



Project Title	Automized manufacturing of pressurized alkaline electrolyser – Calluna
Industry Partner	Nel Hydrogen
Industry Sector	Other Energy Intensive & Hard to Abate
Technology Pathway (Primary)	Low-carbon hydrogen
NIM Pillar	Technology Demonstration
Source	NIM Awards 2025
Description	<p>Through the Calluna project, Nel will establish Europe’s largest automated manufacturing facility for next-generation alkaline electrolysers, supporting the EU’s ambitions for net-zero industry and energy security. This new electrolyser platform is designed to be the most energy- and resource-efficient solution for green hydrogen production, significantly lowering the Levelized Cost of Hydrogen (LCOH) and enabling large-scale integration of renewable energy into industry and transport.</p> <p>The project combines technological innovation with industrial scale-up. The facility will produce modular, scalable 25 MW pressurized electrolyser systems that are compact, outdoor-ready, and optimized for flexible operation with intermittent renewable energy. The design enables rapid deployment, lower installation costs, and safe, reliable long-term operation. By reducing cost and complexity, Calluna makes green hydrogen more accessible to industries seeking to decarbonize.</p> <p>The project will be executed in two phases at Nel’s existing manufacturing hub in Herøya, Norway. The first 1 GW production line will be operational by 2026, with full 4 GW capacity reached by 2028. The facility will integrate best practices from high-volume industries, including robotics and automated quality control, to deliver cost-competitive, high-throughput electrolyser production.</p> <p>Over its first decade, Calluna is expected to replace fossil-based hydrogen with green hydrogen equivalent to avoiding 33.5 million tons of CO₂ emissions. Beyond climate impact, the project will strengthen Europe’s industrial base, create highly skilled jobs, and reinforce Europe’s position as a global leader in clean energy technology.</p>
Innovations Employed	<p>The next-generation alkaline electrolyser represents a step-change in hydrogen technology, surpassing current industry standards in efficiency, scalability, and flexibility. Key innovations include a modular, outdoor-ready design with a significant footprint reduction, pressurized operation, and rapid response to variable power inputs – making it ideal for renewable integration. Advanced cell design, polarization protection, and cell-level voltage monitoring improve safety, durability, and efficiency across all loads – holding shunt currents to a minimum. The manufacturing process leverages automation adapted from mass-production industries, enabling high throughput and low resource use. Together, these innovations reduce CAPEX and LCOH, accelerating the competitiveness and adoption of green hydrogen in Europe.</p>
Dimension of Novelty	New for the Company



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Innovation Collaboration	In house Norway
Intellectual Properties	Nel has secured three patents in Denmark covering key aspects of the product's technical design and manufacturing processes. These will be extended to the EU and other strategic markets. The IP strategy ensures protection of our core innovations while supporting global scalability. Additional licensing and trademark protections may be considered as the product matures.
IP Links	
Timetable & Progress	Development commenced in 2018 The product will be launched commercially first half of 2026, and verified for TRL 7 by the second half.
Financing (Public/Private)	Public funding The project received funding of 135 million Euros from the EU Innovation Fund for the 2023 call for Net Zero Technologies Manufacturing.
Finance Links	
Project Phase TRL	TRL 5 The prototype that will verify TRL 6 is built and the testing will start during September this year. It is expected to be finalized by the end of 2025.
Problems to be Solved and Risks to be Managed	Developing the next-generation pressurized alkaline electrolyser required solving key technical and manufacturing challenges. The automation manufacturing processes utilized, although well-established in other industries, have not yet been utilized for electrolyser manufacturing to this scale. Nel has pushed injection moulding to its limits to achieve high-precision, cost-effective components at scale. Ensuring stack integrity, as preventing leaks under pressure, was critical for safety and demanded extensive design iteration and testing. A major industry issue for alkaline pressurized electrolyzers are shunt currents. Nel has addressed and minimized this issue through advanced cell and manifold design, minimizing losses across all operational loads. These innovations enabled a robust, scalable product that meets demanding industrial and safety standards while supporting high-volume production.
Preliminary or Final Results Achieved	The project has achieved major progress towards industrializing the next-generation alkaline pressurized electrolyser. A first-of-a-kind 25 MW modular system has been designed and prepared for automated large-scale production, raising technology readiness towards a commercial level. The electrolyser has now achieved TRL 5 and awaits a verified TRL 6 by the end of this year. The product has been dimensioned with scalability and supply-chain robustness in mind, ensuring that components can be sourced and manufactured efficiently without reliance on overly specialized processes. Once the 4 GW plant has been deployed, it will enable a reduction of 33.5 million tons of CO2 in its first ten years by replacing fossil-fuel based hydrogen with renewable hydrogen - equivalent to removing around eight million cars from the roads. By leveraging advanced automation for mass manufacturing, the project also



NET-ZERO INDUSTRIES

MISSION



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lays the foundation for significant cost reductions through economies of scale, positioning Europe as a leader in clean hydrogen manufacturing and directly supporting the Green Deal, Fit-for-55, and the Net-Zero Industry Act.

CO2 Emissions Reduction Potential - Implementation and Future Market

The next generation electrolyser will be launched as a product in the first half of 2026, and have the first GW manufacturing capacity from end of 2026. The manufacturing plant will be further expanded to 4 GW in 2028. Over the first 10 years of operating the 4 GW facility, the project is estimated to save 33.5 million tons of CO2 emissions by providing technology for green hydrogen production.

Market Positioning

Nel is currently preparing for technology verification at TRL 6, manufacturing plant at 1 GW, and a commercial product launch in 2026.

Project Location

Norway

Project & Technology Links

<https://nelhydrogen.com/>

<https://nelhydrogen.com/this-is-calluna/>

Presentation from [Gastech 2025](#) about Nel's Next Generation Pressurized Alkaline Electrolyser

Technology Links

