

# HyScaling

Public progress report 1<sup>st</sup> year

June 2022

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.*



## Summary and partners

### 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.

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.

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. In HyScaling novel hardware, low-cost manufacturing processes, optimized integrated system designs and advanced operating and control strategies are developed that all contribute to the overarching target.

HyScaling aims also to establish a Dutch electrolyzer industry. More than half of the consortium partners aim to enter the market by making their innovations into products.

HyScaling concrete deliverables are assembled into 6 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 optimization** – identification of the best performing innovative components and materials for alkaline and PEM electrolysis – focused on performance and manufacturability.
3. **Advanced Alkaline Electrolyzer development** – use-case focused optimized novel components, stack designs for increased manufacturability and innovative system designs reaching 25% lower cost of hydrogen in 2030.
4. **Advanced PEM Electrolyzer 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.
  - Characterization procedures and accelerated stress tests to address a lack of benchmarking tests for electrolyzer 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



## 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. Delft IMP B.V. - *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. - *Eindhoven*
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).



## Activities performed in year 1, Results, Obstacles and perspectives for application

In the first project year, activities focused on further exploration of possible innovations in the electrolyser technology, both alkaline and PEM. First milestones for June 2022 were: a) the set up of a framework (use cases and models) to evaluate innovations, b) aligned test methods, c) positive test results of innovations.

All activities contributed to these milestones or to milestones for the second and third project year.

### Executed activities

- 1) Set up of 5 use cases from supply of green electricity to the application of produced hydrogen at a customer.
- 2) Development of bottom-up cost model for PEMWE and AWE and start of integration with performance model.
- 3) Workshops hold with partners and other stakeholders to investigate measurement requirements and generate a roadmap.
- 4) Design and alignment of standard testing method for AWE cells
- 5) Set up of accelerated test protocol and benchmarking for PEM components
- 6) Performance and stability tests of innovative AWE electrode materials executed (>10 variations)
- 7) Innovative materials for PEMWE MEA developed and/or tested.
- 8) Inventory of obstacles for the development of the electrolyser market in The Netherlands by interviewing partners and literature study
- 9) Needs and status determined for legal aspects, public perception, human capital by internal meetings and literature study.

### Results

By setting up the use case descriptions and the integrated models, story lines are developed which are reference points for all partners to evaluate impact of innovations.

Aligning test methods, testing novel components and detailed discussions about results and experiences gave insights for optimized designs for both AWE and PEMWE.

Knowledge exchange has supported the acceleration of technology development by the partners and an eco-system for the development of a Dutch suppliers community is formed.

It is expected that several findings in the project will be part of future electrolyser systems.

### Obstacles

The world economy is changing rapidly, influencing both costs of materials used in electrolysers and feed-stock and fuel prices. It will be necessary to update techno-economic evaluations during the project for these changes.



World-wide logistic problems and difficulties in recruiting personnel slows down some project activities.

### **Perspectives for application**

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

Application of novel materials and other innovations will depend on results of tests scheduled in the second and third project year.

## **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  $\text{GW}_e$ -scale applicable and enable its integration into production processes as feedstock and fuel for industrial processes, and its integration into the energy system.

## **Spin-off of the project within and outside the sector**

No specific commercial spin-offs of the project yet.

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 the development of a Dutch electrolyser suppliers community is formed.



## Publications about the project

- 1) ISPT Project page: <https://ispt.eu/projects/hyscaling-establishing-a-dutch-electrolyzer-industry/>
- 2) ISPT News 1 July 2021: <https://ispt.eu/news/hyscaling-green-hydrogen-as-an-economic-perspective/>
- 3) TNO website: <https://www.tno.nl/nl/aandachtsgebieden/energietransitie/roadmaps/co2-neutrale-industrie/waterstof-voor-een-duurzame-energievoorziening/optimalisatie-productieproces-waterstof/waterstofproductie-het-economisch-perspectief-nederlandse-maakindustrie/>
- 4) TNO website: <https://www.tno.nl/nl/aandachtsgebieden/energietransitie/roadmaps/co2-neutrale-industrie/waterstof-voor-een-duurzame-energievoorziening/optimalisatie-productieproces-waterstof/waterstofproductie-het-economisch-perspectief-nederlandse-maakindustrie/>
- 5) Voltachem news: <https://www.voltachem.com/news/hyscaling-establishing-a-dutch-electrolyzer-industry-for-the-next-level-of-green-hydrogen-production>
- 6) Agro-Chemie: <https://www.agro-chemie.nl/nieuws/tno-en-ispt-bouwen-aan-duurzame-waterstofketen/>
- 7) Kiemt: <https://www.kiemt.nl/nieuws/sleutelrol-met-hyscaling-programma/>
- 8) MTSA website: <https://www.mtsa.nl/nl/hyscaling-green-hydrogen-as-an-economic-perspective/>
- 9) Alles over waterstof: <https://allesoverwaterstof.nl/hyscaling-project-gaat-voor-duurzame-en-goedkope-waterstof/>
- 10) Presentation Andreas ten Cate, seminar Energy Port Zeeland (25 november 2021): <https://www.pc-nsp.com/nl/nieuws/380-webinar-grensoverschrijdende-samenwerking-in-de-wind-in-zicht>
- 11) Publication Learning Communities: [https://chemistrynl.com/wp-content/uploads/2022/02/Overzicht-stand-van-zaken-rond-Industriële-Learning-Communities\\_Sept2021.pdf](https://chemistrynl.com/wp-content/uploads/2022/02/Overzicht-stand-van-zaken-rond-Industriële-Learning-Communities_Sept2021.pdf)
- 12) Interview partner: <https://innovationorigins.com/nl/nederland-exportland-voor-elektrolyzers-maar-dan-moeten-we-wel-gas-geven/>

ISPT regularly posts updates about HyScaling project activities on Linked-In.