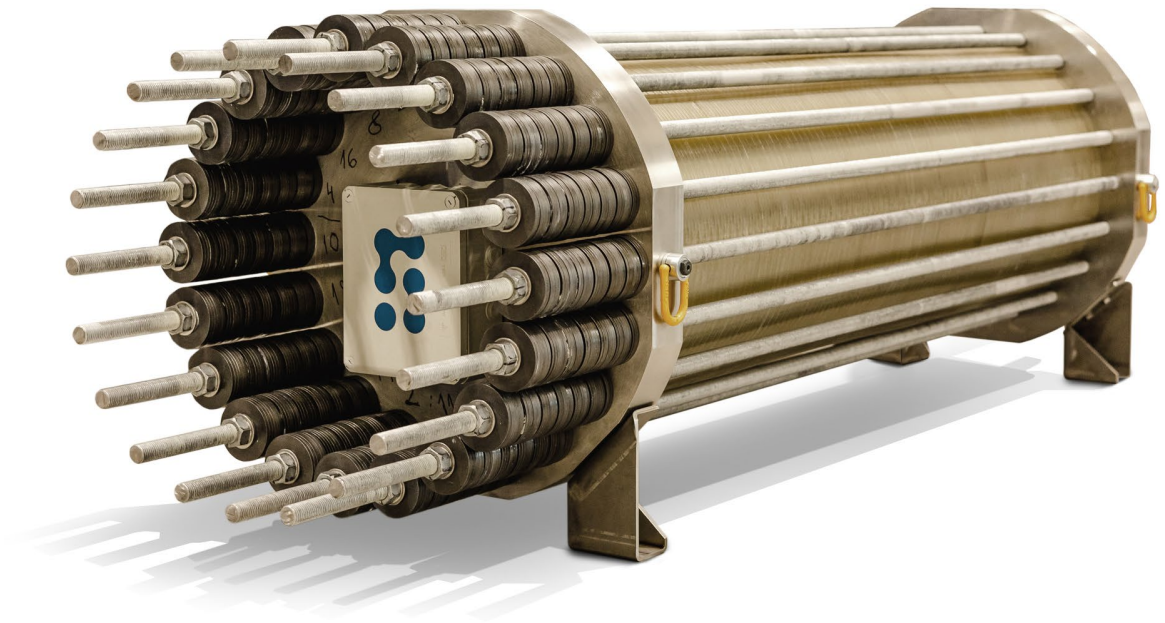
500+ electrodes tested

Most tests carried out at elevated temperature and pressure, in 30% KOH, in a stack-like flow cell

Validation tests done by Fraunhofer IFAM

stellar
SERIES

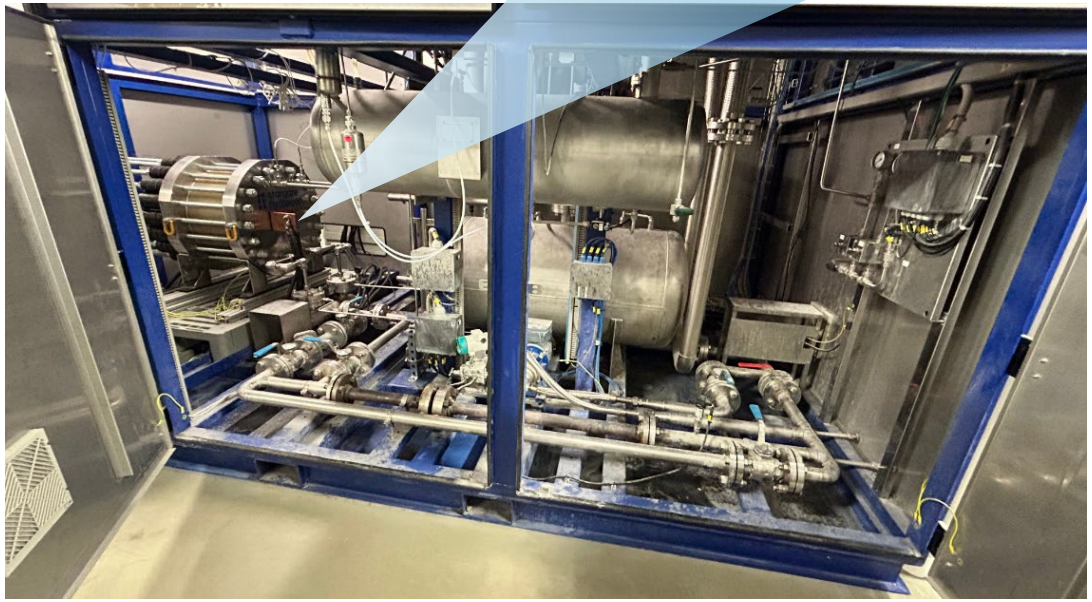
Alkaline electrolyser stacks for system integrators



- Improved stack robustness
- 100 Nm^3/h hydrogen production
- Six-month delivery time
- Comprehensive integration support

Independent performance validation of Stargate Gen1 stack

Stargate Stellar 10 stack has undergone performance testing at **ZSW**,
Zentrum für Sonnenenergie und Wasserstoff-Forschung Baden Württemberg,
an independent electrolysis test center near Stuttgart, Germany.



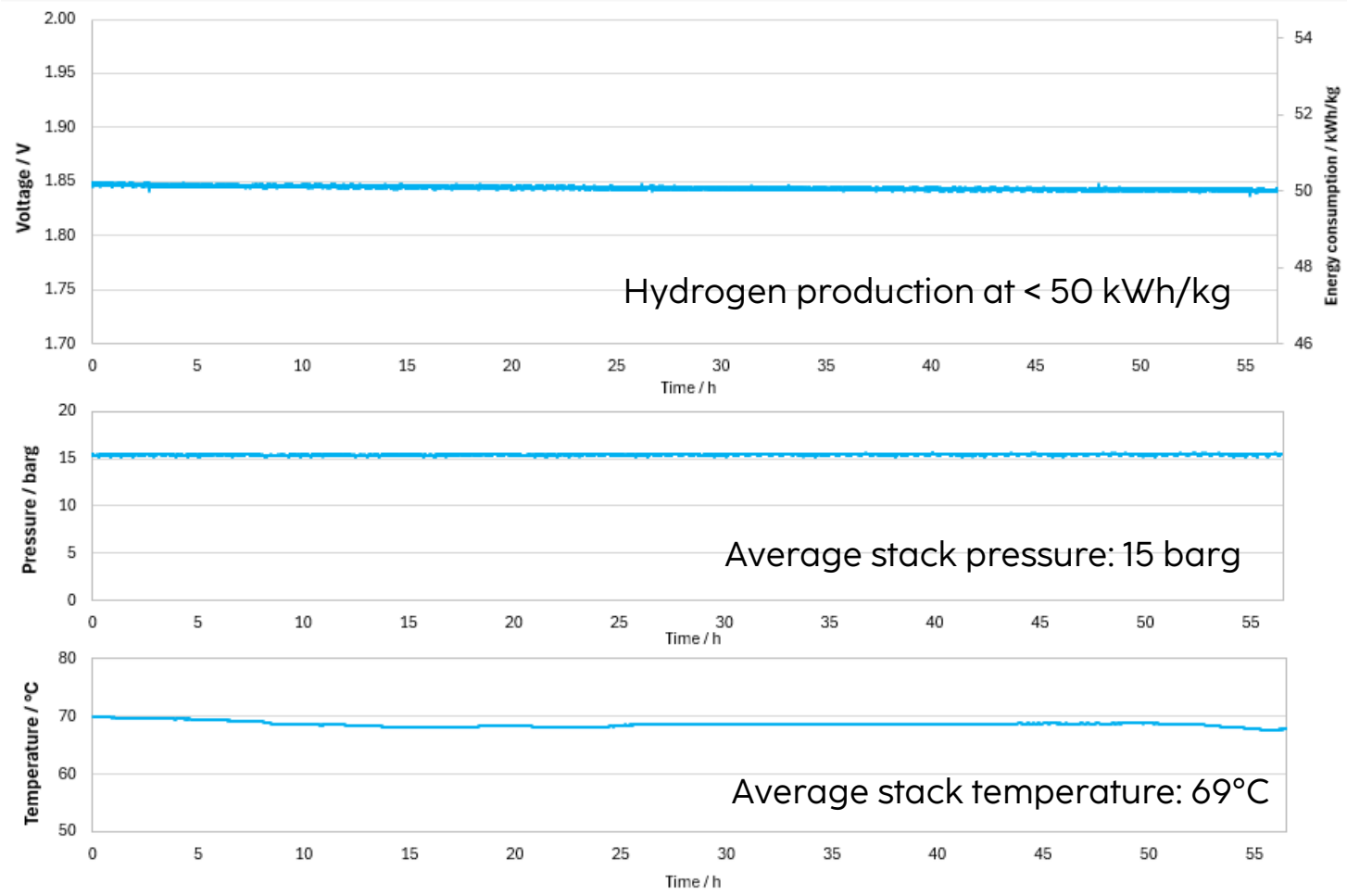
Stable stack operation

The stack was subjected to a short-term durability test of 56 hours.

Stack performance was within specifications.

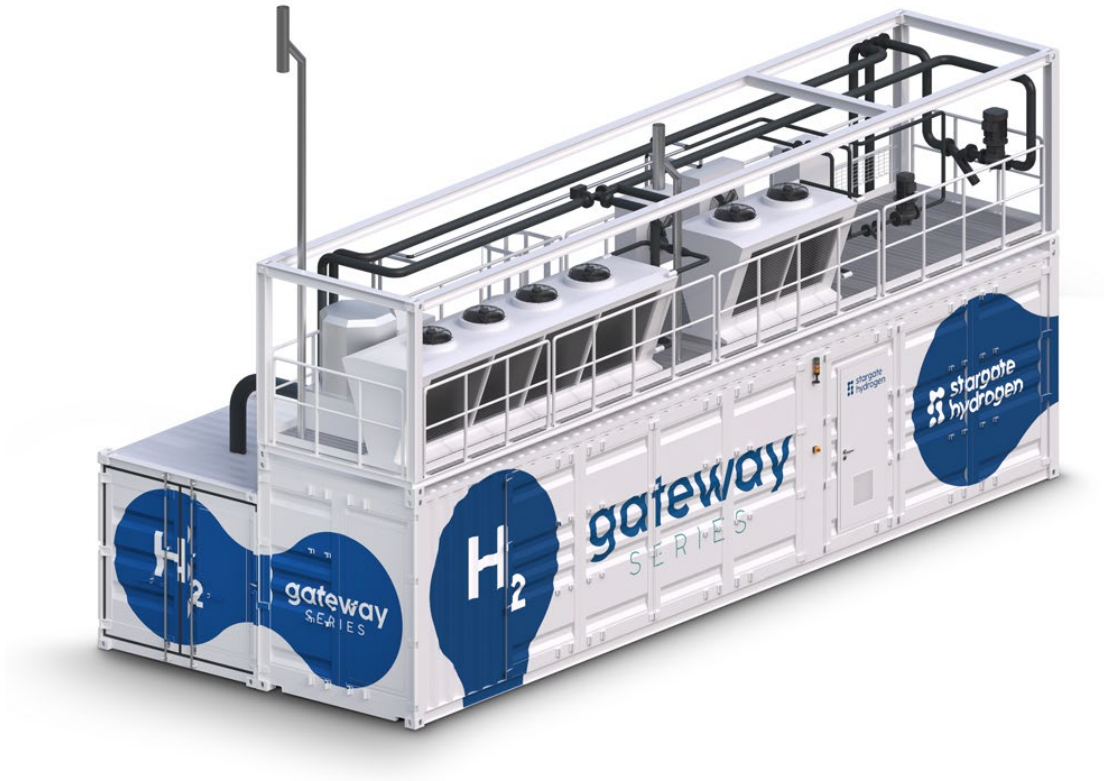
Slight activation of stack performance was observed during the test, while stack pressure and temperature remained stable.

Total test time at ZSW was 160 hours during which the stack did not show any signs of degradation.



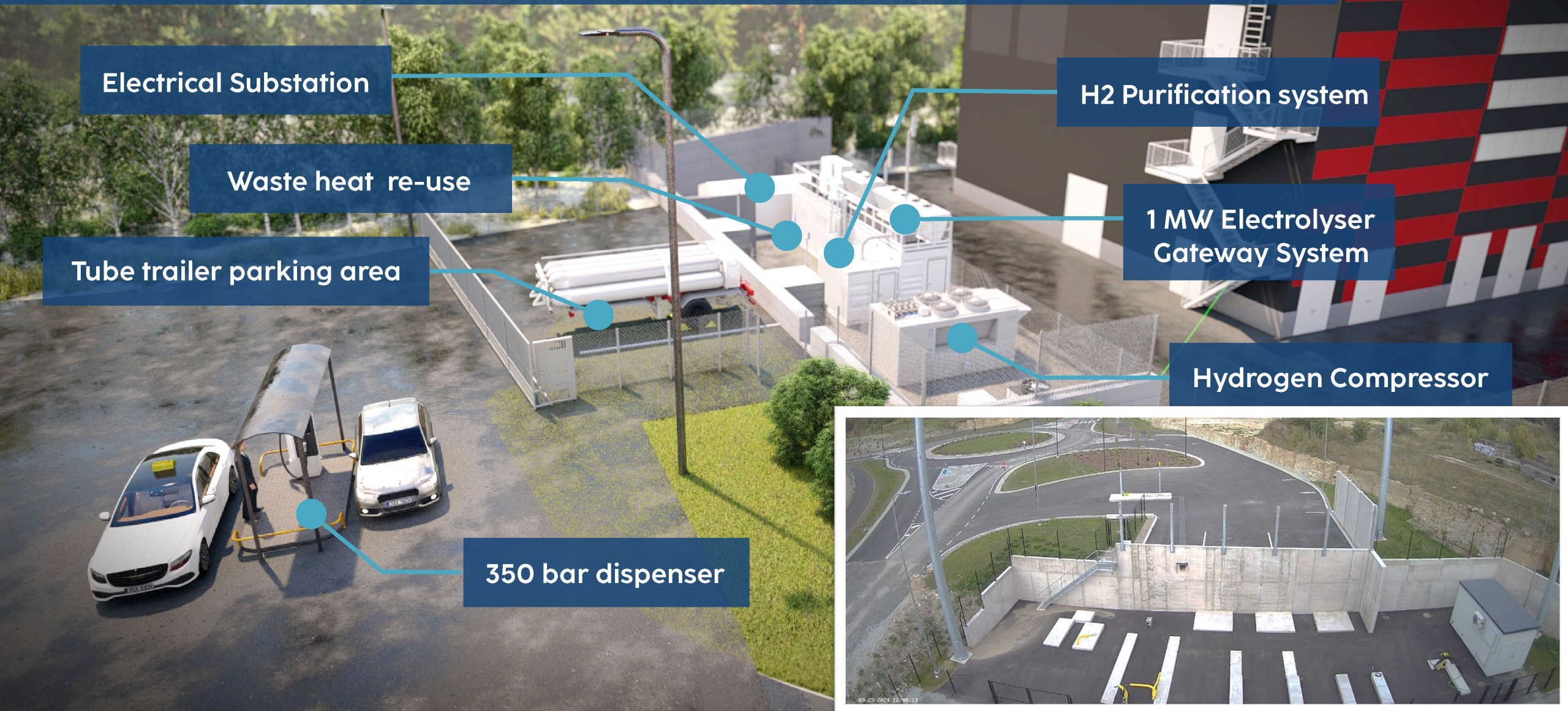
gateway
SERIES

Containerised alkaline electrolyser systems



- Modular approach: 1 MW container
- System efficiency of 74% HHV
- Low CAPEX
- Suitable for direct integration with renewables

Full value chain demo of green hydrogen production



Projects and partnerships

Commercial partners

ABB · fortum · ROCKFIN · MILANI SPA IMPIANTI ELETTRICI E TECNOLOGICI

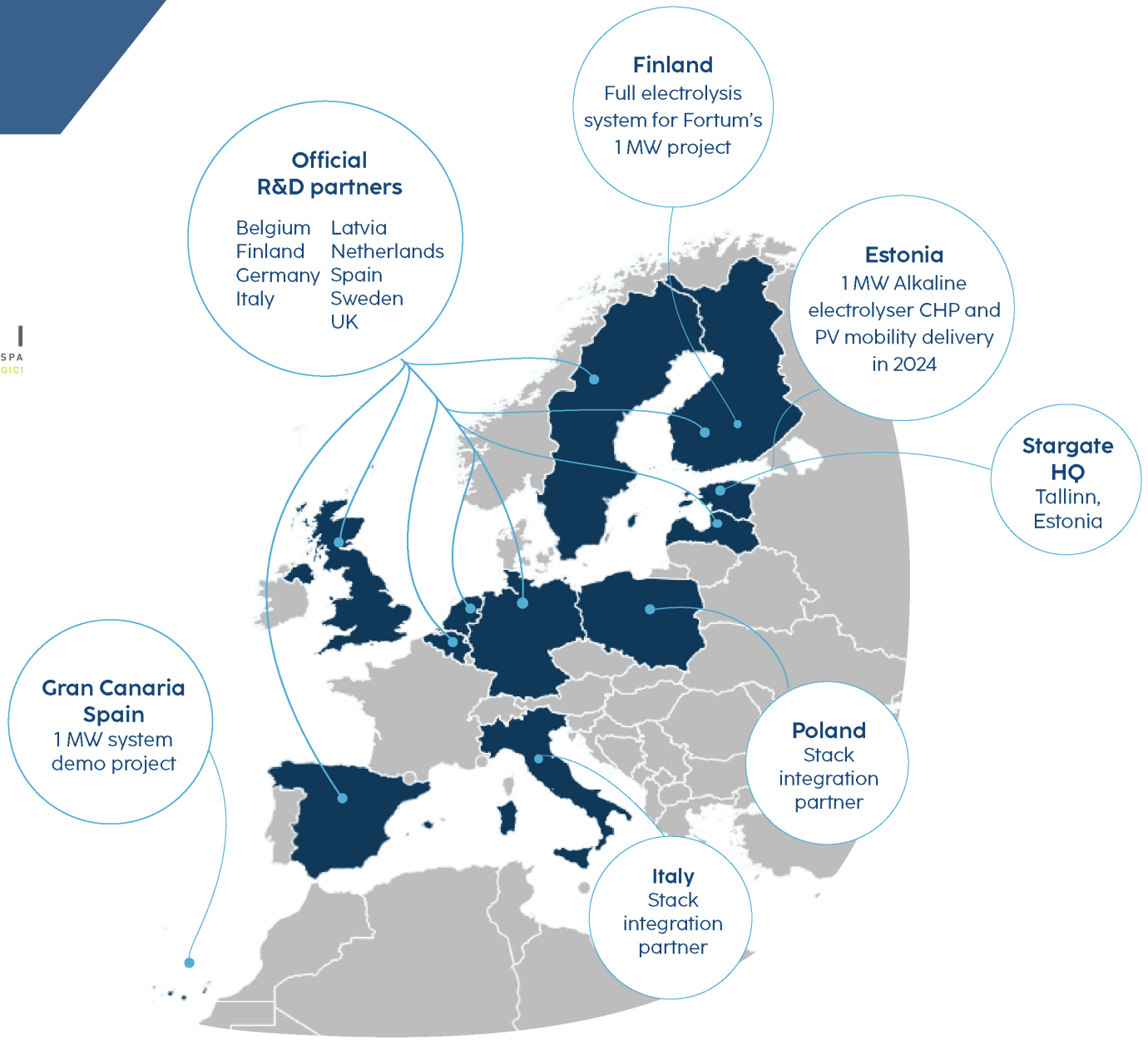
Biga H_2 · NextHeat · ADELE HYDROGEN

R&D partners

University of St Andrews · TAL TECH · Tartu Ülikool 1632 University of Tartu · Fraunhofer IFAM

AGFA · PLOCAN Plataforma Oceánica de Canarias · enel Green Power · TU/e Eindhoven University of Technology

Ha Foundation for the Development of New Hydrogen Technologies in Aragon · VTT · ZSW · PERMASCAND



EXSOTHyC

Start: 01/01/2024
Duration: 36 months
Budget: €3 M

Exsolution-Based Nanoparticles for lowest cost green hydrogen via electrolysis

Scope: EXSOTHyC will optimise electrolyser operation towards lower voltages and higher efficiencies.

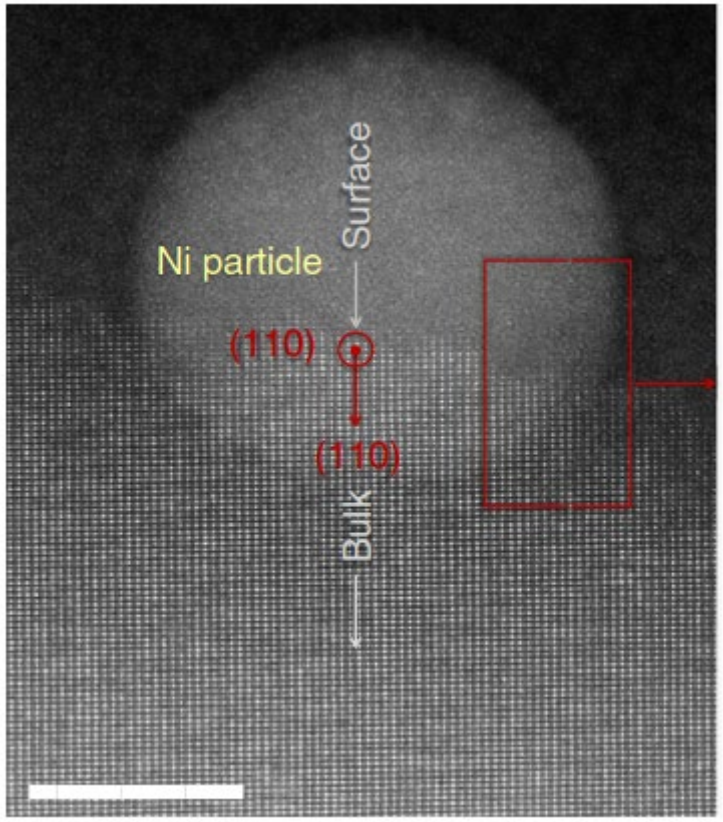
Innovations involve:

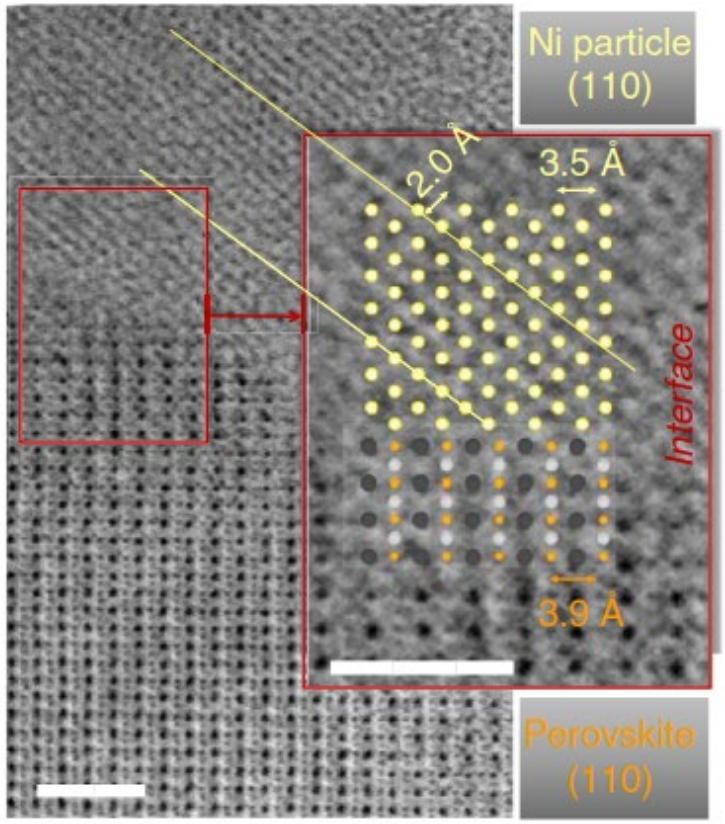
- Uniform 3D coating of substrates with a catalyst
- Electrode structure based on ceramic catalyst particles bonded to the high porosity metallic substrates
- Integration of electrochemically active exsolution materials into electrode structures

stargate hydrogen
Fraunhofer
University of St Andrews
AGFA
Agfa
TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

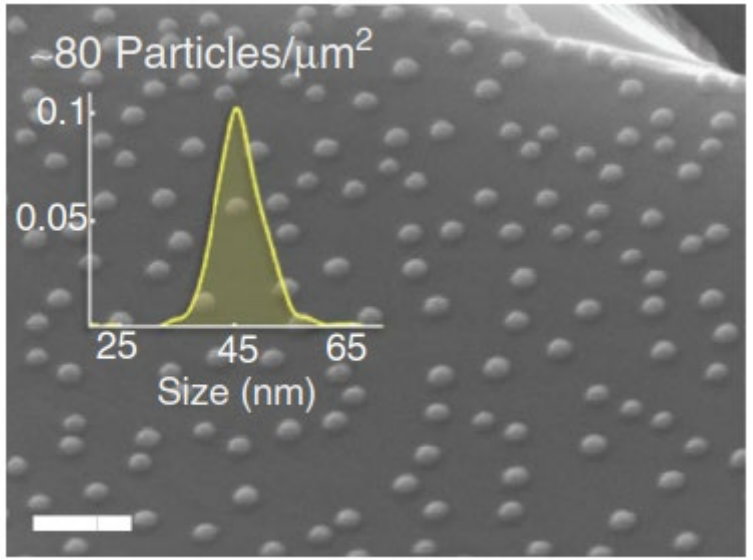
Clean Hydrogen Partnership

EXSOTHyC





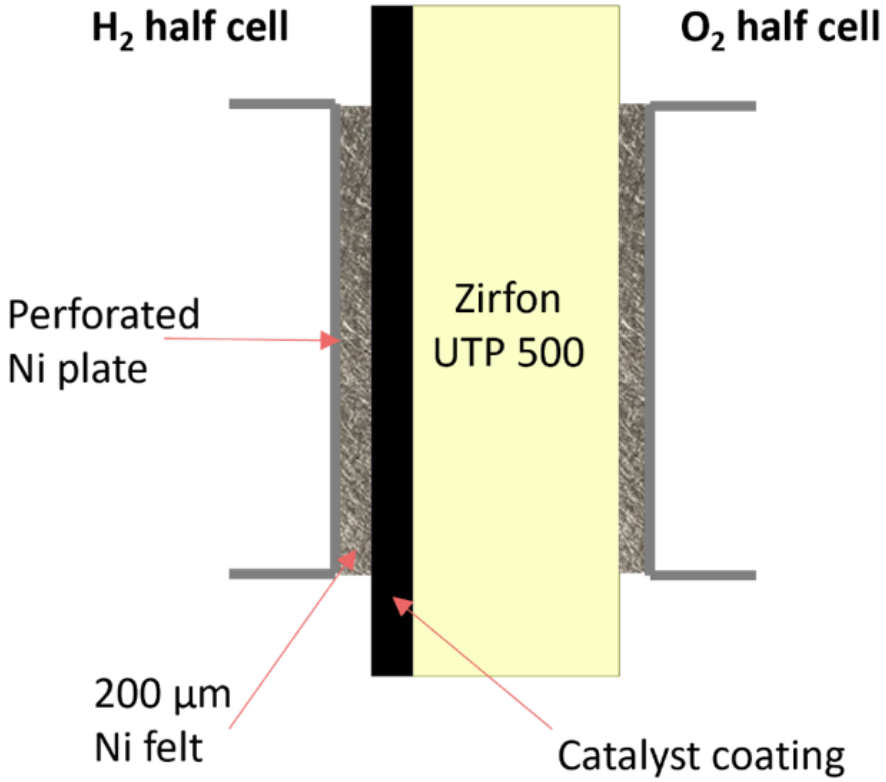
University of St Andrews

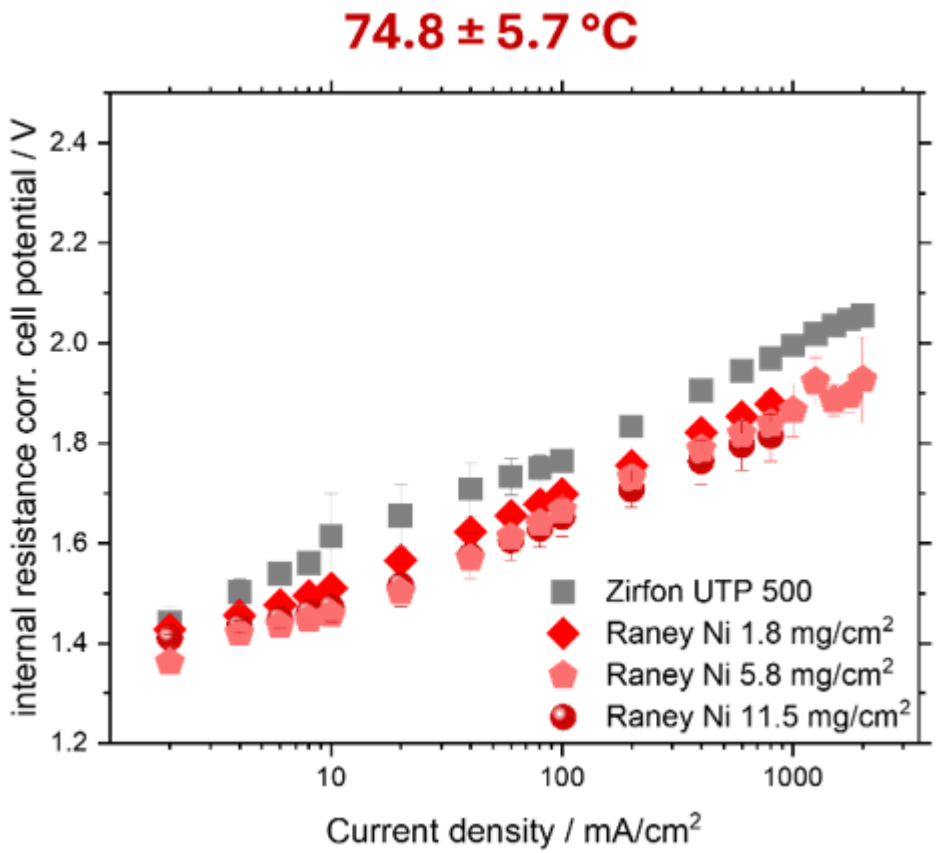


Neagu *et al.*, *Nature Communications*, doi:10.1038/ncomms9120

EXSOTHyC

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY





Demnitz *et al.*, *International Journal of Hydrogen Energy*, in review.

ENDURE

Start: 01/01/2024
Duration: 36 months
Budget: €2.5 M

Alkaline Electrolysers with enhanced durability

Scope:
A PGM-free alkaline electrolyser stack with PEM-like performance and low degradation rate will be developed within a Stargate coordinated Hydrogen Europe project ENDURE (GA:101137925)

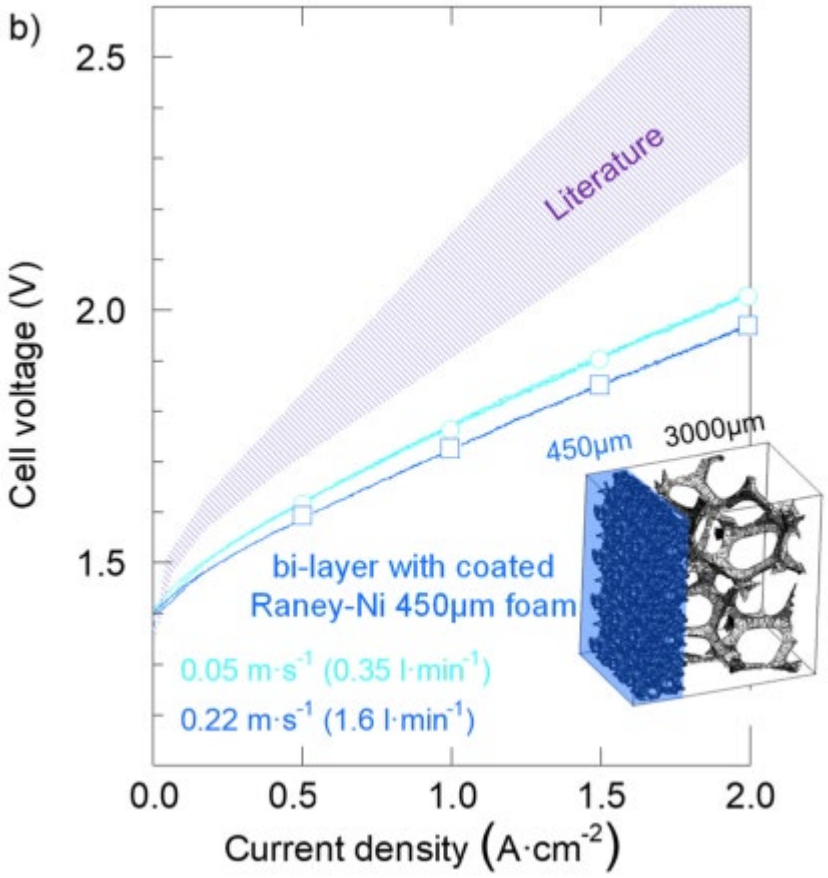
Innovations involve:
- Monolithic porous transport electrodes
- Multi-level computational fluid dynamics modelling
- Novel PGM-free high performance electrocatalysts
- Stack-level improvements and performance validation (100 and 1000 cm^2) stack platforms
- Benchmarking with state-of-the-art and accelerate tests

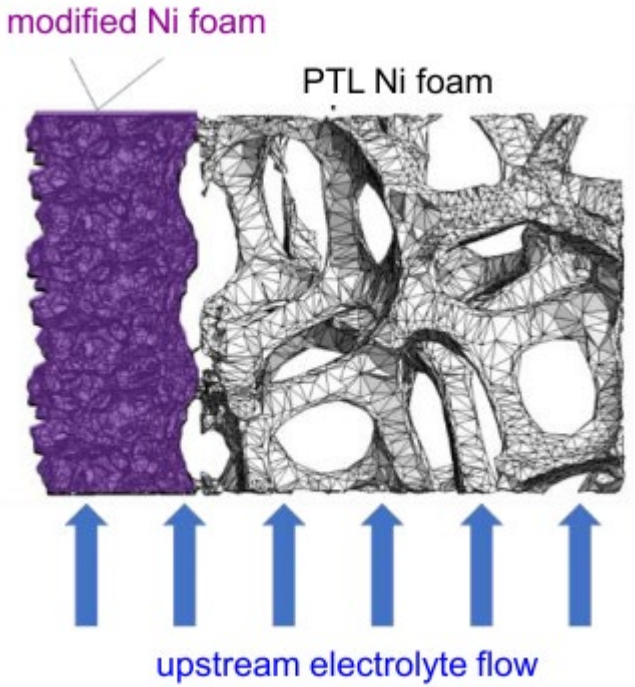
stargate hydrogen
Fraunhofer
UCLouvain
ZSW
PERMASCAND

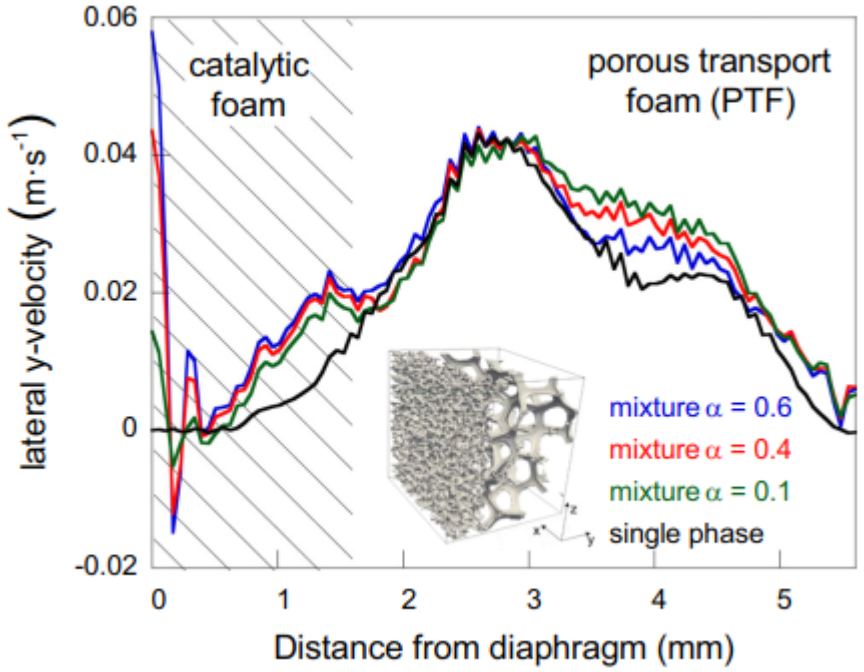
Clean Hydrogen Partnership

ENDURE

UCLouvain







Rocha *et al.*, *Nature Communications*, doi: 10.1038/s41467-024-51704-z

We are scaling up

Thank you!

Scan the QR code to visit our website.

Rainer Küngas

+372 555 78 270

rainer.kungas@stargatehydrogen.com