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OUTFOX

OPTIMISED UP-SCALED TECHNOLOGY FOR NEXT-GENERATION SOLID OXIDE ELECTROLYSIS

Newsletter 1 - October 2023

Welcome!

Welcome to the first newsletter of the OUTFOX project! The OUTFOX project officially kicked off in February this year and has since been working towards realizing two demonstrators with the capacity of 80 kW by 2027.

OUTFOX's primary objective is to remove the scale restriction in the implementation of Solid Oxide Electrolysis (SOEL) technologies and showcase their potential as the preferred method for generating green hydrogen. By integrating experimental findings up to the 80 kW scale and identifying optimal cell and system designs, OUTFOX aims to prepare SOEL for large-scale industrial systems exceeding 100 MW. This will be achieved with a reduced Levelized Cost of Hydrogen of €2.7 per kg H₂ and suitability for mass manufacturing lines.

Throughout the project's duration, we will regularly distribute newsletters to keep you informed of the latest results, upcoming events, and other news. We hope you enjoy reading and hope to hear any feedback that you may have!

Progress Summary

The OUTFOX project is a 4-year initiative funded by Horizon Europe and Innovate UK, under the Clean Hydrogen Joint Undertaking. Our consortium comprises of 9 partners ([TNO](#), [VTT](#), [Elcogen OY](#), [Elcogen AS](#), [Shell Global Solutions International](#), [Convion](#), [Politecnico di Milano](#), [Fondazione](#)

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dissemination. Each partner's role is strategically chosen to maximize synergies and interdisciplinary collaboration, enabling us to achieve our project objectives. In our latest update, we're excited to share significant milestones achieved by the OUTFOX team. More information regarding the consortium can be found on the OUTFOX [project website](#).

In our latest update, we are thrilled to share the significant milestones accomplished by the OUTFOX team. Elcogen AS and Elcogen OY have successfully delivered reference scale cells and stacks, marking the completion of our first project milestone. Furthermore, we've made substantial advancements in enhancing the electrochemical performance of next-generation cells with a remarkable 900 cm² area, moving us closer to our project's ultimate objectives. We're also excited to share that we've developed a comprehensive plant model for techno-economic and scale-up analysis. Additionally, we've initiated critical discussions regarding data management and making data FAIR.

As of now, our project's overall progress stands at an impressive 20%, reflecting our commitment to innovation and sustainability.



Meet a Partner: Cahit Benel (TNO)

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Darmstadt in Germany, where my research centered on solid oxide fuel cell development with a primary emphasis on hydrogen utilization. After finishing my PhD, I remained in Germany at Karlsruhe Institute of Technology. During this phase, I was involved in various projects, with a primary focus on materials for energy applications. After 3 years in academia, I joined EIFER (European Institute for Energy Research) in Karlsruhe, a collaborative research institute bridging the gap between science and industry. There my work focused on steam electrolysis both at cell and stack levels. Since November 2022 I have been part of TNO as a project manager at Sustainable Technologies for Industrial Processes group”

What is the main driver for TNO being involved in the OUTFOX project?

“In this project, TNO will contribute to the realization of larger solid oxide electrolysis cells and stacks. One of the main challenges for solid oxide technology is the scalability and it is a limiting factor in the deployment of solid oxide electrolysis technology. We believe that it is possible to address these challenges and to support the realization of the solid oxide electrolysis technology on an industrial relevant scale. This project is the perfect means to prove this to stakeholders, industrial end users and society.”

What is the key technology that TNO are working on in the project?

“The key technology that TNO is working on in this project is the “*Next Generation Cells*”. Currently within industry the state of the art cell size is around 150 cm². In this project TNO is working towards 900 cm² cells which is a 6-fold increase in cell area compared to commercially available cells. We have already successfully established a solid oxide manufacturing line dedicated for this size and a testing infrastructure to validate its electrochemical performance.”

What are some of the key achievements/milestones TNO has reached within this project?

“We are still at the early stages of the project (M9 of 48), but we have advanced a lot both on the manufacturing of the “*Next Generation Cells*”

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manufacturing and testing activities we are advancing well towards the project targets. Stay tuned for the next newsletters for the results!"

What do you think will be the biggest impact on the project?

"I think the one of the biggest impact of this project will be that it will move the maturity of the solid oxide electrolysis technology towards multi MW scale applications. This will be achieved by developing and validating large area cells, larger stacks and their assembly into larger modules. The beauty of this project is that it is not only focusing on one level of the technology, but covering cell, stack and module levels. Towards the end of the project, we will complete two separate 80 kW testing campaigns at an industrial relevant stakeholder site, which will be with our project partner Shell. I hope that by completion of the project we will show that the maturity of this technology has moved forward to become the preferred option for green hydrogen production."

Any additional comments?

"I am very happy to be part of this project. The partners are all extremely professional and very easy to work with. Every partner has a lot of experience in their field, which I feel is a very important factor to have success in this project and as a coordinator it makes my life a lot easier! Each milestone is one step closer to our project target and it is a great feeling when we see this kind of progress."

New Investment for Elcogen



In the picture, from left to right: Kisun Chung, President and CEO at HD Hyundai. H.E. Alar Karis, President of Republic of Estonia, H.E. Sten Schwede, Ambassador of Estonia to South Korea, Enn Õunpuu, CEO of Elcogen. Credits: Raigo Pajula, Office of the President of the Republic of Estonia.

Korea Shipbuilding & Offshore Engineering, a member of HD Hyundai Group, invests €45m in Elcogen's Solid Oxide technology to further deepen the collaboration on emission-free power generation systems as well as green hydrogen production.

Following this investment, HD Hyundai and Elcogen intend to further strengthen their collaboration with a focus on marine propulsion systems and stationary power generation based on Elcogen's proprietary [Solid Oxide Fuel Cell \(SOFC\)](#) and green hydrogen production based Elcogen's [Solid Oxide Electrolyser Cell \(SOEC\)](#) technology.

This investment will be used to expand Elcogen's manufacturing capacity as it continues to build the company's new factory facility in Tallinn, Estonia, with a manufacturing capacity of up to 360 MW to meet increasing demand for its products.

[More information](#)

Project Consortium Meeting

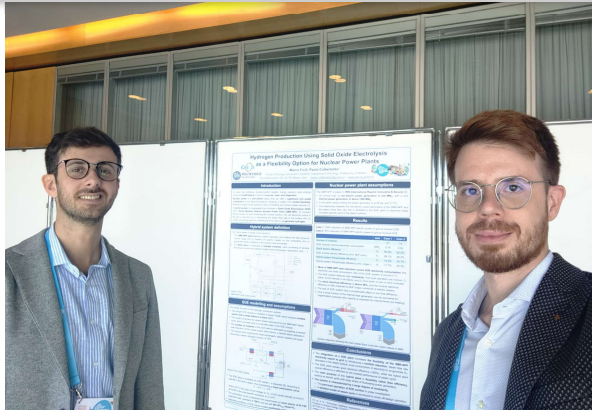


On September 20th and 21st, OUTFOX conducted its second in-person consortium meeting, which was hosted by project partners VTT and Elcogen OY.

During the meeting, each Work Package shared the progress made in the project thus far. The meeting concluded each day with informative lab tours of the hosting partners' facilities.

[Read more](#)

Partner Event Highlights

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partners from Politecnico di Milano, attended the 18th Conference on Sustainable Development of Energy, Water and Environmental Systems in Dubrovnik, Croatia to present their work "Hydrogen Production Using Solid Oxide Electrolysis as a Flexibility Option for Nuclear Power Plants". [Read more here.](#)

On September 27th and 28th, OUTFOX partners Convion and Elcogen exhibited at the Hydrogen Technology Expo in Bremen, Germany, a leading trade fair for hydrogen technologies, materials, components, and engineering solutions. [Read more here.](#)



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