HyScaling

Public progress report 2nd year

June 2023

RVO project nr. MOOI 42010
MOOI regeling 2020: Industrie, Toepasbaar maken van waterstofproductie vanuit elektriciteit

Institute for
Sustainable
Process Technology

Project: HyScaling

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Het project is uitgevoerd met Topsector Energie subsidie van het Ministerie van Economische Zaken en Klimaat, uitgevoerd door Rijksdienst voor Ondernemend Nederland. De specifieke subsidie voor dit project betreft MOOI-subsidie ronde 2020.

1. Summary and partners

1.1 Goal of the project and starting points

The need to produce green hydrogen as a feedstock and as energy carrier is large and urgent in The Netherlands. Nowadays, hydrogen is made from natural gas (a fossil fuel) by steam reforming. Green hydrogen can be made by electrolysis of water from renewable energy sources. However, to make the large amount of hydrogen which is needed, the capacity for producing electrolysers must be enlarged. Moreover, costs of producing hydrogen, using electrolysers must be strongly reduced to increase its competitiveness in the energy sector.

29 innovative companies, SMEs, CRO's have joined forces in the Hyscaling project.

The specific objective of HyScaling is to achieve 25-30% cost reduction for levelized cost of hydrogen compared to the state-of-the-art by bringing the HyScaling innovations to full implementation and roll-out by 2030. Within HyScaling, novel hardware, low-cost manufacturing processes, optimised integrated system designs and advanced operating and control strategies are developed that all contribute to the overarching target. In addition, HyScaling aims to establish a Dutch electrolyser industry. More than half of the consortium partners aim to enter the market by turning their innovations into products.

HyScaling concrete deliverables are assembled into six main results:

1. **Use cases:** 4-5 use cases are fully expanded, with scope, technology baseline and cost-models to assess progress beyond state-of-the-art and cost reduction potential.
2. **Component and stack performance optimisation:** identification of the best performing innovative components and materials for alkaline and PEM electrolysis – focused on performance and manufacturability.
3. **Advanced Alkaline Electrolyser development:** use-case focused optimised novel components, stack designs for increased manufacturability and innovative system designs reaching 25% lower cost of hydrogen in 2030.
4. **Advanced PEM Electrolyser development:** novel membranes, electrodes, catalysts for higher performance and durability, advanced stack and system designs leading to a 30% lower cost of hydrogen in 2030.
5. **Validation @scale:** performance and scalability of innovations demonstrated in full-stack prototypes for alkaline and PEM at TRL 6.
6. **Action plan:** analysis of public support, human capital, legal, barriers and identification of robustness of the supply chains and business cases result in *Action Plans* towards full roll-out and implementation by 2030.

Characterisation procedures and accelerated stress tests to address a lack of benchmarking tests for electrolyser components

Development and testing of a kW range alkaline stack and an alkaline stack suitable for large-scale (to be tested at the Hydrohub)

Experimental validation of selected novel PEM components tested at the Hydrohub in the available full-scale PEM test stack

1.2 Project partners

1) Stichting ISPT (administrator) - *Amersfoort*
2) Brabantse Ontw. Mij.. - BOM Business Development & Foreign Investments B.V.- *Tilburg*
3) Borit N.V. – *Geel (B)*
4) Brainport Development NV - *Eindhoven*
5) Danieli Corus B.V. – *Velsen-Noord*
6) Powall – *Delft*
7) DotX control Solutions BV - *Haarlem*
8) EnTranCe, Centre of Expertise Energy, HanzeHogeschool Groningen - *Groningen*
9) Vereniging FME - *Zoetermeer*
10) Frames Group BV / Plug Power – *Alphen aan den Rijn*
11) Fraunhofer Institute IPT – *Aachen (D)*
12) GreenBergTraurig LLP - *Amsterdam*
13) HyCC B.V. - *Amersfoort*
14) IHI Hauzer Techno Coating B.V. - *Venlo*
15) Ionbond Netherlands B.V. - *Venlo*
16) Magneto Special Anodes B.V. - *Schiedam*
17) MTSA Technopower B.V. - *Arnhem*
18) MX Polymers B.V. *Wageningen*
19) SALD B.V. - *Eindhovem*
20) Stichting S-ISPT - *Amersfoort*
21) Teijin Aramid B.V. - *Arnhem*
22) TNO – *Delft, Petten*
23) TU Eindhoven - *Eindhoven*
24) TU Delft - *Delft*
25) VDL Energy Systems B.V. – *Hengelo (Ov.)*
26) VECO B.V. - *Eerbeek*
27) VONK EUA B.V. - *Zwolle*
28) VSL B.V. - *Delft*
29) ZEF B.V. - *Delft*

The advisory board of the HyScaling project gives high-level guidance and feedback. The members are: Randolf Weterings (Port of Rotterdam), Ulco Vermeulen (Gasunie), Anne Mieke van der Werf (InvestNL), Jelle Blekxtoon (FME), Ad van Wijk (TU Delft), Mark Boneschanscher (TU/e), Michèlle Prins (Natuur & Milieu).

2. Activities performed in year 2, results, obstacles and perspectives for application

In the second project year, technical activities focused on performance and duration testing of novel materials for both alkaline and PEM water electrolyser systems.

Coupled to use cases, which were set up in the first project year, studies have been executed related to human capital assessment, solutions for grid congestion and the legal framework created by CBAM regulations.

2.1 Executed activities

1. Novel alkaline water electrolyser materials and components are investigated and tested.
2. Novel PEM water electrolyser materials and components are investigated, optimized and tested, including a fluor-free membrane.
3. The cost models for both an alkaline water electrolyser system and a PEM water electrolyser system are adopted and verified with information available at partners. Next step is to combine it with the performance model.
4. Design of an optimized small scale alkaline water electrolyser stack.
5. Design of an optimized large scale alkaline water electrolyser stack.
6. Advanced design of sub-systems (balance of plant) for a small-scale alkaline electrolyser system.
7. Review results operational PEM unit and take the lessons learned and improvements possibilities into account to optimize the advanced PEM design also related to the use cases.
8. Start study autonomous operation water electrolysers
9. Several studies related to the use cases

2.2 Results

1. Insights were obtained regarding new materials (substrates) and components (coatings) for alkaline water electrolyser application. Further testing is to be done to confirm stable material properties and required performance.
2. Novel materials and components (Coated BPP and PTL, Ir loading and F-free membrane) for PEM water electrolysers have shown their potential. Validation tests at larger scale still to be done to verify durability, performance and confirm commercial attractivity.
3. Optimized cost model for AWE and PEM allowing calculations at system level and component level.
4. Set up and publication of a roadmap of the measuring requirements for green hydrogen production by electrolysis.
5. Workshop held and publication made about possible solutions for grid congestion in The Netherlands.

Knowledge exchange in the various result area's supports the acceleration of technology development and in depth understanding of each other challenges amongst the partners.

2.3 Obstacles

It will be necessary to update techno-economic evaluations for the changes in prices and regulations in the third project year. Data are scarce and calculations strongly depend on assumptions.

Delay in starting up water electrolyser systems is still common, including the HydroHub MegaWatt Test Centre. It impacts the availability of testing possibilities and therefore alternative testing possibilities are worked out to execute the required tests in line with the HyScaling project requirements.

2.4 Perspectives for application

Knowledge about stack design and characteristics of materials and components will be applied for future stacks.

3. Contribution of the project to the MOOI Goals

The project directly contributes to the MOOI Goal for industry: To develop cheaper, climate-neutral and / or circular products, processes and services that will lead to a first market application in one of the industrial sectors in the Netherlands that is significant for the climate objective by 2030 at the latest.

More specific, it contributes to the subgoal: Making hydrogen production from electricity on a GW_e -scale applicable and enable its integration into production processes as feedstock and fuel for industrial processes, and its integration into the energy system.

4. Spin-off of the project within and outside the sector

VDL and MTSA have broadened their activities in the field of water electrolysers, partly based on insights gathered during this project.

An eco-system for a community of Dutch electrolyser suppliers is formed.

Many partners have contributed to the Dutch National Hydrogen Program.

Many partners have extended their activities in the field of water electrolysers and are participating in other research and development projects or in demonstrations.

A few partners are expanding their activities to the commercial market.

Publications about the project

Year 2

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ISPT regularly posts updates about HyScaling project activities on LinkedIn.