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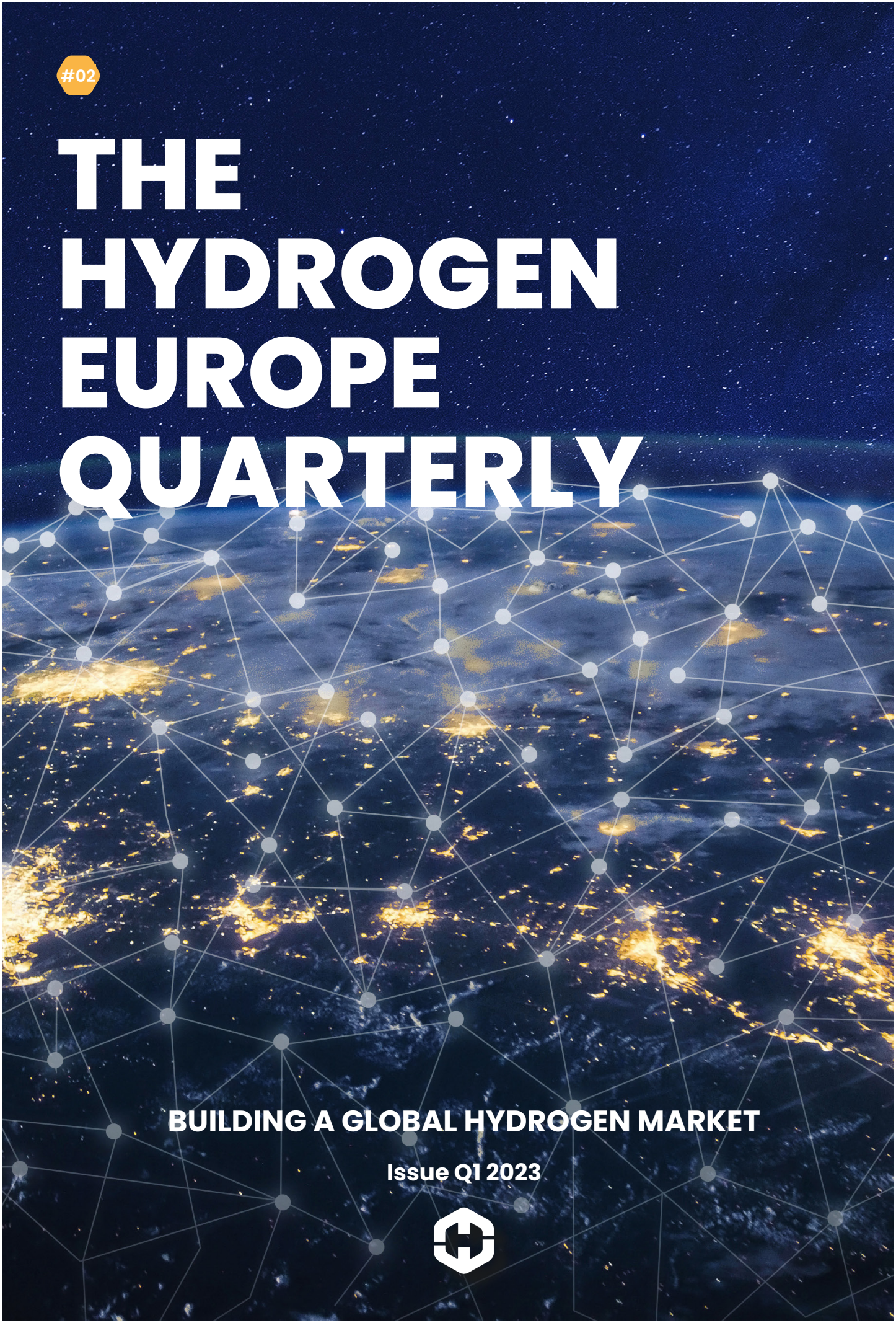
THE HYDROGEN EUROPE QUARTERLY



BUILDING A GLOBAL HYDROGEN MARKET

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Welcome!

The Hydrogen Europe Quarterly Magazine

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From the CEO

Welcome to the second issue of the Hydrogen Europe Quarterly. This first edition of 2023 will be an important reading to keep track of all the recent activity in the hydrogen space.

I am proud to present this second issue of our in-house magazine. We were pleased to see so many positive reactions to the first edition, released in time for our flagship European Hydrogen Week. We look forward to continuing to provide our members and friends with timely updates and relevant analysis on the hydrogen sector.

There are several subjects covered inside these pages, but the overarching theme of this issue is a global hydrogen market. In the last few months, we have seen the passing of the US Inflation Reduction Act (US IRA), a number of hydrogen-related memoranda and partnerships signed at COP27, and the development of hydrogen strategies across the world from Ireland to Japan. It is easy to see that green hydrogen has truly gone global!

Europe can be proud to have led the way on hydrogen and we are delighted to see that the "missing link" of the energy transition is being forged internationally. But how competitive are Europeans today? The US IRA is in fact the centre of attention in this issue's lead story. The views and insights of representatives from Denise Digman (Chemours), Osamu Ikeda (Chiyoda), and David Burns (Linde) help us contextualise the US regulation within the global framework, while shedding some much needed light on European fears of surrendering manufacturing capabilities to other geographies.

The theme of global hydrogen is encapsulated brilliantly by the activities of HDF Energy in this issue's Member Spotlight. The first company to make hydrogen-to-power commercially viable is now turning its sights on becoming a fuel cell manufacturing powerhouse.

In this issue readers will also find an insightful interview with Dr. Mekondjo Kaapanda-Girnus, the Namibian ambassador to Brussels and a proponent of hydrogen. We discuss the ambitions of Namibia and its targeted role in the new energy landscape and the importance of building a just and equitable relationship with Europe.

The Hydrogen Europe Quarterly will now, beginning with this issue, highlight some of its national and regional association members. The work towards a more sustainable future is continuing across Europe requires implementation – and this happens at the local and regional level. This issue sees Paul McCormack of Hydrogen Ireland speak to us.

Finally, you can expect helpful summaries of recent policy developments in the EU, including the Carbon Border Adjustment Mechanism (CBAM) and Renewable Energy Directive (RED) regulations, as well as an interesting exploration of international cooperation and trade opportunities (and challenges).

I look forward to our continued collaboration in building a better, more sustainable world.

Green hydrogen goes global

The announcement of the US Inflation Reduction Act (US IRA), which includes an effective and bold framework for the country's hydrogen market, has increased the already exciting momentum that is building in the sector. Many countries and regions have followed the path that the European community has spent the last few years painstakingly laying out. Now, some may have guidance of their own to offer.

It could be said that the US IRA, at least as it pertains to hydrogen, represents the best of an American approach to policy: simple, efficient, and functional. It is a clear statement of intent from the Biden administration that the largest economy in the world wants in on clean hydrogen. For those of us who are serious about creating a sustainable global economy and mitigating the worst effects of climate change, this is good news no matter where you are from.

The US is the second largest producer and consumer of hydrogen in the world, accounting for around 13% of global demand. Only China is higher.

For the next ten years, green hydrogen production facilities that begin construction by the end of 2032 will be entitled to a clean hydrogen Production Tax Credit (PTC), as well as credits across the value chain resulting in credits of more than $3 per kilogram of green hydrogen produced. Blue hydrogen production can secure an Investment Tax Credit (ITC) for up to 30% depending on the carbon intensity of the production process. The headline here is that green hydrogen is now cheaper than grey in the US and, in states with high solar irradiation like Texas and California and thus a lower levelised cost of energy (LCOE), it could be quite significantly cheaper.

"Now the game has changed," Osamu Ikeda, managing director of Chiyoda Corporation Netherlands, told Hydrogen Europe Quarterly. "The US has delivered a key message to the market, especially for hydrogen producers and supply chain players in the US."

The international engineering and petrochemicals company is trying to enhance its market presence in the US, Ikeda said, and they will surely not be alone among those with an eye on hydrogen.

The title of "game changer" was echoed by Denise Digman, President, Advanced Performance Materials at Delaware-based Chemours, citing

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the now near-parity between green and blue hydrogen.

"The US IRA is very positive, from our point of view," agreed David Burns, Vice President, Clean Energy at Germany multinational Linde. "It's very simple to access. If you meet the targets and conditions, then the process to obtain the tax credit is fairly straightforward."

Urgency needed?

At the risk of overstating it, the Act has caught everyone's attention. Add it to the series of memoranda signed at COP27 related to hydrogen, and the consistent flow of national hydrogen strategies springing up all over the world, and it's also safe to say that green hydrogen has gone global.

But with this in mind, there is understandably some apprehension here in Europe. As the legislative wheels continue to turn in Brussels, albeit evidently slower than in Washington, there is a concern of losing out, of possibly undoing all the good work the EU bloc has done to become a technological leader in the sector.

"The EU has seen this before," cautioned Chemours' Digman. "Where demand has been created but the manufacturing goes somewhere else. Regulators must keep an eye on this."

Obviously, politics work differently in Europe than they do in the US, and for many reasons Europeans can be proud of the bloc's tradition of consensus-building and legislative diligence. But the saying "don't let the perfect be the enemy of good" springs to mind, particularly when time is of the essence.

"EU legislators should accelerate to finalise its rules and regulations, and also the support mechanism," said Chiyoda's Ikeda, emphasising a need for simplicity and flexibility.

"The US IRA shows graded support based on CO2 emissions and I hope for a similar approach based on maturity of the market."

Burns agreed with the need for simplicity but differed slightly on the form, saying it may be difficult for Europe to match the IRA.

"And difficult for the EU bloc as a whole," he continued, "given the different tax regimes – to offer something similar. But anything that can be done to allow funding to be deployed quickly into projects and increase available funding, like H2Global and contract-for-difference models, will enable more projects to get off the ground in Europe."

The hydrogen is always greener

The word "exodus" has been thrown around occasionally when discussing the US IRA and the risk of companies, frustrated with the lack of a clear regulatory framework in place, heading to greener pastures.

The interviewees for this article, all representing international companies with interests in both the US and Europe, naturally acknowledged the undeniable fact that there is now in the States a solid business case for green hydrogen, and clear state support.

"it's difficult to say 'exodus' but it's obviously an opportunity," said Ikeda, adding that global companies which have already been doing business in the US for decades may consider "a change in resource allocation" from Europe.

But any reports of European hydrogen's demise were an exaggeration.

> **"Green hydrogen is now cheaper than grey in the US**

"We continue to be very much focused on Europe and, with the IRA, we have an increasing number of opportunities in the US," said Burns.

"It's more than just incentives that drive decisions," said Digman. "Europe has been leading in this quest for green hydrogen and that's not going to change. Perhaps you can call it [US IRA] a 'wakeup call' but it is important for Europe to continue to be aggressive in this area and make it simple for demand creation."

"As long as there is robust demand, there will be continued investment in Europe. It's a global market and you really do need to have secure local supply chains, our investment in France points to that."

Plenty of deals in Europe

The investment in France referred to by Digman is a US$200m investment to increase capacity and advance technology for its Nafion ion exchange at its manufacturing facility in Villers-Saint-Paul. As part of the investment, the capabilities of Chemours' regional manufacturing site will be expanded to progress the technology and create new products for the worldwide hydrogen economy.

In the company's press release, Chemours CEO Mark Newman directly attributed the decision to invest there to "the French government's goal to

create a reliable and strong hydrogen economy, and the European Union's ambition".

Chemours is now in the process of obtaining all customary permits and licenses necessary for the construction and operations at the 40-hectare site. The site expansion is expected to create 80 full-time jobs in the Hauts-de-France region, and about 50 long-term contracted positions. Works will include the expansion of ionomer production and associated membranes to deliver additional capacity in the Nafion™ materials supply chain.

"The number one thing we are concentrating on is supply reliability," Digman told Hydrogen Europe Quarterly. "Any new and growing market carries uncertainties in critical raw materials and we wanted to make sure we had the right supply chain capacity."

"What's different about us is we're backwards integrated: we're not just making membranes or polymers; we control all the materials, and this gives us more freedom to innovate."

Chiyoda, too, is investing big money in Europe together with Port of Rotterdam, Koole Terminal and Mitsubishi Corporation. The target is commercial-scale imports of hydrogen to the Port of Rotterdam using Chiyoda's hydrogen storage and transportation technology.
"This is a key project in Europe for us," Ikeda enthused.

> **Reports of European hydrogen's demise were an exaggeration**

Rather than worry too much about having to possibly share the ever-growing hydrogen pie, it seems many in the industry are still looking at Europe as a major market for them. The opening up of another market does not change that.

"I think we'll get there, it's just slower," said Burns. "Looking at projections of where we will be, and the role hydrogen will play, we view it as a real growth opportunity."

And neither is Europe's position as global hydrogen leader in jeopardy yet.

"The US IRA was in response to what is going on in Europe and recognising that the US could not fall behind," Digman recalled, adding that Europeans were doing a lot right of which Americans should take heed. For instance, Chemours is optimistic on a pragmatic approach by EU on issues like PFAS and minimising emissions from production and end of life rather than "banning entire categories of products".

"This is an approach that hopefully will translate to the US as well."

"I'm not sure that the hearts and minds in the US have been captured as they have been in Europe, and you need that as well."

PROMINENT HYDROGEN PEOPLE

Dr Mekondjo Kaapanda-Girnus

In each issue of the Hydrogen Europe Quarterly, we will interview a prominent person in the hydrogen sector to talk about their involvement and interest in hydrogen, as well as about the key issues that concern them. For this issue, we spoke to Dr Mekondjo Kaapanda-Girnus, ambassador of Namibia to Belgium.

How long have you personally been interested in hydrogen? How did you learn about it?

My intense engagement with green hydrogen started two years ago but I have been aware of its potential as an alternative to fossil fuels in the energy transition for much longer. Having worked in the field of economic diplomacy for more than 12 years, I have been to many events and conferences which showcased climate-friendly green hydrogen technologies and applications. For example, when I was stationed in Germany, I regularly attended the Hannover Trade Fair, one of the world's largest industrial trade fairs, where I recall seeing many exciting examples of hydrogen technologies and engineering solutions in sectors such as mobility. In the last two years, however, green hydrogen has changed, from being an interesting idea with limited direct relevance to my country, into a very real technological, economic, and social proposition that has moved to the forefront of my work. As part of a broader diplomatic strategy, our embassy in Brussels strives to build new bilateral and multilateral relations and cultivate new partnerships that focus on hydrogen-related technologies. It is satisfying work because it allows us, on the one hand, to contribute towards international climate action and, at the same time, increase energy security, achieve green industrialisation, and build broad-based prosperity at home.

What opportunities does hydrogen offer Namibia?

Namibia has the potential to become a major global green hydrogen producer and exporter. With an optimal combination of abundant and co-located renewable resources, plenty of space for solar and wind farms, access to water, and capabilities to export to off-takers and large demand centres such as chemical clusters in countries like Belgium, the Netherlands and Germany, we are ideally positioned to produce green hydrogen and its derivates at highly competitive prices on a large scale. Model calculations indicate that green hydrogen could be produced for N$25 to N$33 (ca. € 1.50 to 2) per kilogram in Namibia.

The opportunities that green hydrogen represents for Namibia are many and varied. In terms of our domestic economy, we see the potential for a tremendous socio-economic impact. A green hydrogen industry could help us to address critical challenges such as climate change, low economic growth, unemployment, poverty, and inequality. As articulated in the 2021 Harambee Prosperity Plan II, the Namibian Government's action plan towards economic recovery and inclusive growth, the creation of a local green hydrogen economy can play a significant role in transforming the economic structure of the country and unlock new opportunities to industrialise and attract energy intensive sectors that require cheap and clean energy. By adding new productive capacities to our economy,

the hydrogen industry could contribute up to US$6 billion to our GDP by 2030. This is 30% more than current GDP estimates with no hydrogen developments. In terms of employment, up to 85,000 additional jobs could be created in areas such as construction, business services, transportation, and durable manufacturing by 2030.

When it comes to energy, a green hydrogen industry and the gigawatts-scale renewable electricity generation capacity that it would entail can help to increase energy access and affordability and allow us to become more energy independent. Achieving energy security is vital as we are heavily dependent on imports for our energy supply, with almost 60% of our electricity coming from neighbouring countries.

Internationally, we think that green hydrogen could be instrumental in repositioning our country within the global economy. The global green hydrogen market and particularly the cross-border trade of green hydrogen will create new international partnerships, patterns of trade, and investment flows. We see ourselves becoming even more integrated within regional and global supply chains, trading our excess green hydrogen and ammonia production with multiple trading partners across the world and, in doing so, supporting regional and global decarbonization efforts. Last year at COP27 in Egypt, Namibia and the EU agreed to work towards a new strategic partnership in the area of green hydrogen and we are eager to work together with other like-minded partners across the world. With our political stability, democratic government, and good governance credentials, we can be a trusted and reliable partner to countries who are looking for a diversified and clean supply of energy as they seek to decarbonise their economies.

> **the hydrogen industry could contribute up to US$6 billion to our GDP by 2030 and up to 85,000 additional jobs could be created**

What challenges does hydrogen present Namibia?

The establishment of a green hydrogen industry in Namibia is a major undertaking but we have a roadmap to put in place a series of enabling measures to address barriers and bottlenecks. These measures include the establishment of appropriate legal and regulatory frameworks for the production, transportation, and trade of green hydrogen and green hydrogen-based energy carriers. We launched our national Green Hydrogen and Derivates Strategy at COP27 last year and one of the next steps will be to enact a Synthetic Fuels Act that will, inter alia, ensure that our plans are compatible with international green fuel certification, health and safety, and environmental standards. As hydrogen projects are capital-intensive and have high initial investment costs, we will continue to aggressively mobilise capital and work together with international development partners, including development banks, in order to access low-cost financing and develop our own de-risking financial instruments. A significant part of the funding we seek will go towards the establishment of common-use infrastructure (e.g. hydrogen transmission lines, pipelines, ports) to lower development costs and risks. Capital will also be deployed to allow the Government to acquire equity in strategic green hydrogen projects. So far, investors have shown confidence in our approach and last year we managed to secure a €40 million grant of catalytic funding for SDG Namibia One Fund', an innovative blended finance platform that will facilitate and accelerate the development of a green hydrogen sector and economy in Namibia.

Developing the requisite talent pool for an emerging industry can be challenging and we understand that a green hydrogen industry cannot grow without a skilled workforce. Government institutions are therefore currently busy mapping out the skills which are needed for a local green hydrogen economy in order to identify how to close existing gaps by upskilling and reskilling workers through appropriate capacity building and training programmes. The recently established Namibia Green Hydrogen Research Institute (NGHRI) will act as a major skills development centre and offer training courses, promote entrepreneurship, and support the commercialization of innovative projects, frequently in collaboration with international partners in Europe. Skills development has also been at the heart of the Government's diplomatic engagements with our international partners. Success stories include a Joint Communiqué of Intent with the German Federal Ministry of Education and Research through which we secured a grant of € 40 million, € 5 million of which will finance a "Namibia Youth for Green Hydrogen (Y4GH) Scholarship Programme". The Namibian Government will continue to support Namibian institutions of higher learning and vocational training centres in order to put in place training programmes and policies that will enable Namibian citizens to participate meaningfully in the hydrogen economy and supply talent to this new industry.

Finally, as a country that has more than 45% of its land under some form of conservation management and that has enshrined the protection of the environment in its constitution,

> **African people are demanding better returns from their natural resources**

Namibia is determined to develop a green hydrogen industry that adheres to the highest environmental standards and safeguards. As a global leader in conservation and nature-based rural development, we will set the bar for environmental and community-responsible development in the hydrogen economy. We plan, for example, to create a permanent task force to assess and manage biodiversity concerns in the emerging hydrogen industry under the framework of our existing Community-Based Natural Resource Management Programme.

What is your response to those who say that hydrogen is another neo-colonialist tool by Europeans to exploit African resources?

I am not surprised that some people are sceptical about the benefits that green hydrogen will have for African countries given that in the past, African raw materials and resources have not sufficiently generated income, wealth, employment, and better living standards on our continent. This is not something we can or should ignore. The challenge will be for African countries to use the opportunities that green hydrogen will bring to build new and more equitable partnerships with Europe and other parts of the world. Across the continent, African people - especially young people - are demanding better returns from their natural resources. They expect their elected leaders to negotiate beneficial agreements that deliver win-win outcomes, attract investments, create jobs and enable them to have a better future and this is what we intend to do in the area of green hydrogen.

In Namibia, we are very clear about the fact that we wish to leverage our natural resources, including our renewable energy assets, for the benefit of the country in order to achieve inclusive and sustainable growth for current and future generations of Namibians. This commitment and approach also applies to the development of a local green hydrogen sector. In view of the size and structure of our economy, the global demand for hydrogen and the location of the major off-takers, exports will play an integral part of our plans but the needs of the country will always remain a priority, beginning with domestic and regional decarbonisation and energy security. We are also working with investors, developers and international partners to develop local green hydrogen applications through a series of pilot projects which will provide green hydrogen and/or ammonia to sectors such as agriculture and heavy-duty transportation, including trucks, locomotives, mining equipment and ships. The pilot projects will also help to build local knowledge about hydrogen in the country and allow local companies and entrepreneurs to develop their capabilities, capture downstream benefits and establish linkages to global markets. In the long-

term, Namibia will look at how to capture a larger share of the green hydrogen value chain by, for example, examining the viability of producing value-added products such as green steel and fertiliser instead of merely exporting green hydrogen and ammonia as primary commodities.

How much are you engaging with representatives of other African countries on the topic of hydrogen? Which countries in Africa are most determined to make hydrogen their own success story?

The African continent has extraordinary green hydrogen potential and there are several African countries which are well-positioned to become significant players in the emerging global green hydrogen economy. It is estimated that Africa can produce 50 million tons of green hydrogen a year by 2035 and with global demand for hydrogen projected to rise sevenfold by 2050, African countries have a unique opportunity to unlock new engines of economic growth, create millions of jobs and play a key role in driving the world's transition to net-zero emissions. This is good news!

> **It is estimated that Africa can produce 50 million tonnes of hydrogen a year by 2035**

Namibia takes a regional and continental approach in its green hydrogen diplomacy, with dialogue with our neighbours being a very important component of that diplomacy. We are engaging South Africa on the topic of building interconnected infrastructure such as transmission lines and pipelines. We are talking to countries like Zimbabwe which produce fertilisers and agricultural chemicals about the sale of ammonia. With the construction of gigawatts-scale renewable energy assets, green hydrogen could allow Namibia to become a net exporter of energy and enable us to play a pivotal role in energy security for the region. For this reason, we are engaged in dialogue with the Southern African Power Pool about the possibility of trading our excess electricity in the future. We are also investigating the viability of importing iron ore from neighbouring countries in order to reduce the ore to pig iron and supply the global steel industry, which is responsible for 7% of global carbon emission.

Ultimately, Namibia sees green hydrogen as a national, regional and continental opportunity and game-changer. Africans have been talking about the need for more South-South cooperation, intra-African trade, and regional value chains for a long time and, if we act strategically, green hydrogen could provide new pathways to advance these interrelated agendas. So, while building new trade and investment relations with the leading hydrogen demand centres around the world will be key to our success, African countries must also build hydrogen partnerships amongst each other.

Where do you see the Namibian hydrogen sector in 10 years' time?

I feel a great sense of optimism and anticipation when I think about Namibia's future and prospects in the global race for green hydrogen. We aspire to create a large-scale green fuels industry with a production target of 10-12 Mtpa of hydrogen by 2050 at initially three hydrogen valleys in the northern, southern and central regions of the country. In 10 years' time, we will have a successful domestic green hydrogen economy, having put in place a fit-for-purpose regulatory and institutional framework, attracted new investments and mobilised appropriate funding, particularly concessionary climate finance. A comprehensive skill development strategy based on domestic talent sourcing and attractive immigration policies will have made a significant contribution to the creation of a skilled labour force for green hydrogen-related activities. Namibians, especially the youth, will be actively participating in the local hydrogen economy, playing a leading role in the energy transition and drive towards green industrialisation.

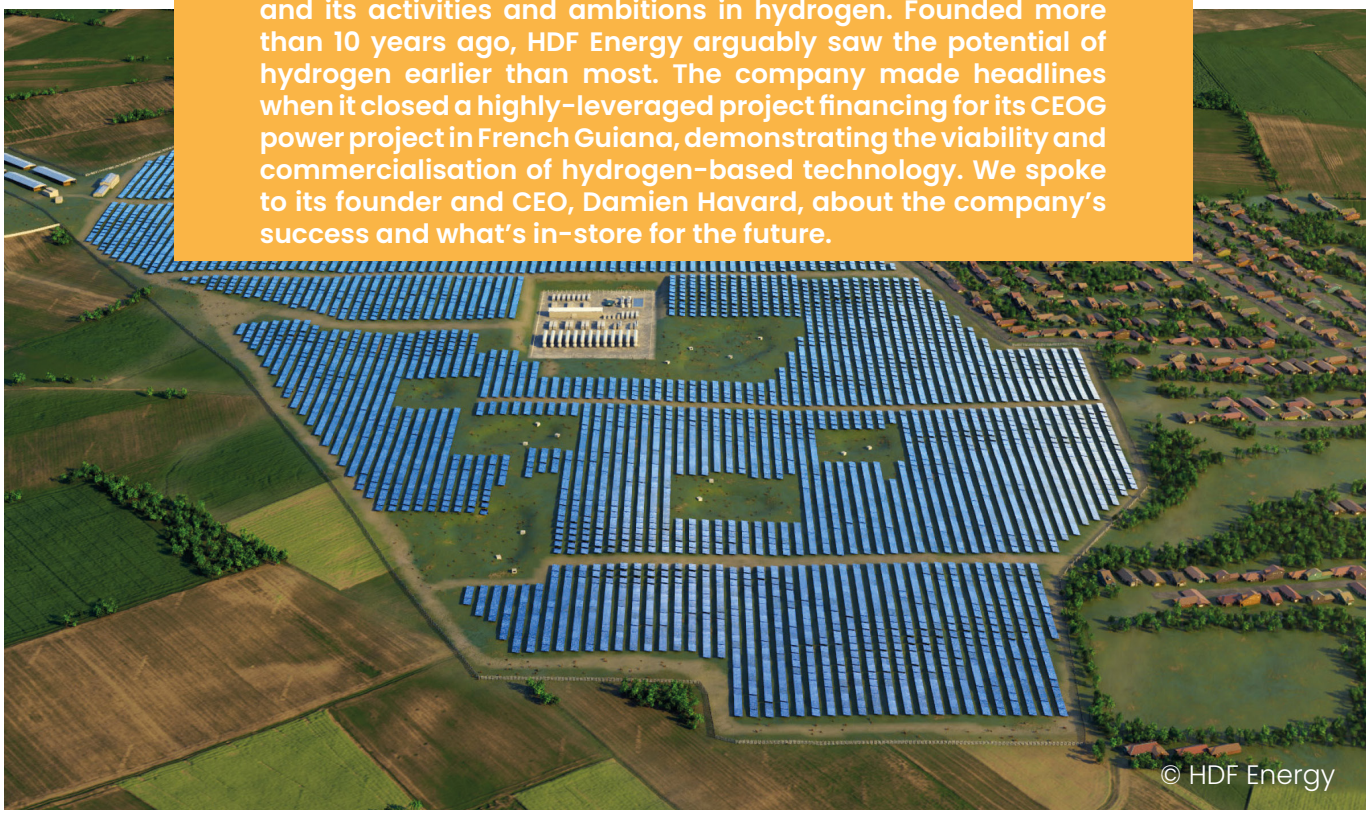
Within the next 10 years, the first green hydrogen projects by developers like CMB.Tech, O&L and Hyphen should be up and running, demonstrating that cost-effective green hydrogen and ammonia production is economically viable in Namibia. I also expect our country to have become a leading African demonstration site for the local end-use of hydrogen to power tugboats, trucks, trains/locomotives, mining vehicles, and excavators in the construction industry. The deployment of hydrogen in the mobility sector will boost Namibia's ambition to become a regional transport and logistics hub with the possibility of green corridors stretching out from the Port of Walvis Bay into the Southern Africa Development Community. In the field of agriculture, we should see local communities making use of domestically produced ammonia-based fertilisers.

As a diplomat, I naturally value and focus on international collaboration. So, I hope that in 10 years, our diplomatic efforts will have succeeded in further fostering mature, strategic and mutually beneficial international partnerships, which will aid our efforts to incubate a green hydrogen economy and strengthen our participation and integration in global value chains.

Member spotlight:

HDF Energy

As part of The Hydrogen Europe Quarterly, each issue our member spotlight covers one of Hydrogen Europe's members and its activities and ambitions in hydrogen. Founded more than 10 years ago, HDF Energy arguably saw the potential of hydrogen earlier than most. The company made headlines when it closed a highly-leveraged project financing for its CEOG power project in French Guiana, demonstrating the viability and commercialisation of hydrogen-based technology. We spoke to its founder and CEO, Damien Havard, about the company's success and what's in-store for the future.



On 12 December 2022, HDF Energy celebrated its tenth birthday with plenty of achievements under its belt. The French outfit had the year before raised €132m in an initial public offering (IPO), opened offices in South Africa, Mexico, and the Caribbean, and closed the €170m project financing of CEOG, a hydrogen-to-power project in French Guiana.

Not a bad year, altogether.

CEOG is the first of a series of projects under the company's 'Renewstable' concept: wind and solar farms equipped with on-site battery storage, electrolysers, and fuel cells to effectively create baseload renewable energy. In the case of CEOG, approximately 75% of the 55MW solar plant is used to produce the green hydrogen (with the rest going directly to the grid), which is then stored under pressure in reservoirs and can be transformed into power via the fuel cells. The next project of this kind is in Barbados, for which the company hopes to close the financing in the coming months. The World Bank and Inter-American Development Bank are backing the project. Not far behind is another project in Indonesia backed by the US Development Finance Corporation (DFC), and a tender victory in South Africa for a €3bn scheme.

As evidenced by these deals, and the number of hydrogen strategies coming out in countries across the world, hydrogen has no doubt attracted significant global attention. But the appetite for expensive, large-scale projects is extremely recent. "This did not exist two years ago," Havard says, referring to the excitement for the technology felt in these target countries.

HDF, though, is not resting on its laurels, or on its Renewstable projects. Part of the funds raised from last year's IPO will be used to develop its first factory for utility-scale (1MW+) fuel cells using PEM technology.

"The strength of the CEOG project was that it demonstrated that hydrogen technology was sufficiently mature for project financing," Damien Havard, founder and CEO of HDF, told the Hydrogen Europe Quarterly.

"Now we are moving forward with our own in-house expertise in both technology and investment."

Havard, who saw the opportunity for hydrogen as a storage and power source a decade ago, is now firmly committed to becoming a European (and global) leader in fuel cell manufacturing. Having been pre-selected for IPCEI status (the EU-run state aid program for Important Project of Common European Interest) for its fuel cell factory in Bordeaux, HDF will soon not only be able to supply its own fuel cells to its Renewstable projects but will also be able to offer the products to other companies around the world.

> **The strength of the CEOG project was that it demonstrated that hydrogen technology was sufficiently mature for project financing**

The final decision on IPCEI status is expected before the summer and will permit HDF to become a full-fledged manufacturer of one of the industry's most important components. The fuel cell business, which is being pursued in partnership with Ballard (and its expertise in PEM fuel cells), is anticipated to become 50% of the total HDF business.

And so, with the expectation of being able to sell these fuel cells to fellow European companies, HDF is watching the legislative and policy developments in Brussels carefully. The ambitions of the REPowerEU plan clearly show a pathway to increased demand for hydrogen.

"As a (soon-to-be) manufacturer, we are very interested in what is happening in Europe and we want to be able to offer fuel cells in Europe," Havard tells us.

It certainly helps that Europe has been such a leader in hydrogen these last few years. But for Havard, the momentum began even earlier.

"In Europe we've always felt a positive attitude to hydrogen. Where it is improving significantly is internationally. Europe has been ahead of the US, China and Japan. Now it's all about staying there, but it's something we are confident we can do."

Is he worried about the perceived lethargy of the regulatory process in the EU?

"We don't share the frustrations of some," he says. "We foresee a long process, but we are used to that. When I founded HDF ten years ago, I didn't expect things to move as fast as they did."

"We are an internationally focused company, and our global presence compensates for any European sluggishness. If I had a question, in the context of the progress in the US, it would be whether Europe can accelerate its decision-making processes."

In the meantime, there is plenty to keep the company busy, with the signing in November of an agreement in Uganda for another Renewstable project and plenty of work to do to develop and finance its on-going plants.

For the second decade of its existence, and to maintain the momentum of the first, HDF is planning to build larger and larger fuel cells for use in power projects.

"For us it's about organising our growth trajectory," says Havard. "We are full of ambition."

Damien Havard
CEO
HDF Energy

REGIONAL MEMBER SPOTLIGHT: Navarre

For each issue of the Hydrogen Europe Quarterly, we speak to a EU region striving to position itself as key hydrogen contributors. For this issue, we spoke to Mikel Irujo, Regional Minister for Economic and Business Development of the Government of Navarre, about the region's ambitious new hydrogen tax policy.

When and how did the Navarre region begin to seriously consider hydrogen?

The Navarre Green Hydrogen Agenda was approved in 2021, with a temporary scenario in this first conception until 2030. It is conceived as a regional planning instrument, to identify the challenges where Navarre must adopt an active role, as well as the actions and measures that will allow a harmonious development of the hydrogen economy, in such a way as it contributes to the decarbonisation of the current energy model and the mitigation of climate change. The Navarre Green Hydrogen Agenda constitutes a management instrument towards the development of an energy, industrial, technological and talent ecosystem around green hydrogen, an energy vector considered as an opportunity for the economic and energy development of the Foral Region in the coming years.

It is expected that by 2030 several flagship hydrogen production facilities will have been built, prompting various actions in terms of infrastructure for hydrogen-based mobility. The hydrogen economy will be a reality with companies in Navarre operating in international value chains and an industrial technological ecosystem with new skills and capabilities. The objectives are: 1,500 thousand tons of CO2 reduced, 5 % of industrial natural gas consumption replaced, 50-75 light and heavy vehicles for freight transport and a minimum 150 MW of green hydrogen production (this goal is to be updated up to 500MW, in view of projects that may be implemented in Navarre).

What does the hydrogen sector currently look like in Navarre – are there already projects under development?

Navarre has 3 initiatives capable of generating 200MW of energy with hydrogen. We can so far mention two of them.

First is the the "GreenH2catudela" initiative. A public-private partnership, it will lead the development and governance of the first green hydrogen plant in Navarre, to be located in the Agrifood City of Tudela (CAT), the business park that brings together some of the most important agri-food companies in Navarre. The project contemplates the construction of a green hydrogen plant with an electrolysis capacity of 10 MW. This plant will supply energy to 70% of the CAT companies, but also to all the industries of the Ribera del Ebro region (south of Navarre) with the remaining surplus. The initiative involves an investment of € 10 million, 2.8 of which will come from Next Generation EU funds. The project identifies the need to create a mixed capital company, which will allow coordinating the construction and operation of the renewable hydrogen generation plant at CAT's own facilities between 2023 and 2025, as well as its subsequent commercialisation.

In addition, Nordex has a project undergoing in Navarre for the development and production of hydrogen generation technology by means of electrolyzers. The multinational firm established a green hydrogen company in Barasoain. The project has received a grant of € 11.6 million from the Ministry for Energy Transition and the Demographic Challenge (Miteco), and € 1.5 million from the Strategic Project for Economic

Mikel Irujo Amezaga
Regional Minister for Economic and Business Development of the Government of Navarre

Recovery and Transformation (PERTE) specific to renewable energies, green hydrogen and storage (ERHA), in addition to € 485.000 granted by the Government of Navarre. Specifically, the firm will develop an alkaline electrolyser between 5 MW and 10 MW, adapted to variable operation and with direct electrical support from a wind turbine and a photovoltaic installation. It involves an R&D phase, "aimed at increasing the flexibility of operation in alkaline technologies", and a second phase "in which a modular prototype will be developed".

Please explain what measures are being taken to encourage the development of more hydrogen projects – we have heard about this fantastic 30% tax break; how will it work?

Navarre has approved an innovative and pioneer tax policy to promote the green transition of the industry settled in the region as well as to boost investments and promote a green economy with new sectors and value chains. Concern for the environment translates into new tax incentives that encourage the use of renewable energy, in particular the consumption of renewable hydrogen, as well as carrying out projects related to the recycling and reuse of components of wind, photovoltaic or battery energy and with the production of renewable hydrogen and manufacturing of components of its value chain.

> **Concern for the environment translates into new tax incentives that encourage the use of renewable energy, in particular the consumption of renewable hydrogen**

The new incentive to promote the hydrogen value chain splits into two types of CIT tax deductions.

Incentives to demand and consumption: Investments made in facilities affected by the entity's economic activity that use energy from renewable sources for thermal use and electricity generation, will give the right to practice a deduction of 15 per 100. In the case of investments in facilities for thermal uses that replace the use of natural gas using renewable hydrogen, the deduction percentage will increase up to a maximum of 15 points, in function of the degree of use of renewable hydrogen. Combining the two tracts, a final deduction of up to 30% of the total investment, can be obtained.

On the other hand, incentives to production and manufacturing: Investments on new elements of the property, plant and equipment necessary in the execution applied to projects for sustainable development and protection and improvement of the environment, will give the right to practice a deduction of the liquid quota of 15 per 100 of the amounts of said investments. Particularly two activities related to Hydrogen are covered by this incentive: 1) production of renewable hydrogen; and 2) manufacturing of components of the value chain of the renewable energy.

Do you see other Spanish regions following your lead in promoting hydrogen?

Navarre is allied with several European and Spanish initiatives. We are joined to the European Clean Hydrogen Alliance, Hydrogen Europe and also to Vanguard and some cross-cutting platforms in energy and ecological transition. From the specific hydrogen point of view, we are actively working in two frameworks: The Ebro Hydrogen Corridor and the Working Community of the Pyrenees.

The Ebro Hydrogen Corridor is a project that seeks to enhance inter-territorial coordination between regional initiatives already underway in north-eastern Spain. It brings together the Aragon Hydrogen Valley (GetHyGA Initiative); the Hydrogen Valley of Catalonia (H2Valley-Cat); the Basque Hydrogen Corridor (BH2C); and the Green Hydrogen Agenda of Navarre. The main objective is to contribute to the rapid and efficient deployment of the hydrogen economy, generating a leading geographical hub for hydrogen development along the Ebro River in Spain.

The Ebro Hydrogen Corridor will promote actions throughout the value chain, including production, transport, uses, and storage. In terms of renewable hydrogen production, the consortium aims to install a production capacity of 400 MW in 2025 (entailing 1.5 GW of associated renewable generation production capacity), and 1.5 GW in 2030 (6 GW of renewables).

Another of its key lines of action will focus on promoting the end uses of renewable hydrogen, both in the transport sector and for industrial use. The objective of achieving an annual production of 250,000 tons of products derived from renewable hydrogen, such as methanol, ammonia or synthetic fuels by 2030, is especially important. The consortium will also promote the creation of an infrastructure network with 20 hydrogen stations by 2025, with up to 100 points by 2030, to facilitate the use of renewable hydrogen in land, maritime, and rail transport.

In addition, we are working on cross-border projects for renewable hydrogen storage and transport with Southern France to facilitate interconnection with Europe and position Spain as a relevant producer in the continental hydrogen market. This will be carried out in coordination with the Working Community of the Pyrenees (Communauté de Travail des Pyrenées, a cross-border, inter-territorial organisation).

> **Navarre wants to play a meaningful role on hydrogen economy**

What challenges do you foresee for hydrogen projects in Navarre, Spain and Europe?

There are many challenges, but I can focus on the following five:

1. Need for scalability to ensure a market cost.
2. Lack of regulatory certainty, as well as an urgent need to regulate guarantees of origin.
3. Need for public investment support, as well as financing mechanisms, also public, in this first phase of development.
4. Need to accelerate regulatory deadlines for the use of renewable energies dedicated to renewable hydrogen production.
5. Need to articulate cross-border cooperation mechanisms.

What advice would you give the Spanish and EU governments for hydrogen?

Hydrogen is an alternative, clean and sustainable fuel that facilitates the use of renewable energies in the global economy. The large-scale implementation of a sustainable hydrogen economy or green hydrogen will change the current energy, economic and political paradigm, by 'democratizing' the production of a renewable and alternative fuel to fossil fuels.

In the case of Spain, and specifically Navarre, the significant potential in renewable energies places us in a very favourable position in the future market of hydrogen technologies.

The use of hydrogen as an energy vector can have a very positive impact on our region since it has a business fabric with high potential to make the most of this opportunity. In fact, in the hydrogen sector and its associated technologies (renewable energies, fuel cells, etc.), niches of opportunity are emerging that both existing companies and new ones that may be created will profit from.

In short, from this technological development new possibilities will arise that can and should contribute to the economic development of Navarre. Also, hydrogen can contribute to ensuring decarbonisation and also to the energy independence of our continent. Navarre wants to play a meaningful role on hydrogen economy.

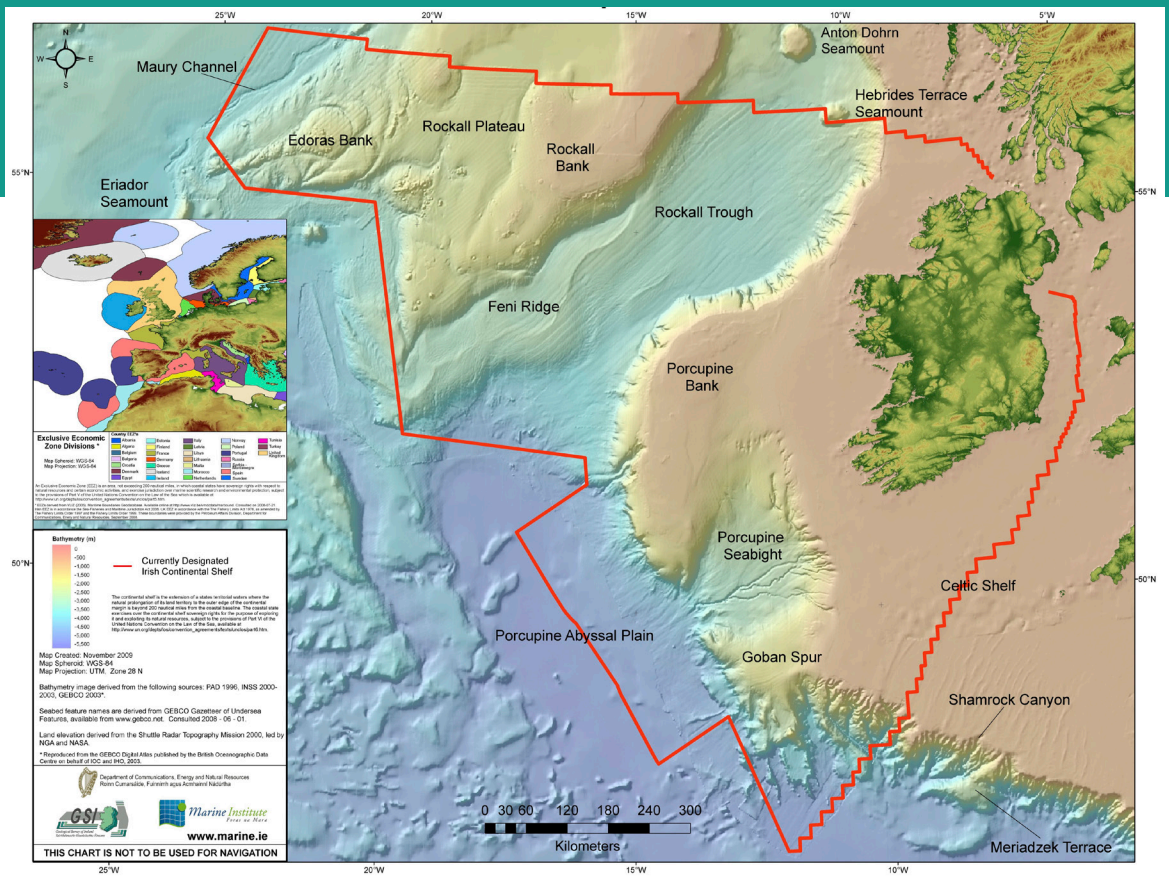
NATIONAL MEMBER SPOTLIGHT: Hydrogen Ireland

For each issue of the Hydrogen Europe Quarterly, we will speak to national hydrogen associations of countries focused on becoming major contributors to the global hydrogen market. For this issue, we spoke to Paul McCormack, Director at Hydrogen Ireland, about the country's ambitions and the challenges ahead.

The 'Real Map of Ireland' shows Ireland's marine territory – the designated Irish Continental Shelf - extends far beyond its coastline up to 880,000 km2, an area more than ten times its land mass and one of the largest seabed territories in Europe. Under the United Nations Convention on the Law of the Sea, Ireland has the sovereign right to explore and develop the natural resources of the continental shelf.

The hydrogen revolution offers an excellent opportunity for traditionally smaller countries to play a big role in the European and global energy mix. For Ireland and its exploitable, windy continental shelf, there is growing optimism that these natural resources can be leveraged to create a fully renewable energy system in Ireland and, hopefully, to produce a substantial amount of green hydrogen.

The Real Map of Ireland



Source: https://www.marine.ie/site-area/irelands-marine-resource/real-map-ireland-0

Despite not being as reliant on Russian fossil fuel imports as its fellow member states, the same conversations taking place in Europe about the need for a new, resilient, and clean energy system also made their way to the Emerald Isle.

The question for policymakers and businesses, put to Hydrogen Europe Quarterly by Paul McCormack, Director at Hydrogen Ireland, was "how can we develop other clean energy vectors to circumnavigate barriers associated with grid saturation and curtailment?"

"The climate and energy crisis has had an enormous impact on the world and has accelerated the opportunities for clean hydrogen," he added. "We need to completely transform the energy system and look at opportunities to move forward as a group, as a country, and as an integral partner within Europe."

> **Concern for the environment translates into new tax incentives that encourage the use of renewable energy, in particular the consumption of renewable hydrogen**

Hydrogen Ireland, momentarily static due to the Covid-19 pandemic, has since returned to the fray with gusto and has expanded its membership base to over 500. Interest in hydrogen has increased substantially in Ireland since the invasion of Ukraine, with the molecule previously disregarded or seen as dangerous and unclean.

These days, McCormack says, the public is far more aware – and interested – in the technology, while lawmakers of all affiliations are fully on "on board for hydrogen as a solution". The Hydrogen Ireland director is also confident that the upcoming Irish hydrogen strategy will have reflected the conclusions of the public consultation, which he and his members enthusiastically participated in. Adding to the optimism is the fact that Ireland's Taoiseach (Prime Minister) Leo Varadkar has on multiple occasions expressed a belief in hydrogen turning Ireland into an energy exporter.

The process seems straightforward enough – The first step is to make use of Ireland's excellent wind resources and offshore capabilities to massively ramp up its renewables production. The ceiling here is certainly high, with the 25MW Arklow Bank project currently the only active offshore wind farm in Ireland (energy company SSE, which owns the wind farm, is currently progressing a second phase in which it hopes to expand it to 800MW).

Step two is to take either the excess power generated that would otherwise fall to curtailment or build dedicated renewable facilities for the production of green hydrogen. Once produced, though, where will all this new hydrogen go?

"When we develop the green hydrogen economy in Ireland, we will develop our own hydrogen topography," said McCormack. "Unlike Germany and other EU countries, we don't have a big industry that needs decarbonising - our primary need is energy security."

"With hydrogen, Ireland, a small and relatively young nation, can become energy independent."

This would be the medium-term goal, anyway. Ireland's Climate Action Plan has set a target for 80% of its electricity to be generated from renewable sources by 2030. Offshore wind, and the long-term storage offered by hydrogen, make this ambition not only achievable but eminently realistic.

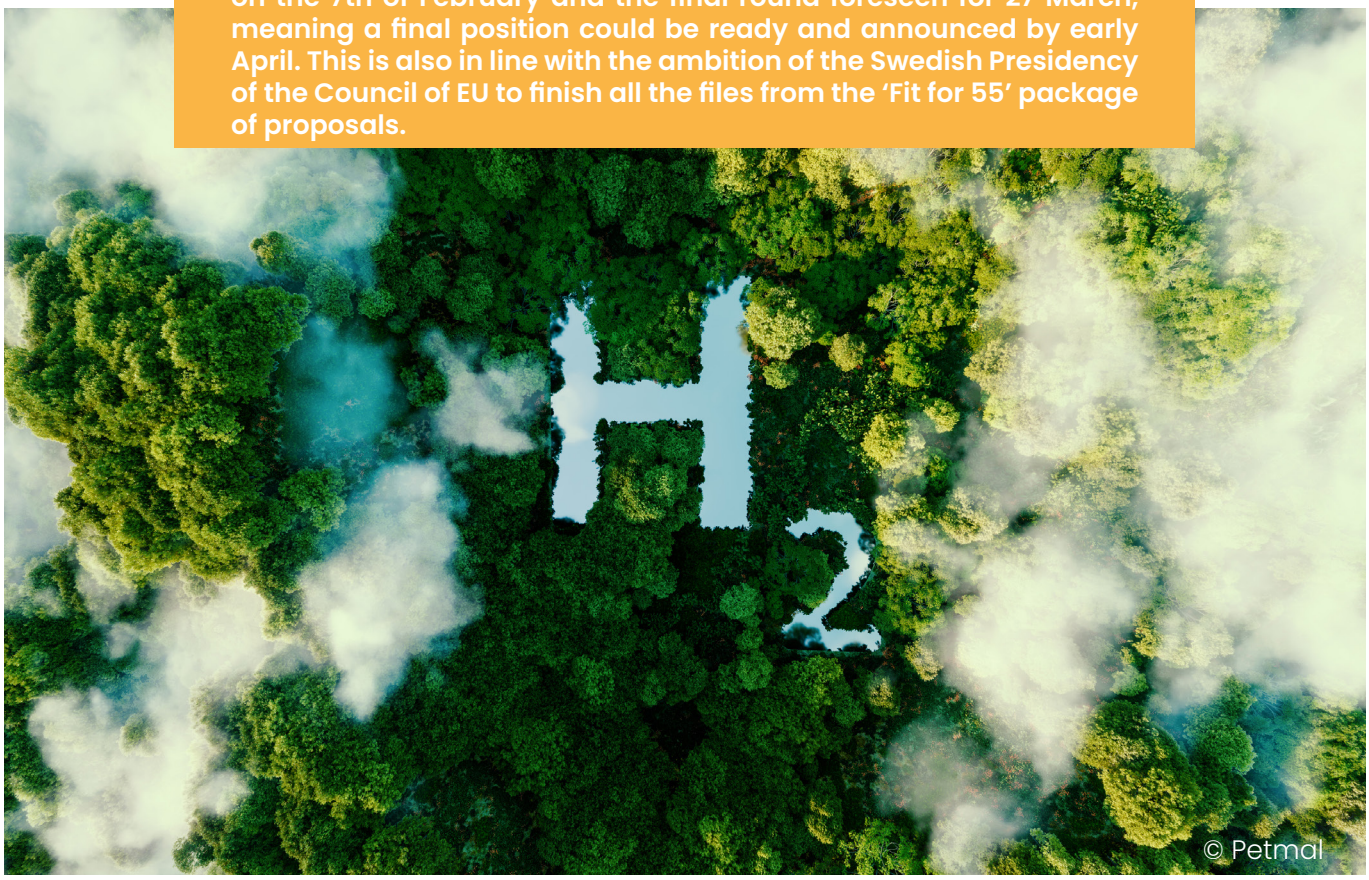
Ireland has already developed micro-hydrogen hubs and is now seeking "how to create synergies" within the country and internationally to create trans-national hydrogen valleys, McCormack explains. Hydrogen Ireland views the country as a test bed for new technologies that can create blueprints for other EU member states to emulate.

"Our goal is to be the green hydrogen capital of Europe", says McCormack. "We don't have the fossil resources to do anything else. We will use green hydrogen for the best possible economic and environmental return."

Paul McCormack
Director at Hydrogen Ireland

Pedal to the AFIR metal

The Alternative Fuels Infrastructure Regulation (AFIR) is progressing through the motions in the halls, chambers and offices of the EU institutions. Trilogues are on-going with the third due to kick off on the 7th of February and the final round foreseen for 27 March, meaning a final position could be ready and announced by early April. This is also in line with the ambition of the Swedish Presidency of the Council of EU to finish all the files from the 'Fit for 55' package of proposals.



© Petmal

When AFIR is adopted, EU member states will be mandated to establish a network of recharging and refuelling infrastructure for deployment of alternative fuels in transport. As regards hydrogen mobility and refuelling stations for fuel cell vehicles (FCEVs), there is some disagreement between the EU branches of government as to exactly how ambitious the hydrogen refuelling station targets should be.

In October, the committee for transport and tourism (TRAN) in the European Parliament voted on AFIR targets. The committee agreed on targets of one hydrogen refuelling station (HRS) every 100km along the TEN-T core and comprehensive networks, each station with a daily capacity of 2 tonnes and with at least one 700bar dispenser. Liquid hydrogen refuelling station should be available every 300km on the network. The minimum number of stations are to be installed by the end of 2027 on the core network.

The initial proposal coming from the European Commission had been mandating the installation of HRS every 150km and liquid HRS every 400km on both networks by 2030, but MEPs have voted for a more robust and ambitious set of policies and targets as requested by the industry.

The proposal from the Commission also mandates at least one HRS at each of the 424 European urban nodes – a functional area that encompasses one or more core cities, as well as the peri-urban and regional areas surrounding those cities. In addition, national access points for alternative fuels data would be set up to provide information on the availability, waiting times and cost differences at different HRS and national policy frameworks would provide national targets for the infrastructure that is not mandated under the regulation.

	Existing petrol stations (in 2020)	Clean Hydrogen JU study: HRS number by 2023	Commission Impact Assessment – the absolute minimum needed for HRS	Industry minimum needs	European Parliament	Council
EU – 27	110.364	~4.800	798	1915	1491	**224**

Figure 1. A comparison of current positions on AFIR hydrogen refuelling station targets

The Council, as readers can see in figure 1, has presented an extremely conservative position on the issue of HRS. The Commission's proposal, while going further than the Council, is still barely more than half of the Parliament's position, which considers the views of industry (also reflected in figure 1).

The Council may be taking heed from certain member states that believe there is a) no commercial appetite to finance the deployment of HRS, or sufficient EU financing support, and b) there will not be enough FCEVs on the roads to necessitate such a wide roll out of HRS.

The realistic forecasts, however, do not reflect these assumptions. Firstly, according to the Commission, there is no shortage of EU funds available for use by member states in the deployment of HRS. The Connecting Europe Facility (CEF) and its Alternative Fuels Infrastructure Facility (AFIF) and the Recovery and Resilience Fund, among others, are already available to countries that wish to present project proposals to the EU.

Meanwhile, commercial appetite is always growing. Hy24, a joint venture between Ardian, Europe's largest asset manager, and hydrogen-dedicated investor FiveT Hydrogen, in October announced the closing of its first impact fund with €2bn of allocations, of which €1bn is earmarked for hydrogen refuelling infrastructure. It is the world's first and largest infrastructure fund to invest exclusively in the entire clean hydrogen value chain.

The anchor investors Air Liquide, VINCI Concessions, TotalEnergies, Plug Power, Chart Industries and Baker Hughes are joined in the fund by more than 50 prominent investors from 13 countries in the Americas, Europe and Asia, including LOTTE Chemical, Airbus, Snam, Enagás, GRTgaz, AXA, Crédit Agricole Assurances, CCR, Allianz, CDPQ, JBIC, Ballard, Schaeffler, Groupe ADP, EDF, Caisse des dépôts, DBJ and Itochu. Such a diverse participation from so many reputable companies of different profiles demonstrates the international pull that hydrogen investments now have.

On the second point of concern – the lack of FCEVs on the road – there is certainly more justification, but not for much longer!

Certainly, it is the logical position of MEPs and the Commission that the infrastructure must come first to solve the oft cited "chicken and egg" problem. But with more and more companies announcing their intent to develop hydrogen vehicles, forecasts of FCEVs on European roads grow larger and larger.

In a recent presentation, representatives from Daimler trucks showed that in Germany alone, there will be between 30,000 and 38,000 heavy duty vehicles (HDVs) powered by hydrogen on the roads by 2030, while the EU and UK will see 60,000 by the same year, according to ACEA, the European automobile manufacturers association. As well as HDVs, light commercial and passenger vehicles are ready for mass production and will hit the market once their prospective buyers are certain of the possibility to refuel them at regularly available refuelling stations.

IVECO, Daimler and Volvo, three of the largest European truck manufacturers, have said clearly and without reservation that fuel cell trucks are of the essence. Daimler and Volvo have even struck a €1.2bn partnership, and established a company Cellcentric, to further develop hydrogen fuel cell technology.

The challenge now is to convince member states and their representatives in the Council to show flexibility and commit to the more ambitious targets proposed by the Parliament and Commission in order to meet this growing demand. MEP Ismail Ertug, the rapporteur on AFIR, is urging member states not to delay any longer in order to get a head start on the roll out of the much-needed infrastructure.

The availability of capital and the issue of demand aside, it is also clear that investment into two infrastructures and decarbonised transport systems is cheaper and creates more resilience than to put all one's eggs into the same basket.

The next couple of months will be pivotal in determining the trajectory of hydrogen road mobility. A final compromise closer to the EP proposal will ensure the basic needs of industry to drive ahead with their plans under the reassurance that the refuelling infrastructure they need will be delivered.

Crunch time for the Renewable Energy Directive

The final outcome of the Renewable Energy Directive, set to be finished under the incoming Swedish council presidency, will have big implications for hydrogen. Meanwhile, the looming shadow of the Delegated Act continues to delay progress

The Renewable Energy Directive is still under negotiation among the three European institutions: the European Parliament, the European Commission, and the Council. And the debate is hot. The Czech council presidency had hoped to close the file during their term but has had to defer it to the incoming Swedish presidency, who took over on 1 January 2023.

The most important agreement is still pending; the co-legislators have yet to agree to a renewable energy target by 2030. Just before Christmas, Member States met for an energy council meeting to discuss their positions on REPowerEU. Countries remain split among those who support a target of 40% (a position agreed upon in June under the French presidency) and a group of eight countries that would see the target increased to 45%, in line with the European Commission proposal that the European Parliament also supports.

Thus, it is likely to see the co-legislators settling somewhere between a 40% and 45% renewable target by 2030. This is significant, not least, considering the previous target stood at 32%. Even if it doesn't reach 45%, it is nonetheless an ambitious objective that will require a massive effort from both industry and governments to accelerate the deployment of renewables across all sectors. Governments also agreed to improve the rules to accelerate the permitting of renewable energy projects, by designating go-to-areas that will require shorter permitting authorisation processes with simplified environmental impact assessments.

Adding a lot of wind and solar plants is necessary but not sufficient on its own, as the power sector still represents a quarter of the total energy demand. And this is where renewable hydrogen becomes a key enabler for the success of our climate goals. Renewable hydrogen can be used widely in all modes of transport and can effectively replace fossil feedstock used in the chemical industry, iron and steel making, and refineries. It can also replace coal and natural gas for commercial and industrial heating, especially high-temperature heating applications where no other commercially viable alternatives exist today.

Besides the overall targets, the co-legislators

discussed in December the issue of binding RFNBO targets in the industry. Originally proposed at 50% by 2030, the three institutions have preliminarily agreed to a level of around 42%, with an increase to 60% by 2035.

The discussions on the RFNBO targets in transport (proposed at 5.7% by European Commission and Parliament) have not yet taken place. There seems to be less appetite by the Council to agree to technology-specific binding targets in transport. But Hydrogen Europe thinks it would make a lot of sense to impose transport fuel supplier obligations for the use of RFNBOs, considering that other pieces of legislation focused on demand side uptake, such as the RefuelEU Aviation and FuelsEU Maritime, are introducing minimum quotas for RFNBO use by transport operators. And governments will also commit to minimum infrastructure targets (e.g. hydrogen refuelling stations) for road transport under the Alternative Fuels Infrastructure Regulation (AFIR). Therefore, aligning supply-side and demand-side obligations will help the market tremendously.

And the Delegated Act on additionality?

A final decision on the industry target for Renewable Fuels of Non- Biological Origins (RFNBOs) is subject to developments on the Delegated Act (DA) on additionality and how restrictive it may or may not eventually be. The European Commission did not adopt the DA before Christmas, as many in the sector were anticipating (All we wanted for Christmas was investment certainty). A final draft was presented and discussed with national government experts in December.

So what's next?

The industry is now told that we should expect an announcement any time during January, but desperation is growing as the topic seems to be endlessly postponed due to a lack of alignment within the European Commission. The temporal correlation (when and how to move towards more granularity) and the start date to apply additionality (currently set on January 2027) are the most political and controversial points.

After the European Commission adopts the two Delegated Acts on additionality and the rules to calculate the GHG emission of RFNBOs, the European Parliament has two months to green light it or reject it. it would need a qualified majority to do so, which seems unlikely to happen.

By Daniel Fraile, Chief Policy Officer at Hydrogen Europe.

The new geopolitics of Hydrogen and European diplomacy

Considering the resources available, Africa, the Middle East and Latin America could become key exporting regions towards Europe and other major economies like China, India, Japan and South Korea. As a result, hydrogen is starting to redefine bilateral energy relations and to emerge as a possible future global commodity.

Hydrogen is expected to play a key role in the global energy and climate transition. Many countries are developing or considering hydrogen roadmaps and strategies that settle ambitions for the production and use of green and low-carbon hydrogen to decarbonise a wide range of sectors.

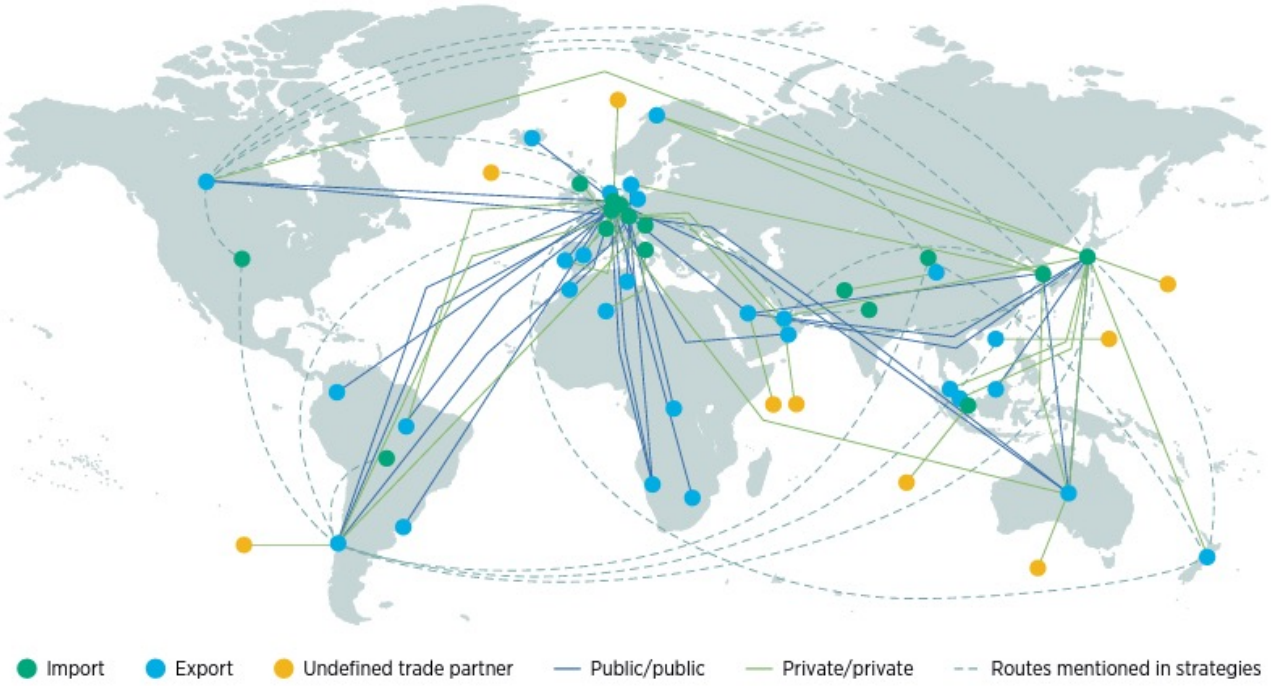


Figure 1. Overview of bilateral trade announcements until March 2022 - Irena (2022): Trade outlook for 2050 and way forward

Europe is positioning itself in the new energy world map, defining new hydrogen trade flows driven by the urgency to diversify its energy supply while meeting its ambitious climate targets. The EU efforts to ramp up domestic production of renewable hydrogen to 10 million tons (Mt) annually by 2030 will however not be sufficient to meet the foreseen demand in the REpower EU plans.

The REPowerEU Communication of March 2022 acknowledges this reality and sets out an ambition to import a further 10Mt of renewable hydrogen by 2030. The major import potential is expected to come from the African and MENA region, followed by UK and Norway, through three major import corridors: the Southern Mediterranean, Ukraine, and the North Sea Region.

However, the attractiveness of the EU as a hydrogen trading partner has yet to be reinforced to trigger production in third countries for export to Europe, rather than to other international partners with similar needs. The main challenges to overcome here are the adoption of clear definitions of renewable and low carbon hydrogen and

certificates suitable for hydrogen trading along with clear demand incentives. Other challenges include the reduction of production and transport costs and the preparation of the required import infrastructure (e.g. terminals at ports). In addition, the EU is expected to further clarify how it will incentivise and de-risk third country projects with EU funding, attract public and private investors, and provide support on technology and skills.

Europe has however a strong cooperation record with many of these potential hydrogen export partners thanks to an extensive network of association agreements and, more recently, dedicated hydrogen Memoranda of Understanding and Letters of Intent promoted by several European countries, like Germany, the Netherlands and Belgium. REPowerEU proposes to enhance this cooperation by developing long-lasting and equitable hydrogen partnerships, starting with the EU's neighbours and Africa, to address the trade challenges and facilitate the import-export of hydrogen and relevant raw materials. To be viable, these partnerships must be based on the principles of equality and mutual respect, and stimulate the development of local hydrogen supply chains and markets. They should also foster cooperation within the region on renewables and hydrogen.

The last COP27 has generated momentum for the cooperation between the EU and third countries on hydrogen. The signing of the EU-Egypt Renewable Hydrogen Partnership last November marked a strategic milestone in the pathway towards a larger Mediterranean Green Hydrogen Partnership. And the EU has also foreseen to engage with the Gulf countries and notably the UAE in the preparations of COP28.

Beyond the MENA region, strategic links have also been established in Sub Saharan Africa with Namibia (MoU on CRMs and H2) and South Africa (Green Partnership), and with other regions (ex: MoU with Kazakhstan on CRM, batteries and H2, and Memorandum of Cooperation with Japan on H2).

From RePowerEU to COP27 and beyond

H2 Partnerships

Green Partnerships

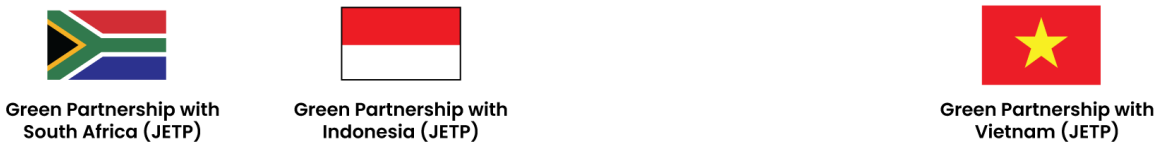


Figure 2. EU ties with the global hydrogen community

These partnerships will only have a strong impact if the European Union is able to facilitate clear and favorable import conditions and convince third countries of the climate, economic and social benefits of stepping into the hydrogen economy.

In a highly competitive environment where other regions like Japan and South Korea are also closing hydrogen import deals, Europe must focus on tackling its regulatory framework first and then addressing, infrastructure and financing import challenges. Only then will the EU's hydrogen diplomacy be able to fully develop and guarantee tangible results towards achieving its ambitions.

By Maria Assumpció Rojo Torrent, Director of Trade and Industrial Development Policy at Hydrogen Europe.

Carbon Border Adjustment Mechanism (CBAM)

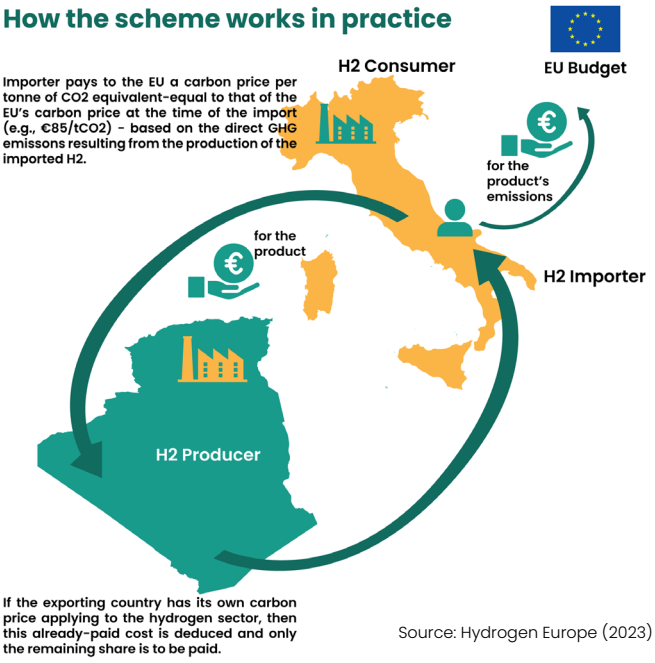
Carbon pricing will apply to hydrogen imports from outside the EU, but loopholes are yet to be solved for a level playing field across energy carriers.

Last December, EU lawmakers reached a final deal on a Carbon Border Adjustment Mechanism (CBAM).

This environmental policy will price the carbon content of selected goods upon import, based on the EU's carbon price and those goods' embedded emissions.

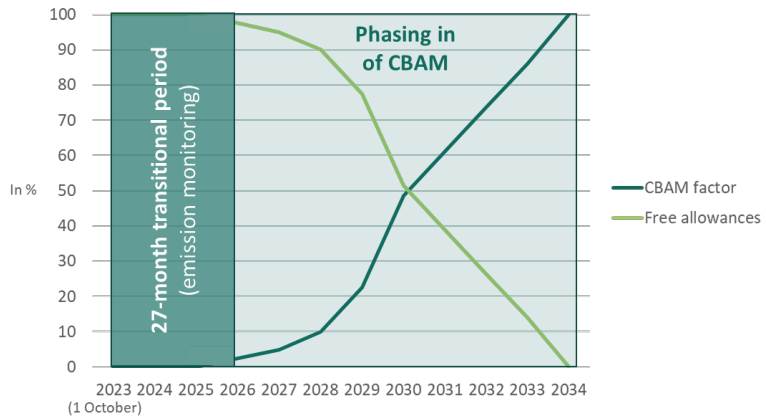
On top of 5 types of goods initially proposed by the Commission (steel, cement, fertilisers, aluminium, electricity), the scheme will also cover imports of hydrogen – as requested by the European Parliament.

With countries and companies laying the ground for the future of green hydrogen trade, the CBAM will become an important regulation affecting the import of H2 and H2 carriers to the EU.



Source: Hydrogen Europe (2023)

The scheme is phased in progressively:



After a transitional period of about two years, the mechanism will kick in in 2026 and be introduced progressively until 2034, when it will fully replace free allowances. For instance, an ammonia producer in 2030 will only receive free allowances for about half of those it would have gotten without CBAM. At the same time, any ammonia importer will need to pay a CO2 price for about half of total emissions of its imported shipment.

How will it affect the hydrogen market?

The CBAM has the potential to provide a level-playing field for EU industry against risks of carbon leakage and can help foster decarbonisation both abroad and domestically. Stronger carbon pricing for EU producers and EU importers means more price-based incentives to switch to cleaner production processes for all CBAM-covered goods, such as the use of clean hydrogen in steel manufacturing and ammonia production.

However, the CBAM deal fails to consider some key aspects for the well-designed coverage of hydrogen. In the coming years, a substantial share of our renewable hydrogen imports will be in the form of H2 carriers. Regrettably, the current CBAM covers only one of those carriers (ammonia), and excludes the likes of methanol, e-kerosene, e-diesel, etc. By applying different rules to products used in the same spaces, the regulation could distort import strategies and negatively affect the direct import of hydrogen via pipelines.

The CBAM deal covers a selection of raw materials and intermediary goods but does not yet address downstream products like electrolysers and fuel cells, as such. This will put EU manufacturers of these products at a disadvantage compared to their international competitors. Indeed, there would be no carbon-linked payment upon the import of these finished products. Yet, their manufacturers in the EU would face higher costs depending on whether the steel and aluminium required for their production is sourced from the EU or abroad, due to the ETS and CBAM rules and the remaining premium on low-carbon basic materials. We estimate that, due to CBAM, the steel cost for a 500-kW alkaline electrolyser produced in the EU could increase by as much as 17% in 2034 in comparison to 2022. Considering the already cheaper steel prices in China and it would result in steel costs being almost 40% higher for EU manufacturers compared with Chinese ones.

So what's next?

The publication of a comprehensive impact assessment could have helped legislators understand and address those issues upfront. It is not too late to do so. The European Commission should follow up with more details regarding the impacts of CBAM on the whole sector's value chain, and subsequently issue the appropriate regulatory proposals.

Considering the scheme's potential impacts on third countries exporting to the EU, European policymakers are also actively holding diplomatic exchanges with main trade partners to explain the rationale of the mechanism and possibly establish some level of coordination regarding carbon pricing policy. These exchanges – some countries would like to see under so-called 'international climate clubs' – are absolutely key to providing a fair international competition framework that matches decarbonisation objectives. The coordination at global level on carbon accounting and pricing of hydrogen products will be a key steppingstone in establishing a truly global competitive hydrogen market.

By Bastien Bonnet-Cantalloube, Senior Industry Policy Officer at Hydrogen Europe.

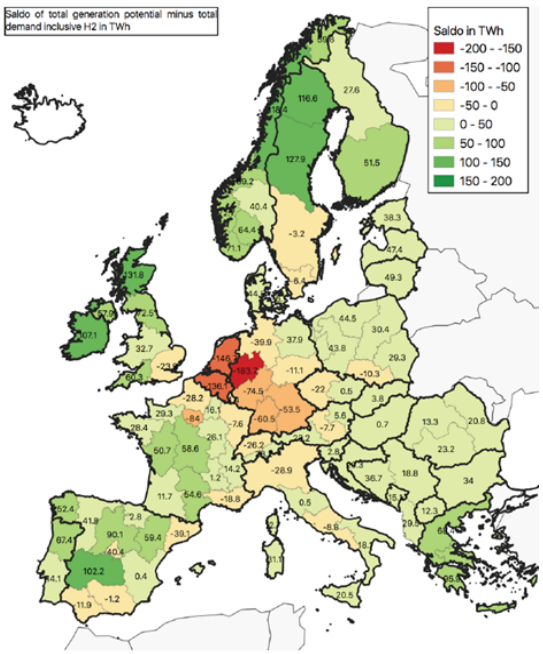
Transporting hydrogen in a global market

As the decarbonisation megatrend will undoubtedly cause demand for renewable hydrogen to increase rapidly in the coming years and decades, the question about the prominence of international trade of hydrogen comes to the fore.

It is especially important for the EU to secure reliable hydrogen import sources, as the relatively low availability of cheap renewable resources in Europe, combined with its high population density and industrialization levels, pose serious challenges for domestic renewable hydrogen supply. Just meeting the REPowerEU domestic hydrogen production target of 10 million tons (Mt) by 2030 will require around 130 GW of electrolysis and a corresponding amount of installed renewable power generation. Looking further ahead to 2050, the expected demand for clean hydrogen in the EU will most likely be around 2,000 – 2,500 TWhHHV (FCH 2 JU, 2019) (ENTSO-E and ENTSO-G, 2022), with some studies expecting even more than 4,000 TWhHHV (Deloitte Finance; IFPEN; Carbon Limits; SINTEF, 2022).

Delivering such quantities of renewable hydrogen domestically would require gargantuan amounts of new electrolyser and renewable power – even exceeding 1,000 GW in the most ambitious scenario. It is simply not possible to maintain a local supply to cover this demand, and highly industrialised regions like the Ruhr Valley or Benelux are especially at risk of facing renewable energy deficits.

FIGURE 1. BALANCE OF RENEWABLE GENERATION POTENTIAL AND DEMAND WITH ELECTRICITY FOR HYDROGEN IN EUROPE 2050



Source: Wuppertal Institut, 2020

One way of alleviating the challenge would be to leverage all existing hydrogen production methods – including low carbon hydrogen.

Another would be to use the potential of large-scale international trade of hydrogen and its derivatives.

To facilitate these exports, import mechanisms such as H2 Global, import facilitators such as the Global European Hydrogen Facility, and Memoranda of Understanding (MoU) between importing and exporting countries or individual companies, including ports, are being established both in the EU and globally. From the European perspective, the importance of imports has been underpinned by the RePowerEU ambition to import at least 10Mt per year of renewable hydrogen annually by 2030. Hydrogen trade will play a crucial role in the future hydrogen economy.

How do we import it?

There are many technological options for importing renewable hydrogen – including transporting hydrogen via pipelines or shipping of hydrogen, either as pure hydrogen – compressed or liquefied – or via various derivatives used as hydrogen carriers such as ammonia, methanol, LOHC or even synthetic LNG. In recent years, multiple studies have shown that there won't be a single solution as each of these options has its own strengths and drawbacks.

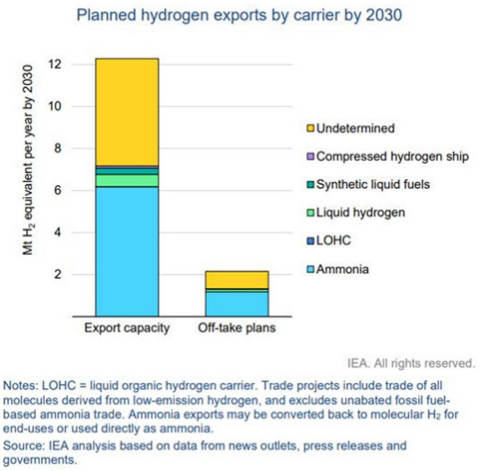
On the face of it, cost-wise, hydrogen pipelines seem to be the most advantageous option. Without the need for any complex chemical processes, the cost of transporting hydrogen via pipelines can be as low as 0.2 €/kg/1,000 km, which can be further reduced to 0.11 €/kg/1,000 km by retrofitting existing natural gas pipelines (Guidehouse, 2022).

When importing hydrogen from the EU's close neighbours, the cheapest available option would be hydrogen pipelines. As the transport distances increase, however, the picture changes. In the case of pipelines, any increase of distance translates itself into a linear cost increase. For shipping, the high upfront investments for liquefaction or hydrogenation plant, storage terminals in the port of origin and the port of destination, as well as regasification/dehydrogenation infrastructure are needed irrespective of the distance. Distance-dependant variable costs of seaborne transport are usually a relatively small part of total delivery cots. As a result, for distances beyond 3,000km to 4,000km, shipping becomes cost competitive with pipelines.

Furthermore, the largest – export-oriented – renewable and low carbon hydrogen projects worldwide are, in most cases, located in regions and countries with significant renewable energy potential like Australia, Oman, Chile or Saudi Arabia. In those cases, imports of hydrogen to Europe by pipeline would be either impossible or extremely challenging due to the distances involved, creating a business opportunity for the shipping of hydrogen.

In the current early stage of hydrogen shipping market development, ammonia is the hydrogen carrier gaining the most momentum: it is expected to account for around half of the planned hydrogen exports by sea, by 2030 (IEA, 2022).

FIGURE 2. PLANNED HYDROGEN EXPORTS BY CARRIER BY 2030



Notes: LOHC = liquid organic hydrogen carrier. Trade projects include trade of all molecules derived from low-emission hydrogen, and excludes unabated fossil fuel-based ammonia trade. Ammonia exports may be converted back to molecular H_2 for end-uses or used directly as ammonia.

Source: IEA analysis based on data from news outlets, press releases and governments.

Source: IEA (2022)

Ammonia has a higher boiling temperature than hydrogen (-33°C against -253°C), which makes liquefaction and transportation easier and less energy intensive. It can also be kept liquid at room temperature when at least 8.6 bar of pressure is maintained. In both cases regular carbon steel tanks are sufficient. In addition, ammonia is already a globally traded commodity with approximately 20Mt traded annually, around 17-18Mt of it by ships. As a result, the logistics infrastructure needed for its efficient and safe handling is already largely in place. If ammonia were to become a dominant hydrogen carrier, this infrastructure would have to be expanded significantly but, to some extent, the existing LPG storage and transport infrastructure could also be relatively easily repurposed to handle ammonia as well, due to their similar storage requirements. While ammonia is very toxic, protocols for its safe handling are already in place and the safety track record proves that ammonia shipments can be executed in a safe way at a large scale.

As no carbon molecule is needed for ammonia synthesis it also has the added benefit of being a zero-emission fuel at the point of use while at the same time making the ammonia production relatively less costly and less energy intensive than most other options.

A significant potential barrier to the wide use of ammonia as a hydrogen carrier is related to the costs of conversion of ammonia back to hydrogen. Ammonia cracking is an endothermic process and can be regarded as the reverse of the synthesis reaction. In order to achieve high conversion rates

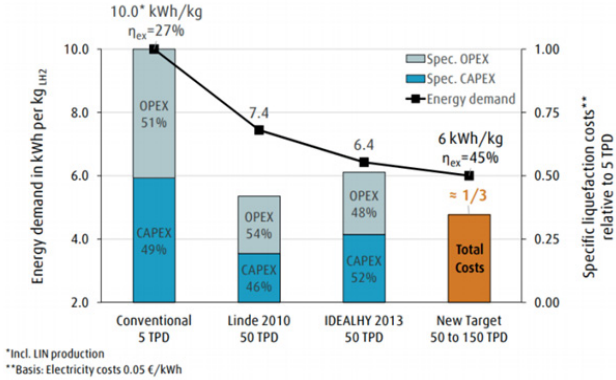
(>99%), ammonia cracking has to operate at temperatures higher than 400°C. While there are some promising emerging technologies, including feedstock versatile membrane reactors, the only technology available at an industrial scale now would be thermal reforming, requiring around 52 GJ/tH2 with a conversion rate of 98.5% (JRC, 2022).

Therefore, unless a relatively low-cost renewable or waste heat source is available for the dehydrogenation process, the costs of ammonia cracking can represent a significant part of the total hydrogen delivery costs - drastically impacting the cost competitiveness of ammonia as a hydrogen carrier. This could potentially limit the viability of ammonia imports only to applications in which it can be applied directly, without reconversion back to hydrogen, like feedstock for fertilizer production or as an alternative fuel for shipping or for power generation.

High costs of dehydrogenation might tip the scale in favor of shipping hydrogen in compressed or liquefied form. Contrary to popular belief, the shipping of compressed or liquefied hydrogen is both technologically feasible and cost-competitive, even considering the relatively worse energy density properties.

One of the main challenges is related to the energy intensity of the liquefaction process, which can require an equivalent of 1/3 of the energy of hydrogen. The energy efficiency of the process can be however improved significantly by scaling up liquefaction plants. As the market for liquefied hydrogen today is limited to several niche applications, hydrogen liquefaction facilities in Europe are rather small scale with a capacity of 5 – 10 tons per day (TPD). If large scale demand for liquefied hydrogen developed over time (e.g. from the maritime sector) it would make it viable to construct liquefaction facilities with capacities an order of magnitude larger. This would not only reduce the CAPEX per unit of production but also would lead to a significant reduction in energy intensity of the liquefaction process from around 10-11kWh per kg of hydrogen today, down to around 6kWh per kg – leading to a decrease of specific liquefaction costs even by 2/3 compared to current state-of-the-art.

FIGURE 3. CURRENT AND PROJECTED LIQUEFACTION COSTS AND EFFICIENCIES.



Source: (Cardella et al, 2020)

By far the biggest obstacle for compressed and liquefied hydrogen shipping is the fact that the entire infrastructure value chain, from large scale liquefaction, storage, and CH2/LH2 tanker fleets, to the port terminals and regasification facilities, would have to be developed almost from scratch. Liquid hydrogen carriers and liquid organic hydrogen carriers (LHC/LOHCs) are another potential interesting alternative. These include a slate of different (most often organic) compounds which can absorb and release hydrogen through a chemical reaction. LHCs & LOHCs can serve as a storage and transportation medium for hydrogen and can be transported as liquids without cooling. LOHCs are very similar to crude oil and oil products, so the existing oil transport infrastructure could be adapted to transport LOHCs – allowing for a cost-effective transportation at a large scale with existing infrastructure.

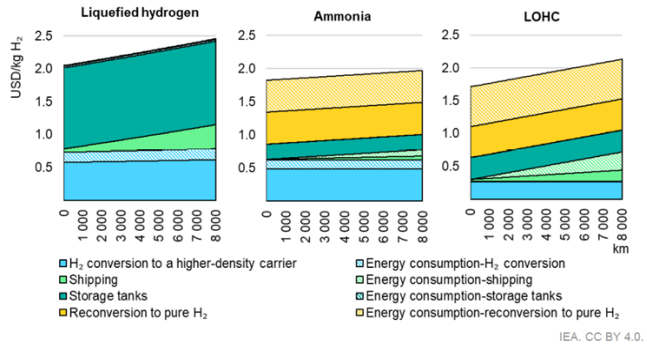
However, a power-intensive dehydrogenation process and the need to double elements of the storage and transportation infrastructure can impact the economics. Nevertheless, if a low-cost, waste heat source can be used for dehydrogenation, LOHC can become the lowest cost option (JRC, 2022).

In addition to the above, It is also possible to use hydrogen embedded in end-product synthetic molecules such as e-LNG, e-methanol or even synthetic gasoline – with each of those options being able to leverage existing storage, transportation and shipping infrastructure. Especially in the case of e-LNG, the potential to tap into to the existing natural gas infrastructure around the EU would be very attractive. However, since these molecules all need a carbon molecule for the synthesis process, their competitiveness is often conditional on access to an abundant and low-cost source of CO2. As a consequence, those carriers are usually more expensive to produce – especially if direct air capture technology is to be used as a source of the CO2. On the other hand, feasibility could be improved through the use of excess CO2 from industrial sites where those synthetic fuels are consumed, often on the same sites as import facilities, potentially opening the possibility for closed-loop circular CO2 utilization.

As shown above there are plenty of options for large scale imports of clean hydrogen to the EU. As each comes with its own strengths and weaknesses the optimal choice of the carrier will, in many cases, depend on project specific conditions, and we may see many carriers co-existing on the market. Irrespective of the chosen hydrogen carrier, there is no doubt that finding a feasible business case for imported hydrogen will be a challenge. The transportation costs alone, even excluding the costs of hydrogen production, could end up being around 1.5 - 2.0 EUR/kg, or 1.0 – 1.5 EUR/kg if dehydrogenation can

be avoided. As a result, even with extremely low hydrogen production costs, the gap between the final hydrogen carrier delivery price and its fossil benchmark are still substantial for most potential applications.

FIGURE 4. INDICATIVE LEVELISED COST OF DELIVERING HYDROGEN, BY SHIPPING-OPTION STEP

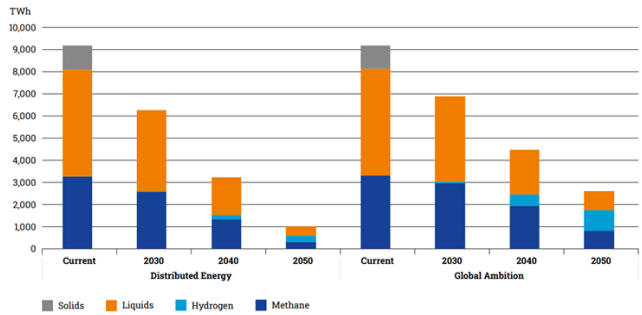


Notes: LOHC = liquid organic hydrogen carrier (methylcyclohexane considered); USD/kg H_2 = USD per kilogramme of hydrogen. The cost per stage includes all capital and operational expenditures except those related to energy, which are illustrated separately with a pattern fill. The discount rate is 5%. It is assumed that import and export terminals handle 20 shipments per year on average.

Source: (IEA 2023)

Consequently, even though hydrogen imports from neighbouring regions and beyond will be key to cover the rapid growth in demand in the 2030s and 2040s and thus are going to be essential for the establishment of a European hydrogen economy, they will most likely only complement and not replace domestic renewable and low-carbon hydrogen production.

FIGURE5. ENERGY IMPORTS TO THE EU-27



Source: ((ENTSO-E and ENTSO-G, 2022)

Hydrogen transmission and distribution infrastructure deployment, including cross-border pipelines are also essential to unlock the intra-EU trade, necessary to evacuate the excess of hydrogen delivered either to major ports, or delivered by pipelines from neighbouring countries, and supply it to main demand centres across the EU.

Notwithstanding those challenges, in some scenarios around a quarter (Deloitte Finance; IFPEN; Carbon Limits; SINTEF, 2022) or even up to 40% of hydrogen supply (ENTSO-E and ENTSO-G, 2022) is expected to be covered by imports by 2050. In either case however, this will still represent only a fraction of the current energy imports of the EU-27 and will allow Europe to significantly increase our energy security and independence.

By Grzegorz Pawelec, Director of Intelligence at Hydrogen Europe.

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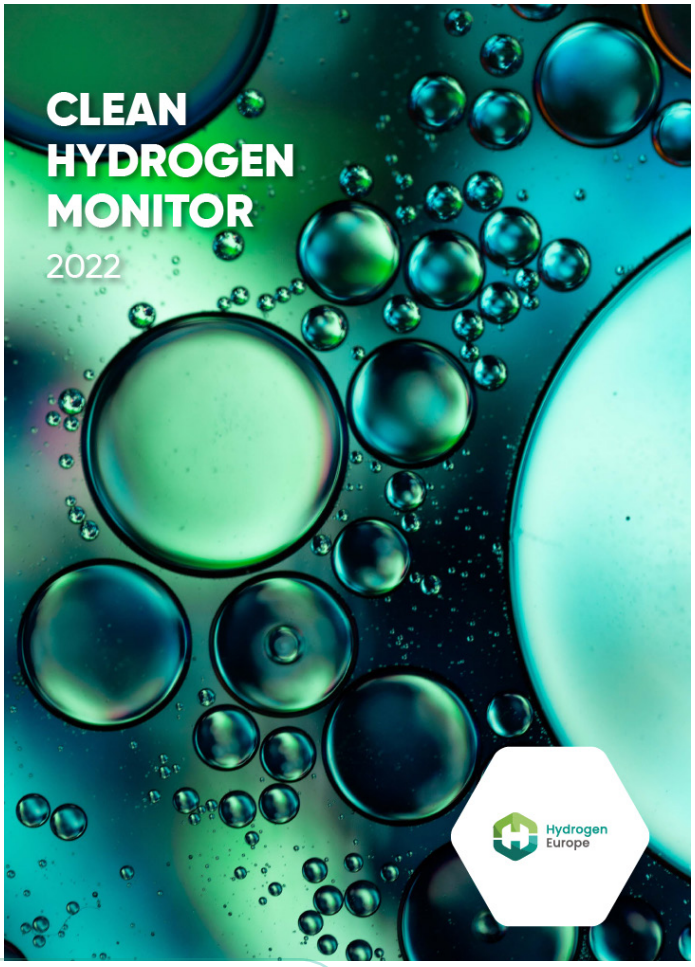

The Clean Hydrogen Monitor aims to provide facts and figures on the current hydrogen market in Europe, the development of the clean hydrogen market, the industry's ambitions, the policy and funding landscape, as well as the supply capacity of some critical raw materials.

In this last edition you will find coverage and analysis of the numerous significant policy developments for hydrogen over the course of this year, from REPowerEU to the Renewable Energy Directive and the Alternative Fuels Infrastructure Regulation.

The report also takes readers through the current hydrogen market, the increasing industry ambitions for clean hydrogen, and clean hydrogen's improving cost competitiveness, leading to a planned power-to-hydrogen project pipeline of 138GWel by 2030. However, even though the pipeline of projects is growing, projects are being delayed due to regulatory uncertainty, expectations of future financial incentives, and supply chain or permitting issues.

A new addition to this report is a perspective on critical raw materials. Chapter 6 focuses on the annual production of platinum and palladium, as two of the key materials for the hydrogen economy used in both fuel cells and electrolysers.

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On the occasion of COP27, Hydrogen Europe presented the second edition of its Special Report on Hydrogen.

The development of the hydrogen economy is one of the central topics in the discussions surrounding the energy transition. However, the potential that this molecule has in paving the way to a climate-neutral society is still partly unknown. That is why we have developed this report with analyses of the current state of play of the industry and a selection of case studies involving Hydrogen Europe's members aimed at demonstrating how hydrogen is a reality and how its many applications can positively impact our daily lives.

This year's edition saw the participation of a variety of contributors. To ensure the quality of the content and to represent the different voices that constitute the sector, the African Hydrogen Partnership and Women in Green Hydrogen contributed with feature articles, while Vice-President of the European Commission Frans Timmermans wrote the forward where he outlined the commitment of the European Commission in the roll-out of the hydrogen sector.

Thanks to our members who supported the report!

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Find out more at https://hydrogen.revolve.media/2022/

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A warm welcome to all our new Hydrogen Europe members

AHMUR

AHMUR is a private, non-profit association and the first Green Hydrogen Association in the Region of Murcia, which has excellent conditions to become a Hydrogen Hub. Its objective is to guide the local energy transition through a sustainable development model towards a decarbonised and electrified economy, based on hydrogen and renewable energy.

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Compagnie Fluviale de Transport (CFT)

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Copenhagen Infrastructure Partners P/S

Copenhagen Infrastructure Partners (CIP) is a fund management company specialised in offering tailor-made investments in energy infrastructure assets globally – in particular within renewables and the greenfield segment. We are pioneers in taking our approach and methods global and in realising a profitable green energy transition based on high ESG standards.

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ECUBES Technology d.o.o

ECUBES Hydrogen & Flexibility - developing infrastructure project Zero Emission Mobility Corridor North Adriatic ZEMC-NA. We exploit hydrogen to decarbonise industry, transport, and energy sector. Our solutions provide flexibility to manage the volatile RES production and load on all timescales, from short term frequency response to long term system adequacy.

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Enerjisa Enerji Uretim A.Ş.

Being the largest private player in electricity production and trading in Turkey, we are delighted to be a part of Hydrogen Europe Organization. Within the scope of our sustainability goals, we have ambitious activities on green energy production including the hydrogen. We believe that cooperation, research and sharing the ideas key for a sustainable and decarbonised fully-integrated energy system.

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EXOGEN's patented hydrogen boiler solution eliminates CO2 and NOx emissions from industrial steam and thermal energy installations. Combusting pure hydrogen with pure oxygen removes the iconic smokestack, with clean water the only by-product of the highly efficient exothermal process. As a system integrator, EXOGEN offers turnkey solutions to clients with an Energy-as-a-Service uptake model (EaaS). We can help switch CAPEX to OPEX and provide maintenance services. EXOGEN operates in two business segments: Industrial Process Steam and District Heating, including large buildings and infrastructure, such as airports and hospitals. In industry, our main client segments are Pulp&Paper, Food&Beverage, Petrochemicals and Pharmaceuticals.

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Free Hanseatic City of Bremen

Bremen and Bremerhaven are renewables pioneers and stronghold for various industries. Hydrogen is a key element for driving the industrial transformation in different fields for example buildout a test region for mobile hydrogen application in maritime and aviation, developing projects in key sectors as maritime and ports, mobility, aviation and space, steel industry, material and research activities and many more.

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Georg Fischer Piping Systems Ltd.

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H2V INDUSTRY

H2V is investing in developing and constructing large-scale renewable hydrogen production plants (100MW or more) to decarbonise particularly carbon-intensive sectors, such as industry and heavy-duty transport.

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Hycamite TCD Technologies Ltd

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We are a leading industrial partner for safe and reliable green hydrogen supplies and circular chemistry solutions to enable the transition to zero-carbon industry. Building on over 100 years of experience in electrolysis and our leadership in safety, we realize pioneering water electrolysis projects to supply industries with zero-carbon hydrogen from renewable power and water.

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Hydrogen Center Bavaria (H2.B)

The State of Bavaria has founded the Hydrogen Center Bavaria (H2.B) to consolidate and expand the strong position of the Bavarian industry in the important future field of the hydrogen economy, to advance the topic of the "hydrogen economy" in Bavaria as quickly as possible and to achieve the use of hydrogen in broad practical application.

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Hystar AS

Hystar makes highly efficient PEM electrolysers for the large-scale production of green hydrogen and aims to be a global leader in the electrolyser market within this decade. Hystar's patented, game-changing technology has a key role to play in decarbonising hard-to-abate sectors and achieving a greener, more sustainable future.

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Imerys Graphite & Carbon is part of Imerys Group, the world leader in mineral solutions manufacturing for industry. We offer a complete portfolio of carbon materials essential for the manufacture of hydrogen fuel cells such as carbon blacks catalyst support, graphite powders and aqueous carbon dispersions for gas diffusion and microporous layers, and graphite / conductive carbon blacks for polymer-based bipolar plates.

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At Immaterial Ltd, we facilitate the energy transition with our advanced materials and systems. Our materials (monolithic metal-organic frameworks) offer superior volumetric hydrogen storage capacity at low pressure conditions and low cost. Combined with our system design expertise, we enable hydrogen purification in production, intermittent hydrogen storage in industrial green hydrogen production, boil-off and storage for transportation. We are looking for industrial partners to make economically viable hydrogen a reality.

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International Platinum Group Metals Association

The International Platinum Group Metals Association (IPA) represents the leading mining, production and fabrication companies in the global platinum group metals (PGMs) industry. The PGM industry supports the EU's transition to renewable energies, and IPA contributes information on PGMs and their role in the hydrogen economy.

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MAGNOTHERM® is a spin-off from Technische Universität Darmstadt with world-leading expertise in permanent magnets and magnetic cooling. Our disruptive technology is about to change the current course of cooling and Hydrogen Liquefaction by increasing both effiency and sustainability. Together with Helmholtz-Zentrum Dresden-Rossendorf, we develop a Hydrogen Liquefaction method utilising the Magnetocaloric Effect and our multidisciplinary expertise.

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MP Industries OU

MP Industries is the parent company of Baltic Hydrogen Group (BHG). With an inhouse team of experts, BHG is focused on solutions for the production, operation, storage and distribution of hydrogen in the Baltic countries.

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NeptHyne

The NeptHyne project consists of two parts – the production of hydrogen installed on the existing offshore platform located in the Polish economic zone and two ships intended for servicing offshore wind farm CTV (crew transfer vessels). Project will be the basis for building new service standards for a zeroemission fleet servicing offshore wind farms.

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PRISMA European Capacity Platform GmbH

PRISMA is the leading platform for gas capacity management around Europe, connecting 20 markets digitally. We want to support the transition towards greener energies and strive to develop and support the uprise of hydrogen into a European market, facilitating a platform to access and trade both conventional gas and hydrogen capacities.

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Provincie Noord-Holland

The province of Noord-Holland sees hydrogen as an essential element in its transition towards a more sustainable economy. It helps to decrease our CO2 emissions, and ensures we provide a healthier living environment in our region. The Regional Government encourages and supports hydrogen projects, especially in (steel)industry, the ports of Den Helder and Amsterdam and at Schiphol Airport.

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Q-en and Co Ltd.

Q-EN is a Bulgarian project developer and hydrogen system integrator company. We have united a team of green energy experts and experienced project developers. Q-EN is an initiator and architect of Faraday Hydrogen Valley, a project aiming at the development of a national hydrogen infrastructure and ecosystem. At present, we are focused on the formation of a Consortium of interested members for the implementation of the project.

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REGION NORMANDIE

Normandy, a leading industrial region, is a pioneer in the development of this sector on its territory. Nearly a third of national hydrogen consumption takes place in Normandy, in particular in the petrochemical sector as well as at the Ariane Group test site. Wishing to capitalize on this potential, the Normandy Region was the first French region to adopt its hydrogen sector support plan in October 2018.

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RegO gmbh

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Seatech Engineering Sp. zo.o

Seatech Engineering Ltd was established in 2003 as a ship designing company with main office in Gdańsk (Poland). Our main activities are focused on high-value added projects of medium sized vessels covering all disciplines of widely understood naval architecture: scientific ships, offshore wind support vessels, LNG bunkering vessels, navy and patrol boats.

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SOGESTION

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Stavanger Region European Office

Stavanger is the third-largest city region and the energy capital of Norway, leading the development of the sector for over 50 years. The Stavanger Region's goal is competitiveness and profound value creation in the green transition – a transition in which hydrogen is central.

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Stichting Projecten Binnenvaart

Stichting Projecten Binnenvaart (SPB) is a Rotterdam based foundation established by the Dutch IWT sector organisations. The foundations primary task is to manage and participate in national and international projects with special focus on further developing the innovation potential of the IWT sector.

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SUBRA AS

SUBRA is a deep-tech company focused on research, development, and production of high-temperature superconductor technology, aimed at making a sustainable impact through green technology development. SUBRA is modelling high performance superconductor magnet designs, enabling the cost effective liquefying of hydrogen by magnetocaloric cooling, building on our innovative production technology.

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Theo Pouw BV

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TU Darmstadt, Technical University of Darmstadt, Functional Materials

The International team at Functional Materials at TU Darmstadt conducts fundamental and applied materials research for the fields of energy conversion, mobility, cooling, medicine and robotics as well as hydrogen liquefaction and storage. The focus is on advanced nanostructured magnetic materials, which are analysed and modelled on all length scales, from the atom to the device.

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Job market

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Full time - Oevel, Belgium

Description: at our Oevel site in Belgium, Cummins is developing innovative Fuel Cell and Electrolyzer technologies that can generate hydrogen for various applications with zero emissions – contributing to a safe and healthy environment for future generations.

We have a diverse team of engineers dedicated to the development of existing and future products for customers on a global scale. We are currently looking for an **Electrolyzer Piping Engineer** to join the team. The role will report to the Design Engineering Manager.

Deadline: 31 March 2023

Apply here: https://cummins.jobs/

Electrical Design Manager- Electrolyzer

Full time - Oevel, Belgium

Description: At our Oevel site in Belgium, Cummins is developing innovative Electrolyzer technologies that can generate hydrogen for various applications with zero emissions – contributing to a safe and healthy environment for future generations.

We are looking for a talented **Electrical Design Manager** to join our team in Oevel (Belgium) or in other Cummins Hydrogen Technologies Locations such as Missisauga (Canada) and Madrid (Spain).

Deadline: 31 March 2023

Apply here: https://cummins.jobs/

Mechanical Design Engineering Leader- Electrolyzer

Full time - Oevel, Belgium

Description: At our Oevel site in Belgium, Cummins is developing innovative Fuel Cell and Electrolyzer technologies that can generate hydrogen for various applications with zero emissions – contributing to a safe and healthy environment for future generations.

We have a diverse team of engineers dedicated to the development of existing and future products for customers on a global scale. We are currently looking for a Mechanical Design Engineering Leader to join the team. The role will report to the Design Engineering Manager.

Deadline: 31 March 2023

Apply here: https://cummins.jobs/

Electrolyzer Structural Engineer- HyLYZER 1000

Full time - Oevel, Belgium

Description: At our Oevel site in Belgium, Cummins is developing innovative Fuel Cell and Electrolyzer technologies that can generate hydrogen for various applications with zero emissions – contributing to a safe and healthy environment for future generations.

We have a diverse team of engineers dedicated to the development of existing and future products for customers on a global scale. We are currently looking for an Electrolyzer Structural Engineer to join the team. The role will report to the Design Engineering Manager.

Deadline: 31 March 2023

Apply here: https://cummins.jobs/

IPCEI project manager | Cummins - Hydrogenics

Full time - Westerlo, Belgium

Description:

- Coordinate the execution of a public funding project including tracking and monitoring of all grant obligations.
- Day to day coordination and management of interdisciplinary internal teams, external project partners (such as industry partners), and funding authorities to enable smooth implementation of the grant.
- Delivery of regular progress reports to the funding authorities (VLAIO and European Commission) including writing and drafting of required materials.
- Set up a project safety board and organize regular meetings.
- Measure project performance, forecasting outcomes and, when necessary, develop proactive course corrections.
- Set up together with the IPT a detailed project plan with clear responsibilities, deliverables, and milestones
- Represent Cummins, as appropriate, towards external stakeholders and organize/attend industry events related to the IPCEI
- Disseminate the results of the project internally and towards external stakeholders
- In collaboration with Cummins' Business Development and Sales experts, support the identification of potential customers, meet with them, and help them to develop their projects with Cummins products and within the framework of Cummins' IPCEI project

Deadline: 31 March 2023

Apply here: https://cummins.jobs/

Product safety leader | Cummins - Hydrogenics

Full time - Westerlo, Belgium

Description:

- You will define Product Safety strategy for Electrolyzers with Corporate / NPBU Product Safety Advisor, and Electrolyzers Engineering Exec. Director.
- Defines and implements Product Safety system that ensures that organization and products comply with applicable laws and regulations, with Cummins product safety Policy, and with product safety related Customer requirements.
- Also, you will lead the assigned organization and related management with regards to product safety
- It is important to ensure that product safety system is regularly assessed for completeness and effectiveness, and that requirements for product safety related auditing are implemented
- Ensures and controls implementation of product safety related quality methods and risk management
- Develops, controls and ensures appropriate product safety reporting
- Ensures that necessary financial and human resources are available to fulfill the product safety tasks
- Ensures definition and implementation of competence management and training for product safety
- Fosters a product safety culture within his/her area and provides support and advice
- Ensures that necessary corrective measures are properly dealt with and implemented
- Collaborates with executives and relevant stakeholders to achieve product safety goals

Deadline: 01 March 2023

Apply here: https://cummins.jobs/

Senior aftermarket sales representative | Cummins - Hydrogenics

Full time - Oevel, Belgium

Description:

- Prospects and develops new opportunities in existing customers to grow the business by phone calls and e mail prospection, customers visits.
- Build positive customer relationships that enable identification of a customer's needs, business model and buying process.
- Acquisition and answer of customer request for quotations. Channels: e-mails or tender or public institution bid.
- Analyze, clarify, and complete customer bidding documents
- Analyze and comment Customer terms and Conditions
- Work in costing tool to build sales price for parts, services, equipment reconditioning, equipment relocation or long-term contract support
- Synthesizes complex information (technical and commercial information) to get internal input to provide clear answer and tailored solutions to fulfill with customer expectations
- Coordinate multidisciplinary teams in Cummins worldwide organization to get the proper deliverable for a wining proposal (Departments interactions: Customer Service, Legal, Sales Operations Support, R&D, Engineering, Finance)
- Coordinate and drive to Cummins customer service team all customer technical issues and lead the process to get scope of works and spare parts definition to deliver the customer proposal
- Conducts contracts and proposals negotiations according to company guidelines, including terms and conditions, payment terms, banks warranties, letter of credits.
- Assists with collection of accounts receivables when needed.
- Develops/Executes account plans with coaching support from Aftersales Manager.
- Achieves sales goals within the assigned sales territory, market segment or channel partners.
- Consistently uses the Cummins Sales Process as well as Cummins tools, processes, and initiatives that support sales, customer satisfaction, and customer value,
- Use a Customer Relationship Management (CRM) tool as example IFS sales module or Sales Force.
- Drive the daily sales activities around CRM tool dashboard tasks, milestones, sales targets, hit rates, sales forecast…
- Reporting and justification to Aftersales Manager of Inquiries intake, orders intakes, sales target
- Be main point of contact for customer
- 80% Commercial offer management and 20% technical.

Deadline: 01 March 2023

Apply here: https://cummins.jobs/

Project scheduler | Cummins - Hydrogenics

Full time - Westerlo, Belgium

Description: Join this dynamic growing part of the Cummins business. New Power is our market leading organization that is the driving force behind the world's most innovative low carbon energy-powered vehicles. As we grow you will grow, our global project management office is already evolving, and you will be a part of a new approach to managing projects. With a focus on collaborating only with internal stakeholders, you will play a vital part in driving forward our engineering projects to ensure we meet our customers' expectations.

Deadline: 01 March 2023

Apply here: https://cummins.jobs/

Finance & Administration Manager (m/f/d)

LIFTE H2 GmbH

Full time - Hybrid, Berlin

Description: LIFTE H2 is looking for a Finance & Administration Manager to support the growth of its German entity, LIFTE H2 GmbH. You will join our business operations team and work closely with the GmbH managing directors, global project teams, global financial controller, and the tax office. Among your responsibilities will be providing administrative support to the company, optimizing current processes, and implementing new processes. You will also be responsible for our local finance processes, and manage the administration and finance of the company's projects and external grants. If you enjoy working in both finance and administrative areas and like a variety of projects, join us!

Deadline: 28 February 2023

Apply here: https://recruiting.paylocity.com/recruiting/jobs/Details/1512198/Lifte-H2-Inc/Finance-Administration-Manager

Business Developer EMEA

HDF Energy

Full time - Bordeaux, France

Description: This role is responsible for driving HDF Energy business development in the EMEA region to deliver consistent and sustainable project developments. The position requires frequent travels. The scope of the job:

Business Development for EMEA
Land Management and Permitting: secure land, obtain permits, studies, secure grid connection, manage stakeholder's relations...)
Negotiation of a Purchase Power Agreement (PPA)
Project Financing
Prepare Investment Presentation to support decision of the company
Regulatory : understanding and update of regulatory and legal frameworks
Follow-up of the development of a project

Deadline: 31 March 2023

Apply here: hanane.elhamraoui@hdf-energy.com

Markt Segment Manager Bereich Energie- und Umwelttechnik

GEMÜ Gebr. Müller Apparatebau GmbH & Co. KG

Full time - Remote, Künzelsau

Description: Zukunft aktiv zu gestalten ist für uns ein integraler Bestandteil unserer täglichen Arbeit – Als innovativer Hersteller verfolgen wir globale Trends ebenso wie sich ändernde Marktanforderungen. Unterstützen Sie uns dabei einzigartige Mehrwerte für unsere Kunden zu schaffen.

Für unser neu geschaffenes Markt Segment Management suchen wir einen Markt Segment Manager (m/w/d) / Business Development Manager (m/w/d) für den Bereich Energie- und Umwelttechnik.

Deadline: 28 February 2023

Apply here: personal@gemue.de

Prozessingenieur industrialisierung neuprodukte (m/w/d)

Greenerity GmbH

Full time - Alzenau, Hanau (Deutschland)

Description:

- Koordination von Industrialisierungsaktivitäten für Brennstoffzellen- und Wasserstoffelektrolyseprodukte über die gesamte Wertschöpfungskette (Pastenfertigung, Beschichtung, Lamination, Assembly)
- Überwachung und Weiterentwicklung des Produktentstehungsprozesses ab APQP Phase 3 (Übertrag Serienfertigung) insbesondere mit dem Fokus auf Prozesssicherheit, Wirtschaftlichkeit und Qualität
- Sicherstellung der prozesssicheren Herstellbarkeit aller Produkte sowie deren Baustufen (Fähigkeits- und Toleranzberechnungen)
- Unterstützung bei der Inbetriebnahme neuer Fertigungsanlagen und der Produktbefähigung
- Enge Zusammenarbeit mit angrenzenden Fachbereichen im Produktentstehungsprozess – vom Projekt- bis zum Serienstart
-

Deadline: 31 March 2023

Apply here: https://greenerity.softgarden.io/en/vacancies

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Hydrogen Europe

#02

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