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HYScale: Pioneering the Future of Green Hydrogen Production

In a groundbreaking leap towards a sustainable energy future, the HYScale project. With a focus on advanced alkaline membrane water electrolysis technology, HYScale is positioned to significantly enhance the efficiency and affordability of green hydrogen production, aligning with the European Union's ambitious climate goals.

A New Era in Hydrogen Production

In response to the European Union's commitment to reducing greenhouse gas emissions to net-zero by 2050, HYScale presents a timely solution. Leveraging state-of-the-art developments from multiple EU-funded projects (NEWELY, Anione, and ECO2Fuel), the HYScale initiative aims to upscale an efficient, durable, sustainable, and cost-effective electrolyser technology. This technology can operate stably at higher current densities than the current state of the art, promising a significant advancement in green hydrogen production.

Dr. Schwan Hosseiny, project coordinator explains "*With HYScale, we're starting an important journey. Green hydrogen is crucial in reshaping our energy landscape. Our commitment goes beyond just innovating; it's a promise to bring in a sustainable era where green hydrogen becomes a cornerstone in our efforts to reduce carbon, creating a cleaner and brighter future for generations to come.*"

Technological Breakthroughs and Innovations

At the heart of HYScale's strategy is the development of anion exchange membrane water electrolysis (AEMWE) technology, a cornerstone for the next generation of electrolysers. The HYScale technology, estimated to have a capital expenditure of only 400€ kW^{-1}, operates with CRM-free catalysts and electrodes* and PFAS-free anion exchange membranes, offering a more sustainable and scalable solution to hydrogen production.

Goals and Objectives

HYScale sets ambitious targets, including the upscaling and optimisation of materials synthesis, component, stack, and system production. With respect to materials and components, particularly membranes, ionomers, and electrodes will be enhanced and production upscaled. While on the system level, a single 100 kW stack will be designed and produced with an active cell area of 400 cm^2 and integrated into a balance of plant at minimal costs to satisfy the target production price of 400€ kW^{-1}. The HYScale electrolyser will be operated in direct connection with renewable energy sources to prove its stability, reliance, and to show its compatibility with the rules under the Delegated Act on a methodology for renewable fuels of non-biological origin.

Driving Towards Industrial Relevance

HYScale's multi-national, industry-oriented, and interdisciplinary approach is geared towards accelerating the development of unique technology and creating a cross-sectoral ecosystem that combines research and commercial expertise. The project's ambition is evident in its goals, which include enhancing and validating the HYScale water electrolyser technology under industrially relevant conditions.

About the Consortium

Led by Cutting-Edge Nanomaterials (CENmat), the consortium includes eight additional partners from seven EU countries. Among these are four renowned EU research centres specialising in hydrogen technology: the German Aerospace Center (DLR), the Italian National Research Council (CNR), the French Alternative Energies and Atomic Energy Commission (CEA), and the University of Ljubljana. Additionally, there are five industrial partners: CENmat itself, the Public Power Corporation of Greece (PPC), which is the greatest energy producer in the south-east Europe, HyGear, Meta Group, and Bekaert. The diverse expertise of these project partners ensures an efficient and targeted pursuit of the project's objectives.

Glossary

Green Hydrogen: A sustainable form of hydrogen gas produced using renewable energy sources, such as wind or solar power, to power the electrolysis of water. This process splits water into hydrogen and oxygen, and since it uses renewable energy, it results in zero greenhouse gas emissions, making it an environmentally friendly energy source.

Water Electrolyser Technology: A technology used to produce hydrogen by electrolysis of water. An electric current is passed through water, splitting it into hydrogen and oxygen gases. This technology is key in producing hydrogen for various applications, including energy storage and as a fuel source.

AEMWE (Anion Exchange Membrane Water Electrolysis): A type of water electrolysis technology that uses an anion exchange membrane. This membrane allows the passage of negatively charged ions (anions) and is used to efficiently produce hydrogen and oxygen from water without the need for expensive and rare catalysts.

CRM (Critical Raw Materials): Materials that are crucial for the economy and have a high risk associated with their supply. CRMs are typically used in the manufacture of high-tech devices, green technologies, and other important industrial applications. Their scarcity or geopolitical constraints on supply can pose risks to economic security and technological progress.

PFAS (Per- and Polyfluoroalkyl Substances): A large group of man-made chemicals that include PFOA, PFOS, GenX, and many other substances. PFAS are used in a wide range of consumer products for their water- and oil-resistant properties. They are known for being environmentally persistent, meaning they do not break down easily, leading to concerns about environmental and human health impacts.

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** with respect to the European critical raw material list of 2020 (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0474)*

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