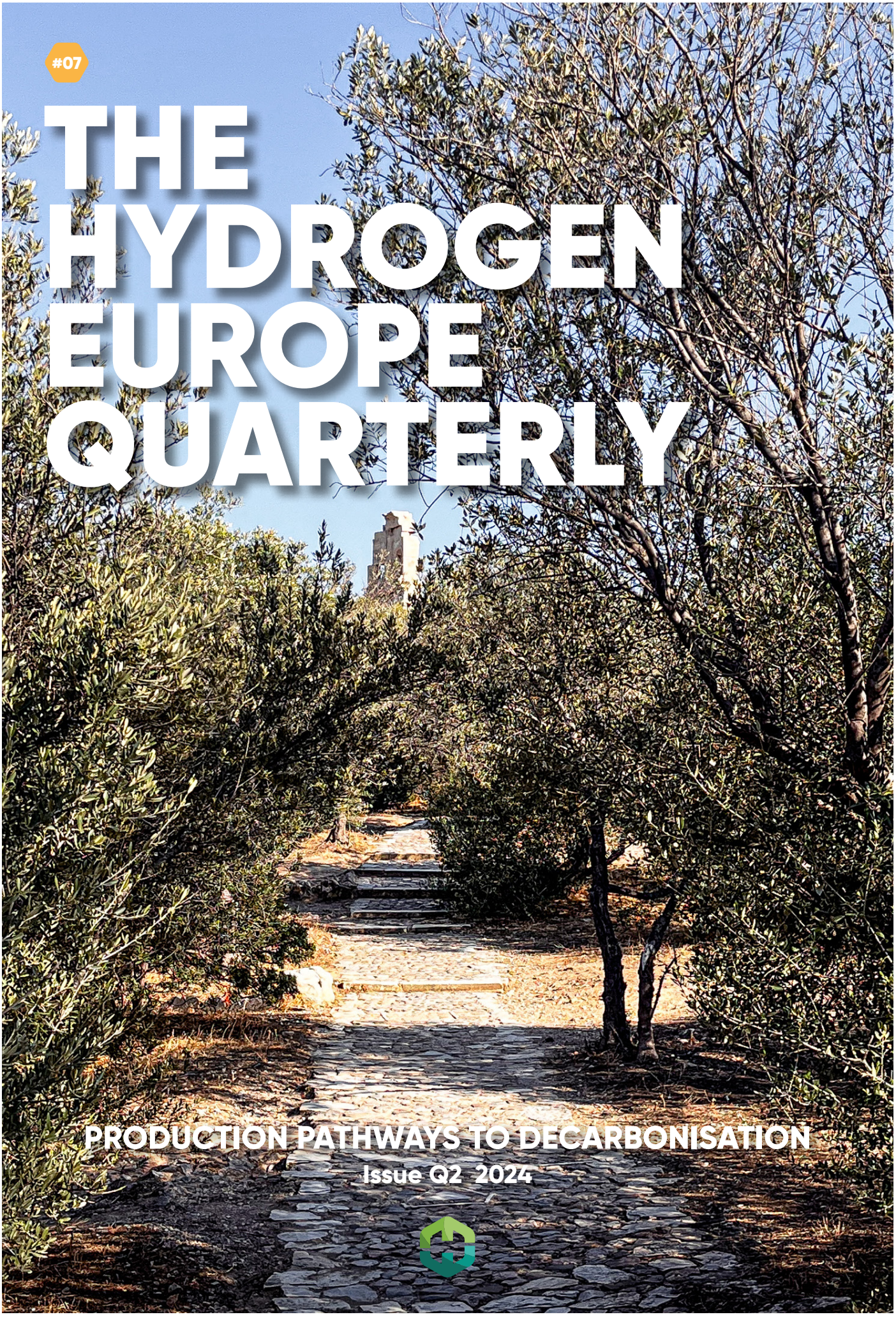
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THE HYDROGEN EUROPE QUARTERLY
PRODUCTION PATHWAYS TO DECARBONISATION
Issue Q2 2024

Welcome!

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Contents

From the CEO

Welcome to the Q2 edition of the Hydrogen Europe Quarterly magazine. This issue will explore the potential of the various production pathways that will get us on the route to decarbonisation while also discussing the issue of European competitiveness.

Growing a new industry, almost from scratch, means adapting to market signals and research & development breakthroughs in real time. For us, it has given us the opportunity to consider and **promote new hydrogen production pathways** that can contribute to our climate goals. Gone is the blue-green paradigm – any truly low-carbon production method must be supported.

There is another advantage to this, too. In a technological race with the US and China, growing the European base of hydrogen technologies will help us stay competitive in this lucrative, global market.

As such, this issue begins with two feature articles: the first on these aforementioned production pathways, thanks to inputs from **Sundus Cordelia Ramli** of Topsoe and **Andy Grabel** of BtX Energy. This is followed by an exploration of how to make sure Europe is competitive through a proper industrial plan.

We are excited to share with you a Q&A with former Italian prime minister, and the author of the recent "Much More Than a Market" report to the Council of the European Union, **Enrico Letta.**

In anticipation of the Hungarian presidency of the Council of the European Union, we are honoured to share an interview with **Attila Steiner,** Hungary's State Secretary for Energy and Climate, as our prominent person in hydrogen. Attila talks about Hungary's priorities for its presidency and the value of hydrogen to our climate goals.

Hungary, specifically the **Hungarian Hydrogen Technology Association,** is also our national association spotlight feature. Meanwhile, our regional member spotlight is on northern Italy's **Emilia Romagna.**

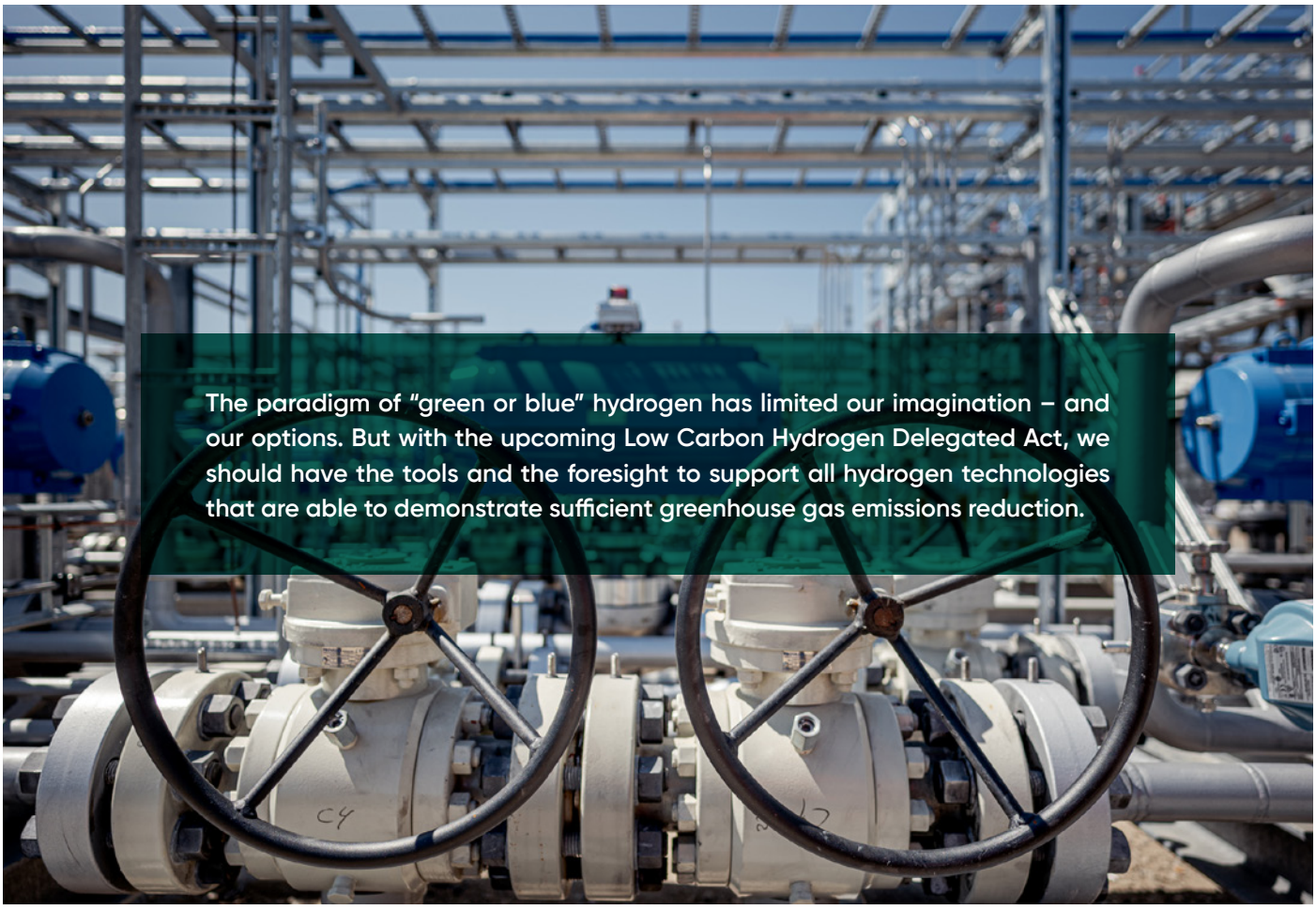
Finally, our policy & market updates take a look at the **hydrogen bank,** which **is gearing up for a €1.2bn second round this autumn,** and the low carbon hydrogen delegated act, on which Hydrogen Europe has released a position paper, among other major topics.

Our trade & funding updates welcome two **submissions from our US and Canadian neighbours** alongside a deeper look at electrolyser technology and an exploration of Mauritanian hydrogen potential.

We hope you will enjoy this issue and find it to be a useful stocktake of where we are, and where we still need to arrive, on our mission to use hydrogen as a catalyst for a sustainable, carbon neutral world.

Jorgo Chatzimarkakis
CEO, Hydrogen Europe

Beyond the rainbow: crowding in production pathways for faster decarbonisation



The paradigm of "green or blue" hydrogen has limited our imagination – and our options. But with the upcoming Low Carbon Hydrogen Delegated Act, we should have the tools and the foresight to support all hydrogen technologies that are able to demonstrate sufficient greenhouse gas emissions reduction.

The name of the game is decarbonisation. The finish line is 2050, by which time we must reach net zero. We can electrify most of our activities thanks to renewable energy and battery storage. And now, after a whirlwind decade, we are in position to produce hydrogen and its derivatives for all those hard-to-abate sectors – as well as to support electrification in selected sectors in the interest of system resilience.

While renewable hydrogen has justifiably received the most attention for its unequivocally green credentials. Even within the umbrella electrolysis there are numerous technologies on offer: Proton Exchange Membrane (PEM), alkaline, and Solid Oxide (SOX) with innovators across Europe continuing to improve the recipe.

Danish company Topsoe, which is set to open the world's first industrial-scale SOEC manufacturing facility in Herning, Jutland, reports efficiency increases of 20-30% compared to competing technologies.

"It's really significant as we anticipate that there will be bottlenecks in renewable energy buildout in the future," explained Sundus Cordelia Ramli, CCO of Topsoe's Power-to-X division.

The factory has received €96m from the Innovation Fund, which arrived after the project had taken final investment decision (FID).

"We took FID before receiving the Innovation Fund grant money because we wanted to ensure the supply was there for our customers. The EUIF grant allows us to ensure an even more competitive product for them." said Ramli.

Each electrolysis technology has its advantages and offers a different use case to buyers and users. But for a plethora of reasons, renewable hydrogen won't be enough in the short term to reach our targets – binding and not. One of the benefits of hydrogen is how many varieties of production methods there are. It is something we ought to take advantage of, particularly given the urgency of the task at hand.

'Blue' hydrogen, produced with natural gas through steam reforming or autothermal reforming and combined with carbon capture and storage (CCS) technology, has long been viewed as the "transition fuel" of hydrogen. There is already plenty of gas to be used for the purpose and CCS capture rates are increasing all the time.

The issue here is the variety of capture rates in practice, resulting in a wide range of eventual greenhouse gas emission rates.

"What's really important is to ensure that whatever alternative pathways you use are actually truly low carbon," said Ramli, who is working on blue hydrogen with Topsoe.

This is where the low carbon hydrogen delegated act (LCH DA), which will define the amount of CO2 emissions permitted before which any production method can be called "low carbon" and, thereby, benefit from funding support and accelerated permitting.

"Once you have a clear and robust low-carbon hydrogen definition, you will boost all different production pathways. But we must ensure pathways are truly low carbon because the overall goal is greenhouse gas emissions reduction," concluded Ramli.

"Lawmakers must keep the laws as open as possible for hydrogen technologies based on greenhouse gas emission reduction and price," agreed Andy Grabel, Managing Director at German group BtX Energy, which specialises in syngas and waste-to-hydrogen processes.

Hydrogen from X

Once the definition is in place then a number of processes, non-renewable but with exciting decarbonisation potential, can get due consideration.

Nuclear hydrogen is an option for countries like France, which boasts a low carbon grid and plenty of nuclear capacity to play with. But few other countries can hope to have the same conditions. Meanwhile, natural hydrogen – extracted from the earth - will not be a legitimate opportunity for some time yet, despite surely being an exciting prospect for the long term.

Pyrolysis, for which Hydrogen Europe produced a paper alongside Germany's DVGW in 2022 and which is talked about in more detail in this magazine in an analysis of the low carbon hydrogen delegated act, shows the potential of producing hydrogen from natural gas through a process which creates carbon as a solid by-product, and zero emissions. Solid carbon is valuable and can be used in numerous other applications. The technology is nearly mature enough to scale and should be an exciting and effective piece of the hydrogen supply chain.

And then there is a solution which is available to all EU member states and beyond, thanks to something which nearly each one has in abundance: waste.

Grabel's BtX Energy, which had been focusing on gasification and

biofuels, soon saw the potential of waste-to-hydrogen and began focusing its efforts there.

"it was a modification of our available technology and components to produce hydrogen directly via syngas and biomass. Hydrogen is in fact even easier than synthetic fuels," explained Grabel.

BtX Energy recently made history by becoming the first company in Europe to receive fuel trade certification for hydrogen of biogenic origin – based on the same rules as biofuels, specifically biomethane.

To Grabel, the way forward is clear and obvious. Waste-to-hydrogen means an abundant feedstock being removed from the environment, the zero-emission production of an important fuel, and an affordable process by which to do so.

"We are focusing too much on importing hydrogen when our local potential for hydrogen from bio waste is huge – and it's not understood exactly how huge," he said.

For example, Grabel explained that if one only considers animal waste in Germany, you have enough potential fuel to supply five times the bus traffic in the entire country.

There is also great potential to create actual carbon sinks with the technology, either by converting methane in fields to CO2 through hydrogen production, reducing the emissions by a factor of 25, or by using solid waste and biomass and keeping the carbon – similar to pyrolysis.

"We burn waste just to produce electricity at low efficiency and we let biogenic residues stay in the fields and forests, unused and creating emissions," lamented Grabel.

Simply by leveraging our societal penchant for creating huge quantities of waste, we can produce a much-needed fuel and create no, or negative, emissions in the process.

Zooming out once more to the larger picture, waste-to-hydrogen and pyrolysis technologies are ready – or nearly ready – to contribute at scale to the decarbonisation mission and to the upscale of the hydrogen market. But they will need the same kind of support we are beginning to see forming for renewable hydrogen.

"***Every single part of the integrated value chain has a chicken and egg problem, so we have to make sure we have a comprehensive and integrated approach to policy making. Hydrogen policies should not be developed in isolation and first movers need to be rewarded because they will ignite the industry,"*** concluded Topsoe's Ramli.

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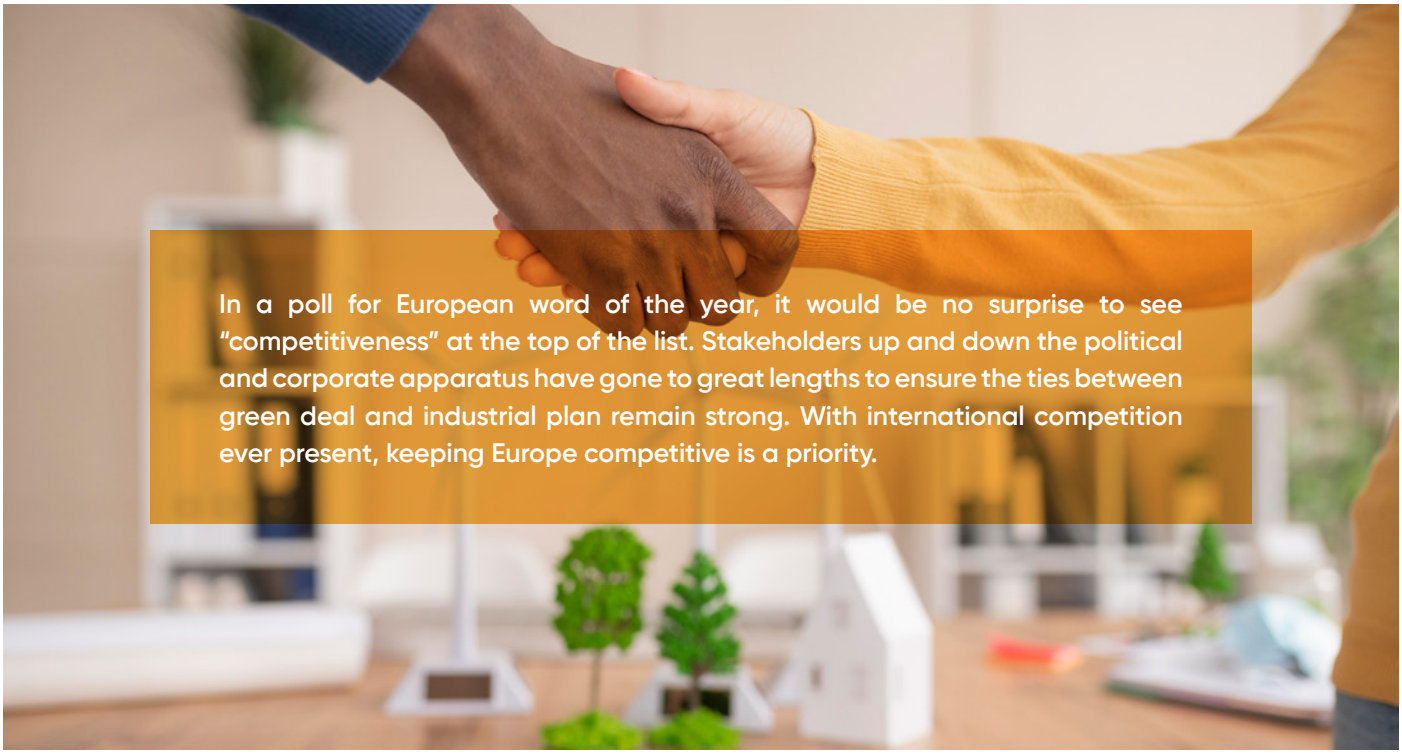
Creating a more competitive Europe



In a poll for European word of the year, it would be no surprise to see "competitiveness" at the top of the list. Stakeholders up and down the political and corporate apparatus have gone to great lengths to ensure the ties between green deal and industrial plan remain strong. With international competition ever present, keeping Europe competitive is a priority.

Hydrogen Europe's manifesto for the 2024 European elections, released in February, set out 3 priority pillars:

1. **An EU industrial policy for a competitive, resilient, and sustainable Europe**
2. **A thriving European market for clean hydrogen**
3. **A pan-European infrastructure that provides resilience and flexibility to the energy system**

The first priority, focusing on competitiveness and resilience within the Net Zero framework, will beget the other two. A successful energy transition, a strong hydrogen market, and a resilient energy system can best be achieved with efficiency and competitiveness at the heart of any strategy.

What does this mean? It means innovating, in the private sector, and legislating, in government, to keep prices low, to improve supply chains and local manufacturing capacity, and to stimulate investment in clean technologies. It means working together across the value chain to build up our necessary infrastructure and set the markets.

The spectre of solar photovoltaic looms large over these discussions. Here is an industry where European researchers and first movers did most of the leg work in the early days, only to see competitor countries undercut them on prices and eventually dominate the market. This was not very long ago, but there is a real risk of repeating these mistakes without a coherent European strategy.

"There will be no energy transition without green molecules. The market for sustainable hydrogen will develop into a multi-billion business in the coming years. Europe is leading the way in terms of the number of projects announced and the total investment announced. But we must actively do something to maintain competitiveness in Europe - to avoid new dependencies and to secure value creation and know-how in Europe," said Alexey Ustinov, Head of Sustainable Energy Systems in Siemens Energy.

Siemens Energy is one of the most active companies in the European hydrogen space, with more than 190MW of electrolyser capacity currently under construction and a large 200MW project with Air Liquide in development.

In November 2023, production began at the new Air Liquide and Siemens Energy Joint Venture gigafactory in Berlin. The 2,000 m² plant is producing electrolysis stacks based on proton exchange membrane (PEM) technology.

"Our plant in Berlin is ready to deliver, now it is a matter of implementation. Targets need to translate into final investment decisions (FID)!" added Ustinov.

Readers may be familiar with the statistic that only 4% of announced hydrogen projects reach FID. Much time has been spent, and many column inches written, about how to improve this rate.

A robust industrial policy

A consensus has emerged in recent months that the key to improving European competitiveness, especially on hydrogen and clean technology, is a bona fide and far reaching European industrial policy.

The European Commission has taken this mantle and launched The Green Deal Industrial Plan, designed to "secure Europe's place as the home of industrial innovation and clean tech".

Its four pillars are focused on:

- A predictable and simplified regulatory environment
- Faster access to funding
- Enhancing skills
- Open trade for resilient supply chains

The pillars demonstrate a key awareness in the Commission of Europe's current limitations, but old habits die hard, and industry leaders have noticed the gap between ambition and implementation.

The Antwerp Declaration for a European Industrial Deal led by Cefic, the European Chemical Industry Council, counts over 1220 signatories across 25 sectors. Simply, the declaration recognises the need for a "European Industrial Deal to complement the Green Deal and keep high quality jobs for European workers in Europe."

Outgoing Belgian PM Alexander De Croo, who was a vocal supporter of the declaration, stated that ***"We need our industry for their innovation capacity. To come up with tomorrow's climate solutions. That is why Europe should not only be a continent of industrial innovation but should remain a continent of industrial production."***

The diagnosis, then, is well understood. But what is the cure, and how should it be administered?

"The Antwerp Declaration started small and has snowballed. It is now a movement in Brussels with over 1200 signatories. If you look at the green deal implementation and 2040 impact assessment, industry investments need to increase by a factor of six." explained Marco Mensink, director general of Cefic.

"Implementation of the green deal, beyond just transition, is about the future of Europe," he added.

Time is of the essence given the rise in competition from the US and China, the world's superpowers, in clean tech.

"Europe has been losing ground; energy prices are double compared to other competing regions, we see China is exporting more and investments are moving to places like the US with the IRA. Europe urgently needs the business case for investments" explained Mensink.

"Now many people in Brussels have acknowledged that we need an industrial deal – we need to see this front and centre of the EU Strategic Agenda 2024 - 2029." he continued.

"All legislation is being developed based on the belief that the EU is leading in world. But what if we made legislation under the assumption that we're losing competitiveness, that we don't have the latest tech, that the US and China move quicker than us. Would we take a different approach to EU decision making, then?".

Made in Europe

International competition is one thing and, while obviously linked, is somewhat separate from ensuring the growth of European industry in Europe. At the very least, you must guarantee the latter before you may consider the former.

So how can this be done?

The EU's single market is a testament to the benefits of economic and political unity between states. Despite its shortcomings, in the single market we have the basis of the solution to our challenges.

Enrico Letta, the former prime minister of Italy, published his report to the European Council entitled ***"Much more than a market".***

As summarised by Brussels-based think tank Bruegel:

"Letta makes a powerful political and economic case for single market deepening and broadening. He explains why the single market is critical to tackle the big problems of our times: boosting investment to finance Europe's many needs through a "savings and investments union"; lowering the costs of decarbonisation; strengthening Europe's ability to defend itself; and making it easier for European companies to grow and achieve scale. The single market is critical not just to give Europe's citizens better choices, but to strengthen Europe in the world."

"The Letta report is very much about the future of the EU and getting the infrastructure in place with high quality jobs for EU workers." We need to implement the EU Green Deal, and we need to do this in a just way. " said Mensink.

There are many recommendations within the report, but essentially the message is that we must empower SMEs throughout Europe and across sectors, invest in the infrastructure we need to achieve our interconnectivity and climate goals, open up our financing apparatus, and not leave any member states behind.

European problems also require European solutions and, when it comes to hydrogen and clean tech, competing on a price-only basis is a losing battle.

"European manufacturers will not be able to compete on price alone, and without policy action, the nascent European hydrogen industry could face the same fate as PV. Policy makers need to apply the learning curve from wind and PV auctions and take concrete steps to include non-price criteria," said Siemens' Ustinov.

Non-price criteria, particularly geared towards decarbonisation and other social components, will ensure that non-European companies do not dominate when competing in, for example, the European Hydrogen Bank. Chinese electrolysers are four times cheaper than European-made ones, but the benefits of supporting European industry are quantifiable too.

We must not abandon our own innovators too soon, as we have done in the past. Doing the right thing here will help us build up resilience and local supply chains to secure our future, and our place in the global market.

Financing

A strong European market also requires a strong financial sector, ready to support innovation and bridge the aforementioned price gap.

One idea, as mentioned in the Letta report and touted by European Central Bank president Christine Lagarde – not to mention by Hydrogen Europe's CEO Jorgo Chatzimarkakis – is a Green Capital Markets Union (CMU).

"We know that public money has its limits and competition for it will increase with new challenges on the horizon. It is therefore paramount that we find new ways to pull in private investment in the transition. The completion of the Capital Market Union is a key piece of that puzzle," explained Ustinov.

The EU is heavily reliant on the banking sector, which accounts for approximately 80% of financing needs. The United States, in contrast, boasts strong capital markets able to contribute to around 40-50% of the country's financing. By strengthening our own capital markets, Europe can unlock billions in financing for its clean tech industry.

Christine Lagarde

Conclusion

The European clean tech industry needs support to thrive and to deliver a sustainable, carbon-neutral world to its citizens. That support must be organised around a strong industrial deal that will accelerate project timelines, build up supply chains, open up access to financing and, ultimately, secure our future as the world's clean technology leaders.

Our two interviewees for this article perfectly summarised the task at hand:

"Put an industrial deal the core of the next political cycle, and install a Vice President in charge of overseeing its implementation. Not only because you need that coordination mechanism but also because it will be an enormous signal to rest of world that Europe is open for business. If we want to increase investments sixfold, we need rest of world to invest in us." said Mensink.

"We need to take care not to repeat the mistakes of the past. The PV industry was conceived and researched in Europe. But the financial support failed, it was stopped too early. The industrial scaling eventually took place in China. And now China has taken the millions of research dollars invested by Europe and put it into industrial production and commercialization. Europe is a great place for investment, we know what needs to be done, we just need to do it," said Ustinov.

PROMINENT HYDROGEN PEOPLE: Attila Steiner

Hungary is about to embark on its presidency of the Council of the European Untion from July until the end of 2024. Tasked with continuing Europe's priorities in the wake of the elections, the Hydrogen Europe Quarterly spoke to Attila Steiner, State Secretary for Energy and Climate in the Hungarian government, about energy and hydrogen.

Attila Steiner

Which are the priorities of the Hungarian EU Presidency in the field of energy policy?

Hungary will hold the Presidency of the Council of the European Union for the second time, at a crucial period when the EU faces a number of security, environmental, economic and social challenges. The combination of Russian-Ukrainian war of aggression against Ukraine and growing global uncertainty requires the European Union to increase its resilience and strategic autonomy. Let's not forget that the EU will have a new Parliament, a new Commission and a new Council President, and Hungary will actively contribute to the new agenda and priorities of the new institutional cycle. Our main focus points of which are: a secure and resilient energy system, a fair, sustainable and clean energy transition, affordability for all

energy consumers and competitive energy prices for European businesses. We want to continue the work of our trio partners and remain focused on the implementation of the Fit for 55 framework, for example by planning exchanges of views and policy debates on National Energy And Climate Plans. We also want to provide guidance on the governance of the Energy Union. We plan to discuss and adopt Council conclusions to strengthen the use of geothermal energy in the context of decarbonisation of the energy sector. We are also planning discussions on grids in order to develop a resilient and flexible energy system.

Competitiveness and technology diversity - will they become an important topic, especially after the European elections?

There is no energy transition without a healthy and sustainable economy. The challenge ahead is how to increase our competitiveness while fully meeting our climate targets. Technology and knowledge are the most important tools to make our economy greener and more competitive. Balanced public policies are needed to increase the potential of technology and skills to enhance the green transition.

It is therefore worth discussing the administrative barriers that unnecessarily hinder the production and use of RFNBO or low-carbon hydrogen. The uptake of some technologies should not be limited by European regulation in favour of another technology if both could contribute to our climate goals. Companies should decide on how to reduce their carbon footprint.

What's your view on the role of hydrogen?

Water will be the coal of the future, the energy of tomorrow, Jules Verne once wrote in The Mysterious Island – and what was once utopia is now reality. We are working to introduce hydrogen to our children now as an affordable, clean source of energy, and we have hopes in connection with its application. On 3 June, we inaugurated Hungary's first green hydrogen plant in the Bükkábrány Energy Park, a first of its kind in the region. In just a few days, three new hydrogen fuel cell buses have been put into service in the suburbs of Budapest and two county towns thanks to support from the Ministry of Energy. Passengers and service providers in the metropolitan agglomeration and in six provincial cities can familiarise themselves with the technology throughout the year in regular service, and free refuelling is also provided at a Budapest location as part of the project. To sum up, we see great opportunities and even greater challenges in hydrogen technology for the time being.

Currently, even within the EU, there are very large differences in hydrogen production potential. The results of the recent Hydrogen Bank auction confirm this, but there is no development without investment. However, the first auction shows that green hydrogen is now a marketable product under the right conditions! This is a huge collective achievement!

Hydrogen has advantages over other technologies in hard-to-reduce industrial sectors and in heavy freight transport, but the price problem must be overcome. At this stage of market development, it is mainly a question of providing financial support.

The EU legislation foresees the adoption of a delegated act on low-carbon hydrogen. Is that one of your priorities?

We need cheap and clean hydrogen. If we can produce low-carbon hydrogen more cost-effectively than green hydrogen, while meeting climate targets, then obviously this technology is also worth developing.

PROMINENT HYDROGEN PEOPLE: Enrico Letta

Former Italian Prime Minister Enrico Letta published a major report to the Council of the European Union on the state of the single market and how to maintain and improve it. "Much More Than A Market" details a number of recommendations around strengthening Europe's global competitiveness. The Hydrogen Europe Quarterly speaks to Mr. Letta on the reaction to the report and his view on the future.

Enrico Letta

What advice would you offer incoming MEPs who are also focused on competitiveness and a single market that works for all?

The Single Market is at the heart of the European integration project - we cannot take it for granted - it requires continuous maintenance. The Single Market is not an abstract concept; it is the lifeblood of European citizens. Protecting and revitalizing it should be the priority of the next legislature. The work of the European Parliament is fundamental in this regard.

Tell us what the rationale behind the "Letta report" was?

When Jacques Delors introduced the European Single Market in 1985, the EU was known as the European Communities, with significantly fewer member states. At that time, Europe was a central player in the global economy, leading in economic weight and innovation. The Single Market aimed to strengthen European integration by eliminating trade barriers, ensuring fair competition, and promoting cooperation and solidarity among Member States. It facilitated the free movement of goods, services, people, and capital through harmonization and mutual recognition, thereby enhancing competition and fostering innovation. Tailored for its time, the Single Market significantly boosted the European economy and became a powerful attractor.

Over thirty years later, it remains a cornerstone of European integration and values, acting as a catalyst for growth, prosperity, and solidarity. However, the global landscape has profoundly changed, highlighting the need for an overhaul of the Single Market. A new approach is necessary to ensure that the Single Market remains relevant and effective in today's more complex

and interconnected world. We need a strong political commitment to empower a new Single Market. This new framework must be able to protect the fundamental freedoms based on a level playing field while supporting the objective of establishing a dynamic and effective European industrial policy. To achieve these ambitious objectives, we need speed, we need scale, and above all, we need sufficient financial resources.

How has the response to the report been?

During the drafting process, extensive consultations with a wide range of stakeholders – including institutions, the private sector, associations, trade unions, and citizens – revealed the fundamental need to modernize the Single Market for the 21st century. The increased attention and interest following the publication of the report highlight the urgent need for rapid and effective reforms to address the many barriers that remain within the Single Market, its untapped potential in areas such as finance and savings, and the gap with the United States. This strong response underscores a broad recognition of the importance of advancing the Single Market to better meet contemporary needs.

Additionally, the reception from European Council leaders has been highly positive. I have been invited to present the report in all European capitals, and there is now an official track for these ideas to advance within the COMPET Council. The incoming Hungarian presidency has shown interest and expressed a willingness to promote some of the report's proposals in their presidency program. This widespread support is a testament to the shared commitment to enhancing the Single Market and ensuring its continued relevance and effectiveness.

How pleased, or displeased, as you regarding the recent progress the EU is making in improving its market competitiveness - particularly in clean technology like renewables and hydrogen?

I find the recent progress the EU is making in improving its market competitiveness, particularly in clean technology like renewables and hydrogen, to be quite positive. Over the past few years, the EU has made significant strides, especially evident in its effective response to the energy crisis, where there were no blackouts or rationing. This demonstrates the robustness of the EU's energy policies and infrastructure. And the energy crisis has been a powerful accelerator of the deployment of clean technologies in Europe, from wind and solar PV to electric vehicles and heat pumps. This is a very clear trend.

However, as I highlight in my report, there is a risk of fragmentation or regression if we will be unable to renew our commitment to our ambitions. To avoid setbacks, it is crucial to reinvigorate our goals. Hydrogen, as highlighted in the report, is a vital component of this strategy. It plays a crucial role in the EU's efforts to enhance market competitiveness by enabling the decarbonization of hard to abate industrial sectors. The EU has adopted the world's most advanced regulatory framework for the future hydrogen economy. But there are still too few hydrogen production projects that move to final investment decisions, and on the demand side, too few offtakers ready to sign contracts to switch to hydrogen. That's why I believe the European Hydrogen Bank plays an important role to promote market development and should be consolidated and expanded. And we need a stronger attention to planning and funding the necessary hydrogen transport infrastructure. The next two-five years will be crucial for the take-off of a hydrogen market and industry in Europe. More efforts, more funding, more coordination are necessary to maintain and improve the EU's leadership in this clean technology.

What role do you see for hydrogen in Europe's sustainable economy?

Hydrogen plays a pivotal role in reconciling Europe's industrial objectives with its green ambitions. By enabling the decarbonization of industrial sectors, like chemicals, cement or steel, hydrogen allows for investment in European production without compromising the EU's climate goals. This balance is essential for advancing both economic and environmental agendas.

Moreover, investments in hydrogen are crucial for the EU to maintain technological leadership in strategic sectors. Such investments bolster the EU's position in global value chains and enhance its strategic autonomy. Hydrogen technology thus supports a sustainable economy by driving innovation, reducing emissions, and reinforcing Europe's competitive edge on the global stage.

Building Europe's first hydrogen ecosystem: reflections on the Hydrogen IPCEI journey

On May 28th, 2024, the European hydrogen sector celebrated a significant milestone: the European Commission officially notified the fourth and final "wave" of the **Important Projects of Common European Interest (IPCEI)** on hydrogen. This marked the conclusion of a journey that began in 2019, almost five years ago.

The **Hydrogen IPCEI** represented one of the most ambitious initiatives for the sector to date, aimed at establishing the foundation of a first-of-its-kind European hydrogen ecosystem, through a collaborative effort between Member States and private players. The first wave provided joint support for electrolysers and fuel cells to produce renewable hydrogen and power vehicles, the second wave supported industrial applications, the third wave aimed at building hydrogen infrastructure such as pipelines and long-term storage facilities, and the fourth one funded hydrogen mobility applications.

Hydrogen Europe can claim to have sparked the idea for a **hydrogen IPCEI** as early as 2018, advocating for hydrogen's potential for decarbonisation, and the need of a Hydrogen Strategy to be enshrined as a main pillar of the yet-to-come Green Deal. But to jumpstart the hydrogen economy, a massive systemic, pan-European initiative was key for connecting future supply and demand of hydrogen. This advocacy bore fruit and, in 2019, Hydrogen Europe participated in the Hydrogen for Climate Action conference and voted in favour of the first **Hydrogen IPCEI**.

At that moment it was all set: Member States launched national calls for interest to companies that saw the opportunity to invest in hydrogen projects, to become the first movers in this new and ambitious challenge. At the end of the calls, more than 200 companies were selected, and were redistributed to the different waves of the **Hydrogen IPCEI**.

The first notification, for the Hy2Tech wave, came in July 2022 and focused on the development of electrolyser and fuel cell technologies. Hy2Tech notified €5.4 billion in public funds, complemented by €8.8 billion from private investments. Shortly after, the Hy2Use wave was approved, targeting hydrogen-ready industrial solutions and infrastructure, with €5.2 billion in public funds and €7 billion in private investments.

Following a nearly two-year silence, 2024 saw the notification of the final two waves. In February, the Hy2Infra wave focused on hydrogen infrastructure (€6.9 billion public + €5.4 billion private funds), followed by the Hy2Move wave, which addressed hydrogen in mobility applications (€1.4 billion public + €3.3 billion private funds), were approved by the Commission.

This collective efforts of 16 European countries should cater for €18.9 billion in public funds, hoping to stimulate an additional €24.5 billion in private investments. This is massive. The unprecedented collaboration will deploy 122 projects across Europe, marking a monumental achievement for the hydrogen sector. Notably, Germany, France, Italy, and Spain emerged as major beneficiaries, with 30, 17, 14, and 13 projects respectively.

While the celebration of the Hydrogen IPCEI is well-deserved, it is essential to recognise and address the challenges that this ambitious, but imperfect initiative, generated. The idea was launched in 2019, with final approval in 2024 - a five-year gap during which economic, geopolitical, and technological perspectives changed significantly, exposing the projects to additional risks. The future Commission should make strong improvements, following our lessons learnt from the hydrogen sector.

Despite the notification of €18.9 billion in public funding by 15 Member States (plus Norway), there have been significant difficulties in deploying these funds. Several projects from the first wave, notified as early as 2022, are still awaiting financing. Many of these projects have had to start operations using their resources, which involves considerable risk in a young sector subject to market failures.

Private investment in the hydrogen sector is also substantial, with over 100 companies committing over €24 billion. However, inflation, supply chain disruptions, and health and energy crisis have significantly increased project costs. The original funding gap identified is no longer sufficient, necessitating a reassessment of financial requirements to ensure projects can move forward without undue financial strain.

A major hurdle in the streamlined implementation of the Hydrogen IPCEI was the lack of harmonised rules and procedures for national allocations. These discrepancies caused delays, particularly for projects with cross-border implications. The varying legal frameworks among Member States hindered the timely disbursement of funds and efficient execution of projects.

Additionally, the initial ambitions of the Hydrogen IPCEI have been tempered over time. Several countries (and companies) have scaled back their projects or withdrawn from the IPCEI process to seek quicker alternatives, e.g. individual notifications (GBER, CEEAG) or funding elsewhere. This shift highlights the need for a more responsive and adaptable framework within the IPCEI to retain participation and meet the sector's evolving needs.

In conclusion, while we celebrate this landmark achievement in the hydrogen sector, it is crucial to address the challenges to ensure the long-term success of the European hydrogen economy. **The Hydrogen IPCEI has set a precedent with its significant public and private collaboration, mobilising more resources than any other IPCEI, including those in batteries, health, and microelectronics.**

The European Commission and representatives from Member States are now actively discussing improvements to the future IPCEI framework and debating which sectors of the economy should be prioritised for state aid support. This dialogue raises the possibility of a new dawn for a reinforced, streamlined, and more coherent IPCEI, potentially benefitting the hydrogen sector further and addressing supply chain segments that have not yet been considered.

By Luca Marsili, Officer,
Industry & Sustainability Policy, Hydrogen Europe

Regional Association Spotlight: Emilia Romagna

Nestled between the Appenine mountains and the Po river, the Italian region of **Emilia Romagna** has much to offer in terms of food, culture, and art. But the region's green ambitions and its experience in gas management also make it a potential hotspot for hydrogen development. We spoke to Claudia R. Romano, the region's Director and Head of Energy and Green Economy Area, about hydrogen opportunities and the roadmap to get there.

> **We have the knowledge. Help us develop low carbon technologies for hydrogen production!**

RegioneEmilia-Romagna

At the end of last year, the Modena Hydrogen Valley, a project led by Snam and Bologna-based utility Hera Group, was launched. The project involves the construction of two solar farms – one ground-mounted and one floating - and a 2.5MW electrolyser with the capacity to produce around 400 tonnes of renewable hydrogen per year. Local transport companies TPER and SETA are lined up to use the hydrogen to decarbonise their fleets in Modena and nearby Ferrara, with TPER having already placed an order to purchase more than 120 hydrogen buses, which should arrive by the end of this year.

The project was awarded €19.5m under the National Recovery and Resilience Plan (NRRP), and is one of around 30 other Hydrogen Valleys across Italy to receive funding from the same plan, including in Abruzzo, Puglia, Rome, Trieste, Tyrol, and more. Back in the region of Emilia Romagna, things are just getting started.

"We are using the hydrogen valley as a pioneer to launch other private initiatives, and we are looking at lots of them," enthused

Claudia R. Romano, the region's director and head of energy and green economy area.

Romano is focused on properly preparing the region for subsequent projects – ensuring an efficient and responsible use of resources to build up its hydrogen capacity.

"We've seen that all regions going ahead with hydrogen have begun with properly mapping their economic system, supply and demand, and so on," she explained.

Last July, a regional forum on hydrogen was inaugurated, grouping stakeholders in research innovation with counterparts in industry to focus on who might be the main offtakers and who would be active in production and storage. The second meeting focused on different sectors and how to abate them, with conversation on cement production as well as glass and ceramics, with the latter sector leading to a discussion on high percentage hydrogen-gas blending in stoves.

These regional hydrogen forums are planned to take place at least twice a year to ensure updated, informed, and involved stakeholder discussions can find solutions and foster partnerships.

This is important for Emilia Romagna because, as a highly developed, densely populated and mountainous region, any large infrastructure projects must be intelligently planned. The Modena Hydrogen Valley, for example, is a brownfield project located in a disused landfill, turning otherwise unkept land into a decarbonisation project for the people.

This success will offer good lessons for future projects because, as Romano explains, ***"Being a very dense region with lots of infrastructure and inhabitants, we don't have much available surface to place PV and wind farms."***

The use of floating solar to complement the ground-mounted plant shows the region's space limitations, but also its smart thinking for overcoming them. Another potential solution is to look to the sea, where a planned 450MW offshore wind farm near Ravenna could be used to produce renewable hydrogen.

And when it comes to the use of this hydrogen, public transportation has long been viewed as a good candidate not only for hydrogen use but also for raising the profile of hydrogen among the public.

For Romano, the signals in Italy and Europe are clear: ***"The market is going in the direction of hydrogen public transport, so we have to help it,"*** she says.

Among the conversations being had in the region are alternatives to renewable hydrogen in response to the space issue mentioned previously. Exploring production pathways like low-carbon hydrogen with carbon capture and storage (CCUS) and Waste-to-Hydrogen could offer solutions where renewable hydrogen isn't possible. But for this to be a viable option, regulatory clarity is essential. The low carbon hydrogen delegated act, which is analysed from several angles in this issue of the Hydrogen Europe Quarterly, is one such piece of the puzzle.

"The discussions in Europe about tech neutrality should go on to make it possible for every EU region to choose the best way according to their territory and economic structure," said Romano.

Meanwhile, at the national level, there is also frustration with the delay in transposing existing EU legislation.

"We are still waiting for a lot of rules to be established at national level. It's a matter of both national and regional competence, but if they don't make them nationally, we can't make them regionally," Romano explained.

Emilia Romagna may never be the largest hydrogen producing region, but with innovative companies working on the technological side, including solid oxide electrolysers, it can be a tech exporter. A strong manufacturing and industrial base also means there are significant end use cases for the region's local production.

Romano's message to investors and innovators? ***"Come and work with our companies and develop technologies for transport, storage and so on. We have the knowledge. Help us develop low carbon technologies for hydrogen production!".***

National Association Spotlight: Hungarian Hydrogen Technology Association

With its ascendence to the presidency of the Council of the European Union, for the next six months all eyes will be on Hungary and its position on energy and security. Since 2020, the country has been building its own hydrogen ecosystem, led by **István Lepsényi,** Chief Executive Officer of the Hungarian Hydrogen Technology Association (HH2TA). We spoke to him about Hungary's potential for production and use.

> **"Hydrogen will be an important part of the Hungarian presidency, there are already some discussions on-going.**

HUNGARIAN HYDROGEN TECHNOLOGY ASSOCIATION

István Lepsényi, having attended a meeting on a hydrogen-based pilot project between a US company and Hungary's Minister of Technology in 2020, saw an opportunity that would pay dividends for his country in terms of both energy security and decarbonisation.

"I participated in this meeting and became very enthusiastic about hydrogen and convinced it was something we should be involved in," he told the Hydrogen Europe Quarterly.

He got to work immediately, first setting up an initial meeting with specialists and stakeholders, leading to a platform for hydrogen talk, sharing information and best practices. This platform was eventually converted this into the association in 2021.

As of today, it boasts 97 members, including more if not all of the big utilities as well as lots of SMEs. Universities, private investors, R&D companies ensure that HH2TA covers whole value chain of stakeholders interested in hydrogen.

In 2021, the Hungarian government adopted its own national hydrogen strategy until 2030, which Lepsényi and his colleagues worked to help prepare.

The main themes for Hungary's hydrogen journey echo that of the rest of Europe: energy security, resilience, and decarbonising the economy.

"We are highly dependent on Russian oil and gas so by 2050, we want to be almost 100% independent," explained Lepsényi. Hungary expects to achieve this through a mix of nuclear and renewables, and hydrogen will be needed in the mix as a clean energy carrier and as a grid balancing storage solution.

Hungary has good renewable energy potential, with 12GW of solar photovoltaic capacity either already installed or in advanced development. With a much lower average power consumption than that, the opportunity is huge, but so is the challenge of avoiding curtailment and grid congestion.

"We need a solution to balance renewables with the grid, and hydrogen will have an important role there," said Lepsényi, for its use as a long-term storage solution that can be converted back to power as needed.

When it comes to use cases, the obvious destination for these renewable and low-carbon molecules will be industry. According to Lepsényi, four solar plants in the country already have electrolysers installed – with more to come. The hydrogen produced has mostly gone to refineries so far. But in Hungary, where 30% of industrial output is related to the automotive industry, mobility is another sector ripe for hydrogen.

Hydrogen-fuelled bus experiments have begun and Lepsényi expects to see the first fleet arrive this year, while there is a plan to purchase hydrogen trucks and cars next year. Naturally, it is understood that battery electric vehicles will lead in the decarbonisation of road transport. But not all vehicles are equal, and needs differ between vehicle classes.

"We see a clear path – the majority of passenger transport will be battery, but H2 will be used for heavy transport and public transport," explained Lepsényi.

Naturally, with big ambitions come big price tags, and Hungary is not exempt from the tough financial decisions that must be taken in government. Securing funding for hydrogen scale up will always be a challenge.

"The big dispute in Hungary is how we can spend our limited investment resources," surmised Lepsényi.

The European Hydrogen Bank, then, which was recently announced to have a €1.2bn budget when it launches this autumn, can be an important source of funding for Hungary's nascent hydrogen sector. However despite being oversubscribed, not everyone was able to apply for the pilot auction.

"The H2 bank is an important means to build up market. But if you look at the result of the first call, the big multinational companies were successful and the central European smaller companies could not even take part. We definitely recommend that this issue be considered," said Lepsényi.

With the conversation turning to Hungary's impending presidency of the Council of the European Union, it is clear both from the government's own statements (including in these pages) and the enthusiasm of Lepsényi that Hungary should be an ally to the hydrogen sector.

"Hydrogen will be an important part of the Hungarian presidency, there are already some discussions on-going," he confirmed.

Back to the Future
Making Fuel from Waste

Do you remember the Hollywood blockbuster **Back to the Future II,** where Doc Emmet Brown used a banana peel and an empty can to create "fuel" in a fusion reactor to power the flux capacitator, turning the DeLorean into a time machine?

This fictitious scene became a reality. The only difference is that the fusion reactor is not built into the vehicle but exists next to places where the feedstock for this "new fuel" is piling up. We are talking about waste, plastics, sludge, manure and dung. And the vehicles consuming the fuel are not time machines, but commercial vehicles.

QUANTRON, from Bavaria, Germany, is a clean tech company and specialist in sustainable transportation of people and goods. They offer - amongst other services - fuel cell-powered trucks. In order to be sustainable, those trucks need green hydrogen as fuel.

Since there is not yet sufficient green H2 available today, and the corresponding fuelling infrastructure for commercial vehicles is not built out, QUANTRON initiated the **Clean Transportation Alliance (CTA),** an association of technology companies, experts, and energy suppliers, all pursuing the common goal of decarbonisation. They espouse a technology diverse approach. The Clean Transportation Alliance is a platform tailored for members to exchange ideas, foster innovation, and collaborate in concrete projects to transition road transport to zero-emission.

Let´s take a step back

Over 2 billion tons of municipal solid waste is generated each year globally. The World Bank estimates that this will surge to 3.4 billion tons by 2050. A share of our waste ends up in landfills and open dumps. **The impact on our planet and the environment is already immense.** Litter causes a variety of problems, from mountains of waste that defile our landscapes, to the pollution of rivers and seas, to the negative effects on flora and fauna.

Recycling and reuse are common methods to get the problem under control. However, this is not enough to dispose of the tons of garbage. Scientists are already working on promising solutions. **One proven method is Waste-to-Hydrogen, where waste is converted into energy and creates the opportunity to overcome the problem.**

Hydrogen demand is projected to potentially account for 10% of the global energy mix by 2050, a significant impact on the global energy landscape. In addition, hydrogen is a pioneer in replacing coal, emerging as a promising clean energy vector and offering a pathway to decarbonise various sectors, particularly transportation. However, traditional methods of hydrogen production, such as steam methane reforming, entail significant carbon emissions and undermine the environmental benefits associated with hydrogen fuel. Meanwhile, renewable electricity demand will soon surpass the available supply. The temporal and geographic variations in wind or solar installations' output poses an additional challenge. Since hydrogen can be stored in the long term, it acts as an energy carrier for renewable energies and as energy storage for surplus electricity from renewable sources to support grid stability.

Against this background, Waste-to-hydrogen (WtH) is being developed as an ecologically sustainable approach with the potential to significantly change our energy landscape. WtH encompasses various advanced technologies such as combustion, gasification

and pyrolysis to extract hydrogen from a range of waste streams such as municipal waste, industrial by-products and agricultural residues.

At first, the solid waste is sorted and collected. A pre-treatment needs to be done to remove contaminants such as non-organic materials or hazardous substances. Afterwards the waste is converted to hydrogen through, for example, thermochemical conversion which utilises high temperatures to break down the organic components of the waste. These processes produce a synthesis gas which is later separated into hydrogen and other gases. Biochemical conversion, as another example, involves the use of microorganism or enzymes to break down organic waste materials through fermentation or anaerobic digestion. The biogas produced undergoes a reforming process, to convert methane into hydrogen rich syngas. **In the end the hydrogen is compressed for efficient storage, in gaseous form or liquefied, and used for various applications.** Thus, WtH leads to a circular economy and promotes the sustainability of local and regional ecosystems by reusing existing resources. By replacing existing waste disposal mechanisms, WtH reduces greenhouse gas emissions and improves air quality.

From an economic point of view, Waste-to-Hydrogen technology offers cost advantages over conventional electrolysis processes, especially since waste materials are often available at lower or even negative costs. In addition, WtH initiatives create local employment opportunities and strengthen regional waste management systems. This process enables the recovery of valuable materials from waste streams and thus a diversion from waste landfills or incineration plants.

WtH technology could significantly contribute to creating a sustainable future by minimising the impact of inefficient

waste management. The integration of this method into our infrastructure promotes a circular system that enables almost limitless recycling. Harnessing unexplored energy resources and extracting value from materials that otherwise end up in landfills, oceans or forests redefines our waste management and creates economic resilience.

The variety of waste types demands the development and commercialisation of assorted WtH technologies, a challenge actively pursued by innovators in this field. BtX energy, based in Hof, Bavaria, developed a process to produce high-purity hydrogen from biogas from feedstock such as manure and dung.

BtX energy is one of the members of the Clean Transportation Alliance that produce hydrogen from waste. Plagazi, Uniwastec, BlueFlux Energy, Green Hydrogen Technology (GHT) and FusionOne Energy are the other partners in the Waste-to-Hydrogen cluster of the CTA, all focusing on production of Hydrogen from various feedstocks which are all considered waste. With a strong network of such like-minded partners, covering the entire value chain, QUANTRON has a real opportunity to help revolutionise the industry.

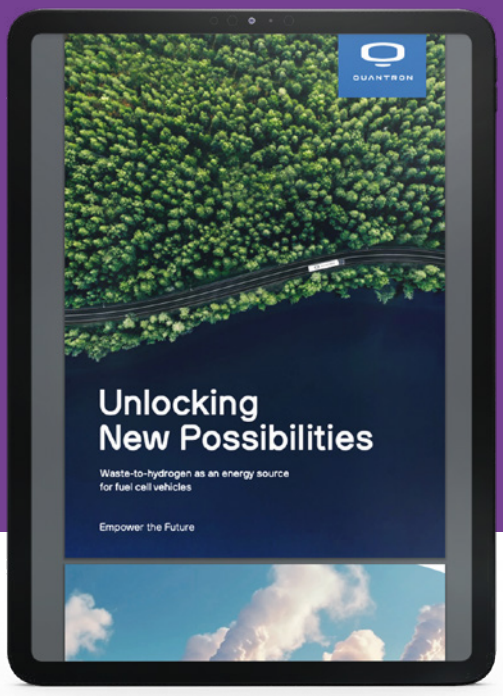
By championing sustainable solutions and embracing technological progress, QUANTRON and the Clean Transportation Alliance reaffirm their commitment to driving positive change and leading the transition towards a cleaner, greener, and more efficient transportation industry. Members of the Clean Transportation Alliance are dedicated to the ambition of decarbonization and making a more tangible sustainable future possible. Through innovative processes such as Waste to Hydrogen, they are creating a cross-generational circular economy that works for the benefit of humanity and nature.

By Dr. Srinath Rengarajan, Head of Strategy, Quantron AG

Read the latest whitepaper by Quantron:

"Unlocking New Possibilities – Waste-to-Hydrogen as an energy source for fuel cell vehicles"

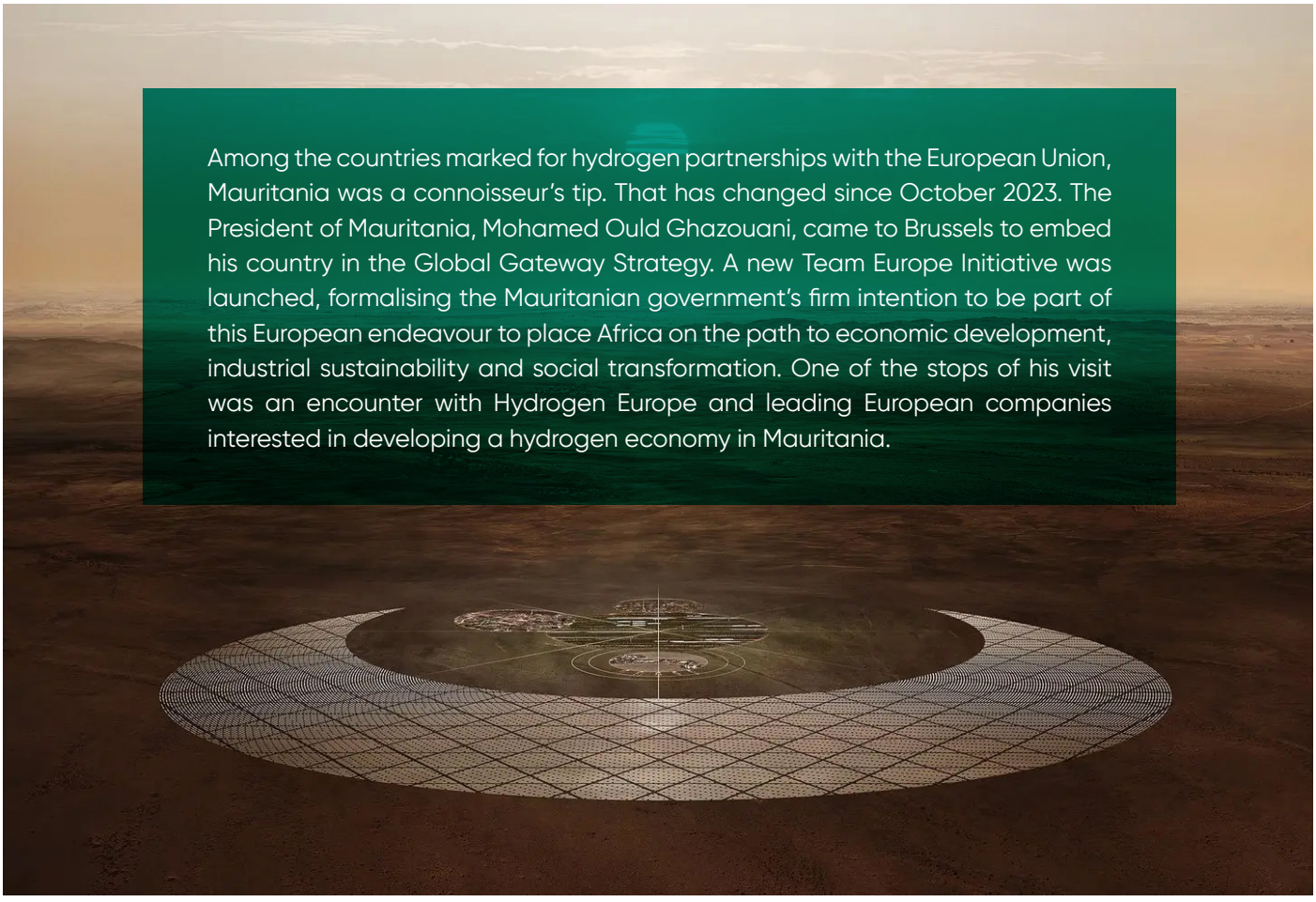
www.quantron.net/wp-content/uploads/2024/04/Waste-to-Hydrogen-Whitepaper.pdf



THIS ARTICLE IS AN EXTERNAL SUBMISSION REFLECTING THE PERSONAL OPINION OF THE AUTHORS

TRADE & FUNDING UPDATES

All eyes on Mauritania



Among the countries marked for hydrogen partnerships with the European Union, Mauritania was a connoisseur's tip. That has changed since October 2023. The President of Mauritania, Mohamed Ould Ghazouani, came to Brussels to embed his country in the Global Gateway Strategy. A new Team Europe Initiative was launched, formalising the Mauritanian government's firm intention to be part of this European endeavour to place Africa on the path to economic development, industrial sustainability and social transformation. One of the stops of his visit was an encounter with Hydrogen Europe and leading European companies interested in developing a hydrogen economy in Mauritania.

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Confirmation of Mauritania's determination to become a pivotal partner of the European Union in hydrogen development was enacted when Commission President Ursula von der Leyen and the President of the Spanish Government Pedro Sanchez officially visited Mauritania in February 2024.

Hydrogen Europe was on board again with the incisive participation of CEO Jorgo Chatzimarkakis, while our organisation had also been instrumental in composing the industrial delegation accompanying the visit of the Presidents. Mauritania hosted European leaders with the intention of staking a claim: **Mauritania wants to be top of the list of future hydrogen suppliers, while intending to utilise this new resource for national and regional industrial development, in partnership with Europe.**

In April then, the Mauritanian government hosted a large delegation of European industrial companies. This delegation, put together jointly by Hydrogen Europe and the EU Delegation to Mauritania, was briefed extensively by members of the Mauritanian government,

and gained physical insights into the country's hydrogen potential through site visits such as to the Port of Nouakchott, and more importantly the industrial sites in and around Nouadhibou, where Mauritanian mining company SNIM prepares its iron ore for export. President Ghazouani received the delegation for a courtesy call, underlining one more time his personal commitment and that of his government to the creation of a veritable hydrogen hub in Mauritania.

All this happened over six months and will now be followed up by an increased number of industrial partnerships, new developers moving into Mauritania and the finalisation of the Mauritanian Green Hydrogen Code, scheduled to be presented to Parliament for legislative approval before summer. Developers and investors had been waiting for this important piece of legislation: it will create the legal and regulatory certainty on which the development of an important new industrial sector depends.

Mauritania intends to host a new economy many times the size of its own current GDP. This economy will have to fit into the country, while it will transform it. All this requires a master plan, including territorial planning, infrastructure expansion, industrial development and transformation, social inclusion and new trade patterns and policies. While a hydrogen hub less than 2500 kilometres away from European shores provides a fantastic outlook for future green hydrogen imports into the EU – even with the realistic perspective of pipeline transport – the future hydrogen economy of Mauritania is also very much for domestic consumption.

Mauritania has become and intends to remain a haven of security and political stability in Western Africa and most significantly the Sahel region. The political leadership of the country, which has always insisted on redistribution of wealth and social policies in a way that few other African states have, intends to use the favourable conditions of today to prove that dynamic economic development is possible. They want to provide the youth of the country with life chances including quality education, training and jobs. They want to create transformative industries instead of merely exporting their mineral wealth. They want to create a modern state and society, true to their ancestral values and open to the opportunities of tomorrow. Hydrogen Europe wants to support exactly that process.

Much of the success of Mauritania's venture will depend on the transformation of its mining company into an iron ore processing company. The ore of Mauritania is now exported without undergoing any relevant transformation in the country. The export map has been diversified over recent years, and China's share in Mauritanian ore exports has shrunk from over 80 to around 50 percent – an indication for the high quality of an ore which is now coveted in Europe as much as it is in China. By producing iron products through direct reduction with hydrogen (DRI), Mauritania can lay the foundations for an emissions-free modern heavy industry. Its overall economic development would be based on a very realistic industrial production.

For this to happen, the production of hydrogen needs to get going, and fast. Many of the projects the developers designed for Mauritania are of mind-boggling size: up to 40 GW electrolysing capacity, dozens of billions of investment. None of these will appear in its final shape within the few years ahead. But a few pilot units are very realistic. Their success will be critical for Mauritania's hydrogen dream to become reality.

A delegation of EU leaders in Mauritania, including Hydrogen Europe CEO Jorgo Chatzimarkakis, promoting partnership in green energy and hydrogen

So here's a plan:

- **The government commits to the infrastructural embedding of pilot projects in three different locations: Nouadhibou port areas, Dakhlet Nouadhibou production areas, and a site closer to Nouakchott. Geographically focussed territorial planning is required.**
- **Those sites host production facilities with different hydrogen consumption perspectives: for DRI, for export, for grid stabilisation. This would establish the viability of the diverse envisioned production sites.**
- **The investors commit to implementing projet sizes and scales, over the longer term. The embryo of Mauritanian green hydrogen production would exist, and with it a plausible narrative for expansion.**
- **Offtake is guaranteed on all sites through a public Mauritanian agency. The produced hydrogen serves the purpose, at the initial development stage, of building up and stabilising the Mauritanian electricity grid. Hydrogen is not yet exported, but future contracts are prepared.**
- **The EU commits to disbursing an adequate amount of budget funds (either from development cooperation or innovation lines) and to providing initial leveraging through the EIB, in order to materially launch the energy partnership with Mauritania.**

This would allow to test the initial signatories or memoranda of understanding as to their willingness to implement quickly and allow for one or the other potential new investor to establish their seriousness as competitors, including for ulterior large-scale developments. It would produce hydrogen for electricity grid scale-up and stabilisation, prepare for exporting it and allow a first test of an innovative takeoff mechanism. If all this works, Mauritania is on track to become a beacon of clean industrial transformation.

By Frank Engel, former member of the Delegation for Relations with the Pan-African Parliament and the Delegation to the ACP-EU Joint Parliamentary Assembly

TRADE & FUNDING UPDATES

Global race on hydrogen technologies: Electrolyser competitiveness

In the drastically changing landscape of energy, a global race is unfolding to spearhead the development of crucial technologies that will define the future of the hydrogen sector. We are pleased to introduce this new section of the Hydrogen Europe Quarterly, which provides an overview of what is at stake on the global race for hydrogen technologies: electrolysis, fuel cells, compression technology, advanced materials and hydrogen carriers. In each issue, Dominik Richter, our Senior Officer for Trade, will be walking readers through the latest developments on these five key areas. This quarter, we examine electrolyser competitiveness.

The urgency of the climate change challenge and the role of electrolysers as part of the solution granted the technology a priority status in many strategies and incentive schemes across major economies, including the United States, the European Union, India and China.

According to the International Energy Agency (IEA)[1], in 2023, the combined investments in electrolyser manufacturing by the EU and the US surpassed those of China, highlighting the competitive landscape of this emerging market.

The IEA elaborates that as of the end of 2023, global manufacturing capacity for electrolysers had increased to approximately 23 gigawatts (GW) per year, up from just over 12 GW in 2022. However, this capacity is unevenly distributed, with China accounting for 60% of the total, followed by Europe at 20%, and the US at 16%. This concentration highlights a significant challenge: while manufacturing capacity exists, its full potential is often not immediately realised due to upstream supply chain constraints (e.g. materials, key components) and other logistical hurdles. The existing capacity could meet over 15% of the deployment needs outlined in the Net Zero Emissions (NZE) Scenario by 2030, but only if all planned expansions materialise.

The outlook for electrolysers in terms of manufacturing capacity expansion, however, remains uncertain. The IEA notes that in 2023 only 13% (19 GW) of the announced capacity expansions have reached the final investment decision (FID) stage, a modest increase from 7% (6 GW) in 2022. This slow progress is partly due to the high costs of electrolytic hydrogen production, the increased costs of capital, weak and concentrated supply chains, and slow implementation of supportive policies.

Despite these challenges, there are encouraging signs on a global scale. Manufacturing output nearly doubled from 2022 to 2023, though utilisation rates remain low. On the other hand, the rapid expansion in China, which accounts for two thirds of global capacity, presents a competitive challenge to other regions.

A trait of this competition is still the costs of manufacturing, which has increased significantly in the past few years. As a recent report from BNEF states[2] a significant increase in cost of manufacturing alkaline electrolysers materialised, rising by 50% since 2022 due to broader cost coverage, general inflation, and slower market scaling. Currently, alkaline electrolysis systems cost more than $2,000 per kilowatt (kW) in Europe and the US, compared to $480-$720/kW in China. This could be attributed to cheaper labour, different supply chains, an overestimation on yields and mostly, indirect subsidisation of projects (e.g. zero-interest loans, free land allocation), that helps pushing down the costs.

This skewed playing-field in addition to the inherent EU location conditions (more regulation, higher energy prices, higher cost of land and labour, etc.) makes it impossible for European companies to compete on price alone. Market dynamics for clean tech should opt for products capable of justifying their green premium: projects should aim for the best-in-class technology, that operate more efficiently, safer and that will, ultimately, deliver a lower cost for the hydrogen produced over the long term.

To counteract the lack of level playing field of pricing and to promote the manufacturing of best-in-class technologies, the EU must act proactively and employ several strategies. Firstly, the EU should push for the enforcement of European and World Trade Organisation (WTO) multilateral principles, such as anti-dumping measures and market probes, to deter unfair competitors.

1 / Advancing Clean Technology Manufacturing (International Energy Agency (IEA), 2024).
2 / BloombergNEF, Electrolyzer Price Survey 2024: Rising Costs, Glitchy Tech (2024).

Secondly, it is also crucial that EU subsidies should be spent on companies that decide to have their manufacturing facilities on European soil, or that ensure that their technologies are in line with European standards and play by the same rules. This could include the introduction of pre-qualification criteria in competitive mechanisms (e.g. Hydrogen Bank, public procurement) that could help mobilising billions of Euros towards strategic projects for Europe, especially where electrolysers will be used. For instance, pre-qualification criteria could be introduced for the critical processes (cell unit and stack assembly of electrolysers) that mandate for their EU/EEA origin. The requirements of production within the EU/EEA would ensure that high-impact, IP-intensive and added value processes are kept in Europe, thus enhancing the resilience and robustness of our supply chains to the benefit of the ecosystem.

Furthermore, there are critical production steps such as the coating of membranes with catalyst materials, the galvanisation and etching of cells, that are essential to build electrolysers stacks and are key for their performances. European companies are well placed to deliver on most of those coating processes, with an important footprint also based in UK, US and Japan. Therefore, ensuring these processes take place within Government Procurement Agreement (GPA)[3] signatory countries seem suitable.

Moreover, Europe offers a unique network of critical components manufacturers for electrolyser stacks. These manufacturers specialise in sustainable, environmentally friendly, and high-quality production of membranes or diaphragms, bipolar plates or current collectors, anodes and cathodes, and gas diffusion/porous transport layers. To align with the EU's net-zero ambitions and uphold the principle of fair international competition, pre-qualification criteria could mandate that these components be manufactured in GPA countries.

Thirdly, developing European supply chains while improving their circularity will consequently lower the risk of dependencies, ultimately strengthening the resilience of the EU in the global market. European manufacturers need to leverage their technological expertise and reliability to justify a premium on their products: in that regard, adopting international standards on safety and performance characterisation are key to improve transparency and accelerate market uptake.

Focusing on non-price criteria and maintaining a technological edge will be key to overcoming the challenges posed by lower-cost competitors and securing a sustainable future for the industry. **Once a technology gains traction abroad, as it happened for the solar sector, the financial burden to reshore it to Europe would be prohibitively expensive.** The EU should consider these recommendations to prevent the same mistakes of the past from arising in the nascent electrolyser industry.

By Dominik Richter, Senior Officer,
Trade & International Relations, Hydrogen Europe

3 / Agreement on Government Procurement, WTO.

TRADE & FUNDING UPDATES

European Hydrogen Bank: Pioneering a Green Future

The European Hydrogen Bank has taken a significant step towards fostering a green hydrogen economy in Europe. The results of its first auction, announced on April 30, revealed a robust interest and commitment to renewable hydrogen production, with 132 bids received by the European Commission. Seven projects across Spain, Portugal, Norway, and Finland have secured a total of €720 million in funding to produce 1.58 million tons of renewable hydrogen over ten years. This initiative is expected to avoid more than 10 million tons of CO2 emissions, demonstrating the critical role of hydrogen in Europe's decarbonisation strategy.

Commissioner for Climate Action Wopke Hoekstra addressing the European Hydrogen Week in 2023

First Auction Results: A Milestone in Green Hydrogen

The winning projects bid for premiums between €0.37 and €0.48/kg of hydrogen, significantly below the ceiling price of €4.5. This competitive pricing highlights the potential for cost-effective hydrogen production under the right conditions. It also reflects the producers' confidence in the sector's future and in their customers' willingness to pay for the associated premium.

Notably, the two largest projects, each with a 500MW capacity in Portugal and Spain, received 66% of the total budget. Both initiatives plan to inject part of the produced hydrogen into the local gas grid and transport it by pipeline, optimising transportation costs and enhancing their scalability. The hydrogen will primarily be converted into ammonia for maritime transport and fertiliser production. The involvement of fund manager Copenhagen Infrastructure Partners further highlights the strength of their business model, given CIP's mandate to ensure a solid risk-adjusted return for their investors.

90 percent of the 132 projects that applied were deemed eligible to bid, demonstrating the high quality of the pipeline. The average Levelised Cost Of Hydrogen (LCOH) of bids ranged from 5.8 to 13.5€/kg, while the projects offtakers were primarily from the industrial and mobility sectors, with expected average sale prices of €5.67/kg and €8.34/kg, respectively.

Lessons Learned and Future Auctions

- Considering an average Levelised Cost of Hydrogen (LCOH) of €7.44/kg in bidding countries the green premium can thus be assessed to fall between €5.44 and €5.94/kg. This means that the clearing premium of 0.48€/kg did not even cover 9% of the total gap. The success of this pilot auction will rely indisputably on the strength of the projects' offtake strategies - only pre-contractual offtake agreements covering 60% of total volumes were required from bidders.

- If the €2.2 billion from the second auction are awarded under the same conditions as the pilot, it would result in approximately 6 million tonnes of renewable hydrogen production over ten years or 0.6 million tonnes produced per year, demonstrating the budget's limits and the need for further auction rounds.

- The high LCOH reported by the bidding projects, along with the relatively low number of bids compared to Hydrogen Europe project pipeline database (848 projects by 2030), highlights the challenges posed by the strict regulatory framework and auction terms of reference.

- Through all bids, the average electrolyser capacity utilisation was notably higher in Norway and Sweden (countries with highly decarbonised grids benefiting from the above-mentioned exemptions), reaching nearly 8000 hours compared to a median of 5000 hours elsewhere. This variance highlights the potential impact of the regulatory framework on the business model of RFNBO production.

- Adding to these challenges, complex aid cumulation rules may have deterred many potential bidders and increased the LCOH reported by projects.

Analysing the Second Auction Draft Terms and Conditions

Hydrogen Europe has made recommendations for the proposed changes to the terms and conditions of the second auction, which is to be launched this year.

Firstly, clarity on the budget and support available for projects taking part in subsequent auctions is crucial. If the entire €2.2 billion is allocated in the second auction, future rounds need clear articulation to maintain industry momentum. Additionally, flexibility in aid cumulation is essential for broader sectoral inclusion. The Commission's current stance against cumulation with EU funds or state aid restricts sectors with higher production costs or temporary lower willingness to pay and penalises competitive projects which have been partially supported in the past.

Secondly, the EC's suggestion to reduce the maximum entry into operation time from five to three years is concerning. Although the median expected time was 2.9 years in the pilot auction, this was skewed by outliers with times under 1.5 years. Such rapid timelines are highly improbable. A five-year timeline is more realistic, especially for larger projects. At the same time, increasing the completion guarantee from 4% to 10% could equally deter participation, especially if a shorter timeline is envisaged for a project's entry into operation.

Thirdly, while Innovation Fund support to the maritime sector is welcomed, as ship operators are now subject to ETS pricing, the simplicity of the pilot auction where project developers could combine different offtakers needs to be preserved to allow for larger participation. Moreover, maritime sector targets are based on GHG emission reduction instead of RFNBOs, raising the question on whether support from the Hydrogen Bank should be open to low-carbon hydrogen-based solutions. Furthermore, ensuring sufficient budget allocation without compromising general support capacity is critical. Specificities of the decarbonisation pathway for the maritime sector should also be considered in this new window.

Finally, more detailed information on electrolyser sourcing from project developers is needed to align with the Net-Zero Industry Act (NZIA). The introduction of non-price criteria would allow European players to thrive within Europe, while being funded by European taxpayers' resources. **The most effective measure to introduce non-price criteria is through the establishment of prequalification criteria, that would exclude players that are not complying while leaving the architecture of the auction untouched.** Pre-qualification criteria on resilience could be introduced for the establishment of cell unit assembly and stack assembly in EU/EEA countries. Production steps such as the coating of membranes with catalyst materials, the galvanisation and etching of cells are essential and irreplaceable to electrolysers manufacturing and performance. Moreover, Europe offers a unique network of manufacturers for electrolyser stacks, specialized in sustainable and high-quality production of critical components (membranes or diaphragms, bipolar plates or current collectors, anodes and cathodes, and gas diffusion/porous transport layers).

As European companies are well placed to deliver on most of those critical production processes, with an important footprint also based in UK, US and Japan, including key manufacturing components, it would be suitable to open these processes to Government Procurement Agreement (GPA) countries, to align with EU's net-zero ambitions and foster competition.

The EU should be able to introduce pre-qualification criteria that would ensure minimum EU benchmarks when it comes to electrolysers safety and performance (ISO 22734:2019), social positive externalities and cybersecurity requirements.

Future Developments and Market Making

The pilot auction, despite its quite strict terms and conditions, was impressively competitive, demonstrating that the clean hydrogen sector is ready to scale up. It also provided valuable first market price signals.

Yet, as discussed, the regulatory framework will negatively impact the projects' LCOH, and the current budget will only bridge a small portion of the premium. This places customers under increasing to fund the remaining gap.

Meanwhile, most of the funding for hydrogen which is available today supports producers rather than users. This matters as **the main bottleneck for projects reaching Final Investment Decision are the agreement of long-term offtake agreements.**

We believe in the need for a coordinated support for supply and demand, with a flexible approach to cumulation and a coordinated view on infrastructure development. In the future, the Hydrogen Bank should follow this dual pillar approach to give project developers more visibility and more confidence to financial institutions in the stability of cash flows.

By Marie Espitalier-Noël, Manager, Funding, and Niccolò Giusti, Officer, Funding, Hydrogen Europe.

TRADE & FUNDING UPDATES

Canada's Hydrogen Revolution: Pioneering the Global Clean Energy Future

On June 14th 2024, Hydrogen Europe and the Canadian Hydrogen Association signed a Memorandum of Understanding (MoU) to accelerate hydrogen deployment and facilitate trade in clean molecules. The agreement was signed during the EU-Canada Stakeholder Roundtable on Regulatory Cooperation in Hydrogen with representatives from the European Commission, the Government of Canada and industry stakeholders from both sides of the Atlantic in attendance. It aims to strengthen cooperation on regulatory frameworks and exchange best practices on R&I, skills, and financing, among others. The agreement will facilitate industry-to-industry and public-private exchanges between the EU and Canada, and also seeks to strengthen the role of hydrogen for decarbonisation in global climate and energy negotiations.

Canada is uniquely positioned to become a global leader in the hydrogen economy due to its abundant natural resources, technological innovation, and strong commitment to reducing carbon emissions.

The Hydrogen Strategy for Canada Progress Report, issued in May 2024[1], outlines the country's vision and action plan to harness hydrogen's potential as a clean energy source. This strategy emphasizes Canada's competitive advantages and the steps being taken to integrate hydrogen into the national energy framework[2]. Up to 18% of Canada's total energy use could be provided by low-carbon hydrogen by 2050, representing up to 69 Mt in domestic greenhouse gas emissions reductions (or up to 109 Mt in global reductions when considering exports).

ABUNDANT NATURAL RESOURCES: Canada's regional resources and competitive advantages allow the entire country to contribute to the hydrogen economy. The country has an abundant supply of renewable energy sources, including hydro, wind, nuclear, and solar power, essential for producing hydrogen through electrolysis, resulting in zero carbon emissions. Additionally, Canada's extensive natural gas sector provides a significant resource for hydrogen production via processes that capture and store carbon emissions, making it a low-carbon alternative. This combination positions Canada as a key player in the global hydrogen market.

TECHNOLOGICAL INNOVATION: Canada's robust technology sector plays a crucial role in advancing hydrogen technologies. Canadian companies and research institutions lead in developing innovative solutions for hydrogen production, storage, and utilization. Canada is renowned for its electrolyser technologies and advancements in fuel cell technology, crucial for transportation and industrial applications. Canadian expertise enhances the efficiency and cost-effectiveness of hydrogen technologies, making them globally competitive. Additionally, Canada is pioneering novel hydrogen production pathways like methane (CH4) pyrolysis, promising significant advancements soon.

STRONG POLICY SUPPORT: The Canadian government has shown a strong commitment to the hydrogen economy through supportive policies and strategic investments. The Hydrogen Strategy for Canada sets clear goals and provides a roadmap for achieving them. This includes creating hydrogen hubs, incentivizing research and development, and establishing regulatory frameworks that facilitate the integration of hydrogen into various sectors. Government support is crucial in de-risking investments and encouraging private sector participation, which is essential for scaling up hydrogen projects. For example, the Clean Hydrogen Investment Tax Credit (ITC) aims to provide CAD 17.7 billion for clean hydrogen production[3].

STRATEGIC INVESTMENTS: Canada has made significant investments in hydrogen infrastructure and projects. Public and private sector investments are driving the development of hydrogen production facilities, refueling stations, and distribution networks. Projects like the Edmonton Region Hydrogen HUB and British Columbia's H2 Gateway project demonstrate Canada's commitment to building comprehensive hydrogen infrastructure. In Quebec, the emphasis is on decarbonization via battery, hydrogen and other (ultra)low-carbon energy production technologies through its "Vallée de la Transition Energétique (Energy Transition Valley)". These investments not only boost domestic hydrogen production but also position Canada as a potential exporter of clean hydrogen (and its derivatives such as ammonia, methanol, LOHC, SAF etc) to international markets.

ECONOMIC OPPORTUNITIES: The hydrogen economy offers substantial economic opportunities for Canada, both domestically and abroad. The global hydrogen market is projected to be worth trillions of dollars by 2050, and Canada is well-positioned to capture a significant share. Developing hydrogen technologies and

1 / https://natural-resources.canada.ca/climate-change/canadas-green-future/the-hydrogen-strategy/hydrogen-strategy-for-canada-progress-report/25678
2 / https://sencanada.ca/content/sen/committee/441/ENEV/reports/Hydrogen-energy-report_e_Final_WEB.pdf
3 /https://www.pbo-dpb.ca/en/publications/LEG-2324-021-S--investment-tax-credit-clean-hydrogen--credit-impot-investissement-hydrogene-propre

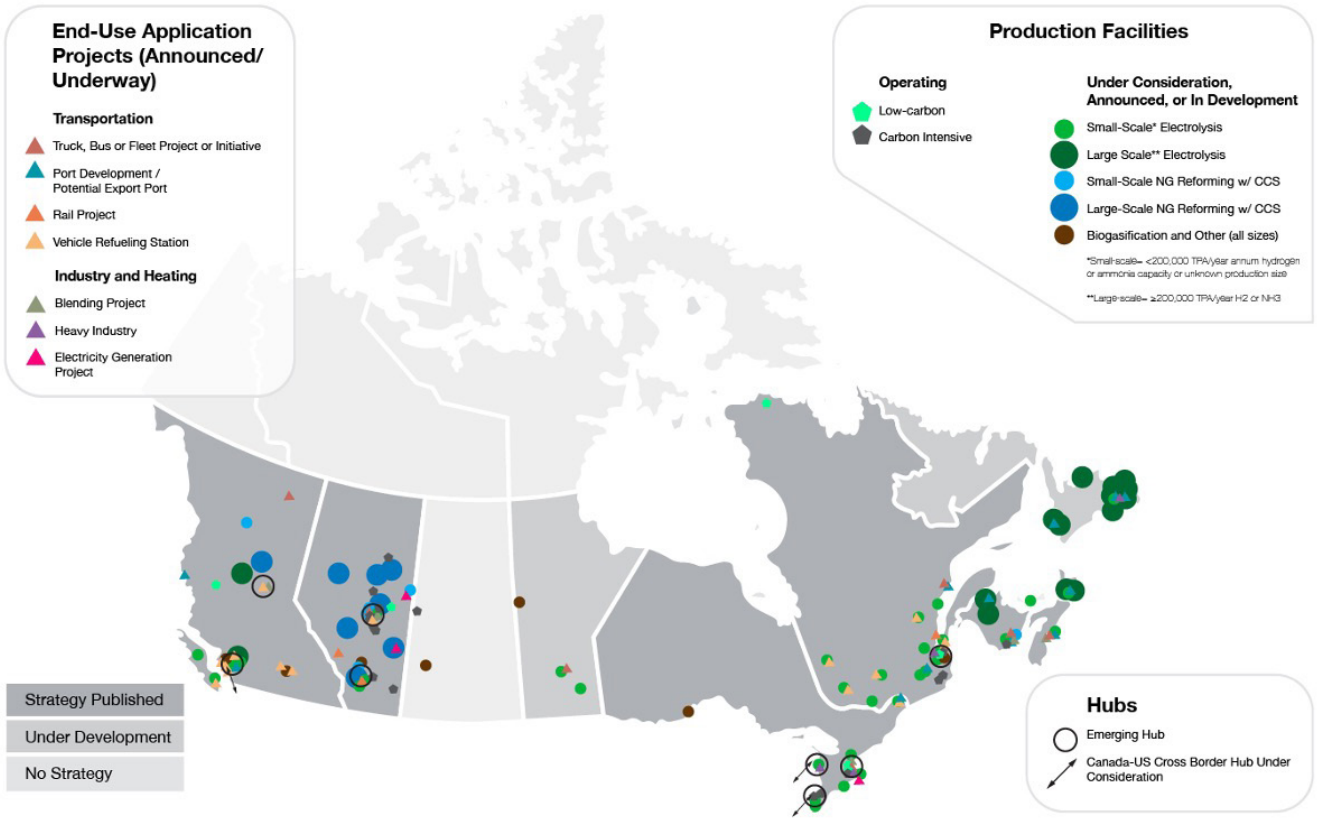


Figure 1 - Map of hydrogen developments in Canada since 2020, across the hydrogen value chain[1].

infrastructure can create jobs, stimulate economic growth, and foster innovation. Canada's expertise in energy production and strong trade relationships provide a solid foundation for becoming a leading hydrogen exporter. Projects on the East and West coasts are leveraging regional advantages to export hydrogen and derivatives to Europe and Asia. As energy security and climate crises become global priorities, Canada has the chance to lead in the global clean energy arena.

INTERNATIONAL COLLABORATION: Canada's approach to the hydrogen economy includes fostering international collaborations. These collaborations are vital for developing standardized regulations and technologies, which are essential for the global hydrogen market's growth. As examples, there are currently agreements in place for direct foreign investments in projects from Japan and South Korea, and in March 2024, Canada and Germany signed a Joint Declaration of Intent to establish a Hydrogen Alliance and a transatlantic energy corridor.

INDIGENOUS PARTICIPATION: The Canadian hydrogen strategy progress report emphasizes the importance of Indigenous participation in the hydrogen economy. Indigenous communities are key stakeholders in many hydrogen projects, ensuring that the benefits of the hydrogen economy are shared broadly. This includes providing financial support and building partnerships that enable Indigenous ownership and participation in hydrogen infrastructure projects. Such inclusive approaches not only support social equity but also enhance the sustainability and acceptance of hydrogen initiatives.

ROLE OF THE CANADIAN HYDROGEN ASSOCIATION: The Canadian Hydrogen Association (CHA) is pivotal in establishing Canada as a global leader in the hydrogen economy. Serving as a central hub for collaboration, advocacy, and education, CHA drives advancements in hydrogen technologies and policies. By fostering partnerships between government, industry, and academia, CHA accelerates innovation and investment in the sector. Its initiatives promote hydrogen as a cornerstone of clean energy, support cutting-edge research and development, and facilitate the commercialization of new technologies. Additionally, CHA actively collaborates with international hydrogen associations, such as Hydrogen Europe, to strengthen global partnerships and share best practices. This international collaboration enhances CHA's efforts in policy advocacy, ensuring that regulatory frameworks foster growth in the hydrogen sector. These combined efforts keep Canada at the forefront of the global hydrogen market, ensuring a favorable environment for hydrogen projects and positioning Canada as a key player in the global clean energy landscape.

Conclusions

Canada's leadership in the global hydrogen economy is indisputable. With abundant natural resources, cutting-edge technology, robust government support, and strategic investments, Canada is poised to dominate this rapidly growing market. Domestically, the hydrogen economy will revolutionize energy use, reducing greenhouse gas emissions by up to 69 Mt annually by 2050 and supplying up to 18% of the nation's total energy needs. The Canadian Hydrogen Association (CHA) is at the forefront, driving collaboration and innovation while fostering international partnerships. As the world prioritizes energy security and climate solutions, Canada is uniquely positioned to lead the global clean energy revolution, transforming its hydrogen potential into economic and environmental success.

By Ivette Vera-Perez, President and CEO of the Canadian Hydrogen Association, and Bruno G. Pollet, Board member of the Canadian Hydrogen Association, Director of the Green Hydrogen Lab at the University of Quebec at Trois-Rivières

TRADE & FUNDING UPDATES

U.S. Clean Hydrogen and its post-2025 Outlook: A view from Washington D.C.

The development of the clean hydrogen industry in the United States is slowed by two fundamental challenges.

The first stems from difficulties associated with the commercial and technological maturity of carbon capture and storage for steam methane or autothermal reforming applications, the processes which produce blue hydrogen.

Secondly, U.S. green hydrogen's near-term growth potential market is challenged by the competition for electrons, compounded by high electrolyzer and capital costs, and other non-45V barriers.

Under Biden 2.0, the U.S. would likely maintain a modified version of the status quo for green hydrogen. What Trump 2.0 would mean for green hydrogen, however, is a matter of uncertainty.

In any case, fears of Chinese-made electrolyzers dominating the U.S. market seem misplaced. DC will almost certainly apply tariffs on Chinese-made electrolyzers if imports surge, no matter who wins the election.

Zero-carbon electrons: A tight market and tightening

While clean electricity is critical for the development of U.S. green hydrogen, the story is complicated. Only 40 percent of U.S. electricity production is from clean sources, and the country is struggling to deploy new clean electricity generation and transmission, with difficulties primarily tied to onerous permitting requirements, high interest rates, and broad cost inflation.

The story is not uniformly negative, however. Solar and batteries for storage are being deployed at record pace. This trend shows no sign of stopping, especially since batteries are "pushing back the solar wall" by increasing solar power's share of generation and mitigating the duck curve.

But U.S. clean electricity supply is stumbling. The U.S. added nearly 34 Gigawatts (GW) of new solar capacity in 2023, 12.5 percent higher than the previous annual record, set in 2021. Yet Europe is having more success in deploying solar capacity, as the EU installed 56 GW in 2023. Similarly, U.S. wind sector deployment has slowed, as electricity generation from wind fell in 2023. The U.S. deployed additional nuclear energy capacity in 2023, but at significant cost and schedule overruns.

Disappointing growth in clean energy supply comes at a bad time, as electricity demand is rising.

Given the slow growth in electricity supply, and a rise in electricity demand, green hydrogen must compete for electrons in an increasingly tight market, and amid strict regulatory requirements.

The requirements are MAD (Matching, Additionality, Deliverability).

The Inflation Reduction Act was lauded for accelerating the United States' low-carbon hydrogen industry, but the law's impact has been muted as the industry awaits clarity regarding implementation.

In December 2023, the US Department of the Treasury issued draft guidance detailing the provisional requirements to claim the "Clean Hydrogen Production Tax Credit", or "45V". The Treasury is responsible for issuing this regulation because tax credits are administered by its Internal Revenue Service.

In the case of electrolytic hydrogen, these guidelines call for three principles to be met. First, matching (or "temporality") must be adhered to on an annual basis until 2028, followed by hourly matching requirements. Additionality (or "incrementality") will be required, except when clean electricity projects are built within a three-year window from production. Finally, the guidelines call for deliverability considering the disaggregated U.S. grid.

Clean hydrogen developers generally regard the requirements as too restrictive. On the other hand, many environmental, and some industry organizations were pleased, holding that lax regulations would raise emissions.

Those opposed to the proposed regulations believe they will impede deployment and fail to stimulate a domestic electrolyzer supply chain, ensuring costs remain elevated.

However, other analyses contend that strict guidance could spur developers to opt for PEM electrolyzers, typically made by Western manufacturers, over alkaline electrolyzers, which are typically made

in the PRC. That's because PEM electrolyzers are better able to track available clean electricity production.

China's role is important, with its share of the global electrolyzer market currently projected to stand at 50 percent in 2027. It will admittedly be difficult to compete with China's current manufacturing edge, with installation costs for US and European electrolyzers presently four times higher. The PRC's electrolyzer manufacturing capacity also exceeds global electrolyzer demand. However, some leaders in the Chinese hydrogen ecosystem assert that capacity estimates are overinflated by counting non-operating assets.

Regardless, we believe that the U.S. is highly unlikely to accept large-scale imports of Chinese-made electrolyzers, as U.S. policymakers have demonstrated – on a bipartisan basis – that they will respond to Chinese overcapacity via tariffs. We expect this pattern will repeat if imports of Chinese-made electrolyzers surge.

Will there be a shift in DC's clean hydrogen policy?

The election in November could have significant implications for clean hydrogen.

Biden 2.0 would likely pursue a modified version of the status quo. If re-elected, Democrats would maintain the Inflation Reduction Act and seek to implement permitting reform to spur deployment of clean electricity generation and transmission. The value of the 45V tax credit might increase, given the administration's desire to jumpstart the industry without increasing emissions. This may evoke bipartisan interest, especially if blue hydrogen/carbon capture and storage is incorporated.

It's difficult to predict clean energy policy under Trump 2.0. If the Inflation Reduction Act were scrapped or carved out, some technologies would fare better than others. Trump may be more favorable to blue hydrogen, given its complementarities with the U.S. shale complex. When it comes to clean hydrogen, broadly speaking, actors in Republican policymaking circles characterize Trump as a "blank slate."

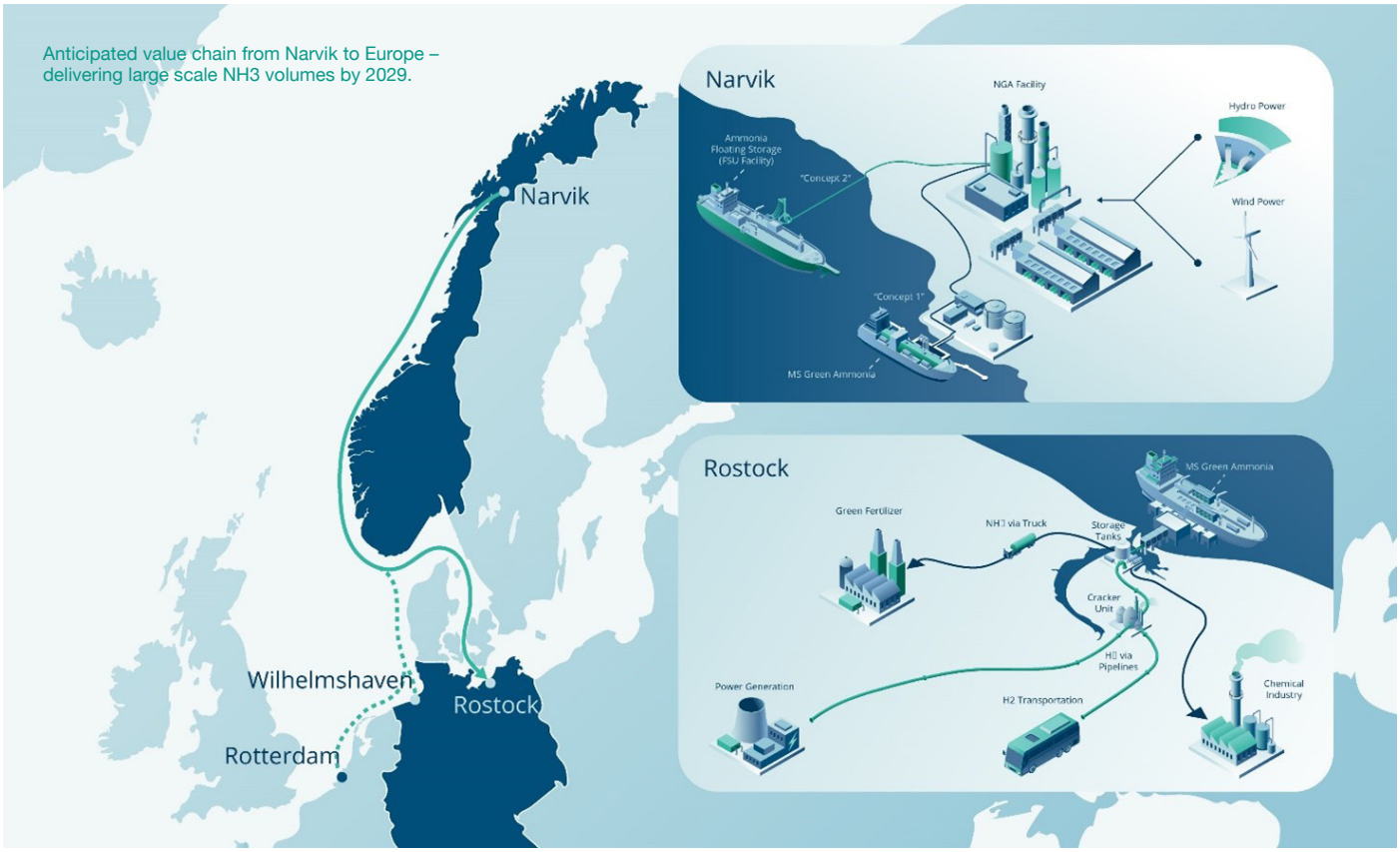
Accordingly, the future of U.S. hydrogen policy in Trump 2.0 will be hard to predict, especially regarding green hydrogen. Trump's detachment from technical policy details suggest he may adopt a hands-off posture towards the technology. U.S. hydrogen policy in Trump 2.0 may hinge on his formal and informal advisors. Given these conditions, clean hydrogen policymaking under Trump will likely be tumultuous.

By Joseph Webster, senior fellow at the Atlantic Council Global Energy Center, and William Tobin, assistant director at the Atlantic Council Global Energy Center.

AKER HORIZONS

Decarbonising with Narvik Green Ammonia

The town of Narvik, located just above the Arctic Circle is set between mountains and fjords, with a deep-water, year-round ice-free harbour credited to the Gulf Stream. Narvik Green Ammonia (NGA), a joint development by Aker Horizons and Statkraft, aims to leverage the unique location of Narvik with access to abundant natural resources and a rich industrial heritage to build a large-scale green ammonia production facility to service European markets and aid in EU decarbonisation targets.



Anticipated value chain from Narvik to Europe – delivering large scale NH3 volumes by 2029.

Key success factors for green ammonia production include access to abundant renewable power, strong grid connection, political support coupled with good community engagement, short distance to key markets and an accessible and efficient export route for offtake. The Narvik region meets all these criteria:

Renewable Power:

The region's power production is mainly based on hydroelectric power and some onshore wind power, i.e it is 100% renewable from the grid making it ideal for green hydrogen production and ammonia synthesis.

Baseload Power From Hydroele:

The hydroelectric power used in the Narvik region is generated in many locations where water reservoirs are routed through turbines to produce power; on demand when it is needed. These reservoirs act essentially as the world's largest batteries. This creates some clear cost advantages for the project: No investments in hydrogen storage, no battery storage and the electrolysis capacity is aligned with the baseload.

Export Infrastructure:

Export of product - just as with the existing iron ore exports from Narvik, exporting green ammonia is made easier with the ice-free deep-water port. The proximity to Europe makes the logistics effective and lowers risk of shipping disruptions.

Local Political Support Incentivised By Local Value Creation:

Narvik's political leaders have welcomed the NGA project, seeing it as an opportunity for the Narvik region to take a leading role in developing green industries and contribute to the European clean hydrogen economy.

Narvik Green Ammonia – Key Figures

Partners

Aker Horizons:

Aker Horizons develops green energy and green industry to accelerate the transition to Net Zero. The company is active in renewable energy, carbon capture and hydrogen, and develops industrial-scale decarbonisation projects. As part of the Aker group, Aker Horizons applies industrial, technological and capital markets expertise with a planet-positive purpose to drive decarbonisation globally. Aker Horizons is listed on the Oslo Stock Exchange and headquartered in Fornebu, Norway. Across its portfolio, the company is present on five continents.

Statkraft:

Statkraft is a leading company in hydropower internationally and Europe's largest generator of renewable energy. The Group produces hydropower, wind power, solar power, gas-fired power and supplies district heating. Statkraft is a global company in energy market operations. Statkraft has more than 6,000 employees in over 20 countries. With experience from more than a century of renewable energy generation, Statkraft has started to develop green hydrogen production facilities.

Market, offtake and policy support

Hydrogen has the potential to rapidly decarbonise hard-to-abate sectors such as fertilizer, refineries metals, glass, and chemicals. Replacing grey hydrogen, based on natural gas combustion with green hydrogen, is essential for the further reduction of carbon dioxide emissions, contributing to greater regional energy autonomy and security.

The European Union has set ambitious targets for ramping up green hydrogen and hydrogen derivative production, to meet the initial target of 10 million tonnes of production and 10 million tonnes of import of green hydrogen and its derivatives by 2030. Furthermore, through the revised Renewable Directive ("RED III"), Member States must ensure that at least 42% of hydrogen used in the industry comes from renewable fuels of non-biological origin (RFNBO).

To achieve this, Europe needs to scale up supply quickly and introduce green hydrogen and hydrogen derivatives made with 100% renewable energy.

Project progress

In Kvandal, the site selected for the proposed 430MW development, initial ground works have already concluded. The substation has also been completed for the initial grid allocation and the cables laid to the nearby Statnett operated 420kV substation – substantially de-risking the project execution. The zoning process is underway for the full development and the pre-FEED study has concluded. The integrated Aker Horizons and Statkraft project team are now maturing preparations for the Define phase and the commencement of the FEED studies.

Narvik Green Ammonia site in Kvandal, close to Narvik – where the initial ground works and substation are now complete

The NGA project represents a critical step forward in achieving the EU's climate-neutrality goals while also creating a more sustainable and independent energy system in Europe. The project team is working towards reaching Decision Gate 2 for the project in quarter 3, 2024 and to make a final investment decision in 2025.

THIS ARTICLE IS AN EXTERNAL SUBMISSION REFLECTING THE PERSONAL OPINION OF THE AUTHORS

POLICY & MARKET UPDATES

The European Council finally discusses energy infrastructure, but where is hydrogen?

Back in January, when Belgium took over the rotating Presidency of the Council, one of the priorities outlined in their program was the topic of "Advancing Sustainable Electricity Grid Infrastructure"[1]. This was concretised by a series of Energy Councils devoted to the topic of grids, culminating in the final conclusions adopted on May 30.

The adopted text continues the Action Plan "Grids, the missing link - An EU Action Plan for Grids"[2] published by the European Commission in November last year, it misses out on part of the solution by focusing only on electricity grids while leaving hydrogen aside.

1 / Programme, Belgian Presidency of the Council of the European Union, accessible here.
2 / European Commission Communication "Grids, the missing link – An AU Action Plan for Grids", accessible here.

This is a missed opportunity: to create **a more integrated energy infrastructure in Europe, a cross-sector approach** is essential not only for accelerating development of the EU power grids, but also for a more cost-effective clean transition and increased resilience in the power system.

There are several examples where the Council could have underscored the multitude of functions hydrogen can play in the power sector. To begin with, the Council conclusions point out **the necessity to reduce network congestion and ensure a fully interconnected, integrated, and synchronised European power system through infrastructure deployment, flexibility, and non-wire solutions.**

Hydrogen can facilitate this: it has the potential to provide long-lasting security of supply via hydrogen-fired power plants and demand side response by adapting electrolysers operation to market conditions. Moreover, it is one of the most efficient clean technologies to deliver seasonal flexibility through storage. This point will be crucial in the years to come as **flexibility needs will more than double by 2030, according to ACER,** the EU Agency for the Cooperation of Energy Regulators.

If Europe fails to deploy adequate flexibility solutions, it will face massive losses: in 2023 alone, Europe experienced a 12-fold increase of negative price occurrences. These negative prices drive up the congestions management costs, which then lead to curtailments in renewable energy: only in Germany, this amounted to 10bn EUR in 2023[3].

The conclusions also underline the importance of cost efficiency in the roll out of the grid. The clean transition in the EU has caused a massive mismatch between power generation and transport capacity, driven by increase in Variable Renewable Energy Sources (VRES) production. The above-mentioned Grids Action Plan estimates that scaling up the electricity grid by 2030 will cost more than €584bn. The limited availability of critical raw materials, transformers and HVDC breakers is also slowing down power grid deployment even further: lead times have doubled compared to last year[4]. In comparison, **hydrogen transport and storage infrastructure will often offer a cost and time effective alternative to the deployment of the electric grid.** The European Commission expects the roll out of the EU's hydrogen transport and storage infrastructure to only require €34-49bn until 2030[5].

This is particularly relevant in the offshore environment: the Council drew attention to the need to develop offshore energy production in a cost-effective manner. Indeed, curtailments are more prone to happen there due to limited onshore grid capacity. For instance, onshore grid bottlenecks in Northwest Germany led to a quarter of offshore wind power generation being curtailed in the first three months of 2023. Hydrogen infrastructure could be an additional option to connect offshore VRES and maximise their integration to the onshore grid, as foreseen in the TEN-E Regulation. Hydrogen production could also alleviate the pressure on expanding landing points capacity and HVDC cables build-out.

Additionally, the Council text calls for a reconciliation of grid development and demand expansion with environmental protection and social acceptance. Indeed, overhead power lines are significantly more impactful on the environment than any other energy infrastructure. That's why, to make them more socially and environmentally acceptable, some sections of cabling are built underground, increasing their costs more than 10-fold[6]. **Hydrogen is a more environmentally friendly and socially acceptable alternative to overhead lines, an advantage compounded if the vast repurposing potential of the natural gas grid is factored in.**

3 / European Scientific Advisory Board on Climate Change, Towards EU climate neutrality Progress, policy gaps and opportunities, accessible here.
4 / Euractiv, Europe's looming power grid roadblock: Transformers, accessible here.
5 / European Scientific Advisory Board on Climate Change, Towards EU climate neutrality Progress, policy gaps and opportunities, accessible here.
6 / U.S. government, Underground Electric Transmission Lines, accessible here.

Finally, to further mitigate costs of power grid investments, one of the Council's proposals is to focus on integrated planning across energy carriers. This is crucial since the EU should now shift towards an integrated approach to infrastructure planning. Present-day power grids need to be modelled and planned hand in hand with future hydrogen infrastructure. **A swift implementation of the Decarbonised Gas and Hydrogen Package, and the creation of ENNOH[7] could ensure that planning is carried out in full collaboration among the gas, hydrogen, and electricity infrastructure operators.**

The Council conclusions represent a major step when it comes to helping Europe tackle insufficient power transmission capacities. Yet it is disappointing to see that hydrogen is barely mentioned in the text. The Hungarian presidency has announced its intention to continue tackling the issue of grids during their *tour de garde*, and hydrogen's role cannot be ignored. Alternatively, a similar cycle of Energy Councils dedicated to advancing hydrogen infrastructure should be considered, along with the adoption of a Hydrogen Grid Strategy, akin to the Grids Action plan, which could support and streamline the build out and financing of the hydrogen grid.

By Léa Malfrait and Isabel Alcalde,
Policy Officers, Energy & Infrastructure, Hydrogen Europe

7 / Regulation on the internal markets for renewable and natural gases and for hydrogen (recast), article 57, final version accessible here.

POLICY & MARKET UPDATES

Low Carbon Hydrogen Delegated Act – closing the gap in the legal framework

After the adoption in June 2023 of the framework of what is commonly referred to as renewable hydrogen - in the form of two main delegated acts that define criteria to produce Renewable Fuels of Non-Biological Origin[1] - the hydrogen sector now has its eyes turned towards a similar framework for Low Carbon Hydrogen (LCH).

While for RFNBOs, pathways are clearly outlined in the existing legislation and include electrolytic hydrogen sources by Variable Renewable Energy Sources (VRES), plus its derivatives (listed in Annex III of REDIII), technological pathways for LCH are much more diverse[2].

As far as the regulatory framework is concerned, the outline of what will be considered as LCH is provided in the Directive on common rules for the internal markets in renewable and natural gases and in hydrogen (part of the Gas & Hydrogen Package)[3], in article 2(10)): ***"Low-carbon hydrogen' means hydrogen the energy content of which is derived from non-renewable sources, which meets the greenhouse gas emission reduction threshold of 70% compared to the fossil fuel comparator for renewable fuels of non-biological origin (....)"***. It also details in article 2(12) what is considered as 'low-carbon fuels', of which low-carbon hydrogen is a sub-set[4]. Following article 8(5) of the same directive, the European Commission has until June next year (approximatively) to present a proposal for such a Delegated Act (DA), but has already committed to coming up with it before the end of its current term[5], with an expected consultation coming this autumn.

Why does this upcoming piece of EU legislation stir so much frenzy within the EU bubble? Mainly because Low Carbon Hydrogen and its derivatives are essential pieces of the emerging hydrogen economy. Especially in the market ramp-up phase, it will be required for several decarbonisation purposes, where renewable hydrogen is not yet available in sufficient quantities or at sufficiently affordable prices. Along with RFNBOs, Recycled Carbon Fuels (RCF) and biohydrogen, it will help quickly replace grey H2, and other unabated fossil fuels across the economy. In parallel to the crucial scale-up and uptake of domestically produced and imported RFNBOs mandated by renewable targets in EU legislation such as the REDII, LCH will accelerate the hydrogen market's build up beyond these existing targets, thereby providing clear signals as regards essential infrastructure investments.

Because of that, the new rules contained in the upcoming DA are crucial for the entire hydrogen sector. They will guarantee regulatory certainty required for investments to happen at the pace expected by all stakeholders. The upcoming DA will complement the RFNBO DAs, enable a clear distinction between renewable

1 / Delegated Regulation (EU) 2023/1184 of 10 February 2023 establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin accessible here and Commission Delegated Regulation (EU) 2023/1185 of 10 February 2023 supplementing Directive (EU) 2018/2001 by establishing a minimum threshold for greenhouse gas emissions savings of recycled carbon fuels and by specifying a methodology for assessing greenhouse gas emissions savings from renewable liquid and gaseous transport fuels of non-biological origin and from recycled carbon fuels accessible here.
2 / Low carbon hydrogen (LC H2) can be produced by employing a wide range of technological pathways such as the following, but not limited to: electrolysis (low and high temperature); reforming with carbon capture (SMR, ATR with CCS); by-product hydrogen; and methane splitting (pyrolysis of methane) with carbon black storage.
3 / Yet to be published in the Official Journal.
4 / Low-carbon hydrogen and synthetic gaseous and liquid fuels (as defined in Article 2 of Directive (EU) 2018/2001) the energy content of which is derived from low-carbon hydrogen, which meet the greenhouse gas emission reduction threshold of 70% compared to the fossil fuel comparator for renewable fuels of non-biological origin set out in the methodology adopted according to Article 29a(3) of Directive (EU) 2018/2001.
5 / That is before November 2024.
6 / Explanation to be fine-tuned according to the latest version of our position paper

(RFNBO and bio-hydrogen), RCF, and LCH and thus apply respective regulations accordingly to clear definitions. The LCH DA is going to be equally important for project developers focusing on RFNBOs since whenever renewable energy based PPAs are going to be complemented with grid electricity, there is almost always going to be a simultaneous production of RFNBO and LC hydrogen[6]. Finally, it will be decisive in enabling and facilitating the certification process on hydrogen market.

Hydrogen Europe has formulated a set of recommendations for the Commission to be taken into consideration when drafting this document:

General recommendations

- Speedy adoption and simplicity **of the rules are paramount.**
- **Ensuring** consistence with RFNBO DAs (**DA 2023/1184 and 2023/1185) by:**
  - **Keeping the same GHG reference of 94 gCO2/MJ for calculating the 70% threshold in both transport and industry applications.**
  - **Allowing for the same electricity sourcing strategies** for both RFNBO and low carbon hydrogen producers.
  - **Same rules for allocation of GHG emissions to hydrogen and other co-products.**
- When policy options chosen under the upcoming low carbon hydrogen DA deviate from the methodology under the RFNBOs DAs, this should be considered as grounds for the revision/amendment of the existing rules under the RFNBOs DA.

Specific recommendations

Some rules for low carbon fuels should be adapted to the various low-carbon production pathways, with different set of factors to be considered. New rules need to mirror these fundamental differences and for the reason we propose:

- **A distinct regulatory framework for using dispatchable low-carbon electricity** that will reflect the characteristics of dispatchable sources and enable low carbon hydrogen producers to sign PPAs with low-carbon electricity sources.
- **Clear and unambiguous rules for establishing emissions from the use of waste heat:** while full carbon intensity of waste heat should be accounted for, waste heat used for high temperature electrolysis should not contribute to the energy character of the final fuel (i.e. the character of produced hydrogen should be defined by electricity inputs).
- **Increased accuracy and flexibility of natural gas upstream emissions accounting** by using project specific values.
- **Tailoring the allocation of emissions to by-product hydrogen** to follow a similar approach as for the RFNBOs and RCFs for existing installations, where a substitution approach should be adopted, while for new installations, the emissions should be allocated based on relative energy content (in case hydrogen is co-produced with other fuels) or based on economic value in other cases.
- **Equal recognition of all carbon removal solutions** to make sure that other (than CCS) means of permanent and long-lasting CO2 and carbon binding technologies are given the possibility.

By Kamila Waciega,
Director, Energy & Infrastructure Policy, Hydrogen Europe

POLICY & MARKET UPDATES

The diversity of hydrogen production pathways

Multiple clean hydrogen production technologies are available and technologically ready to contribute to Europe's decarbonisation goals. To demonstrate that and bring awareness to the various feedstocks and processes that can be used to produce clean hydrogen, Hydrogen Europe prepared its report on five different production pathways. These are: low and high-temperature electrolysis, reforming of natural gas with carbon capture, methane splitting, biowaste-to-hydrogen, and non-biological waste-to-hydrogen.

© Justin Jin for Hydrogen Europe

All of these technologies are needed to decarbonise the existing hydrogen production as well as satisfy new demand. According to European Commission's own modelling, EU would consume 58 Mt of hydrogen to be used across various sectors to meet its Net Zero by 2050 commitments compared to the current water electrolytic capacity in Europe of around ~40,000 tonnes a year. That is an ambitious scale-up and other technologies and feedstocks can help deliver those volumes of clean hydrogen.

The report provides a standardised perspective on each technology that includes technology descriptions, deployment, costs, emissions, policy considerations, and scalability challenges. It does not seek to compare the technologies but highlight their unique benefits and challenges which lead to the different business models pursued by the developers.

TECHNOLOGY READINESS LEVELS

While low-temperature electrolysis is a mature technology, reforming of natural gas with high carbon capture rates of at least 94% are also reaching FIDs but are less mature based on current deployments. Methane splitting and waste-to-hydrogen (from bio or non-biological feedstocks) are at various stages of development with some pilot and commercial projects under construction today. High-temperature electrolysis is close to commercialisation and there are several other pathways at an earlier stage, including solar thermochemical and natural hydrogen. Each production pathway has its unique benefits and challenges related to scale, feedstock availability, carbon footprint, infrastructure requirements, and regulatory treatment.

COSTS

We had a look at the levelized cost of hydrogen (LCOH) for different technologies, which ranges from €1.7/kg to €10.2/kg. For assessing the LCOH, we also account for the revenues from the sales of by-products and free ETS allowances. Modelled water electrolysis costs range between €5.2 and 10.2 €/kg driven by electricity costs, grid charges and CAPEX, with still large potential for cost decrease. Reforming with carbon capture reached LCOH of €4/kg with natural gas as the largest cost driver. By-product revenues are integral parts of methane splitting and biowaste-to-hydrogen business models. Methane splitting relies on solid carbon sales lowering the base LCOH from €5.1/kg to €3.3/kg and biowaste-to-hydrogen by 14% to €4.8/kg. For bio and non-bio waste pathways with LCOH at €4.8 and €5.0/kg respectively, CAPEX is the largest cost driver with the highest potential to decrease. The report aims to shows average scenarios; there will always be projects with significantly better project economics.

EMISSIONS

All technologies were evaluated against a threshold of 3.4 kgCO2eq/kg of hydrogen as established in the Renewable Energy Directive Greenhouse Gas Delegated Act for RFNBOs and RCFs and in the Hydrogen and Decarbonised Gas package for low-carbon fuels. All technologies can stay below the threshold, some can even be carbon negative, but it depends on a variety of factors including electricity greenhouse gas (GHG) intensity, gas upstream emissions, carbon capture rates, feedstocks, and CO2 allocation rules. Emissions intensity is evaluated on a well-to-gate basis, considering direct and indirect emissions from the production process. GHG intensity of electrolytic hydrogen only depends on indirect emissions related to the supplied electricity and varies widely from 0kg of CO2 equivalent per kg of hydrogen (kgCO2eq/kgH2) produced directly from renewables up to 36 kgCO2eq/kgH2 if produced with Poland's grid. Hydrogen from natural gas reforming depends on the source of natural gas and the effective CO2 capture rate with hydrogen from Norwegian gas having emission intensity of 1.8 kgCO2/kgH2 versus hydrogen from imported LNG at 5.1 (assuming captures rates of 94% in both cases). For methane splitting, upstream gas emissions and electricity GHG intensity are the decisive factors determining the low-carbon character of the produced hydrogen. For waste-to-hydrogen technologies, the feedstock is the most important source of emissions, with gasification plus carbon capture and storage (CCS) (94% capture rate) of municipal solid waste that otherwise would have been landfilled resulting in GHG footprint of up to -17.2 kgCO2/kgH2.

REGULATORY BARRIERS

The regulatory environment is complex and regulatory barriers exist for the presented technologies. While GHG calculation rules for renewable electrolytic hydrogen (RFNBO) and recycled carbon fuels (RCFs) are defined, that is not yet the case for the other pathways. Demand targets only exist for RFNBOs, limiting the regulatory demand for hydrogen from the other production methods regardless of its emission intensity.

Electrolysis grapples with the strict and inflexible rules which impact its final costs including hourly temporal correlation requirement (post 2030) and additionality requirements including making electricity from subsidized renewable energy assets ineligible for RFNBO production. For high-temperature electrolysis, the rules on using waste heat or steam are not clearly defined. The possibility to sign PPAs with non-renewable electricity source and have the actual carbon intensity of that electricity reflected in the hydrogen's carbon footprint are also not yet established, but ought to be.

For reforming with CCS and methane splitting, natural gas upstream emissions represent a significant impact on the overall GHG emission. The low-carbon delegated act should clarify and include a more targeted approach to differentiate among upstream natural gas emissions from different sources rather than having a single default value.

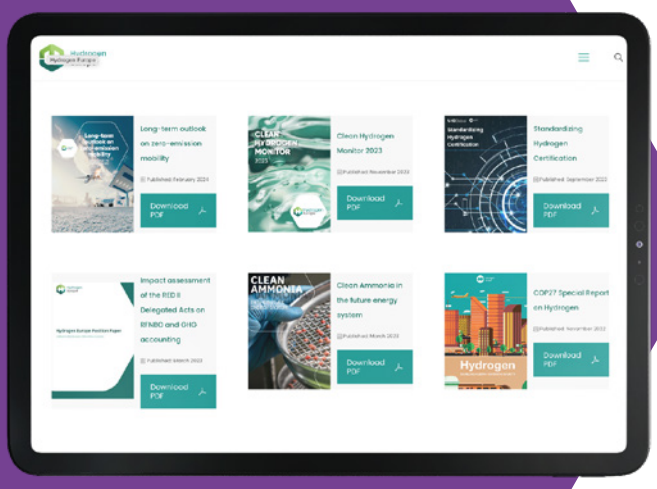
For biohydrogen production, biochar is not recognised by the ETS as solid carbon, thus making biowaste-to-hydrogen plants eligible only for free allowances for hydrogen and not for the carbon store in the solid output. Biohydrogen is classified as advanced biofuel and could be used towards compliance with the transport targets but could not contribute to the industry specific targets under the same directive.

Hydrogen produced from non-biological waste streams is today classified as a recycled carbon fuel (RCF) under the renewable energy directive, provided it is below the 3.4kgCO2eq/kgH2 threshold. However, targets and incentives (e.g. H2 bank) exclude this solution.

There is a lot of regulatory work still to be done, with the upcoming definition on the low-carbon fuels delegated act expected to lead an interesting debate on the value and role of these technologies. Stay tuned.

By Matus Muron, Manager, Market Intelligence

Please check Hydrogen Europe's latest producton pathway report on our website at www.hydrogeneurope.eu/in-a-nutshell/reports/



POLICY & MARKET UPDATES

Navigating the ambitious path of the RED III Directive

The Renewable Energy directive (REDIII) aims to promote energy from renewable sources by creating a favourable regulatory and investment framework that helps accelerate emissions reduction and reduce reliance on fossil fuels. It specifically mandates the use of renewable fuels of non-biological origin (RFNBO) in transport and industry. For industrial uses, it sets ambitious targets, requiring at least 42% RFNBO usage by 2030 and 60% by 2035.

To address these challenges, REDIII incorporates flexibility mechanisms. Member States can adjust their industry targets based on progress in renewable energy, non-fossil hydrogen production, and plans for retrofitting existing installations with carbon capture and storage (CCS). These adjustments can reduce the target by up to 20% under specific conditions. Furthermore, the directive raises concerns about the potential impact of imports on achieving these targets, adding another layer of complexity to its implementation.

Member States are required to transpose the directive into national law by 21 May 2025, determining how to achieve the RFNBO targets. Options include imposing obligations directly on hydrogen users, maintaining obligations at the national level with investment incentives, or a combination of both. Each approach has its pros and cons regarding investment attractiveness, industry competitiveness, market development, and regulatory complexity.

What is important to highlight is that for any strategy to be effective,

several enabling conditions must be met. These include a predictable regulatory framework, robust infrastructure development, adequate funding, a transparent certification framework, and renewable product labeling initiatives. If obligations are placed on companies, in addition to the above, there must be clear penalties for non-compliance and a functional crediting system, alongside measures to protect against carbon leakage.

The directive's implementation faces further complexity, as Member States often miss deadlines for such transpositions. With new targets and mechanisms introduced in REDIII, delays are likely to happen. Some Member States such as the Netherlands are ahead in designing mechanisms for transposition, while others lag. The European Commission is planning to publish a guidance note by note in June/July but will leave the specifics to individual countries, particularly for transport and industry sector targets involving RFNBOs. In the coming months, national authorities must engage with industrial stakeholders to establish targets and pathways. The uncertainty around target transposition is currently causing project promoters to delay investment decisions. Clear strategies need to be adopted to provide the necessary investment certainty.

For successful implementation, Member States must ensure predictable and timely target structuring, develop robust hydrogen infrastructure, and provide adequate operational funding that help derisking projects. RFNBO targets are central to the coherence of National Energy and Climate Plans (NECPs). By June 2024, all EU governments must present their update NECPs and specific references to industrial RFNBO consumption targets or detailed proposals for compliance tools, which need to be clearly indicated and developed.

One option is for national authorities to retain obligations, using incentives like tax reductions or subsidies to promote RFNBO uptake. This approach minimises risks for industries and prevents carbon leakage but demands significant state resources. It could also lead to fragmented markets and reduced commercial incentives due to the absence of company-level penalties.

Alternatively, placing obligations directly on individual companies could drive RFNBO production through compliance mechanisms such as tradable certificates or tax systems. While this mobilizes private capital and reduces direct government costs, it may harm industrial competitiveness and pose carbon leakage risks, challenging new market entrants.

A third option is to set sector-specific targets, considering competitiveness and carbon leakage risks, supported by compliance schemes like tradable credits. This tailored approach drives RFNBO production and mobilizes private capital while minimizing direct government costs. However, it involves regulatory complexity, potential delays, and uneven burden distribution, which could distort market dynamics.

Whatever path Member States choose the successful implementation of REDIII targets requires coordinated efforts between Member States, industry stakeholders, and regulatory bodies. Tailored approaches, rather than a one-size-fits-all strategy, are necessary to accommodate diverse industrial structures and RFNBO production potentials across the EU. Achieving these ambitious goals will promote sustainability and competitiveness within the European Union, provided the enabling conditions are carefully and promptly addressed.

Please check Hydrogen Europe's recommendations in its latest position paper, which can be found at www.hydrogeneurope.eu/policy-priorities/position-papers/

By Antigone Pafiti,
Officer, Energy & Infrastructure Policy, Hydrogen Europe.

Indeloop: a Croatian company pioneering Waste-to-Hydrogen technology in Europe

As Europe marches towards a greener, more sustainable future, the quest for innovative solutions that align with the European Green Deal has never been more crucial. In this context, Indeloop, a Croatian energy company, emerges as a trailblazer with its cutting-edge Waste-to-Hydrogen technology. By converting various types of organic waste into clean hydrogen, Indeloop not only addresses the continent's waste management challenges but also contributes significantly to its energy autonomy and sustainability goals.

Danica Maljkovic, CTO, Indeloop

The European Commission calculates that additional annual investments of over €620bn are needed to meet the goals of the European Green Deal. Moreover, the European Investment Bank forecasts that EU energy investments must nearly double during this decade, while investments in the coming decades will need to increase to as much as €575bn annually.

In addition to this, every year 2.2 billion tonnes of waste are generated in the EU. More than a quarter of it (27%) is municipal waste and the average amount of produced waste per capita is increasing rather than decreasing yearly. However, the share of landfill in the EU decreases gradually but still accounts for about 20% which is why we need more solutions supporting the circular economy. Indeloop stands ready to lead this change, proving that with innovation and commitment, we can turn waste into wealth and pollution into progress.

Meeting European green targets with hydrogen

The European Green Deal aims to make Europe the first climate-neutral continent by 2050. Achieving this ambitious goal requires a multi-faceted approach, including waste reduction, increased recycling, and the adoption of renewable energy sources. Indeloop's waste2hydrogen technology aligns perfectly with all these objectives. By converting organic waste into hydrogen, it not only reduces the need for landfilling but also minimizes pollution of soil, air, and water. Moreover, the production of hydrogen from waste supports energy diversification, reducing Europe's dependence on fossil fuels and enhancing energy security.

Hydrogen, often dubbed the "fuel of the future," holds immense potential as a clean energy source. It is abundant, versatile, and when used in fuel cells, it produces only water as a byproduct, making it a zero-emission energy carrier. However, the challenge lies in producing hydrogen sustainably. This is where Indeloop's approach comes into play.

Indeloop's energy plant named "Looper" is capable of producing hydrogen from by gasifing any type of organic waste. This includes biowaste, sewage sludge, mixed municipal waste, textile waste, and non-recyclable plastics. The process not only diverts waste from landfills but also creates a valuable clean energy source in the form of hydrogen.

Innovative Waste-to-Hydrogen solution

At the heart of the Looper plant is an advanced gasification technology that operates in a vacuum system. In essence, the ingoing waste is shredded to its optimal size, then gasified under 1100°C and finally treated by chemical processes to produce syngas and ashes as byproducts. Syngas is a hydrogen rich compound from which it is then easy to extract hydrogen. The final hydrogen product can easily be stored or transported but it can also be directly integrated into the energy system. This system ensures that no emissions are released into the atmosphere. In fact, latest calculations done the European Climate, Infrastructure and Environment Executive Agency (CINEA) show that CO2 savings from the LOOPER plant are at the level of 108% - in other words, LOOPER actually emits less than zero greenhouse gases (carbon dioxide) into the atmosphere and even achieves a negative carbon footprint. The byproduct of ashes is further treated and used in construction sector thus concluding the fully sustainable circle.

Among the various types of waste that Indeloop can process, biogenic waste holds particular significance. This includes biomass, sewage sludge, biogas, wood, cotton and wool. Traditionally, biowaste ends up in landfills, where it decomposes and releases methane. Indeloop's Looper plant offers a sustainable alternative. In fact, the used process of gasification in the plant is leading the mentioned materials to permanent carbon removal. Additionally, biogenic materials are classified as renewable energy sources as per REDIII Directive. This is the precise reason why we see the topic of biogenic waste and production of hydrogen from such materials a rising topic across the Union that is only gaining momentum.

Testing the Pilot

Indeloop has already demonstrated the viability of its technology through a pilot plant that treated textile waste in the Croatian town Čakovec, a project supported by the Innovation Norway fund. This successful pilot not only validated the technology but also highlighted its potential for broader applications. Building on this success, Indeloop is now planning a new project to treat sewage sludge in Zagreb, the capital of Croatia.

Benefits for Local Communities

Indeloop's technology brings numerous benefits to local communities. First and foremost, it eradicates the need for landfills, which are often sources of environmental contamination and local nuisance. By eliminating landfills, communities can reclaim valuable land and improve their overall quality of life. Additionally, the reduction in CO2 emissions and other pollutants contributes to a healthier environment. The production of hydrogen from waste also creates local jobs and stimulates economic growth. Finally, depending on how energy communities evolve, hydrogen may also be a valuable energy source helping local communities to not only reduce their monthly expenses but also plan their consumption more efficiently and autonomously.

The road to 2050

As the world pivots towards renewable energy sources, hydrogen is poised to play a crucial role in the energy mix. The development of green hydrogen is therefore essential for decarbonizing various sectors and achieving climate goals. Waste2hydrogen technology thus represents a significant step forward as it addresses more sustainability goals at once, solving the challenge of producing green energy on one hand and reducing waste landfilling on the other. The road ahead will see further integration of green technologies, increased investment in renewable energy infrastructure, and a continued push towards innovation. Indeloop is at the forefront of this transformation, pioneering solutions that are not only environmentally friendly but also economically viable.

By Danica Maljkovic, CTO, Indeloop

THIS ARTICLE IS AN EXTERNAL SUBMISSION REFLECTING THE PERSONAL OPINION OF THE AUTHORS

Focus On:
Valérie Bouillon-Delporte, new executive director of the Clean Hydrogen Partnership

The EU's Clean Hydrogen Partnership (CHP) has appointed Valérie Bouillon-Delporte as its new executive director. Bouillon-Delporte leaves her previous role as hydrogen ecosystem director at French tyre company Michelin, where she spent 14 years. Bouillon-Delporte was Hydrogen Europe's President of the Board from 2017 to 2021 and was on the board of France Hydrogène, project developer Lhyfe, and EPC firm Rely.

Throughout the journey of growth in European hydrogen over the last ten years, Valérie Bouillon-Delporte has been ever-present. Spending the early years of her time with French tyre giant Michelin as a director in the clean technology team, since 2016 she has been focused specifically on hydrogen and its potential to decarbonise mobility and large parts of Europe's economies.

Her new role in the Clean Hydrogen Partnership (CHP) is, in her words, ***"a natural continuation"*** of her career trajectory, ***"having begun in the hydrogen movement years ago and been active in both Europe and France."***

Now, ***"having the possibility to join the Commission and bring my expertise and industry background will be a good complement to the people here and continuing Mirela's good track record."***

The latest news coming out of the CHP has involved the signing of a cooperation agreement on 3 June with the New Energy and Industrial Technology Development Organization (NEDO) of Japan at the Japan-EU Hydrogen High-Level Business Forum, as well as the latest funding call of €113.5m which closed in April with 151 applicants competing for 20 research and development (R&D) projects covering the whole value chain from storage to transport and hydrogen valleys.

The partnership has been instrumental in advancing the all-important area of R&D, incubating and stimulating innovation of new technologies and improvement of existing ones, as the hydrogen sector fights tooth and nail to bring down the price of renewable and low-carbon hydrogen. It is also crucial for maintaining Europe's competitiveness with the US and China.

"The Clean Hydrogen Partnership's role is to make sure we promote innovation and H2 tech for both our industry and stakeholders to strengthen competitiveness, their role in global competition," said Bouillon-Delporte who, with her track record in Michelin and the French and European associations is able to bring industry experience to the role.

"At the beginning I was wondering 'what could my contribution be?' and, I think I can make a difference by rocking the boat and help move the value chain forward to help the sector blossom and scale up" she explained.

Some of the priorities in mind for the next few years are:

1

To populate these SME "unicorns" in the value chain. The CHP is committed to ensuring that companies which have received CHP funding in the past, like Sunfire, ITM, Nel, Everfuel, Symbio, and many others, continue to establish themselves in the value chain, while the next generation of SMEs manage to follow in those same footsteps.

2

To reassess and refresh the strategic R&D agenda and make sure priorities are matched with those of industry. On this topic, hydrogen valleys continue to play an important role, having become pillars of European hydrogen development.

3

To renew the Joint Undertaking and push forward, taking the voices of R&D and industry into account, something which is *"where the true DNA of the CHP comes into the picture".*

Indeed, when it comes to the future of hydrogen, it will take strong synergy between industry and R&D to scale up at pace and meet 2030 and 2040 climate and energy targets. For Bouillon-Delporte, it is a question of continuing the good work so far with a renewed focus on uniting the value chain.

"Industry and research support will be a key element in order to get this continuation - we cannot do it alone," said Bouillon-Delporte.

Production pathways and tech diversity

One of the key areas requiring the attention of the whole value chain will be production pathways, and specifically opening as many 'routes to decarbonisation' with hydrogen as possible. While renewable hydrogen, RFNBOs, will naturally be the preferred and most effective option for many projects around Europe, there are always regions, companies and individual projects where the best business case might involve another production method.

What is most important is ensuring that the best projects – those with the highest potential for emissions reduction – are recognised, expedited, and completed.

Asking Bouillon-Delporte about this, she mentioned the apparent potential – in the long-term – for natural hydrogen found in underground deposits. Though it is but a relatively recent discovery, it highlighted the fact that new solutions can appear very suddenly, and it is up to the sector to be ready to explore them.

France has allocated funds to its exploration, and outside of Europe we see potential in Australia, but the priority should also remain on what is possible in the short-term while staying informed on the long-term opportunities.

"Natural hydrogen is not something new but it is still in its early stages on its potential. It is also good to see that clean hydrogen can be produced in many different ways (electrolysis, pyrolysis, waste-to-H2,…). However our focus is clearly so far on hydrogen being produced by electrolysis." said Bouillon-Delporte.

More generally, she highlighted what many between the pages of this magazine and beyond in the wider hydrogen sector have echoed: ***"We have to identify the steps to embrace a neutral and unbiased view on all these production technologies."***

EU Hydrogen Week

As many readers will already know, the European Hydrogen Week in Brussels is co-organised by Hydrogen Europe with the CHP and European Commission. Welcoming thousands of visitors and hundreds of exhibitors each November for the last two years, we are now gearing up for the third hydrogen week, with plans to make it bigger and better than ever.

The growth of the event reflects the increasing profile and importance of hydrogen in the decarbonisation conversation, with some of Europe's biggest companies dedicating time and money to production and use of the molecule.

"I knew a time when it was not the EU H2 week, but the 'stakeholder forum', and it was only one day. Now we have a full week with a strong presence of high-level institutions. This demonstrates the importance and value of a robust , innovation-driven hydrogen ecosystem in Europe and beyond." said Bouillon-Delporte.

The agreement signed with NEDO, though initiated a while ago, was aided by the visit of their delegation to the Hydrogen Week.

"It's a very important event which opens doors in terms of international cooperation. We have to use U Hydrogen Week as a springboard and that will help everyone participate in the value chain," said Bouillon-Delporte.

It should be clear to all that the CHP, under its new executive director, will focus on synergy, symmetry, and scale-up of the hydrogen value chain. With only a few years before the 2030 climate targets, among them binding renewable hydrogen use targets, a forward thinking, unifying, and ambitious leadership is exactly what the sector needs.

"We will not succeed if we don't do it together. We would never be where we are today if we hadn't done that so far, and it's important to carry on – industry, research, and the EU. We're like a rugby team," Bouillon-Delporte concluded.

European Hydrogen Week

18–22 November 2024
Brussels, Belgium

The **European Hydrogen Week** is a melting pot of powerful and influential leaders, policy makers, researchers, and consumers each looking for the next big thing. Organisations at the event will be able to find customers, investors, and partners in the exhibition area and will be attending thought-provoking sessions while engaging with the entire hydrogen value chain.

For more information, visit
www.euhydrogenweek.eu

Hydrogen Europe

Clean Hydrogen Partnership

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For enquiries and/or to reserve your space, contact **info@euhydrogenweek.eu**

Hydrogen Europe

Clean Hydrogen Partnership

The European Hydrogen Week in numbers

4 days event

8000+ visitors

90+ countries represented

200+ exhibitors

800 sqm of exhibition area

30+ supporting organisations

200+ speakers

Our sponsors

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Registrations open in summertime

Hydrogen Europe · Clean Hydrogen Partnership

Events Overview

A look back at...

NATIONAL ASSOCIATION CHARTER SIGNING

EVENT DESCRIPTION:

The event took place at the **Marriott Hotel Rotterdam** from 14:00 to 16:00, followed by networking drinks from 16:00 to 18:00.

We used this occasion to reinforce our joint commitment to position hydrogen technologies as a key solution for **decarbonisation across Europe** by signing a Cooperation Charter for European Associations.

1. MEET THE CANDIDATES

Thursday, 20th June 2024

ONLINE

MEMBERS ONLY AREA >>

EVENT DESCRIPTION:

Ahead of the Hydrogen Europe General Assembly, this webinar will allow Board candidates to present themselves, providing an opportunity for attendees to become acquainted with them and ask questions ahead of the elections.

More information regarding the agenda, **registration link and next steps will be shared with members on Members Only Area closer to the day.**

2. HYDROGEN EUROPE GENERAL ASSEMBLY

Tuesday, 25th June 2024

HYBRID | BRUSSELS AND ONLINE

MEMBERS ONLY AREA >>

EVENT DESCRIPTION:

Hydrogen Europe General Assembly takes place twice per year online. More information regarding the agenda, registration link and next steps will be shared with members on Members Only Area closer to the day.

3. HYDROGEN EUROPE SUMMER MARKET DRINKS RECEPTION

Tuesday, 25th June 2024, 18:30 – 22:00

IN-PERSON | BRUSSELS

EVENT DESCRIPTION:

Hydrogen Europe's Summer Market takes place in Brussels, Belgium, face-to-face, and invitees have the opportunity to come together with members and stakeholders of the hydrogen sector, in a **great networking atmosphere.** It is a great opportunity with great food and drinks, set in a beautiful Summer Market ambiance! Kindy note that this event is reserved for the Hydrogen Europe Members and invited guests.

During the evening, come taste the HYDROGIN®, thyssenkrupp nucera's signature drink with a hydrogen-inspired twist!

EXCLUSIVE
TO MEMBERS AND INVITED GUESTS OF HYDROGEN EUROPE

4. EUROPEAN HYDROGEN WEEK

18th – 22nd November 2024

IN-PERSON | BRUSSELS

EVENT DESCRIPTION:

Join us at the European Hydrogen Week! Building on the success of the 2023 edition, the next event will take place from 18 to 22 November in Brussels. This flagship event offers access to multiple conference streams, featuring over 25 sessions and 200 speakers who will delve into various hydrogen-related topics, including industry trends, challenges and opportunities, innovation, new technology, and more. Alongside the High-level Policy Conference and the B2B Forum, we are excited to introduce a new feature: the Innovation Hub.

Don't miss this opportunity for a week of dedicated hydrogen discussions, exchanges, and learning experiences!


Hydrogen
Europe
South Africa
EURO

A warm welcome to all our new Hydrogen Europe members

INDUSTRY CORPORATE MEMBERS:

GMZ Enerji Sistemleri Industry and Trade Limited Company

GMZ Enerji is a start-up company established in 2021 by being entitled to receive a grant from the entrepreneurship support program. GMZ Enerji develops innovative and sustainable products for fuel cells and electrolysers, which are hydrogen energy technologies that it believes will contribute significantly to energy supply security.

CONTACT
gamze@gmzenerji.com

HH2E AG

HH2E is a new green energy company that developed a technology-mix capable of converting the surplus of solar and wind power into green hydrogen. With over 10 prime locations already reserved in Germany, it aims to establish 4 GW capacity by 2030, emerging as a top green hydrogen producer in Europe.

CONTACT
info@hh2e.de

Hy2BWasserstoff GmbH

Hy2B Wasserstoff GmbH „Green Hydrogen“ is a public-private partnership venture located in Lower Bavaria, Germany, to produce and distribute green hydrogen from renewable power plants (PV and Wind). The green hydrogen is used as a fuel for mobility as well as an energy carrier for industry and energy in Bavaria.

CONTACT
info@hy2b.de

Hyzon Motors Innovation GmbH

Hyzon builds high-performance hydrogen fuel cells that provide zero-emission power tough enough to transform industry. Our hydrogen fuel cells are among the most powerful in the industry and they're designed to perform. Built in the U.S. and based upon our decades of experience, we have refined our technology to deliver a new era of clean power.

CONTACT
salesanz@hyzonfuelcell.com

MG Energy Group Hydrogen B.V.

MG ENERGY GROUP HYDROGEN B.V. is a newly established company belonging to the Energy Group of companies, which has started developing a hydrogen project in Poland, based on large-scale RES. Once the project is completed, the achieved annual production is expected to be about 110,000 tons of renewable hydrogen and about 600,000 tons of renewable ammonia. The companies estimate the cost of the entire investment at around 22.6 billion euros.

Neopet Ltd.

Neopet Ltd. provides engineering and design in the field of power and electrical equipment, covering various fields of design, production and services. We provide design, production, service platform, fabrication, installation and commissioning. We are a qualified supplier for complete power plants. In Construction of Power Plants, Substations and Electrical systems, Neopet Ltd. strives to use innovative solutions, providing high standards in the implementation of all projects.

CONTACT
neopet@neopet.bg

SinterCast AB

SinterCast is the world leader in material development and process control technology for the reliable high-volume production of Compacted Graphite Iron (CGI). Widely used in commercial vehicle cylinder blocks and heads, CGI enables increased peak firing pressures, leading toward improved thermal efficiency, improved durability, and reduced CO2 emissions.

CONTACT
vitor.anjos@sintercast.com

TEAL Mobility SAS

TotalEnergies and Air Liquide join forces to develop a network of hydrogen stations for heavy-duty vehicles in Europe. This initiative will help facilitate access to hydrogen, enabling the development of its use for goods transportation and further strengthening the hydrogen sector. We are developing a network of more than 100 hydrogen stations for heavy duty vehicles over the next 10 years. Our stations will be mainly located on major strategic corridors in France, the Netherlands, Belgium, Luxembourg, and Germany and operated under the TotalEnergies brand.

CONTACT
info@tealmobility.com

EUROPEAN REGIONAL MEMBERS:

Regional Council of Ostrobothnia

The Ostrobothnia region is a pivotal hub for the Nordic energy technology ecosystem. It comprises 180 companies with a combined turnover of approximately 6 billion euros, 80% of the production is destined for international markets. The region is a significant contributor to Finland's technology export sector and the companies are investing 250 million euro s in R&D annually.

www.obotnia.fi/en

Municipality of Fyli

The Municipality of Fyli is located on the west of the Athens metropolitan area. It is a very active authority with numerous ongoing and completed environmental projects. Our Goals: sustainability, energy efficiency in municipal and public buildings, the exploitation of renewables serving its citizens, and the city's infrastructures with free green electricity.

CONTACT
gd@fyli.gr

GLOBAL PARTNER MEMBERS:

Monolith Materials, Inc.

Monolith is a next–generation hydrogen and materials company that has developed proprietary pyrolysis technology to convert conventional, renewable, or responsibly-sourced natural gas into carbon black and hydrogen in a more environmentally sound manner. Monolith is backed by investors including Azimuth Capital Management, Cornell Capital, Decarbonization Partners, Imperative Science Ventures, Magnetar Capital, Mitsubishi Heavy Industries America, NextEra Energy Resources Inc., SK Inc., TPG Rise Climate and Warburg Pincus.

monolith-corp.com

Torrent Power Ltd

Torrent Power Limited - Brief Profile
— One of India's leading integrated energy companies having all round experience in Power Generation, Power Distribution, City Gas distribution & Cable Manufacturing.
— Generation: Total operational power generation capacity is 4.27 GW a mix of Gas, Renewable and coal sources, of which 1.18 GW is RE.
— Distribution: Licensee for 5 Cities in Gujarat, power availability >99.9% & T&D losses of 3.57% (one of lowest in country). Franchised distribution in 3 Cities of Maharashtra & UP State. Torrent has acquired 51% stake in UT of DD&DNH.
— Transmission: Operates ~500 Km, 220 kV and 400 kV Transmission line in Gujarat.
— Manufacturer of high-quality cables at a state-of-art manufacturing facility in Gujarat.
— Turnover of $ 3.13 Bn, Market Capitalization of $ 5.4 Bn & Employees 8,100+.

OTHER NON-PROFIT MEMBERS:

Cluster TWEED

The TWEED cluster (Technology Walloon Energy– Environment and sustainable Development) is an organization which brings together companies, research centers, universities and public bodies active in renewable energies. There are dedicated activities for the free-carbon hydrogen within the cluster. Today, this association brings together more than 200 members.

CONTACT
communication@clustertweed.be

hySOLUTIONS

hySOLUTIONS, founded 2005, implements decarbonisation concepts in the industry with stakeholders based in Hamburg, the metropolitan region or beyond. hySOLUTIONS supports and coordinates the deployment of fuel cell and hydrogen technology, innovative electrical drive and supply systems in accordance with funding schemes on the local, regional and federal level.

CONTACT
info@hysolutions-hamburg.de

Port Authority Network of the North Tyrrhenian Sea

Port Authority Network of the North Tyrrhenian Sea (AdSP MTS) is the public body that manages and coordinates the ports of Livorno, Piombino and Portoferraio, along with minor ports located in the Tuscan Archipelago. AdSP MTS is in charge of planning and developing port activities and therefore has direct competences not only in medium and large infrastructural development projects, but also in ensuring that private operators respect national rules in their activities.

CONTACT
adsp@portialtotirreno.it

PROJECT MEMBERS:

1s1 Energy Portugal, Unipessoal, Lda

1s1 Energy Portugal is a private Portuguese materials science company established in 2020 to work on breakthrough technology in the fields of PEM fuel cells and water electrolysis. The company aims to develop and manufacture next-generation water electrolysis equipment for low-cost green hydrogen production and components for PEM fuel cells.

www.1s1energy.com

Actemium NDT E&S

In a context where controlling industrial performance is at the heart of concerns, our teams support you on all Non-Destructive Testing (NDT) techniques to detect, size and monitor the evolution of certain surface defects. or at the heart of the material and thus guarantee the integrity of your equipment. In France and abroad, we operate in all industrial sectors where non-destructive testing is necessary, such as: Energy, Naval, Petrochemicals, Boilermaking, Parapharmaceuticals, Testing laboratory...

www.actemium.fr

Aéroports de Lyon

As the leading airport in the VINCI Airports network in France with 10 million passengers in 2023, Lyon-Saint Exupéry offers 120 direct destinations in 2024 and is connected to the main international hubs. It offers recent infrastructure and an innovation strategy focused on a quality passenger experience and operational excellence for airlines. Lyon-Saint Exupéry Airport is developing in total control of its environmental impact.

www.lyonaeroports.com

Arkema France

Hydrogen: Arkema's solution for carbon-free mobility. Hydrogen fuel cells will have their role to play in post-oil mobility options, alongside all-electric vehicles. Arkema has anticipated this shift, developing materials and solutions that are already contributing to improving the industry's performance and business model.

CONTACT
contact@arkema.com

Axelera

Axelera is the French cluster at the crossroads of the chemical and environmental sectors. It was created in 2005 in the Auvergne Rhône-Alpes region of France. Axelera is committed to developing sustainable, efficient, circular and clean solutions for industry. Axelera gathers 400 members.

CONTACT
info@axelera.org

Bontaz Centre

Bontaz is a family-owned industrial company that equips one in every two cars in the world and is committed to the decarbonisation of mobility. Bontaz produces sustainable technological solutions for hydrogen fuel cell and battery electric vehicles and light mobility.

CONTACT
contact@bontaz.com

Capenergies

The competitiveness cluster facilitates the emergence of innovative projects and supports their financing and development to accelerate the Energy Transition in the regions. It helps low-carbon energy sources and its members in Provence-Alpes-Côte d'Azur, Guadeloupe and the Principality of Monaco.

www.capenergies.fr

CARA

CARA gathers 430 members (manufacturers, research centers, universities, transport operators and local communities) and supports the transformation of passengers and goods transport systems to meet the challenges of public health and the ecological and digital transition. CARA implements collective actions to support its members: R&D projects, pilots in real life situation, industrial development.

www.cara.eu

Cutting-Edge Nanomaterials UG

We are CENmat, a vertically integrated water electrolyser company built for the climate era. Our breakthrough technologies allow the production of economical and truly green hydrogen. At CENmat we are reimagining water electrolysis – at the materials, components, stack and plant level – designing it to be scalable, environmentally sustainable, flexible and economical.

cen-mat.com

Colas Ireland Group

The Colas Ireland Group of companies are committed to being the leading supplier of end-to-end solutions for the road maintenance sector in Ireland. Thanks to the range of products and services that our subsidiaries provide, we can help clients to construct new pavements, maintain them and then fully recycle them, when they have reached the end of their service lives.

CONTACT
info@colas.ie

Compagnie Nationale du Rhône (CNR)

CNR, Compagnie Nationale du Rhône, holds the concession for the River Rhone, utilizing it for hydroelectricity production, river transport, and agricultural purposes. As a leading producer of 100% renewable electricity, CNR leverages water, wind, and solar energy to drive ecological transitions in territories. With 4000MW installed capacity, including wind, solar, and hydropower plants, CNR specializes in various forms of photovoltaic (PV) systems like bifacial and floating PV, along with hydroelectric and river engineering. They offer expertise in testing new technologies and are open to collaborations and opportunities in renewable energy and innovation, including hydrogen and osmotic energy.

www.cnr.tm.fr

CoorsTek Membrane Sciences AS

COORSTEK MEMBRANE SCIENCES AS (CTMS) (Norway) is a company specialised in protonic membranes and chemical reactor technology with a clear strategy aimed at commercialisation. CTMS has a pilot manufacturing line for tubular ceramic membrane fabrication in clean room environment, specifically set up for semi-automated manufacturing ceramic membranes.

www.coorstek.com

Córas Iompair Éireann

CIÉ Group is the largest public transport provider in Ireland, operating bus and rail services. Our goal is to provide accessible, efficient, and low carbon public transport in Ireland. CIÉ Group is exploring alternative fuels, including green hydrogen, in our bus fleet and freight rail fleet where electrification is challenged.

CONTACT
info@cie.ie

Département de Loire-Atlantique

The Departement Loire-Atlantique is a local authority operating two ferry lines crossing the Loire River downstream from Nantes, Basse-Indre-Indret and Coueron-Le Pellerin, attracting two million passangers per year. A project is ongoing to construct a new green ferry for the Loire with hydrogen as fuel (50%) by 2026/27 with an estimated consumption of 55t H2 per year.

CONTACT
contact@loire-atlantique.fr

Dublin City University

Dublin City University (DCU) is a leading innovative European university renowned for the impact of its teaching and research on multiple stakeholders and issues of global concern. DCU Strategic Plan 2023-2028 "Transformation for an Unscripted Future" aligns with its core mission is to transform lives and societies through education, research, innovation and engagement. DCU embeds sustainability at its core, in its teaching and learning, research, development and innovation, its operations and promoting it through its national and international engagements.

www.dcu.ie

ECO MED SARL

Established in 2003, ECO MED is a biodiversity consultancy firm dedicated to assisting stakeholders in implementing biodiversity management practices compliant with regulatory standards. Headquartered in the Provence Alpes Côte d'Azur Region, their expertise extends across the Mediterranean basin and beyond, including regions like Occitanie, Auvergne Rhône Alpes, Bourgogne Franche Comté, Corsica, and international locations. ECO MED's services encompass ecological expertise, technical assistance, mediation, ecosystem restoration and conservation, and regulatory training. Their primary goal is biodiversity conservation, supporting local economic development through sustainable practices.

CONTACT
contact@ecomed.fr

Economic and Social Research Institute

The Economic and Social Research Institute is an independent research institute working towards a vision of 'Informed policy for a better Ireland'. The ESRI seeks to support sustainable economic growth and social progress in Ireland by providing a robust knowledge base capable of providing effective solutions to public policy challenges.

CONTACT
projectoffice@esri.ie

Eidgenössisches Institut für Metrologie METAS

The Swiss Federal Institute of Metrology METAS serves as the federal centre of competence for all issues related to measurement. As the national metrology institute METAS ensures the availability of measurement and testing facilities with the degree of accuracy needed to meet the requirements of the economy, research and administration.

CONTACT
info@metas.ch

Energy Co-operatives Ireland Ltd

Energy Co-operatives Ireland Ltd promotes community-owned renewable energy projects in Ireland, engaging communities, providing project support, and advocating for cooperative ownership of sustainability projects. They are also involved in pioneering hydrogen research (SEAFUEL, GENCOMM, HUGE) and most recently in GreenHysland and Sh2amrock.

CONTACT
info@energyco-ops.ie

EnR44

EnR44 is a public-private cooperation created in May 2018 at the initiative of the of the energy office of the department Loire-Atlantique , Territoire d'énergie Loire-Atlantique. EnR44's mission is to support, develop and operate projects dedicated to the production and sale of renewable energy in the Loire-Atlantique region in partnership with local authorities.

www.enr44.fr

ESK GmbH

ESK is an international engineering service company specialising in energy storage, consultancy and project management. Its team has a wide-ranging know-how in the field of energy storage. It covers not only the classical gas storage business, but also hydrogen / compressed air and oil storage.

CONTACT
info@esk-projects.com

Gabadi S.L.

More than 25 years of experience in shipbuilding and presence around the world. Our core business is the construction and maintenance of LNG tanks with CCS systems (LNG carriers, fuelled ships and onshore tanks.) World leader in LNG tank maintenance during 3 years, with qualified operators and construction of prototypes.

CONTACT
gabadi@gabadi.com

Galway Aviation Services Ltd T/A Aer Arann Islands

Aer Arann islands is a small regional airline based in the west of Ireland.Our mission is to provide a safe and sustainable air service to the three Aran Islands. We operate approximately 8000 flights per year and in December 2023 we were awarded Best Aviation Customer focus in Ireland.

CONTACT
info@aerarannislands.ie

Géométhane

Géométhane is an industrial player specialised in the massive storage of natural gas in deep geological formations. Operated by Storengy and established in the heart of the Luberon Regional Natural Park since 1993, the company contributes to energy security and the supply of the SUD Region in France.

www.geomethane.fr

Ginhoux

Established after the upheavals of the revolution and 1st Empire, our Founder Théodore Ginhoux started his transport services on the Royal Route of the Auvergne, the future RN102. The first automobile was acquired in 1910 and the first car in 1920, and the following generations of Ginhoux have never stopped to develop their business with a great variety of forms of transport and energy.

www.ginhoux-autocars.com/fr/autocars

GRDF

In accordance with its public service remit, GRDF designs, builds, operates and maintains the largest distribution network in Europe. GRDF works with local authorities, manufacturers and transporters to integrate a growing share of green gas, including hydrogen, in order to decarbonize their processes, heating systems and vehicle fleets.

CONTACT
contact@grdf.fr

Hive Hydrogen (Ireland) Ltd

HIVE Hydrogen, with extensive experience in the hydrogen and industrial gas sector, recognizes hydrogen's potential in global decarbonization efforts. While progress has been made, the renewable energy sector faces challenges in meeting energy demand. Hydrogen expands renewables into mobility fuels and heat applications, but scaling up is needed for reliable low-cost green and low-carbon hydrogen. HIVE Hydrogen employs a whole-systems approach to help clients understand their position in the hydrogen value chain, identify missing elements, and achieve their goals. Through a technology-neutral approach, they optimize business cases and maximize decarbonization at the best cost.

CONTACT
info@hivehydrogen.com

Hydrus Engineering

Hydrus Engineering S.A. is a premier global engineering firm specializing in the maritime and energy industries. Our core focus lies in spearheading the energy transition and decarbonisation efforts within the maritime sector.

CONTACT
mail@hydrus-eng.com

HyEnergy Consultancy

HyEnergy® is an experienced consultancy specialising in hydrogen and energy communities. Helping to deliver new, clean technical solutions for a sustainable future. Our goal is to ensure that the systems and technologies gain commercial acceptance by delivering low cost, clean, onsite energy solutions which compete with fossil technologies. Beginning in the industrial gas sector, we have grown to work with many sector stakeholders – including industry, local/regional public sector organisations and national governments.

hy-energy.co.uk

Hyliko

In order to encourage and accelerate the transition to hydrogen for heavy-duty mobility, Hyliko has developed a pay per use leasing offer for hauliers, covering four key areas: the truck and its maintenance, the hydrogen, and the follow-up of the CO2 footprint.

hyliko.com

Hympulsion

Hympulsion is a Public-private network, pioneer of renewable hydrogen mobility to connect territories. We deploy hydrogen infrastructure and support the adoption of hydrogen vehicles, particularly in Auvergne Rhone Alpes region, acting as a key player in France's clean transportation transition.

hympulsion.com

INRETE Distribuzione Energia S.p.A.

INRETE Distribuzione Energia is part of Hera Group, which is one of Italy's largest multi-utility companies, with more than 9000 employees and a rapidly growing business plan in gas, energy and water distribution and in waste treatment. INRETE is a gas and electric Distribution System Operator. INRETE operates mainly in the Emilia-Romagna region (in the north of Italy). INRETE manages gas distribution networks in 138 municipalities and more of 1,1 million of gas customers and more than 14.000 km of pipelines, more than 1,2 million of gas meters and more than 30.000 gas volume conversion devices.

CONTACT
inrete_distribuzione@legalmail.it

Institut National De Lenvironnement Industriel Et Des Risques (Ineris)

Established in 1990, Ineris is France's national competence center for industrial safety and environmental protection. It operates under the supervision of the French Ministry of the Environment and focuses on assessing and preventing risks from industrial activities, chemicals, and underground works. Ineris conducts research to understand these risks and improve their identification for decision-makers in both public and private sectors to enhance environmental safety.

CONTACT
ineris@ineris.fr

Institute for Research in Environment, Civil Engineering and Energy

IECE has set fields of occupation and research disciplines in environment, civil engineering and energy. The latter include clean energy sources, conversion methods, transitions, with the hydrogen being one of the most perspective components thereof. IECE's strategy on building sustainability of systems and communities includes clean energy as a driver of development and the green hydrogen in this span.

CONTACT
info@iege.edu.mk

Institute of Higher Education King Danylo University

King Danylo University is a private Ukrainian institution with 20 years of quality education. It has a growing number of students and teachers, and offers innovative education to meet modern demands. The university prioritises students' professional success and has over 250 motivated staff and 600 partnerships. It is expanding internationally and has completed successful projects in climate change mitigation and energy efficiency.

CONTACT
university@ukd.edu.ua

IZES gGmbH

IZES is a non-profit research organisation established in 1999. Our mission is to promote environmental protection through a systemic approach, with applied research and development across various domains, including energy markets, infrastructure and municipal development, material flows, technical innovations, and environmental psychology. We tackle environmental problems by finding sustainable solutions.

CONTACT
sekretariat@izes.de

Kaleseramik, Çanakkale Kalebodur Seramik San. A.Ş.

Kaleseramik, the leader of the Turkish ceramic industry, operating under the umbrella of Kale Group, is the 4th largest ceramic tile manufacturer in Europe and the 18th largest in the world. Kaleseramik pioneered the establishment of the Turkish ceramic industry; Çanakkale Seramik, as one of the most important players in the international ceramics market with Kalebodur, Kale Banyo and Italian brands Edilcuoghi and Edilgres, reaches consumers with 400 sales points in more than 100 countries. Kaleseramik realized Turkey's first ceramic export in 1962 and aims to reach a permanent market share in the targeted countries by thoroughly analysing the preferences and expectations for ceramic coating materials and sanitary ware products. Italy, the ceramic base of Europe, where Kaleseramik invested in a brand in 2011, has now become the third largest country among the target countries.

Keolis SA

Keolis is more than just a public transport operator, we are an expert in multimodality. Driven by the notion of public service, we enhance everyday life in cities and communities by imagining and operating safe, smart and sustainable, like using Hydrogen, mobility solutions, accessible to each and everyone. Across 13 countries, our 68,000 employees work on a daily basis to offer an appealing alternative to the private car. In doing so, we are delivering on our determination to accelerate the ecological transition.

CONTACT
keolis.communication@keolis.com

Lodz University of Technology

Lodz University of Technology is one of the best technical universities in Poland, we are educating engineers for 75 years. TUL ranks fifth among technical universities and ninth among public universities in Poland. We are the fourth most popular university in Poland - Ministry of Education and Science.

p.lodz.pl/en

MONOLITHOS Catalysts & Recycling Ltd.

MONOLITHOS has strong commercial background in producing and recycling of automotive catalytic converters. Over the last 23 years, the company has been established as the biggest player of the Greek automotive aftermarket and important stakeholder of the EU automotive sector. Since its establishment, in 2017, MONOLITHOS' Research & Innovation Department is focusing in producing and recycling of electrocatalysts for Hydrogen Devices (Fuel Cells and Electrolysers).

CONTACT
info@monolithos-catalysts.gr

National Institute of Chemistry

National Institute of Chemistry, Slovenia (NIC), is a leading Slovenian research institution in the field of chemistry and related disciplines. It has close to 500 employees of whom around 350 carry out research work in 9 departments and two infrastructure centres.

CONTACT
glavna.pisarna@ki.si

SATA Group

Created in 1959 to support the tourist development of Alpe d'Huez, SATA (Société d'Aménagement Touristique de l'Alpe d'Huez et des Grandes Rousses) becomes SATA Group in 2021. Operating the legendary resorts of Alpe d'Huez, Les 2 Alpes and La Grave, SATA Group is reinventing the mountain experience within a multifaceted territory that lives by the rhythm of the seasons. Whether you are looking for a premium, trendy or sporty experience, Groupe SATA capitalises on these differences to offer a unique offer that reflects complete expertise in mountain tourism. Mountain domain operators, mountain restaurant managers and tourist real estate operators: skills and people serving the development of the Alps.

CONTACT
info@sataski.com

Technische Universität Dresden

The Technische Universität Dresden is one of the leading and most dynamic universities in Germany and was identified as a 'University of Excellence'. With 17 faculties in 5 Schools, the university offers a broad variety of 119 degree courses and covers a wide research spectrum. Today, around 8,300 employees from 89 countries work here, around 29,000 students are enrolled.

CONTACT
servicecenter.studium@tu-dresden.de

Transports LTR-Vialon

LTR VIALON is a French transport and logistics company with more than 60 years of experience. Our more than 780 employees stay true to our family values in facing the issues of our sector: security, reliability, and the energy transition.

www.transport-ltr.com

University of Patras

The University of Patras, in Greece, renowned for its academic prowess, encompasses seven faculties and 31 departments. With over 33,000 students and 700 faculty, plus 234 scientific staff, it offers diverse programs in sciences, engineering, humanities, and social sciences. Founded in 1964, it champions innovative research and premier education

CONTACT
rectorate@upatras.gr

Warrant Hub S.P.A.

Warrant Hub, part of Tinexta Business Innovation, is the leading consulting company for innovation, digital transformation, and sustainable business development in Italy. With over 900 professionals and nearly 30 years of experience, it has built a portfolio of over 10,000 clients across various industrial sectors. Warrant Hub's extensive network of partnerships in academia, technology, finance, and institutions enables it to support companies in navigating complex challenges. The team offers expertise in research, development, innovation projects, production investments, and digitalisation. Founded in Correggio, Warrant Hub operates throughout Italy and in Belgium, Bulgaria, France, and Spain.

CONTACT
info@warranthub.it

Zamenhof Exploitation

A leader in the transport and logistics market in France the Group Jacky Perrenot (Zamenhof Exploitation) is active in the energy transition since 2012 and provides its clients concrete expert decarbonisation solutions that allows it to operate the largest fleet of low carbon vehicles on the market today.

www.perrenot.eu

Job Market

Manager of Electrolysis

BOSS Energy Consulting

Full Time, United Kingdom

12-07-2024

JOB DESCRIPTION:

- Manage hydrogen activities as a technical expert for asset-based projects, including the development of green hydrogen projects in the UK.
- Support the technology selection of hydrogen and hydrogen derivative technologies (e.g., SAF, methanol, ammonia).
- Assess and maintain a hydrogen OEM radar to monitor developments and efficient technologies for green hydrogen.
- Develop asset-based business models for hydrogen production and derivatives targeting long-term hydrogen-based contractual relationships.
- Stay technology agnostic and monitor project developments on various TRLs.
- Provide overall support for projects in feasibility, pre-FEED, or FEED stages, focusing on the process of electrolyser packages.
- Review process engineering documents and steer contractors for process engineering matters Participate and contribute to safety studies such as HAZID, HAZOP, SIL analysis, and LOPA.

MORE INFO: https://hydrogeneurope.eu/job-market/manager-of-electrolysis/

Application Engineer (f/m/d) Systems / Software for Commercial Vehicles

Cummins

Full Time, Germany, Nürnberg

20-07-2024

JOB DESCRIPTION:

- Working closely with the customer, the responsible project management as well as the system architects to identify customer requirements on vehicle level.
- Tracking new feature development against schedule and requirements fulfillment.
- Based on the existing system configuration and architecture, specifying and executing vehicle-level test cases.

Analyzing system behavior and verify expected system responses.

- Modifying component parameters and optimizing drive system parameters on the customer vehicle, according to customer requirements, while considering prevailing norms.
- Creating and managing customer-specific software packages, generating test protocols and reports.
- In case of deviations, defining them and monitoring the processing with the development team and attending the acceptance on the vehicle in compliance with the applicable processes.
- Configuring the test tools according to the test strategy.

MORE INFO: https://hydrogeneurope.eu/job-market/application-engineer-f-m-d-systems-software-for-commercial-vehicles/

Technical Project Leader – Traction

Cummins

Full Time, Germany, Nürnberg

20-07-2024

JOB DESCRIPTION:

- Lead eAxle system level product development activities on special projects and/or new innovative products and manage related documentation, including: Stakeholder (internal & external) requirements and tracking risk / compliance for eAxle platforms
- Liaise with cross functional Traction engineering teams and other support functions for activities such as problem resolution, system integration, analysis / validation.
- Makes decisions in the areas of design and project risk trade-offs that impact program cost or delivery without sacrifice of quality expectations.
- Contribute to and facilitate implementation of system level eAxle product platform strategies.
- Obtains input and negotiates with program leadership, customers, customer teams, product engineers or technology teams to deliver robust prototype and production designs, technical risk mitigation plans, and coordinated deliverables of new or current product change activity.
- Recommending and driving decision making on all aspects of the product and/or projects
- Serve as key representative of product both internally and externally
- Product Knowledge – Experienced with design and engineering of powertrain systems, with transmission and/or drive axle experience preferred.
- Product Development Execution, Monitoring and Control – Plans, schedules, coordinates and executes the activities involved in developing a product to a respectively aligned hierarchy of requirements and technical profiles.
- Builds networks – Effectively building formal and informal relationship networks inside and outside the organization.
- Optimizes work processes – Knowing the most effective and efficient processes to get things done, with a focus on continuous improvement.
- System Requirements Engineering – Uses appropriate methods and tools to translate stakeholder needs into verifiable requirements to which designs are developed.
- Decision quality – Making good and timely decisions that keep the organization moving forward.
- Project Management – Establishes and maintains the balance of scope, schedule and resources for a temporary effort (a “project”).
- Ensures results/impact from temporary effort are fully realized as possible.

MORE INFO: https://hydrogeneurope.eu/job-market/technical-project-leader-traction/

Functional Safety Engineer (m/f/d)

Cummins

Full Time, Germany, Nürnberg

20-07-2024

JOB DESCRIPTION:

- Define and engineer safety requirements on System, Component and Discipline level.
- Work together with our FSM on Platform development as well as Customer projects.
- Support and consult the project teams in all questions regarding the ISO26262.
- Create and support the creation of ISO26262 work products along the safety plan.
- Verification and Validation

MORE INFO: https://hydrogeneurope.eu/job-market/functional-safety-engineer-m-f-d/

Product Manager (m/f/d) – Traction

Cummins

Full Time, Germany, Nürnberg

20-07-2024

JOB DESCRIPTION:

- Manage product lifecycles, stay updated on market trends, and lead marketing efforts for new and existing products.
- Develop long-term product line strategies, forecasts, and annual operating plans.
- Provide budget requirements for your product line in the annual operating plan.
- Lead product introduction planning and pricing activities throughout the lifecycle.
- Ensure effective implementation of your branding strategy and manage internal and external communications.

Improve customer satisfaction, resolve issues, and determine product obsolescence, while engaging globally to ensure profitability

MORE INFO: https://hydrogeneurope.eu/job-market/product-manager-m-f-d-traction/

Base Software Engineer (m/f/d)

Cummins

Full Time, Germany, Nürnberg

20-07-2024

JOB DESCRIPTION:

- Investigate product software problems, understand causal mechanisms, recommend appropriate action, own problem resolution, and document results
- Improvement of product software development processes and tools
- Obtain input and negotiate with product and software development teams and deliver verified software features, components
- Use systems knowledge and expertise to make decisions in the areas of software requirements, architecture, design, and test
- Review of less-experienced developers/testers' work to ensure robust, reusable, and efficient designs

MORE INFO: https://hydrogeneurope.eu/job-market/base-software-engineer-m-f-d/

A Technologist for control of Hydrogen system

Fondazione Bruno Kessler

Full Time, Italy, Povo - Trento

17-06-2024

JOB DESCRIPTION:

- Participate in the engineering activities and control aspects, mainly focusing on developing control logic and PLC deployment on prototypes and test benches.
- Elaborate control strategy and logic for H2 systems and prototypes.
- Collaborate on the risk analysis activities performed within projects and industrial consultancies.
- In collaboration with the H2 technical team, support the head of the unit in defining the safety requirements for equipment to be installed in FBK's facility.
- Support and collaborate with the H2 team in the definition of equipment requirements and equipment procurement.
- Collaborate with the H2 team on research activities within the mentioned projects, proposing and leading specific innovation aspects.
- Leading research activities on novel control paradigms for H2 systems in collaboration with the H2 team.
- Develop technical files related to the control of the H2 system in compliance with european normative.

MORE INFO: https://hydrogeneurope.eu/job-market/a-technologist-for-control-of-hydrogen-system/

Study Engineer Wind Energy

Eoly Energy

Full Time, Belgium, Braine l'Alleud

31-12-2024

JOB DESCRIPTION:

As a study engineer within our production team, your goal is to contribute to our green mission through the following tasks:

- You carry-out technical studies that underpin the development of our production park;
- You carry out feasibility studies (working with lots of data);
- You manage the relationships with external study agencies;
- You help prepare investment decisions by making yield calculations and determining the financial feasibility;
- You provide technical support for the active production installations.

MORE INFO: https://hydrogeneurope.eu/job-market/study-engineer-wind-energy/

Not yet a member?

Join us with the attached QR code

#07

THE HYDROGEN EUROPE QUARTERLY