PEACE

NEWSLETTER No. 4

on hydrogen production

August 2024

Content

1. Editorial

As the Paris 2024 Olympics have just concluded, our collective enthusiasm for these historic Games has been palpable...

The PEACE project proudly aligns with the Olympics' visionary goal of becoming the first-ever carbon-neutral Games. This monumental event has aimed to achieve this through the use of 100% renewable electricity, promoting sustainable transportation, and implementing stringent waste management practices. Pars pro toto, even the Olympic cauldron in the shape of a hot air balloon which lit every night was operating entirely fuel-free: the illusion of flames was produced by a combination of water mist and LED spotlights run on 100% renewable electricity...

The PEACE project, funded by the Clean Hydrogen Partnership, is dedicated to sustainability and innovation in hydrogen production technology. We are pioneering high-pressure alkaline electrolysis to produce green hydrogen, which significantly reduces the levelized cost of hydrogen (LCOH). Our work not only supports the sustainability goals of the Olympics but also contributes to a greener future for all.

Join us as we strive towards these goals, and stay tuned for more updates.

PEACE website

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Institute of Engineering Thermodynamics / Energy System Integration Department
@DLR_Energie

2. About 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 and coordinated by the German Aerospace Center (DLR). The PEACE project 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).

Project members: German Aerospace Center (DLR); Materials Mates Italia (MMI); Eindhoven University of Technology (TU/e); Brandenburgische Technische Universität Cottbus Senftenberg (BTU); GRANT Garant (GG); The Hydrogen Chemistry Company (HyCC); Technical University of Denmark (DTU)

Fig. 1 PEACE Project Team (Feb. 2024), Source: PEACE project

2.1 Significant advancements in PEACE stack development

The PEACE team, notably our colleagues of Materials Mates Italia (MMI), made significant progress in three key areas within the development of the PEACE stack for highly pressurized AEL. First, they initiated the operation of the gantry mill, focusing on setting the tooling and methods for optimal results. Second, they have designed and begun production of the end plates, with an emphasis on optimizing pressure-to-weight performance. Lastly, they made a decision on gasketing based on experiences with test items already delivered to the MMI team by other PEACE members. Moreover, results from the leak tests are expected this fall, alongside the full stack design. Meanwhile, performance optimization is ongoing with reduced-scale cells.

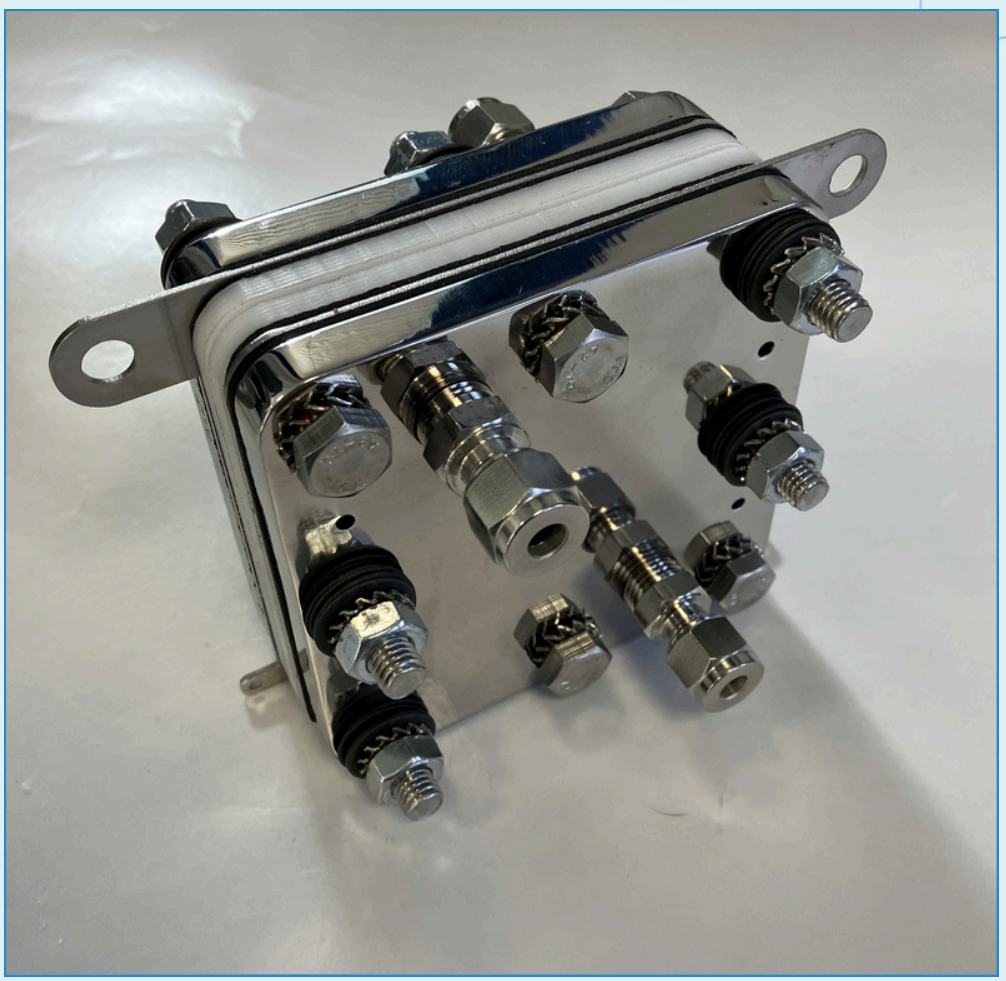

Fig. 2 PEACE Project Test Cell, Source: MMI (CC-BY-NC-ND 4.0)

2.2 PEACE on Zenodo

In March 2024, the PEACE project joined Zenodo, the catch-all repository for EC funded research. As part of our commitment to Open Science, collaboration, and the dissemination of knowledge, we have established the PEACE Community on Zenodo, that will serve as a single point where PEACE publications, datasets and other research outputs can be found to be shared and further used in research.

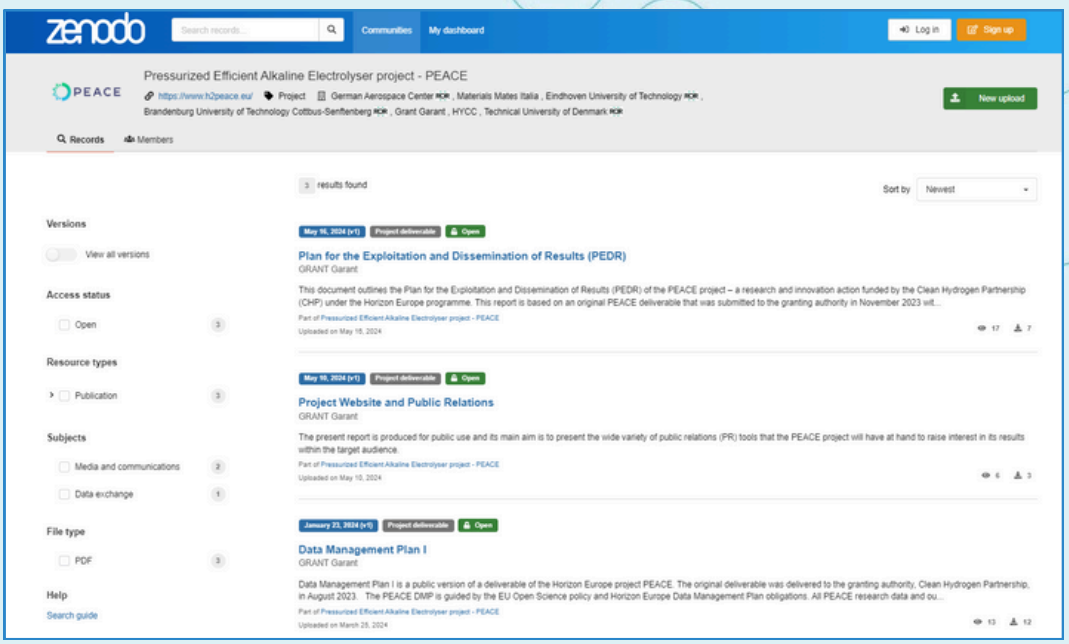

Fig. 3 PEACE Zenodo Community Page

By creating the PEACE Community on Zenodo, we aim to foster collaboration, enhance visibility, and promote the exchange of ideas within the field of hydrogen production and clean energy. The PEACE Community serves as a centralized hub where researchers can access datasets and publications related to our project. Furthermore, Zenodo offers robust infrastructure for the long-term preservation of research data and publications. Our contributions to hydrogen research will be archived and maintained for future reference, ensuring that our work remains accessible and valuable for years to come. Let's visit the PEACE Community on Zenodo!

2.3 PEACE at the GroenvermogenNL-ECCM Graduate School

The PEACE project did not miss the opportunity to be present at the 2024 GroenvermogenNL-ECCM Graduate School on electrochemistry! This four-day event at the end of June 2024 brought together over 50 PhD students and industrial researchers and delved into the fundamental concepts of electrochemistry and its diverse applications.

PEACE team member **Saksham Pandey**, a PhD candidate from TU/e, was selected for attendance at the GroenvermogenNL-ECCM Graduate School. Beside the intensive knowledge gaining and sharing, he presented a poster entitled "Bubblolysis: The Ohmic Resistance Story of Alkaline Electrolysers" to introduce findings on the behaviour of bubbles during alkaline water electrolysis.

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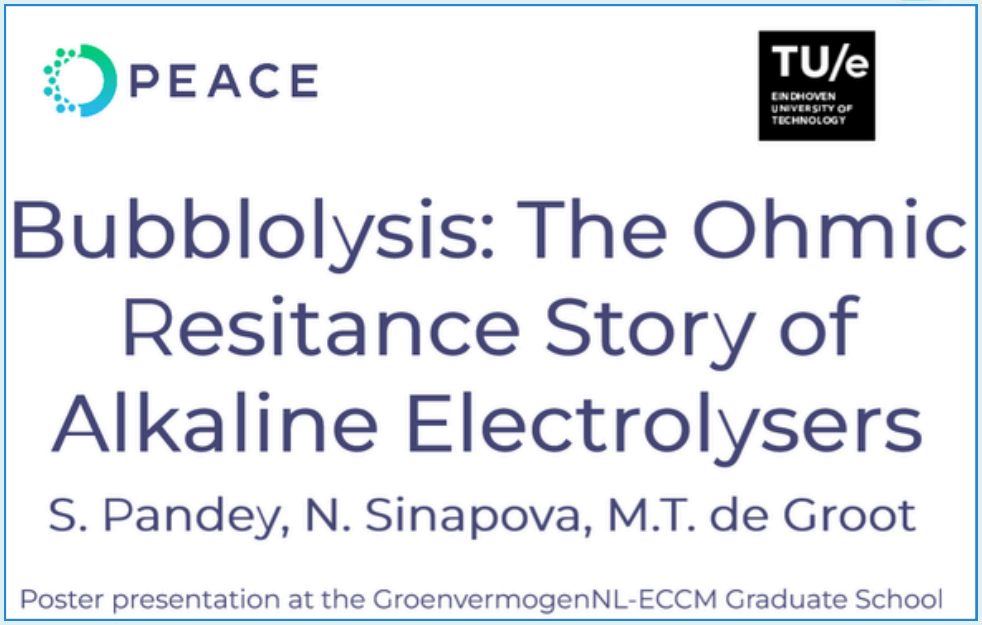


Fig. 4 PEACE contribution at the GroenvermogenNL-ECCM Graduate School

Using a high-speed camera, Saksham analysed bubble dynamics on the electrode surface and within the flow channel. The initial results reveal that hydrogen and oxygen bubbles are quite small, averaging around 20 µm. This discovery provides a valuable step towards a deeper understanding of bubble behaviour in electrolysis processes and will be explored further on. The poster is available here.

Excellence of the PEACE project team leaders has been acknowledged by the selection of **assoc. prof. Thijs de Groot** (TU/e) as a lecturer of the GroenvermogenNL-ECCM Graduate School. His speech on industrial water and chlor-alkali electrolysis mirrored his expertise and insights on the industrial applications of electrolysis, providing valuable knowledge to the attendees and stimuli for further discussions. To know more on PEACE at the GroenvermogenNL-ECCM Graduate School visit our PEACE website.

2.4 PEACE Plan for the Exploitation and Dissemination of Results

PEACE is a research and innovation action project financed by the Clean Hydrogen Partnership under the EU Horizon Europe Programme. As with all Horizon Europe projects, creating a Plan for the Exploitation and Dissemination of Results (PEDR) is a mandatory deliverable that must be addressed at the project's inception. The PEDR is a strategic document outlining how the project consortium will effectively communicate its activities and disseminate project results to various audiences. Additionally, it sketches the future exploitation and potential commercialization of the project outcomes.

Horizon Europe obligations for PEDR

The PEACE PEDR has been developed within the framework of the following Horizon Europe obligations, applicable to all research and innovation projects in the fields of communication, dissemination, and exploitation(C&D&E) of results:

All consortium members are required to promote project actions and outcomes.

Communication and dissemination activities must acknowledge the funding provided by the granting authority and the EU, including the use of logos, EU emblem, funding statements, and a disclaimer.

Dissemination of results is subject to a prior notice protocol, ensuring all consortium members are informed before any project results are published.

Scientific publications must be made available under open access, with peer-reviewed articles deposited in a trusted repository under the latest version of the Creative Commons Attribution International Public Licence (CC BY) or an equivalent.

Metadata accompanying all project scientific publications should be openly accessible under the public domain dedication CC0.

All digital research data must adhere to the FAIR data management principles, with open access to research data provided via a trusted repository under the principle of 'as open as possible, as closed as necessary'. Metadata should be open under CC0 (see the PEACE Data Management Plan for more details).

The exploitation of results is a fundamental responsibility of each result owner. Result owners must be defined at the end of the project within the results ownership list. Beneficiaries must use their best efforts to exploit their results for up to four years after the project ends. If results are not exploited within one year post-project, beneficiaries must use the Horizon Results Platform to find interested parties for exploitation.

The PEACE project considered all relevant Horizon Europe obligations and produced (under the authorship of the partner GRANT Garant) the initial version of the PEACE PEDR in November 2023. The document serves as a practical guide for PEACE's communication, dissemination, and exploitation activities. It comprises a Communication Plan, Dissemination Plan, and Exploitation Plan, each addressing different aspects of public outreach and the utilization of project outcomes.

PEACE PEDR Tools

The PEACE PEDR strategy employs various **C&D&E tools** to convey the main communication messages and key project results to the defined target groups. All promotional tools, namely the visual identity, are based on the blue-green project **logo** (see Fig. 5), symbolising green hydrogen.

Fig. 5 PEACE Project Logo, Source: GRANT Garant (CC-BY-NC-ND 4.0)

Key promotional tools of the project lie within the online world. The PEACE **website** presents the project's main features and updates. Simultaneously, the PEACE project is active on **social media** platforms X and LinkedIn, with the LinkedIn profile amassing over 500 followers and integrating into the hydrogen community.

Printed items (see the flyer in Fig. 6) to introduce and publicize the project at conferences, exhibitions, and other events are used as well.

Fig. 6 PEACE Project Flyer, Source: GRANT Garant (CC-BY-NC-ND 4.0)

A large-format PEACE **roll up banner** (Fig. 7) is available to enhance the visual impact at scientific and industry events attended by consortium members.

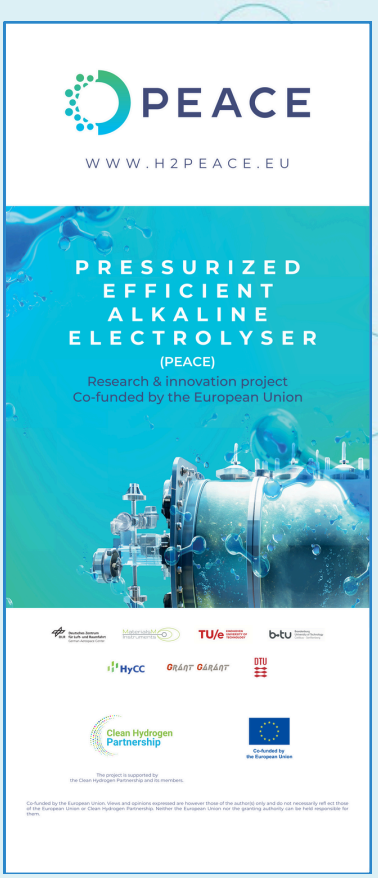


Fig. 7 PEACE Project Roll Up Banner, Source: GRANT Garant (CC-BY-NC-ND 4.0)

Furthermore, the Coordinator (DLR) will organize two PEACE project **workshops**: one internal workshop to review current results and a second workshop to present final key outcomes to an external scientific audience at the project's end. These events will facilitate direct communication, bilateral meetings with relevant stakeholders, and networking within the research community.

PEACE PEDR Strategy

The PEDR strategy unfolds in three distinct phases, aligned with the production of PEACE results:

I. Project Awareness Phase (June 2023 – January 2025): Focuses on rich communication efforts to build a pool of followers.

II. Components Dissemination Phase (February 2025 – November 2025): Involves communication and dissemination activities as scientific results, particularly concerning PEACE stack components, are generated.

III. Demonstrator Dissemination and Exploitation Phase (December 2025 – May 2026): Primarily dedicated to disseminating outcomes related to the PEACE AEL demonstrator, optimization of components, and operation strategies. This phase includes the Life Cycle Assessment (LCA) and stack integration with downstream processing.

The PEACE PEDR strategy aims to reach four target groups:
I. Research communities: Including university students, research audiences, and complementary innovation projects
II. European institutions: Including hydrogen-oriented networks
III. Industry and business: Focusing on hydrogen production and usage, particularly within the chemical industry
IV. Public and media: Engaging those concerned with ecological issues, innovative technologies, decarbonisation, or renewable energy

The PEACE PEDR strategy consists of three interlinked plans which tackle the distinct fields of project promotion – i.e., project communication; results dissemination; and results exploitation.

PEACE Communication Plan
The communication measures aim to reach out to society, demonstrating the impact and benefits of PEACE in promoting global carbon neutrality by accelerating the European hydrogen industry. The strategy differentiates its communication based on the characteristics of each target group, delivering distinct key messages through various tools. These include raising awareness about the project and its benefits, promoting EC and Clean Hydrogen Partnership funding for R&I, and fostering collaboration and networking opportunities (for details see here).

PEACE Dissemination Plan
The dissemination plan aims to maximize the project's societal impact by promoting the use of PEACE results. The team has identified main results, which will be disseminated through peer-reviewed articles and conference presentations. (see Fig. 8 below, for more details see here).

PEACE Results	Authors
1. High performance stack components	TU/e, MMI, DLR
2. Findings on a stack design and BoP optimization	BTU CS, MMI
3. Safety concepts for high pressure operation – HAZOP, FMEA	DLR, MMI, BTU CS
4. A demonstrator of > 50 kW AEL as PoC capable of operation at 70% LHV at 1 A/cm² up to 90 bar	BTU CS, DLR, MMI
5. Performance and durability assessment data of HP-AEL system demonstrator	BTU CS, DLR
6. Simulation algorithms for optimizing the HP-AEL operational strategies	DLR
7. Integration concept in chemical industry	HYCC
8. LCA - potential environmental impacts and benefits of the technology	DTU
9. Test protocols for cold start, dynamic operation, warm standby, shut down	DLR

Fig. 8 PEACE Project Results for Dissemination

PEACE Exploitation Plan

The exploitation plan seeks to transform PEACE R&I actions into tangible societal benefits, particularly by reducing the levelized costs of hydrogen, thus stimulating demand for hydrogen and the hydrogen economy. The project will primarily pursue scientific exploitation pathways, with identified key exploitable results. Detailed exploitation visions will be developed during the project implementation period (for more details see here).

3. Hydrogen News

DLR Authors Publish Intriguing Review Article

A team of authors from the Institute of Engineering Thermodynamics, German Aerospace Center (DLR) has recently published an intriguing review article in "Current Opinion in Electrochemistry" by Elsevier. The article, titled “Advancements in Hydrogen Production using Alkaline Electrolysis Systems: A Short Review on Experimental and Simulation Studies,” presents a comprehensive overview of recent developments in the field of alkaline water electrolysis (AWE). The review article delves into the advancements in materials, cell design, and upstream and downstream system integration (find out more here).

Article details

Title: Advancements in hydrogen production using alkaline electrolysis systems: A short review on experimental and simulation studies

Authors: Lucía Campo Schneider, Maryem Dhrioua, Dirk Ullmer, Franz Egert, Hans Julian Wiggenhauser, Kamal Ghotia, Nicolas Kawerau, Davide Grilli, Fatemeh Razmjooei, and Asif Ansar

Journal: Current Opinion in Electrochemistry, Elsevier, 2024, Volume 47, no. 101552.

Available in open access here

Source of the news

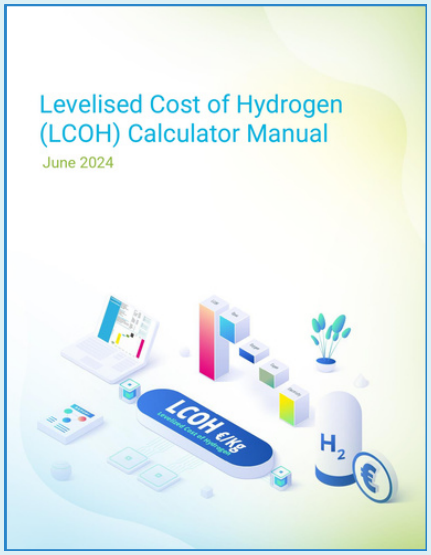
The Final Adoption of the Net-Zero Industry Act (NZIA)

The Net-Zero Industry Act (NZIA), an important part of the Green Deal Industrial Plan, entered into force in June 2024. It aims to enhance the EU's domestic manufacturing of clean technologies. The Act creates a supportive environment for the clean tech sector, aiming to make the EU more competitive and resilient while also creating quality jobs. The NZIA sets a target for the EU to meet at least 40% of its annual clean technology deployment needs domestically by 2030 and aims to establish a 50-million-tonne CO2 storage capacity. It simplifies permitting procedures, promotes sustainability in public procurement, and supports various net-zero technologies. Additionally, it includes measures for education, training, and innovation, such as the creation of Net-Zero Industry Academies and regulatory sandboxes for testing new technologies.

The NZIA has recognized hydrogen technologies as key strategic technologies for Europe's clean transition. However, as some point out, it does not provide sufficient specific support measures to boost these technologies...

Source of the news

Levelised Cost of Hydrogen Calculator – the Manual



In the PEACE Newsletter#3, we have informed you about the launch of a European Hydrogen Observatory calculator to estimate the cost of hydrogen production in European countries by low temperature electrolysis. In June, the European Hydrogen Observatory released an additional publication (a manual) providing an explanation of the methodology behind the Levelized Cost of Hydrogen (LCOH) calculator and demonstrating how to use the calculator for estimating hydrogen production costs in Europe, considering various electricity sources.

Source of the news

Second Hydrogen Bank Auction Budget Set at €1.2 billion

The European Commission has announced a €1.2 billion budget for the second auction of the European Hydrogen Bank, compared to €720 million of the first auction (see PEACE Newsletter#3). This second competitive bidding process is set to take place later this year. Key considerations for the auction's design, as expressed by Hydrogen Europe, include maintaining a 5-year commissioning period, increasing flexibility on aid cumulation, and supporting the European technology value chain through resilience criteria.

Source of the news

Dutch and Spanish Green Hydrogen Schemes Approved by the European Commission

In late July, the European Commission approved Dutch and Spanish funding schemes for green hydrogen production. The **Dutch** scheme, amounting to €998 million aims to construct at least 200MW of electrolysis capacity, with funding provided through a competitive bidding process to be concluded in 2024. It will support projects with a minimum capacity of 0.5 MW by a direct grant scheme combining an upfront investment grant (up to 80% of the investment costs) and a variable premium over a period of 5 to 10 years. Beneficiaries must comply with EU criteria for renewable fuels of non-biological origin (RFNBOs). This initiative is expected to reduce CO_2 emissions by 55 kilotonnes annually until 2030, aiding both Dutch and EU climate targets.

Spain received the EC approval of a €1.2 billion scheme to support investments in the production of renewable hydrogen. Funded through the Recovery and Resilience Facility, this scheme will focus on producing renewable hydrogen with at least 100 MW of installed capacity. Investments may encompass not only the production of renewable hydrogen-derived fuels, but also renewable hydrogen storage and the production of renewable electricity. Applicants must secure agreements covering at least 60% of the hydrogen or derived fuel output. The aid, distributed via direct grants, will be determined through a competitive bidding process and must be granted by the end of 2025.

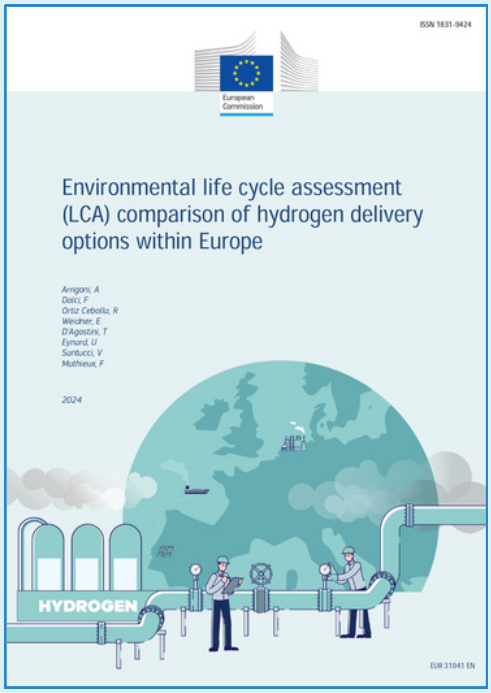
Both schemes align with the REPowerEU Plan and Green Deal objectives, targeting a reduction in fossil fuel dependence and supporting the EU's green transition goals.

Source of the news

European Commission Publication on Environmental Life Cycle Assessment Comparison of Hydrogen Delivery

The Joint Research Centre of the European Commission has recently published a report comparing the life cycle environmental impacts of on-site production by steam methane reforming (SMR) or electrolysis vis-à-vis hydrogen importation from distant locations through hydrogen compression, or liquefaction, or chemical bonding to other molecules (namely ammonia, dibenzyltoluene - LOHC, methanol and synthetic natural gas were specifically analysed). The answer to be found is whether importing hydrogen make sense from an environmental perspective and which is the transport option with the lowest environmental impacts. The analysis is based on the Environmental Footprint impact assessment method.

The study finds that while all delivery options offer lower global warming potential than on-site fossil fuel-based production, local hydrogen production via SMR has lower impacts in 12 of 16 environmental categories. For a 2500-km distance (assumed by the analysis), transporting renewable liquid hydrogen by ship and compressed hydrogen by pipeline were identified as the most environmentally friendly methods. However, packing hydrogen into carriers for transport does not provide an environmental benefit due to the significant energy required for packing and unpacking. The report notes that these findings are preliminary due to the current lack of large-scale hydrogen infrastructure, highlighting the uncertainty in technology and emissions assumptions.



Publication Details

Authors: European Commission, Joint Research Centre, Arrigoni, A., Agostini, T., Eynard, U., Santucci, V. and Mathieux, F.

Title: Environmental life cycle assessment (LCA) comparison of hydrogen delivery options within Europe.

Publisher: Publications Office of the European Union, Luxembourg, 2024.

Source of the news

4. Hydrogen Events

5th ELECTRA Symposium, 11-12 Sept., 2024, Aachen (DE)

The 5th edition of the ELECTRA Symposium is focused on electrochemical CO2 reduction, water electrolysis and (cell) design aspects of electrochemical processes. Invited speakers will merge with ELECTRA project status presentations and poster session. The symposium will also be broadcasted online.

Do not miss the keynote speech of Dr. Thijs de Groot, a distinguished member of the PEACE project team at Eindhoven University of Technology. His contribution will focus on enhanced performance, flexibility, and durability in alkaline water electrolysis. His speech is scheduled for Wednesday, September 11, 2024, at 9:45 AM.

Event link

19th Conference on Sustainable Development of Energy, Water and Environment Systems, 8-12 Sept., 2024, Rome (IT)

The 19th Conference on Sustainable Development of Energy, Water and Environment Systems (SDEWES) focuses on advancing knowledge and methods for sustainable development, emphasizing the need to decouple economic growth from natural resource use and transition to a knowledge-based economy. It addresses the integration of various life-supporting systems — such as electricity, heating, cooling, transport, water, buildings, waste, wastewater, industry, forestry, and agriculture — to enhance efficiencies and sustainability.

Event link

Wind & Solar Integration Workshop, 8-11 Oct., 2024, Helsinki (FI)

The 23rd edition of the Wind & Solar Integration Workshop provides a platform for discussing and sharing ideas on key issues related to the large-scale grid integration of renewable energies. The 2024 edition will highlight the role of hydrogen - new topics such as fuel cell and electrolyzer modeling, hydrogen systems modeling, renewable hydrogen technologies, and applications for decarbonizing transport and industrial processes, as well as energy system management with hydrogen have been introduced.

Do not miss the Electrolyzer Integration morning session on the 10th of October where our colleagues from DLR are presenting – see H. Wiggenhauser, F. Sedeqi, F. Egert, F. Razmjooei, A. Ansar: Validation of a Two Phase Fluid Model for Transient Simulation of Alkaline Electrolysers!

Event link

Hydrogen Technology Expo Europe, 23-24 Oct., 2024, Hamburg (DE)

The Hydrogen Technology Expo Europe is a conference and exhibition dedicated to advancing technologies in the hydrogen and fuel cell industry with more than 15,000 attendees. It serves as a crucial gathering for stakeholders across the hydrogen value chain, focusing on innovations in low-carbon hydrogen production, efficient storage, distribution systems, and diverse applications in both stationary and mobile contexts. The event takes place at the Hamburg Messe and involves more than 300 speakers in 6 conference tracks and 800 hydrogen industry exhibitors.

Event link

European Hydrogen Week, 18-22 Nov., 2024, Brussels (BE)

One of the biggest hydrogen event in Europe is open for registration! A meeting point for leaders, policy makers, researchers, and end users provides a high-level policy conference together with large exhibition area and B2B forum. The challenge to bring the entire hydrogen sector to Brussels for a whole week is organised by Hydrogen Europe, the European Commission and the Clean Hydrogen Partnership. Not to miss the PEACE stand there!

Event link

5. Hydrogen Project Funding Opportunities

Hydrogen Valleys Facility (research and development services and related consultancy services - call for tender)

Within a call for tender CLEANH2/2024/OP/0002, the Clean Hydrogen JU (Clean Hydrogen Partnership) invites economic operators to set up a 'Hydrogen Valleys Facility' to accelerate the development of Hydrogen Valleys in Europe. This facility will provide project development assistance at various stages of maturity and may extend its support to third countries. It will also focus on retaining, collecting, analysing, and widely disseminating knowledge and lessons learned from the implementation of the assistance and of the Hydrogen Valleys projects.

Deadline date: 27 Sept., 2024

ERC Starting grants

A new call for proposals for ERC Starting grants has been opened in July. The ERC Starting Grants support outstanding Principal Investigators who are establishing their own independent research teams or programs. Applicants must demonstrate the innovative nature, ambition, and feasibility of their proposals. Grants can be up to EUR 1,500,000 for a five-year period. Additional funding of up to EUR 1,000,000 may be requested for specific eligible costs, such as start-up costs for relocating to the EU, major equipment purchases, access to large facilities, and major experimental and field work costs, excluding personnel costs.

Deadline date: 15 Oct., 2024

ERC Synergy grants

The ERC Synergy Grants (call open since July) aim to support small groups of two to four Principal Investigators working together on ambitious research projects that cannot be tackled by individuals alone. These projects should enable significant advancements in knowledge, often through interdisciplinary collaboration, innovative methods, or unconventional approaches. The research funded is expected to be globally transformative. Grants can be up to EUR 10,000,000 for six years, with additional funding up to EUR 4,000,000 available for specific eligible costs, like relocation, major equipment, and access to large facilities. All requested funding is carefully evaluated. The group members must have competitive track records and provide detailed CVs in their proposal.

Deadline date: 06 Nov., 2024

Development of next generation synthetic renewable fuel technologies

Find out more details on the Horizon Europe call HORIZON-CL5-2024-D3-02-02 for a research and innovation action developing next generation technologies for the production of novel synthetic renewable liquid and gaseous fuels from CO2, and/or renewable carbon, nitrogen, hydrogen or their compounds and from renewable energy. The planned opening date of the call is September 17, 2024. It is expected that 3 projects will be selected for funding, with about €4 million EU contribution to each.

Deadline date: 04 Feb., 2025

PEACE

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"Pressurized Efficient Alkaline EleCtrolysEr" (PEACE) is a research and innovation project funded under the EU **Horizon Europe programme** by the **Clean Hydrogen Partnership.**

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HyCC

GRANT GARANT

DTU

Clean Hydrogen Partnership

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