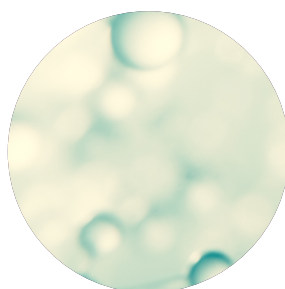
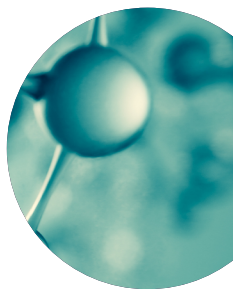
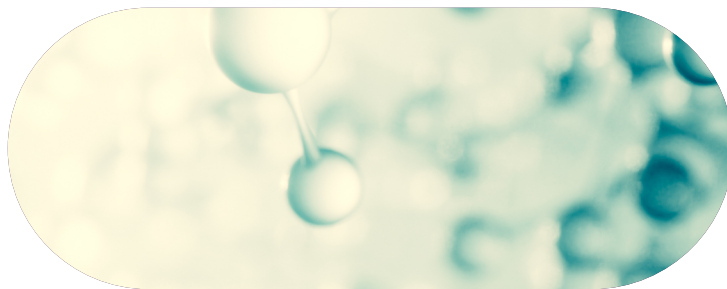
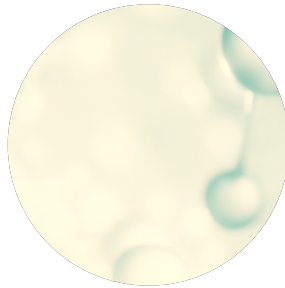


● Whitepaper

# Europe's Lost Green Hydrogen Momentum:

An Opportunity for Global Suppliers?



# Green Hydrogen: The Decarbonization Enabler

## Is the Market Moving in Europe?

The Europe Green Deal (announced in December 2019) and Fit for 55 plan (in 2021), set the ball rolling towards the bloc's effort to decarbonize itself. The target of achieving net zero emissions by 2050 and an intermediary 55% reduction by 2030 (vs 2019 levels) was set. Clean Hydrogen (preferably Green H2) was identified as one of the 5 major pillars [Fig-1] or enablers of the energy transition in Europe.

The industry also responded positively with a series of clean hydrogen project announcements, the launch of H2 policies and targets, and market murmurs of equal support from the demand side as well.

The EU Hydrogen Strategy (adopted in 2020) set ambitious targets to produce 10 million tonnes (MMT) and import 10 MMT of green hydrogen in the EU by 2030 (interim production target of 6 million tonnes by 2024).

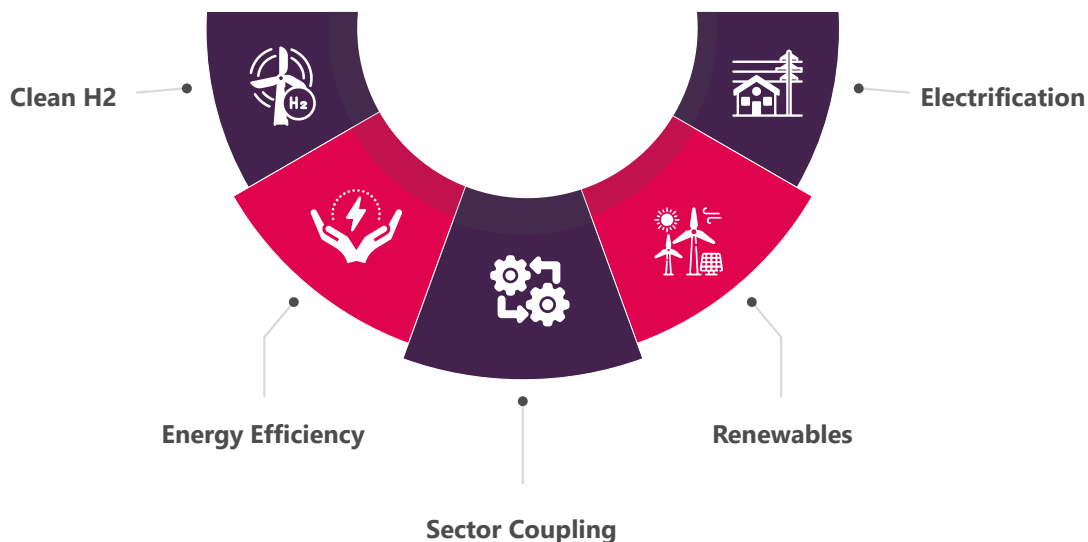


Figure 1: 5 Claimed Major Enablers of the European Energy Transition Scheme

## Has Green Hydrogen (GH2) Taken Off: Where are we in 2024?

The IEA's Global Hydrogen Review (GHR) 2024 revealed that:

- Europe's GH2 project pipeline (for/by 2030) has witnessed a massive 160% growth in the last 3 years – 22 GW in 2021 to 58 GW in 2024
- The estimates further jump to around 150 GW in 2024 (vs 32 GW in 2021) when all projects at early stages of development <sup>[1]</sup> are also included.

However, the above statements are just one side of the coin.

A deep dive into numbers reveals that out of the total 58 GW – only 4% of the projects have achieved FID by 2024. Several projects are getting delayed or shelved in Europe with other geographies like China, India, the US, and the Middle East, looking to gain a competitive advantage out of it. This white paper is aimed to evaluate the reasons, market impact, and potential way around for Europe.

[1] Projects which have been continuously delayed and have low-chances of getting commission by 2030

## Green Hydrogen Growth in 2024: On-Ground Installation Happening but at Snail Pace

In the past mini-decade, Europe’s installed electrolyser capacity has more than doubled to reach 508 MW by 2024. One could say that growth is happening but when compared with countries like China – the growth could be considered at a snail’s pace. Of the 340 MW of global installed electrolyzer capacity in 2020 – ~70% was in Europe, which has now drastically reduced to only 31–32% of the 1.6 GW global total in 2024.

Around 270 MW of electrolyzer capacity has been installed in Europe b/w 2021-Sep’24, but it is way off from what was initially expected out of Europe. A closer look at the data reveals that 508 MW capacity was less than 20% of what was initially predicted by the IEA Global Hydrogen Review (GHR 21) – clearly highlighting the slow/negligible actual progress. The current situation further worsens when compared to the interim target for 2024 by the EU Hydrogen Strategy – Not Even 10% Target Achieved.

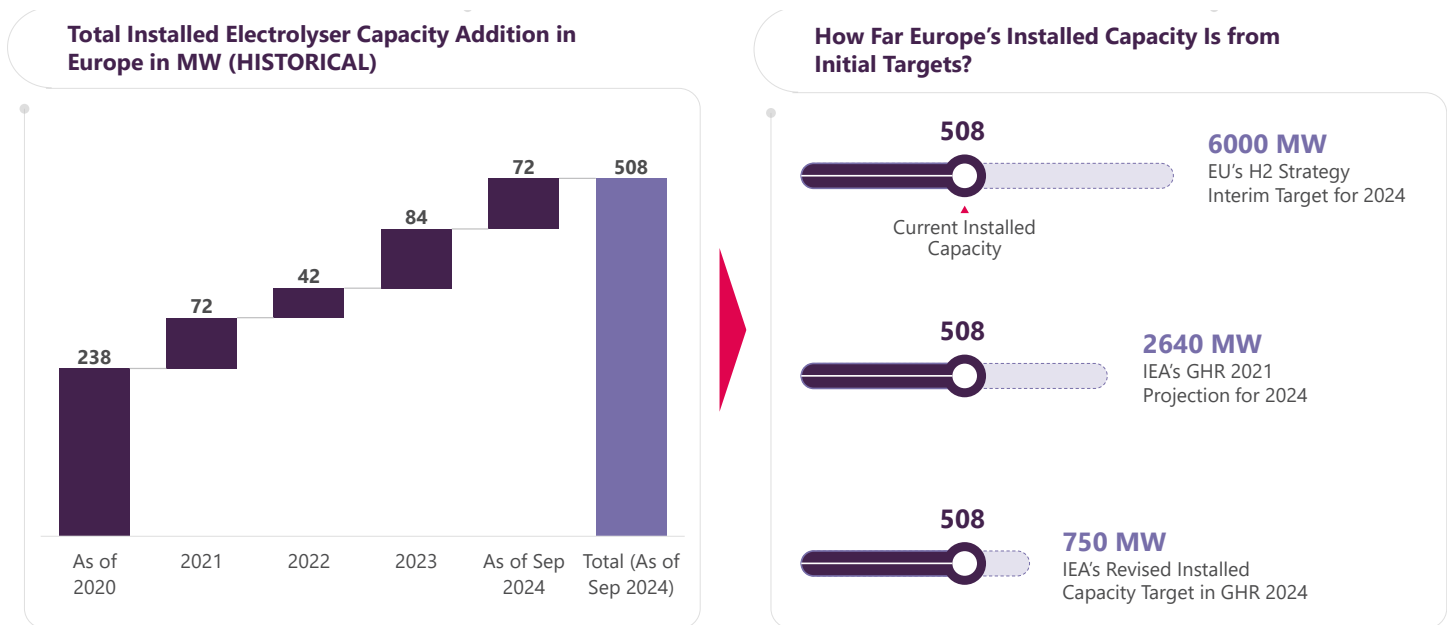


Figure 2. Installed Electrolyzer Capacity Addition in Europe vs Potential Gap from Initial Targets

Source: Evalueserve Insights, IEA

## Navigating Market Dynamics: Project Pipeline for 2030 Grows but FID Slows

The conventional (grey) hydrogen consumption in Europe in 2022 and 2023 witnessed a slump of **18%** and **6%** respectively amid the impact of the Russia-Ukraine war – primarily around the ammonia and chemical end-use sector. However, there is a slow additional cascading impact emerging on the European decarbonization efforts – **Delay in project pipeline achieving FIDs.**

The enthusiasm remains strong in European GH2 projects (and globally) – visible from the fact the total project pipeline (see below chart) by 2030 could well be now touching 130 GW (57.5 base-case, 92.5 GW additional if all announced projects are implemented). However, **project delay is also a reality now.**

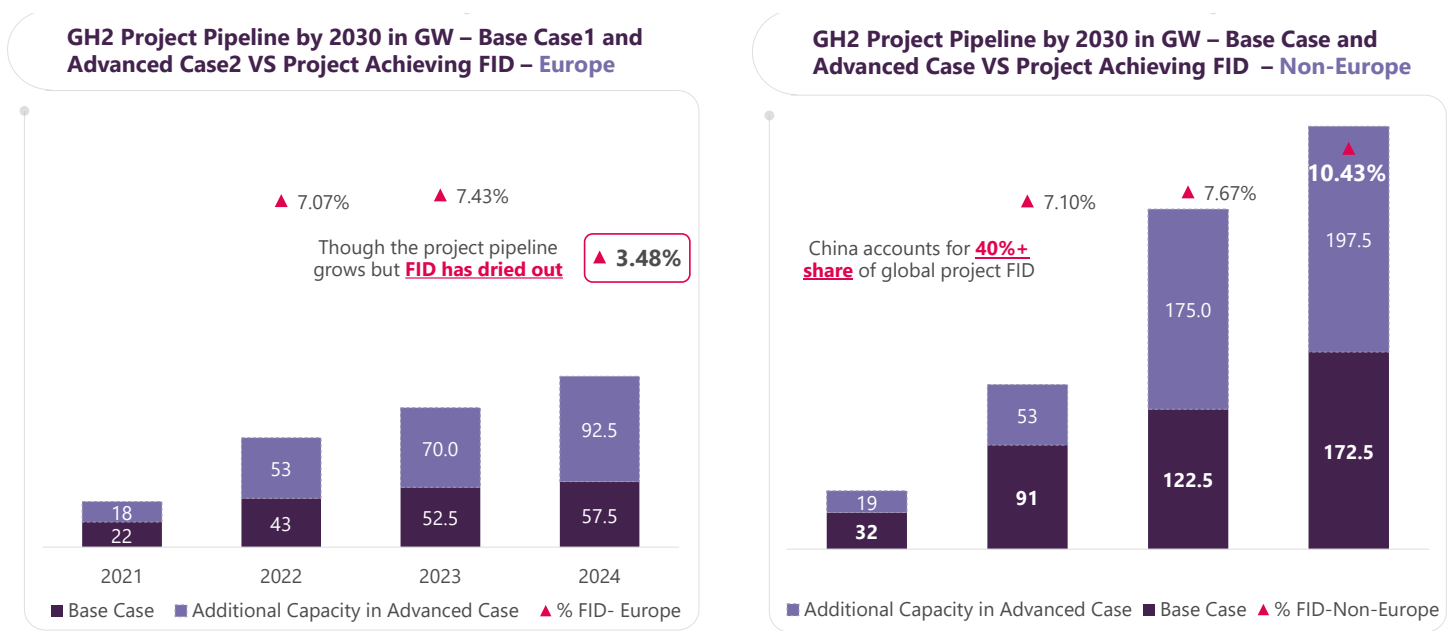


Figure 3: GH2 Project Pipeline in Europe vs Non-Europe Under 2-Different Scenarios\*

Note: 2024 numbers are till September 2024; Source: Evalueserve Analysis, IEA

[1] \* Base-Case: Projects with some progress (e.g. feasibility) and have a good chance of getting commissioned by 2030

[2] \* Advanced-Case: Projects with only announcements but delays and have low chances of getting commissioned by 2030

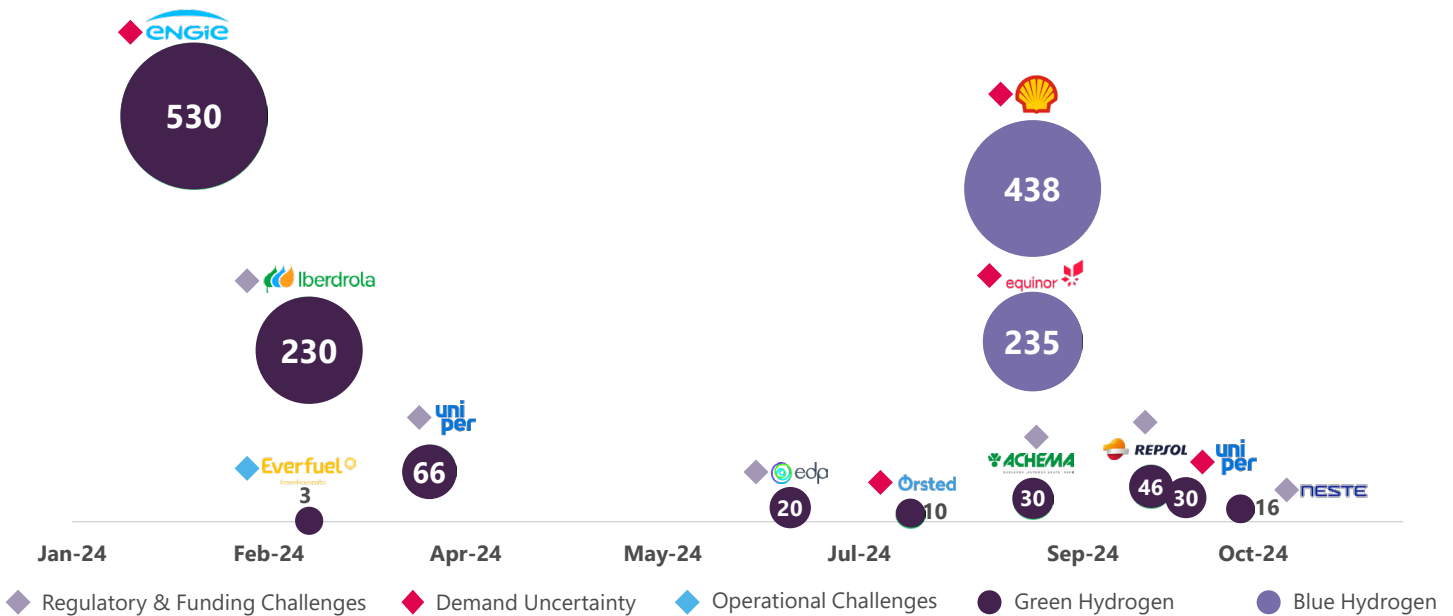
**Key Attribute**

**GH2 Projects Achieving FID in Europe:** In the past 1-2 years, Europe has witnessed a stagnation/ slump in projects actually achieving FIDs – roughly 3.48% of the total 57.5 GW (OR ~2 GW in 2024) in the base-case scenario. The number will further decrease if the entire spectrum of projects (advance case), i.e. 130 GW is evaluated.



**Project Getting Scrapped Even After FID**

“Hydrogen Volume Impacted (in KTPA) in 2024: Europe”



Several project developers in Europe – aiming to capitalize on Europe’s hydrogen momentum have announced project delays, postponement to FIDs and even cancellation of the project owing to different reasons (discussed below). Evaluateserve analysis highlighted that till Oct’24 alone over 1.6 MMTPA of GH2 volume have been impacted/delayed – few of them might not even reach the market ever.

Some of these announcements have even come from well-known developers like Equinor, Shell, Ørsted, Repsol (and others) with advanced market capabilities. This has led to the creation of serious doubt over the prospects of regional hydrogen (particularly green) in the bloc’s decarbonization quest.

Even IEA (in GHR 2024) toned down its earlier estimates of projects finally achieving FID by 2024 from earlier estimates of 4 GW to 2 GW – a massive 50% reduction.

Similar trends were also observed in the regional electrolyzer manufacturing as well as associated supply chain infrastructure projects as well (such as hydrogen projects).

The project cancellations/delays could well signal that the market is slowly commercializing with more rational business decisions being made and all the ‘fuss and hype’ observed might be slowly reducing.

## What is Impacting/Delaying the Projects?

Evalueserve analysed the major project delay announcement made in 2024 and even reached out to key stakeholders to identify the top 10 reasons for the project delay.



Figure 4: Major Reasons for European Project Delays

## What the Industry Said About Project Delays?

### Not Enough Market Pull (Lack of Firm Demand Commitment)

Delay in securing firm commitment was attributed to being one of the top reasons for project delays. While similar reasons have been highlighted by other global players and projects such as **Aramco**, **Air Products**, and **ADNOC's Ta'ziz**, European players (in particular) are likely to face more strong headwinds from the stakeholders. European project developers have to balance between committing capital on further developing green hydrogen projects or to prioritize other avenues such as renewables.

Though most of the European players remain hopeful of future green hydrogen demand to pick up from the buyers' side, they want to hold their cards in financial commitment – something that could give a **competitive edge to the blue ammonia/hydrogen project developers of the US and the Middle East**.

Lower-than-expected demand from European buyers from GH2 projects was attributed to not enough pressure/mandates on the buyers to do fuel switching as well as buyers' low confidence in GH2 (or Electrolyzers') operational capabilities to deliver future needs. Majority of the European buyers (as of Oct 24) are **conducting discussions but are not ready to make long-term commitments from GH2 projects of Europe**.

## **Not enough pressure or financial support on the demand side for fuel switching: -**

Several sellers also acknowledged that the visible demand impact will be slow until new avenues of green hydrogen consumption are encouraged. And to do so, will require encouraging customers to switch fuel in their domestic operations like the hydrogen-fired power plants, iron & steel, and several others via measures such as mandates, clear guidelines, financial incentives, and better regulatory clarity.

Further, there are some imminent gaps around the implementation and financial impact of key regulatory measures such as the phase-out of allowances within the EU ETS – which is also delaying the uptake of green hydrogen produced.

Award of **EUR 1 Bn+ of subsidy by Germany** to 5 Industrial clusters to switch to Hydrogen in Oct'24 is seen as a positive development/first step. Buyers highlighted the need for similar initiatives by other EU member states.

## **The 'Chicken and Egg Problem' for European Buyers:**

**Key Decision for European buyers:** Either convert Renewables to GH2 and reconvert it back to electricity (with less than or at 50% efficiency) OR just directly use renewables to decarbonize their own operations.

Buyers also expressed their **lack of confidence in Electrolyzer's operational capabilities** to deliver as not many projects (in the world) have functioned as expected. For example, **Sinopec's Kuqa project** – the world's largest operational electrolysis plant (260 MW), inaugurated in 2023, is **still facing operational challenges and is not expected to operate at full capacity until 2025**. Everfuel has also delayed the commissioning of the project because of similar reasons.

They have also raised concerns over – whether European domestic electrolyzer manufacturing capacity will be self-sufficient enough (and efficient enough) – as **2<sup>nd</sup> round of Hydrogen Bank Auctions** have incorporated clauses to **reduce dependence on Chinese electrolyzers** and promote the use of domestic electrolyzers. They currently feel that the domestic manufacturing industry might not be fully ready yet.

Openness to pay a premium for GH2 is currently limited unless it is cost-competitive – which makes them tend more towards renewables' direct use in their own operations (currently). They feel that (despite their challenges) direct use of electrification or RE will help to decarbonize their operations better.

**Apart from the demand side gaps highlighted above, the industry also feels that regulatory gaps and lack of clarity also further add to the problems.**

## Financial Uncertainty and Regulatory Challenges:

- **Incentives are just not enough to cover the cost:** European subsidies/ financial incentives across many countries are just not enough to meet overall costs (e.g. high land cost, equipment cost, and others) of the associated GH2 projects in Europe.
- Stricter regulations such as **temporal matching and additionality need** also add to the uncertainty of whether GH2 could deliver the actual impact. There are already existing examples where project have been delayed due to the same.
  - Uniper failed to sign the grant agreement with EU Innovation Fund for its H2Maasvlakte (Rotterdam) project as it was not able to secure electricity PPA meeting above law.
- Citing the lack of demand certainty, financial and banking firms along with the investors of the European companies have also delayed their commitment towards GH2.
- Management of top European firms have also refrained from committing aggressively to GH2 citing regulatory uncertainty, gaps, and delays in receiving committed funding.

## Gaps in GH2 Definition in Europe :

European Commission's requirement to ensure features like additionality requirements and temporal matching **are met by 2028** to be eligible for GH2 is not at all feasible (based on the current market).

- Germany has already **made a formal request** to delay the requirements from 2028 to a phased introduction from 2035.
- Fertilizer producer **Achema** became one of the latest companies to pause and forfeit subsidies for its 213 MW GH2 project in Lithuania as the above requirements made it economically unfeasible.
- **Portuguese utility EDP** delayed its (FIDs) on its Spanish green hydrogen projects due to the promised funding from the government failing to materialise. *The list is long.*
- Important Project of Common European Interest (**IPCEI**) has been slow in responding to buyers' requests, queries and maintaining transparency around how much will be issued, when it will be issued, and even slow in moving the files. This has also resulted in projects not proceeding ahead as planned.



## Delayed Infrastructure Ramp-up: Cascading Impact on Supply-Demand Dynamics

Ramping up the use of green hydrogen in Europe requires infrastructural ramp-up—both Transport and Distribution infrastructure (which either has to be built or results from repurposing gas pipelines) and storage infrastructure. Hydrogen Strategy (2020) estimated ~EUR 65 billion of value chain investment in infrastructure for GH2 to flourish, most of which was to be financed by the private sector & EU funding.

However, a recent report by the **European Court of Auditors** has flagged concerns over the pace of infrastructure funding and development – a concern reciprocated by many reputed firms. Global Hydrogen Review has flagged hydrogen-pipeline-related FID globally to be as low as 2% in 2024.

### Boomerang b/w Infrastructure Projects-based Players and Demand-Side Buyers

Multiple infrastructure projects (particularly H2 pipelines) have been **recently delayed** citing the **lack of minimum H2 offtake agreement from the pipeline by buyers** along with financial viability. On the other hand, European buyers are also slow in committing to a substantial offtake citing project delays. There is an evident gap visible in the market, where the government and regulatory authority need to pitch in to not only put in the 1st investment but also bring all parties on the same page.

Pipeline Section	Length (in KM)	Planned Startup	Revised Startup	Source
Denmark-Germany Network	550	2028	2031	<a href="#">Oct-2024</a>
Equinor's Norway-Germany Pipeline Network	1000+	2030	Scrapped	<a href="#">Sep-2024</a>
Delta Rhine Corridor (Dutch-Germany)	720	2028	2032	<a href="#">June-2024</a>
German Pipeline Network	~9700	2032	2037	<a href="#">Apr-2024</a>

Table 1: Strategic Hydrogen Pipeline Project Announced in Recent Times

Apart from the ones mentioned above, majority of the other announced corridors are at a nascent stage (either announced or feasibility stage) only. Most of the hydrogen pipeline hasn't proved to be **financially viable** for companies exploring it and **lack of firm long-term commitments from European buyers**.

Further, project delays are hampering the cost viability of projects. As per Hydrogen Europe, the cost of European Hydrogen Backbone (EHB), a planned 52,000 km network made from new and repurposed pipelines is expected to significantly increase due to global supply chain issues amid continuous project delays. The cost was initially estimated in April 2023 to be between **EUR 80 billion** and **EUR 143 billion**.

Delays in the development of hydrogen infrastructure, have a **knock-up effect on establishing a link between production and demand**. This, in turn, further escalates the boomerang game b/w buyers and suppliers and eventually results in a delay in the commissioning of new regional hydrogen projects.

## Investment in Hydrogen Storage Infra

Ensuring a hydrogen-based economy in Europe requires a **scale-up of storage capacity** as well along with the pipelines. Though hydrogen storage capacity potential is significant, its development (incl. underground storage) will require significant investment – both from the government and the private sector. As of Sep'24, Europe's existing underground storage capacity could **accommodate as much as one-third of hydrogen demand** including seasonal spikes in demand for heating.

As Europe transitions towards green and low-carbon hydrogen, hydrogen storage capacity needs to be scaled up. Currently, **most of the newly announced projects are in the initial stages only**.

For example, in August 2024, **Uniper** inaugurated a hydrogen storage pilot project at a salt cavern site in Northern Germany. Further, multiple other projects have been included in the EU Important Project of Common European Interest (**IPCEI**) funding, but so far most of them failed to reach the FID stage – something that needs careful evaluation and expedition so that European projects are not delayed.

## One's Loss is Another's Gain

While EU regional players struggle to get the ball rolling, low-carbon H<sub>2</sub>/NH<sub>3</sub> project developers of regions such as the US, and the Middle East are continuing to maintain their pole position in energy supplier status for the future as well by committing to not only their own projects but also exploring access to European buyers and infrastructure.

IEA announced that low-carbon H<sub>2</sub> (primarily produced from fossil fuels) could increase **18x** eighteen-fold, from around **0.6 MMT by 2023 to 11 MMT H<sub>2</sub> by 2030**

As per IEA's GHR 2024, announced low-carbon H<sub>2</sub> projects using CCUS reaching FID (as of Sep'24) has increased significantly in the last 1-year, with the US leading the race due to US IRA 45Q tax schemes, amongst others (~\$85/ton benefit for per ton of CO<sub>2</sub> stored). There seems to be a race amongst NOCs, and Asian-buyers to secure project offtake and equity partnership in US Gulf-coast

The **Middle Eastern NOCs** have also begun preparations to consolidate their presence in the future energy landscape by investing in both green and blue H<sub>2</sub> projects with Europe and Asia being their primary supply target market. These NOCs are trying to capitalise on the cheaper feedstock, as well as invest in decarbonizing their upstream emissions to ensure products meet EU's guidelines.

**Indian GNH<sub>3</sub> projects** on the bank of cheaper renewables and supporting regulations that have also emerged as a potential hotspot with players like RWE, and **Yara**, securing offtake deals. China also has **huge plans for GNH<sub>3</sub> exports** – but their operational efficiency challenges have raised serious questions.

Though low-carbon H<sub>2</sub>/NH<sub>3</sub> projects are expected to be subject to greater scrutiny in markets like the EU (e.g. CBAM application post-2026), the project developers of low-carbon fuels remain upbeat about their prospects, in the medium-to-long run. Few of the developers have even started identifying potential collaboration in Europe around infrastructure.

## Saudi-Italy Hydrogen Co-operation Agreement

In Sep'24, Saudi Minister of Investment, Khalid Al-Falih, highlighted Italy as a crucial enabler of Saudi's H<sub>2</sub>/NH<sub>3</sub> plans in Europe. Saudi Arabia is positioning itself as a key supplier to meet Europe's potential demand. Cooperation between Italy and Saudi Arabia would accelerate the development of the infra (including ports and pipelines) needed to support H<sub>2</sub>/NH<sub>3</sub> delivery in Europe.

At the same time, Italy emerges as a key potential supply/logistics hub. A similar arrangement is reportedly being explored with other European nations (e.g. Germany) by global NOCs/investors with low-carbon H<sub>2</sub>/NH<sub>3</sub> interests. In July 2024, **UAE-based Fertiglobe** was awarded a tender by Germany to **buy at least 259,000 metric tons of green ammonia** between 2027 and 2033. The auction established a **contract price of EUR 1,000 per ton**, including delivery to Europe from Egypt, as per Reuters.

To summarise, despite headwinds, low-carbon (and even green) project developers from regions like the US, the Middle East are trying their best to explore all possible synergies and opportunities in Europe that emerged due to the lost- momentum of GH<sub>2</sub> projects in Europe.

## Key Recommendations: What Could be Changed for European Projects?

Hydrogen in Europe, despite its current headwind, will play a significant role in Europe's decarbonization efforts. Many have termed it as the 'fuel of the future' and Europe collectively needs to retrospect and implement certain challenges to curb the lost momentum.

Evalueserve talked with several industry experts, who have highlighted recommendations that could enable the creation of a better market environment.

- **Timely Financial Support (in its initial phase) and Better Long-Term Regulatory Clarity: -**
  - A significant chunk of recently delayed GH2 projects have cited delays in receiving committed funding, lack of clarity on the next steps in grants, and even slow response to queries, amongst others. **These need to be addressed.** Many of the project developers also cited that for better risk coverage, incentives-level needs to be higher when the market is at a nascent stage and support levels could be gradually decreased as the sector matures and costs decline.
- **Expanding Forms of Financial Support (apart from the incentives): -**
  - Owing to the nascent nature of the industry, European project developers are not able to easily secure financial support from private investors. The government could explore (apart from incentives) financial supports such as loan guarantees, public equity investments, lower interest rates, and green bonds, amongst others – that could help in securing project funding.
- **Increase Public Procurement of H2/NH3 and Incentivizing/Mandating Fuel Switching**
  - Countries like South Korea, and Germany have taken the lead in public procurement of low carbon/ green H2/NH3 in their respective countries by pooling demand of end-use avenues like power, steel, amongst others. However, these initiatives are very rare and **needs to be expedited.** Further, alternate avenues such as iron & steel, will not be able to actually uptake H2/ NH3, unless and until provision of demand-side incentives as well mandates are made.
- **Strengthen Standards, Certification, and Regulatory Environment Attributes**
  - End-users across new demand avenues such as the iron & steel sector are still not 100% certain of the exact regulatory certification/standards that need to be met. The same goes out for other industries such as shipping (such as RFNBO credits). Similarly, there are still evident gaps in key regulations such as the definition of low-carbon H2, the actual applicability rule of CBAM, and others, which decrease the commitment level of both buyer and seller.

- **Strict Requirements such as Additionality, Temporal Matching Could be Gradually Implemented –**
  - The requirement of temporal matching and additionality to be eligible for Green H2 in Europe has already hindered many announced GH2 projects and is on the verge of hampering the business prospects of others. Despite all the goods benefits envisioned, the EU could consider delaying or gradual implementation of these needs to boost the cost-competitiveness of projects in the short-run. Gradual implementation is recommended.
- **Public Private Partnership in Infrastructure**
  - Supplementing demand and supply sides with incentives still won't be enough for the H2/NH3 market in Europe till the associated infrastructure develops. The recent pipeline project was a real market damper – possibly resulting in creating uncertainty for both producers and consumers. Immediate government support in infrastructure, promoting public-private partnerships, ensuring pipeline offtake commitment, fostering cross-border and international cooperation with global suppliers, and financial support to derisk investment, could be considered to ensure greater uptake of infrastructure projects.

Thus, to summarize, Europe's Green Hydrogen momentum has lost the wind currently, but its future potential still remains strong. Despite challenges, green hydrogen is still going to be a key enabler for Europe's decarbonization efforts – however, the actual impact may be delayed and challenges could still be addressed. However, concerned European hydrogen industry and government needs to collaborate more effectively to solve the emerging concerns and imminent gaps.

On the flip side, this also opens up an opportunity to explore for low-carbon hydrogen developers – particularly with better financial capabilities, existing infrastructure, past oil & gas experience, and established business relations. All will come into play when they will sit down with the potential buyers.

## Authors



### Pritam Kumar Singh

Senior Consultant,

- Pritam is an agile and enthusiastic decarbonization and low-carbon fuels consultant with 8+ years of experience in assisting clients (incl. Fortune 500 IOCs and NOCs) in enabling their energy transition and low-carbon journey.
- He holds a multi-sectoral working background in the areas of oil and gas, LNG, low-carbon hydrogen, renewables, circular economy, and FMCG sustainability projects.
- Within the hydrogen space, Pritam has been working with global energy majors in strategy formulation and implementation, project economics assessment, new opportunities and market evaluation, supply-demand, market and competitive environment support, and others.
- Pritam has co-authored several other articles and whitepapers on energy-related topics that have been widely published and appreciated by global platforms.



### Surbhi Tyagi

Consultant,

- Surbhi has 9+ years of market research & strategy consulting experience in decarbonization, refining & petrochemicals, and mining sectors.
- She has been working with global energy players to deliver actionable strategies for their energy transition journeys and low-carbon ambitions. Her expertise includes assessing key decarbonization strategies, developing sustainability roadmaps, and conducting cost-competitive assessments of low-carbon projects, with a strong focus on hydrogen and ammonia markets. Surbhi excels in analyzing market and competitive landscapes, evaluating economic viability, and assessing supply-demand dynamics etc.

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