PEACE

NEWSLETTER No. 2

on hydrogen production

February 2024

Content

1. Editorial

The second issue of the PEACE quarterly Newsletter is now available, marking the beginning of the year 2024. We have closed out 2023 - a year of significant progress for the hydrogen economy, showing that hydrogen is no longer merely a component of the energy transition but rather an important force in the decarbonisation process. The period of 2023 was marked by the successful conclusion of the legislation process on the EU Revised Renewable Energy Directive which set new binding targets on renewable energy shares (including green hydrogen), particularly in industry and transport. This has created strong incentives for green hydrogen producers.

It is within this shifting framework that our PEACE ('**Pressurized Efficient Alkaline EleCtrolysEr**') project has begun its journey towards demonstration of an innovative technology in high-pressure alkaline electrolysis for producing (green) hydrogen at reduced costs. We are currently in the early stages of project implementation, with research activities yielding initial results. Issue #2 will shed light on the actors involved in the PEACE project and their contributions to PEACE actions.

On behalf of the PEACE project team, I wish you peace and prosperity in 2024. Stay with us and subscribe to our newsletter: www.h2peace.eu/newsletter

Dr. Fatemeh Razmjooei, project coordinator
German Aerospace Center (DLR)
Institute of Engineering Thermodynamics / Energy System Integration Department
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2. Meet the PEACE

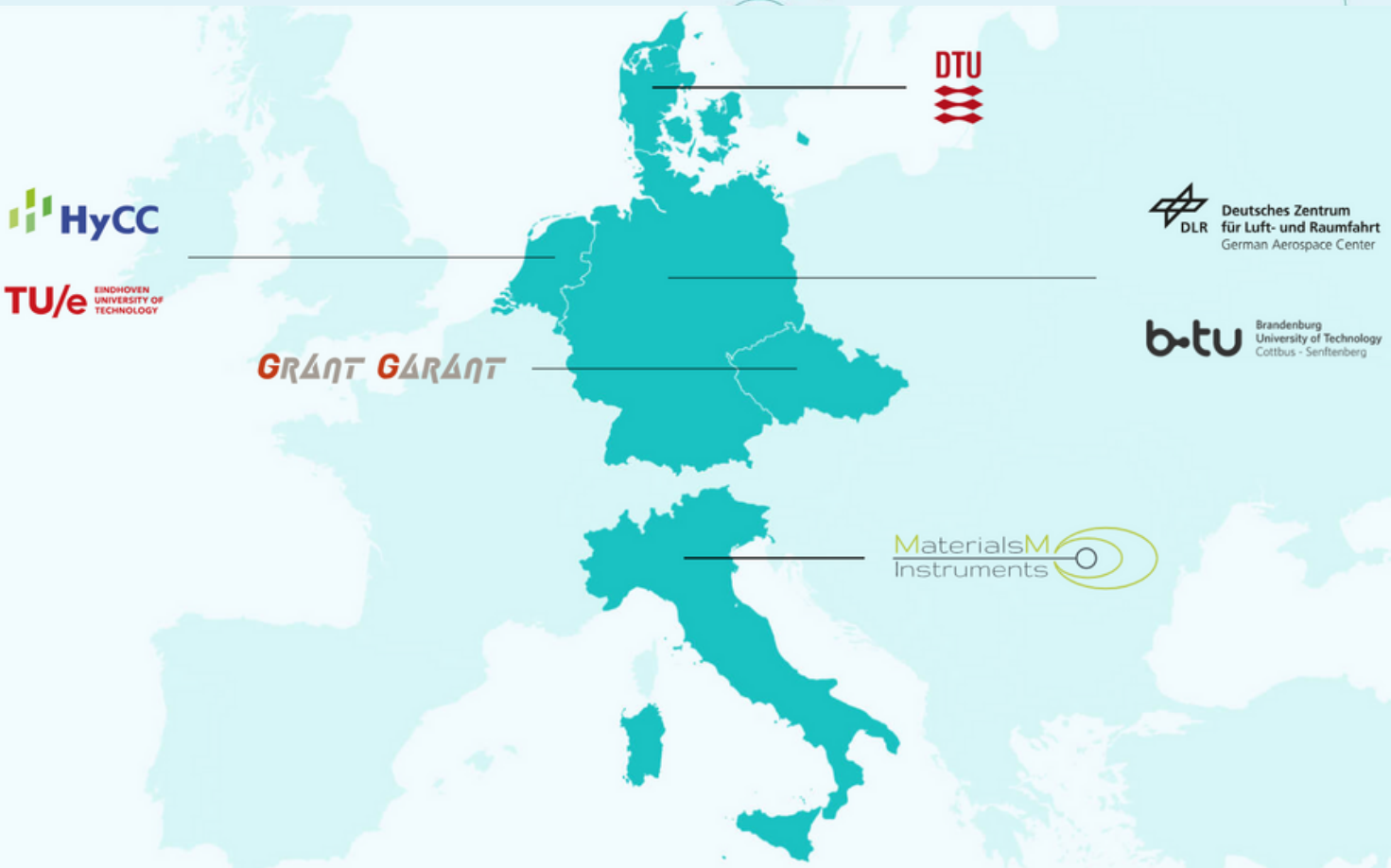
"Pressurized Efficient Alkaline EleCtrolysEr" (PEACE) project is a research and innovation activity funded under the EU Horizon Europe programme by the Clean Hydrogen Partnership. PEACE has started in June 2023 and will deliver high-pressure alkaline electrolysis (AEL) technology which will substantially reduce hydrogen production costs. We will propose a new concept of hydrogen production with two-stage pressurization that will be demonstrated on an AEL system of more than 50 kW capable of operating at pressures exceeding 50 bar. The integration of advanced components, innovative design, and optimized operation strategies will be explored through modelling and experimental testing, ultimately aiming to demonstrate a system with impressive efficiency characteristics (see more on PEACE website).

The EU-based PEACE project is led by the German Aerospace Center (DLR) and joined by six other entities ensuring a smooth and high-quality implementation (see Fig.1 below).

In the following section, the floor is given to all participating institutions to present their roles in the project, including a brief presentation of the granting authority – the Clean Hydrogen Partnership – without its generous support the PEACE would hardly exist.

PEACE

Fig. 1 PEACE Members



2.1 German Aerospace Center (DLR): Coordinator

DLR Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center

German Aerospace Center (DLR) is leading and managing the whole PEACE project.

DLR is the Federal Republic of Germany's research centre for aeronautics and space. DLR conducts research and development activities in the fields of aeronautics, space, energy, transport, security and digitalisation. The German Space Agency at DLR plans and implements the national space programme on behalf of the federal government.

Climate, mobility and technology are changing globally. DLR uses the expertise of its 54 research institutes and facilities to develop solutions to these challenges. Its more than 10,000 employees share a mission – to explore Earth and space and develop technologies for a sustainable future. By transferring technology, DLR contributes to strengthening Germany's position as a prime location for research and industry.

The DLR Institute of Engineering Thermodynamics, Department Energy System Integration, is the coordinator of the PEACE project. It has a track record of expertise in alkaline electrolyzer qualification, and possesses extensive expertise in system development, utilizing both experimental work and simulation approaches. The PEACE project coordinator is Dr. Fatemeh Razmjooei, who currently holds the position of team leader of the Low Temperature Electrolysis Systems team.

In the PEACE project, DLR leads research activities based on both AEL qualifications and simulation for processes within electrochemical reactors (WP5). DLR researchers provide expertise in modelling and validation of simulations, process system modelling capabilities for steady-state and dynamic modelling. The in-house modelling library for dynamic modelling of electrolyser stacks and systems, known as the Transient Electrochemical reactor Model for Process and Energy SysTems (TEMPEST), contributes to installations, operations, and monitoring of electrolyser demonstrator systems. Moreover, DLR's expertise contributes to the AEL testing and qualifications, BOP reviewing and discussion. The coordinator is responsible with the project overall management and its role in active results dissemination and exploitation (e.g., PEACE workshops organisation, publication of peer-reviewed articles) is of utmost importance.

2.2 Materials Mates Italia (MMI): stack components designer and producer

MMI, an Italian SME, was founded in 2006 to produce advanced scientific instrumentation in the field of Material Science and to provide technical support to both industries and universities. Its product range include Fuel Cells and Electrolysers test benches, bespoke cells, and specialized measuring instruments developed in cooperation with the most important laboratories studying energy generation and storage. Throughout the years, MMI has transferred knowledge and solutions from its laboratory to industrial customers through its Engineering /Consulting Branch. MMI has supplied more than twenty hydrogen system shared between fuel cells and electrolysers. In the last four years, MMI has also provided high pressure (30 to 50 bar) electrolyser test stands, including cells and stacks.

Within the PEACE project, MMI is in charge of the technical needs of the project regarding the adaptation and utilisation of the test rig. MMI designs, produces, and commissions the mechanical and hydraulic components of the stacks to be employed in the PEACE project, up to the proof of concept (PoC) level. This includes exploration of materials and working techniques to be applied. The PEACE activities are managed by Paolo Lupotto, Executive Director of MMI.

2.3 Technische Universiteit Eindhoven (TU/e): cell testing

TU/e is one of the two Dutch entities in the PEACE project – a dynamic university in science and technology, successfully integrating education and research. TU/e aims to find solutions to the global challenges of a sustainable world, the digital technological revolution and the impact of technology on society. Across its nine departments, the university enrols more than 12,500 students and 1,400 PhD candidates. Besides, in its Eindhoven Institute for Renewable Energy Systems (EIRES), TU/e researchers from different departments jointly work on materials, processes and systems for energy storage and conversion to accelerate the energy transition.

In the PEACE project, TU/e is represented by the Sustainable Process Engineering group of the department of Chemical Engineering which excels in setup and reactor design. It possesses both atmospheric and pressurized electrolysis setups for AEL and AEM electrolysis and employs 3D printing for the design of electrochemical reactors. TU/e PEACE activities consist of single cell and short stack testing, testing at elevated pressures and temperatures to achieve optimal performance in terms of cell potential and gas crossover and are led by Thijs de Groot.

2.4 Brandenburgische Technische Universität Cottbus Senftenberg (BTU): stack and pressure vessel assemblage and testing

BTU belongs to the most dynamic scientific communities in Germany, with close collaborative connections in science and industry within its region. The university comprises six faculties and caters about 7,000 students across nearly 60 study programmes. The research focus of BTU revolves around four major themes: energy reform and decarbonization, health and life sciences, global change and transformation processes, and a cross-cutting theme of artificial intelligence and sensorics.

BTU has over 15 years of experience in operating and optimizing AEL plants for hydrogen production. Their AEL-related laboratories comprise a 100-kW prototype of an alkaline pressure electrolyser, an alkaline pressure electrolyser test bench, an atmospheric AEM electrolyser test bench, a chemical lab, and an energy technology lab. Additionally, BTU has actively participated in numerous collaborative R&D projects focused on AEL and AEM technologies.

The BTU team for the PEACE project is led by Lars Röntzsch, head of the Hydrogen Research Center of BTU. His team will undertake the reconstruction and operation of the dual-stage high-pressure AEL device. Furthermore, BTU will make contributions to stack components design as well as modelling efforts within the PEACE.

2.5 The Hydrogen Chemistry Company (HyCC): end-users' requirements integration

HyCC is a leading industrial partner for safe and reliable green hydrogen supplies and circular chemistry solutions to enable the transition to zero-carbon industry. Building on over 100 years of experience in electrolysis and its leadership in safety, HYCC realizes pioneering water electrolysis projects to supply industries with zero-carbon hydrogen from renewable power and water. From making sustainable steel to circular jet fuels – HYCC believes that green hydrogen is the key to providing a growing population with essential products, with zero emissions to realize more sustainable economic development. HyCC is a joint venture of European essential chemical company Nobian and Macquarie Asset Management's Green Investment Group.

Within the PEACE project, HyCC undertakes the role of owner-operator of large-scale water electrolysis plants. HyCC will contribute insights regarding the most suitable applications, locations, and scales at which the technology developed through the PEACE project can be effectively deployed. HYCC will provide end-user requirements for the developed technologies, focusing on crucial aspects like required gas purity, safety protocols, operational flexibility, allowable plant costs, and essential operating strategies, all of which are necessary for achieving certification as green hydrogen. Additionally, HYCC will perform calculations to determine the total CAPEX (Capital Expenditures) and OPEX (Operating expenditures) costs for an entire plant built upon the developed technology. The HYCC team is led by Fernanda Neira D´Angelo.

2.6 GRANT Garant (GG): communication, dissemination, exploitation

A Czech enterprise, GG has been providing consulting services since 2004 for the preparation and management of international research and innovation projects, as well as conducting research project management. GG offers services in analysing target groups relevant to technology transfer, including communication with key regulators and policy-makers through its expert network. The company has expertise in data management for scientific projects, communication, dissemination, and exploitation of results from research and innovation projects. Additionally, GG assists clients in commercializing their project results.

The GG team, under the lead of Karolína Řípová, ensures PEACE project communication and dissemination. GG will define the project´s communication and dissemination strategy, encompassing exploitable results and plans for their further use. GG manages PEACE promotion, runs the project website and social media accounts. Alongside these responsibilities, GG supports the consortium in terms of data management and intellectual property issues.

2.7 Danmarks Tekniske Universitet (DTU): technology life-cycle assessment

DTU is an elite technical university renowned for its high-level research and education, catering more than 13,000 students across 87 study programmes. DTU sees technology as a pivotal tool for driving change and adopts the UN Sustainable Development Goals as a foundation for its activities. The university research in natural and technical sciences frequently takes a cross-disciplinary approach and involves other academic, private and public partners to foster innovation transfer. DTU is recognized for its provision of highly competent scientific advice and its support for innovation through wide assistance to start-ups.

The Circularity & Environmental Impact research division of the DTU Sustain department has been immersed in environmental assessments of technologies and systems for over two decades. During this time, EASETECH, a Life Cycle Assessment model tailored for conducting detailed bottom-up evaluations of environmental technologies has been developed. This DTU's know-how will be applied to the PEACE pressurized hydrogen production. The Life Cycle Assessment will focus on evaluating the circularity and sustainability aspects of the PEACE technology, with a particular attention to the impacts of pressurization. This analysis will involve a comparative assessment of the technology vis-à-vis alternative methods that do not involve pressurisation. The DTU team is led by Valentina Bisinella.

2.8 Clean Hydrogen Partnership: Granting authority

The Clean Hydrogen Partnership (as per its legal name Clean Hydrogen Joint Undertaking) is a public-private partnership consisting of the European Commission, Hydrogen Europe (the leading European association of hydrogen industries) and Hydrogen Europe Research (the European association of research and technology organisations within the hydrogen and fuel cell sector). The aim of the Clean Hydrogen Partnership is to fund research and innovation activities (see section 3) in hydrogen technologies in Europe under the guidance of the EU Green Deal and EU's Hydrogen Strategy.

3. Hydrogen News

The Revised EU Renewable Energy Directive came into force

The importance of green hydrogen in energy transition has been recently affirmed by the revised EU Renewable Energy Directive (EU/2023/2413), which entered into force on November 20, 2023. The revision sets a binding target of at least **42.5% of renewable energy** sources' share of total energy consumption. Specifically, new targets have been set for industry and transport in the procurement of **renewable fuels of non-biological origin** (RFNBOS). RFNBOs are based on hydrogen which is mainly produced by electrolysis powered by renewable electricity.

In this respect, the directive states that **42% of the hydrogen used in industry** should come from these RFNBOs by 2030, and even 60% by 2035. In **transport**, new o**verall targets for renewables** were set - a 14,5% reduction in greenhouse gas intensity or at least 29% of renewables within the final energy consumption by 2030. Moreover, at least 5.5% of the fuel mix must be composed of advanced biofuels and RFNBOs, and, more specifically, a minimum sub-target of **1% of RFNBOs in the share of renewable energies supplies** was set **for the transport sector** by 2030. These are strong incentives for hydrogen producers to satisfy the growing demand for green hydrogen.

https://hydrogeneurope.eu/h2-is-cornerstone-of-eus-renewable-energy-directive/

The European hydrogen market landscape published

A new **report of the European Hydrogen Observatory** is available now, summarising the current state of the European hydrogen market. Interestingly, more than 99% of hydrogen produced originate from conventional H2 production methods (mostly steam reforming of natural gas). Water electrolysis production is on the rise, though still represents a minor production force (0,3 %).

https://observatory.clean-hydrogen.europa.eu/tools-reports/observatory-reports

COP28 achieved

The UN Climate Change Conference, known as **COP28**, took place in the first half of December 2023 in Dubai. COP28 concluded the first "**global stocktake**", assessing worldwide endeavours to combat climate change within the framework of the Paris Agreement. Its findings revealed an insufficient progress in various spheres of climate action - from reducing greenhouse gas emissions to strengthening resilience to a changing climate and securing financial and technological support to vulnerable nations. In reaction, countries collectively determined strategies to expedite efforts across all fronts by 2030. This entails urging governments to hasten the shift from fossil fuels to renewable sources - a specific target to **triple renewables** by 2030 was introduced, along with a target of **doubling energy efficiency** in the next 7 years.

Interestingly, as some observers have pointed out, the final COP document specifically mentioned **low-carbon hydrogen production** as a climate mitigation measure to reduce greenhouse gas emissions for the first time ever.

https://www.hydrogeninsight.com/production/historic-cop28-text-calls-for-acceleration-of-low-carbon-hydrogen-production-for-the-first-time/2-1-1570572

Clean Hydrogen Partnership launches a new call for hydrogen projects

In mid-January, the **Clean Hydrogen Partnership** launched a new **call for hydrogen research proposals** worth more than € 113 million within the Horizon Europe programme. Twenty topics covering hydrogen production, storage, distribution, as well as heating, power and transport are included in this call. Simultaneously, new small-scale and large-scale Hydrogen Valleys will be funded. This call supports both Research and Innovation, and Innovation Actions. One topic is specifically dedicated to Coordination and Support Actions (CSA) on guidelines on safety and sustainability in the design and development of FCH systems. Importantly, all grants will use simplified lump sum funding. The deadline for submission is **17 April, 2024**.

https://www.clean-hydrogen.europa.eu/media/news/clean-hydrogen-partnership-launches-eu-1135-million-call-projects-across-whole-hydrogen-value-chain-2024-01-17_en

4. Hydrogen Events

Symposium on Electrochemical Energy Technology, 20 Mar., 2024, Stuttgart (DE)

This symposium, organised by DLR Institute of Engineering Thermodynamics, focuses on cutting-edge topics in the field of electrochemical energy technology: fuel cells, water electrolysis, and rechargeable batteries – addressed by academia and industry.
https://seet2024.welcome-manager.de/

Hydrogen Days, 20-22 Mar., 2024, Prague (CZ)

The 14th edition of international conference on hydrogen technologies and experience across European regions is entitled “Hydrogen – implementation lost in regulation?“. It includes exhibition as well as matchmaking sessions.
https://www.hydrogendays2024.cz/

Hannover Messe, 22-26 Apr., 2024, Hannover (DE)

The world’s most important industrial trade fair will host more than 500 exhibitors from the hydrogen and fuel cell sector.
https://www.hannovermesse.de/en/

1st Electrochemical Conversion National Symposium, 21 May, 2024, Amare The Hague (NL)

The Dutch Symposium, entitled: The Future of Electrochemical Conversion - Hydrogen and Beyond! will serve as a meeting point for the entire innovation chain community around electrochemical conversion. Don’t miss the Water Electrolysis session where Dr. Thijs de Groot, PEACE WP2 leader, will be the keynote speaker!
https://www.tudelft.nl/e-refinery/eccns

5. Hydrogen Project Funding Opportunities

Clean Hydrogen Partnership call on hydrogen research projects

Find out more details on the Horizon Europe Clean Hydrogen Partnership call on hydrogen research projects: Call HORIZON-JTI-CLEANH2-2024. Twenty topics are ready for your hydrogen research and innovation proposals!

Deadline date: 17 Apr., 2024

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MaterialsM Instruments

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b-tu Brandenburg University of Technology Cottbus - Senftenberg

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Co-funded by the European Union

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