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WHAT OUR CLIENTS ARE TALKING ABOUT

Unlocking Green Hydrogen Projects

Overcoming investment barriers

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Executive summary

The world finds itself at a pivotal moment with green hydrogen. The industry is being built from the ground up, with decisions today influencing how well the fuel integrates into the wider economy in the coming decades. For green hydrogen to fulfil its potential as a cornerstone of the global energy transition, the challenge lies in scaling its contribution to decarbonisation efforts. Without a holistic approach to developing the sector — spanning demand creation, infrastructure and financing — the rollout risks being fragmented, characterised by stop-start progress that undermines momentum.

For its part, the UK aims to create a scalable, self-sufficient and resilient hydrogen economy that will play a central role in the country achieving its target of net zero by 2050. The government took a step in this direction on 20 December 2024, signing funding agreements for three projects under its first Hydrogen Allocation Round (HAR1).

At the same time, while climate change targets will be a driving force in the fuel's widespread adoption, economic realities mean that failing to address concerns around industrial competitiveness and energy security will undermine green hydrogen's relevance over the long term.

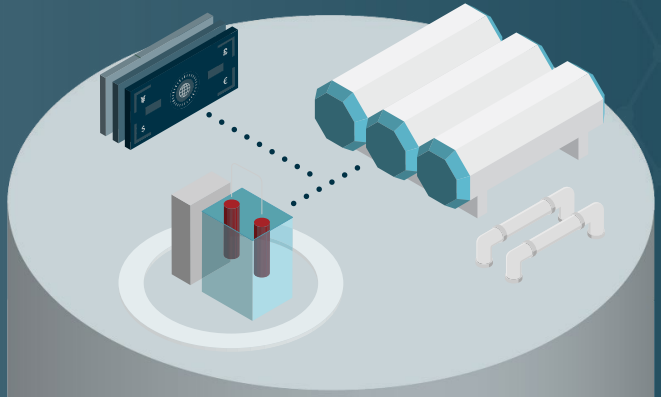
This white paper explores the key aspects that will determine green hydrogen's success. It is structured around three central pillars: creating foundational demand, addressing infrastructure and financing uncertainties, and fostering market growth while mitigating risks. These pillars are explored through the lens of the UK's particular challenges and opportunities, with comparative insights drawn from other European jurisdictions.

In doing so, we identify the fundamental building blocks of a sustainable hydrogen economy and the critical threats that could impede its progress. From fragmented policy frameworks to the absence of long-term market stability, these barriers must be confronted head-on to ensure hydrogen's long-term role in the decarbonisation journey is scalable.

To inform these findings, we have engaged with a range of industry players through a recent roundtable in London and a series of one-to-one interviews. These discussions provide valuable insights into hydrogen strategies and policy alignment. This white paper offers practical recommendations for policymakers, investors and industry leaders as they make key decisions that will shape the sector's future.

Those choices will determine whether green hydrogen becomes a central pillar of decarbonisation or remains an underutilised niche technology. Ultimately, to accelerate the transition of green hydrogen into a viable commodity, it is essential that the complex and challenging task of aligning policy, stakeholder interests and financial mechanisms is addressed.

Hugo Lidbetter
Partner, Head of Sustainable Infrastructure, Osborne Clarke UK



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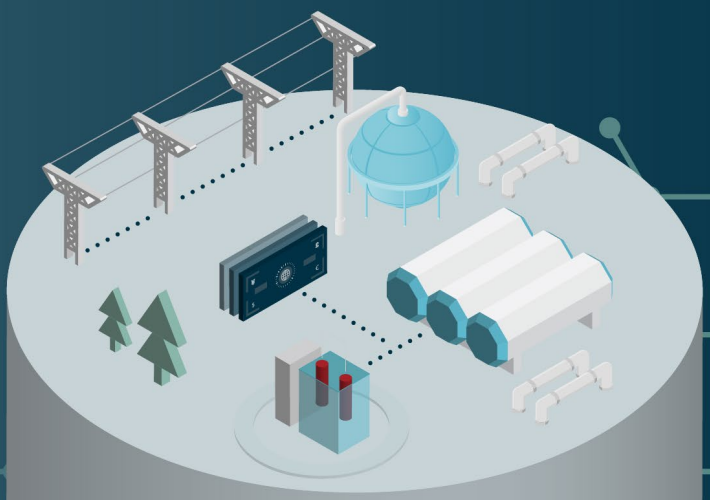

1. Building foundational demand

1.1 Strategic use cases and demand shaping

The UK remains focused on scaling hydrogen production to establish a self-sufficient domestic market insulated from international volatility. Two HARs are already underway, with plans for annual rounds until 2030 to sustain production momentum. However, scaling production is only part of the equation; a robust hydrogen market cannot thrive without corresponding demand. As a European leader in green hydrogen, Germany has taken a different approach by doubling its hydrogen demand targets and prioritising infrastructure development to drive consumption, while accepting that imports will play a central role in meeting future supply needs.

The UK's National Energy System Operator (NESO) is currently drafting the country's first Strategic Spatial Energy Plan (SSEP), due in 2026. While the plan focuses on clean electricity generation, storage and hydrogen production facilities — reflecting the growing recognition of the role of hydrogen in decarbonising the energy system — immediate challenges remain in scaling demand and ensuring commercial viability.

Green hydrogen carries a significant price premium, which suppresses demand. Indeed, it is estimated to amount to two to three times the cost of grey hydrogen, which is produced from natural gas without carbon capture. This demand suppression creates a negative cycle: uncertain demand increases investment risk, delays projects and drives up costs, further undermining demand. It also postpones the ability to deliver cost savings through economies of scale and deployment learnings.

For hydrogen to become a tradable commodity, it is essential that the UK first establishes foundational demand. This requires the government to narrow the cost gap with incumbent fuels by introducing carefully targeted compliance measures and incentives, including industry consumption quotas and mandates, carbon pricing and targeted regulations. Building an initial, stable and scalable demand level will help de-risk investment, scale production and eventually reduce costs.

In terms of where the scalable demand will come from, industries that already use hydrogen as a feedstock, including ammonia production and petrochemical refining, can drive green hydrogen demand as they seek alternatives to costly grey hydrogen supply chains. The government needs to identify strategic use cases where green hydrogen can provide the greatest decarbonisation impact, particularly in sectors that cannot easily electrify, with glass, ceramics and steel manufacturing being typical examples. These industries represent a significant share of emissions and can anchor foundational demand. By prioritising support for these sectors — through subsidies, infrastructure investment and clear regulatory frameworks — the UK can reduce the cost gap, de-risk projects and create scalable demand.

Subsidies for green hydrogen and effective carbon pricing will be especially important to narrowing the cost gap, making the fuel more competitive and accelerating adoption. Without these measures, industries face significant barriers to balancing decarbonisation goals with operational needs.

With this in mind, the government should also avoid making decisions that could lead to carbon leakage. Excessive cost pressures could undermine domestic industries' competitive edge, driving them to relocate to countries with more lenient regulations and lower costs. Ultimately, this would erode the UK's decarbonisation efforts and economic strength. As such, a holistic approach to hydrogen policy, long-term carbon pricing and carbon border adjustment mechanisms is essential.

The alternative to adopting a holistic approach will be a relentless focus on simplistic targets, which is likely to inadvertently incentivise tactical avoidance from industry, with some opting to lobby for relief when carbon prices rise rather than transitioning proactively.

> **"While we want to drive decarbonisation, we need to be careful not to lose further industries and skills that exist in our chemical clusters. We need to find a way to balance decarbonisation goals with industrial competitiveness, ensuring subsidies and policies encourage adoption without penalising industries into relocating or shutting down or even doing nothing. The key is to reduce the cost of energy significantly."**
>
> Deniese Ramsundarsingh — Development Director, HYRO, Octopus Energy Generation

Strategic takeaway

Scaling production alone is not enough: Establishing foundational demand is critical for the UK's green hydrogen market to thrive. It requires targeted policies, strategic use cases and incentives that balance decarbonisation goals with economic competitiveness.

1.2 Demand liquidity and offtake challenges

Arguably, the biggest challenge facing the UK's green hydrogen sector is its lack of a deep, liquid demand pool. Unlike natural gas, which is easily tradable and benefits from decades of infrastructure development, green hydrogen is not yet considered a tradable commodity. The market is fragmented, with the fuel lacking the transportability and demand flexibility that characterise gas markets. It also suffers from inconsistent categorisation across markets, particularly regarding the carbon intensity of its production, which further complicates efforts to establish a unified market.

The green hydrogen sector is still in its infancy, with global operational electrolyser capacity hitting only 1.4GW by the end of 2023, with that number projected to reach 5GW by the end of 2024. Compare this with the UK's aspirations of installing 10GW of green hydrogen capacity by 2030, and the scale of the ambition becomes evident.

While incentivising production is essential, prohibitive costs mean the demand needed to make new projects commercially viable may not materialise. Green hydrogen does not introduce fundamentally new applications. Instead, it competes with far cheaper incumbent solutions, forcing the challenger to rely on narrow use cases and one-to-one offtake agreements. Inflexible bilateral contracts severely limit scalability and increase financial risk.

Liquified natural gas (LNG) projects provide a useful comparison in the gas sector. Despite benefiting from a deep, global pool of demand for gas, LNG projects still require long-term contracts with multiple offtakers (which typically covers 80% of their production). These agreements spread risk and provide the revenue certainty needed for final investment decisions (FIDs).

Green hydrogen, by contrast, lacks a similarly deep and flexible demand pool. This absence of diversified, underlying demand significantly increases project risk, leaving developers reliant on one-to-one offtake agreements with predominantly onsite creditworthy offtakers. While such arrangements are easier to finance and reach FID, they limit scalability.

For green hydrogen to succeed in the UK, the government must support demand liquidity. Acting as a buyer of last resort, it could guarantee the purchase of unsold hydrogen volumes at pre-agreed prices through backstop mechanisms. It could also broaden the eligibility requirements for the Contracts for Difference mechanism used to underpin the Low Carbon Hydrogen Business Model.

This would reduce financial risks associated with offtake agreements, encourage private-sector investment and eliminate the reliance on single offtaker projects. Ensuring stable demand growth effectively prevents the stop-start disruptions that undermine market development.

One practical option on this front might be green hydrogen blending. Incorporating green hydrogen into the national gas grid would provide an immediate fallback for unsold volumes while supporting demand growth and market stability.

> **Blending hydrogen into the existing methane grid acts as a quasi-buyer of last resort mechanism, ensuring producers have a constant offtake even when demand fluctuates. This guarantees market stability, improves project financing by reducing risk, and helps scale the market faster. Over time, this approach can lower production costs and reduce the need for government subsidies."**
>
> Kim Lamza — Head of Strategy, National Gas

The government could also consider introducing green steel quotas in key sectors, such as construction and luxury automotive manufacturing. In construction, quotas could require a minimum percentage of steel used in public infrastructure projects to be green, creating a stable market and encouraging domestic production. This capitalises on the government's considerable power as a purchaser of services to drive market change.

Similarly, in the luxury automotive sector, quotas could mandate the use of green steel in vehicle manufacturing, strategically targeting less price-sensitive high-end consumers. This approach acts as a 'wealth tax', introducing green steel into the private sector without placing undue financial pressure on the broader economy. Leveraging the sector's premium branding focus could drive early adoption within the wider industry.

Strategic takeaway

The role of government in de-risking demand: For green hydrogen to succeed in the UK, the government must play a central role in ensuring demand liquidity. Acting as a buyer of last resort and/or broadening the eligibility criteria in support mechanisms like the Contracts for Difference (CfDs) would provide the certainty needed to stabilise demand, reduce financial risk and unlock private-sector investment.

2. Overcoming infrastructure and financing challenges

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2.1 Infrastructure deficit

One of the great challenges in developing any commodity market is achieving a relatively seamless balance between supply and demand. Green hydrogen is no different, though facilitative logistics are at a much earlier stage of development. For the UK, which has embraced a cluster-based approach, the challenge will be ensuring these localised hubs can be connected to create a cohesive network that supports both near-term adoption and long-term market growth.

Focusing on clustering production in industrial hubs may help de-risk supply projects by aligning them closely with local demand, but the strategy sacrifices market scalability. Without a national network, clusters facing supply imbalances lack the flexibility to efficiently redistribute resources. Cluster models are nonetheless an essential first step, providing the foundation for a broader, interconnected national network.

For the UK, connecting green hydrogen projects in Teesside and Humber is a logical first step towards building an integrated national network. Both regions are pivotal to the UK's decarbonisation efforts, with significant potential for green hydrogen production and ongoing development of carbon capture and storage (CCS) infrastructure as part of the East Coast Cluster. Linking these clusters would strengthen the emerging green hydrogen ecosystem, balancing production and demand while demonstrating the value of network integration.

> **"There is a benefit to connecting clusters from a resilience perspective, allowing surpluses and deficits to be balanced. From our point of view, it's really important to put that network in place as a key enabler."**
>
> Kim Lamza — Head of Strategy, National Gas

The long-term success of a national pipeline network requires not only integrating existing clusters into a broader system but also addressing where and how future clusters should be located. Site locations will need to be picked using a supply-and-demand model and/or with potential infrastructure impacts in mind to avoid connection challenges.

Germany offers valuable lessons on tackling the logistical 'chicken and egg' dilemma, having also grappled with which approach to take. Its 2020 National Hydrogen Strategy provided a clear path forward, earmarking billions in funding to develop a 9,000 km hydrogen backbone by 2032. The network will link principal production, storage and consumption hubs.

Nevertheless, the backbone is not without its difficulties, with the most significant being uncertainty around its completion timeline. German hydrogen producers are stuck in a waiting game, as delays and ambiguity surrounding the project's completion make it difficult to finalise offtake contracts. This challenge nonetheless only highlights the importance that buyers and sellers already place on the backbone and interconnectivity more generally.

> **"The hydrogen backbone is essential to creating a liquid hydrogen market as it connects diverse offtakers and producers, reducing risks for all participants. Unlike the current point-to-point model, which leaves risks on the shoulders of just two parties, a connected network enables storage, flexibility and alternative sourcing, making it possible for hydrogen to become a true commodity."**
>
> European Green Hydrogen Developer

Without the UK government intervening on the infrastructure front, building a national green hydrogen market will be much more complex. Lessons can also be learned from Spain, where the absence of hydrogen infrastructure — such as pipelines and storage facilities — creates significant logistical obstacles. The UK can avoid these pitfalls by prioritising infrastructure alignment early in its hydrogen strategy.

A national hydrogen network is essential to bring hydrogen to all levels of industry. Brick and cement manufacturing, for example, while smaller in size in comparison with steel production or refineries, is still a significant user of natural gas. Solutions must extend beyond the most prominent players if the goal is to retain and strengthen the domestic industry.

Strategic takeaway

Connecting clusters to unlock scalability: An integrated hydrogen network is essential to balance supply and demand, avoid bottlenecks, and ensure equitable access. Connecting clusters like Teesside and Humber can lay the groundwork for a market that is both resilient and scalable.

2.2 Financing and creditworthiness

The difficulty in financing green hydrogen projects is inherently tied to the depth of the demand pool. Shallower demand levels make securing investment more challenging, with investors and lenders wary of an overreliance on a single offtaker. To unlock financing at an acceptable cost of capital, the UK market must demonstrate sustainable use cases and long-term resilience — a task that will require stronger government intervention and support.

Traditional long-term offtake agreements, such as 15-year contracts, may not in themselves be sufficient. The brittleness of single offtakers — particularly their ability to fulfil long-term agreements — has led financiers to consider alternative approaches. If a primary offtaker fails, secondary demand within the same hub or cluster becomes essential.

"An offtake contract's tenure means little if the counterparty's credit isn't strong. Bankability depends on confidence in a fundamental, sustainable use case as well as the counterparty itself."

Bruce Riley — Managing Director, Head of Energy Transition, Natwest

This demand liquidity could come from other industries or facilities in the same hub with similar hydrogen needs, or from projects supported by government policies that create stable and reliable demand, such as blending mandates or guaranteed pricing mechanisms. Yet, in the UK, these tools remain underdeveloped, creating gaps that heighten financing risks. Without these safety nets, projects remain riskier for lenders. While no projects have fully tested this model, the need for diversified, localised demand to back green hydrogen investments is clear.

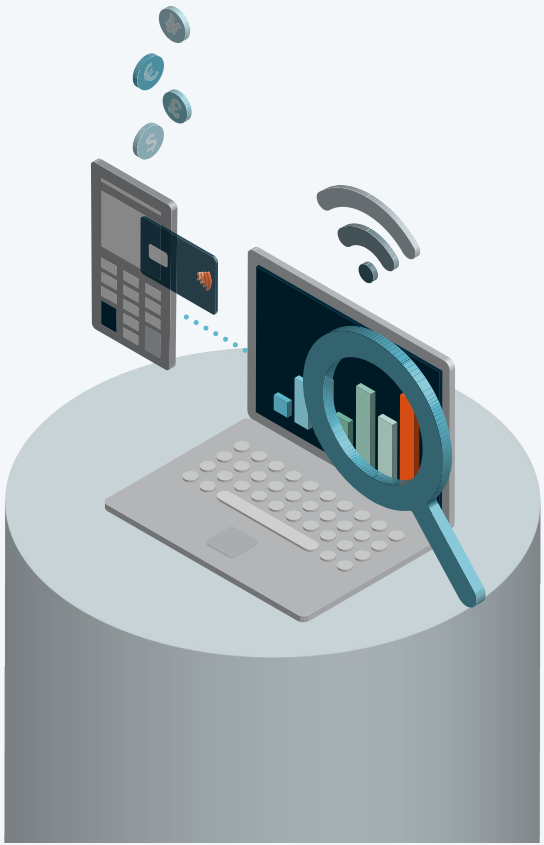
Spain offers a cautionary example of how insufficient demand and market uncertainty can hinder progress. Spanish commercial banks often view the hydrogen sector as a high-risk greenfield industry, complicating access to debt financing for long-term infrastructure projects.

> **"Without clear guarantees of stable demand or predictable pricing structures, banks remain reluctant to extend credit, forcing developers to rely heavily on equity financing or alternative funding mechanisms."**
>
> José María Gómez — Business Development Manager, Hive Energy

Germany, having faced similar challenges, provides valuable lessons for the UK. While heavy industries such as steel are logical candidates for decarbonisation, they remain reluctant to commit to fixed-price agreements that carry a green premium. The lack of an established market and clear price benchmarks has made securing investment-grade offtakers willing to sign 10-15 year contracts even more difficult.

"Without clear benchmarks or predictable revenue streams, it's nearly impossible to determine the 'right price', especially in sectors like steel where investment-grade offtakers are scarce, making long-term fixed-price agreements a rare occurrence."

Björn Heinemeyer — Senior Director Structured Finance Europe, NORD/LB



Germany's climate contracts provide a potential pathway to address these challenges. Designed as a type of CfD, these contracts allow industrial users — such as steel and ammonia producers — to purchase hydrogen at affordable prices while ensuring producers remain financially viable.

By adjusting subsidies based on future cost assumptions, the scheme reduces financial risks for both producers and consumers. This approach underscores how targeted financial mechanisms can help overcome the barriers posed by the lack of clear benchmarks and predictable revenue streams."

Martin Geipel — Partner, Osborne Clarke, Germany

It is essential that the UK learns from these experiences by prioritising foundational demand in hard-to-abate sectors, where hydrogen can deliver the greatest decarbonisation impact. Tools such as CfDs, blending mandates and direct subsidies can help narrow the cost gap with incumbent fuels, reduce the green premium, and provide the stability needed to attract private-sector investment.

Unlike power markets, where mature grid infrastructure allows offtakers to be replaced relatively easily, hydrogen lacks the flexibility of a fully developed distribution network or liquid market. This leaves projects vulnerable to disruptions, as the termination of an offtake contract or a counterparty's financial troubles cannot be quickly mitigated. For investors, this reflects significant commercial risk and further complicates financing.

Hydrogen's financing structure further compounds this challenge, diverging sharply from established renewable sectors like wind and solar. While these sectors can typically secure 80 to 90% of their capital through debt financing, hydrogen projects are often capped at 50%, reflecting their higher risk profile. This forces reliance on costlier funding options to fill the gap, like equity and equity-like sources, including grants. To overcome this, targeted risk mitigations — such as government-backed guarantees, revenue support mechanisms and policy certainty — are essential to attract investment and make projects bankable.

"Grants can play a crucial role in bridging the equity gap for hydrogen projects, especially in capital-intensive sectors like steel, where companies often struggle to provide large upfront contributions. However, equity remains a baseline expectation for lenders, alongside other risk mitigants such as revenue guarantees or state export credit support. These mechanisms are essential to reduce financing risks and make projects bankable."

Björn Heinemeyer — Senior Director Structured Finance Europe, NORD/LB

Strategic takeaway

Building confidence to unlock investment: To unlock financing for green hydrogen, It is essential that the UK prioritises foundational demand in hard-to-abate sectors while deploying targeted interventions — such as CfDs, blending mandates and revenue guarantees — to reduce risk.

3. Ecosystem growth and risk mitigation

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3.1 Price vs technical considerations

The previous sections highlighted the importance of building foundational demand and infrastructure to support a scalable green hydrogen market. However, green hydrogen faces stiff competition from established renewable energy solutions and cheaper alternatives like grey hydrogen and natural gas. This competition necessitates a closer examination of hydrogen's viability through two key lenses: price and technical feasibility. By addressing these factors, it becomes clearer where green hydrogen can compete, complement or fall short against these existing energy solutions.

Price remains the biggest thorn for green hydrogen producers. Unlike renewable energy solutions — where feedstock is essentially free — the cost of green hydrogen is closely tied to power prices and higher technology costs in early-stage projects. These challenges are compounded by strict production standards in both the European Union and the UK, where compliance frameworks add complexity and cost for producers.

In the EU, the Renewable Energy Directive (RED) and its Delegated Act on renewable fuel of non-biological origin (RFNBO) establish demanding criteria for green hydrogen production, such as additionality, and temporal and geographic alignment with renewable energy availability. While these rules aim to ensure the credibility of green hydrogen, their strict definitions place significant cost pressures on producers.

"We have to somehow rework the regulatory framework on what green hydrogen really is. We've modelled several scenarios over the last two years and under the current regulatory framework, green hydrogen is at least 50 to 60 euros per MWh more expensive than it has to be."

European Green Hydrogen Developer

While transitional provisions — such as relaxed requirements for additionality and monthly temporal correlation until 2028 — offer a degree of short-term flexibility, the evolving nature of these rules creates further uncertainty. Ambiguity around their practical application by regulators, certifiers and competent authorities has made long-term planning and financing riskier, particularly for cross-border projects.

The UK's Low Carbon Hydrogen Standard (LCHS), meanwhile, imposes even stricter emissions thresholds than the EU's RED. While the EU limits green hydrogen to 3.4 kg CO_2e/kg H_2 (28.2 g CO_2e/MJ), the UK sets a tighter cap of 2.4 kg CO_2e/kg H_2 (20 g CO_2e/MJ). This raises the bar for emissions reductions but adds cost and complexity for producers navigating early-stage market development. If applied without sufficient consideration of scalability and cost-effectiveness, these ambitious standards risk stifling growth before the market can gain momentum.

The lessons from mainland Europe highlight the importance of balancing ambition with pragmatism.

"While the EU's RED sets demanding production criteria, its transitional provisions — such as relaxed requirements for additionality until 2028 and monthly temporal correlation until 2030 — offer early movers short-term flexibility to scale projects. However, the uncertainty caused by the evolving nature of these provisions underscores the need for clear and predictable frameworks."

Luis Gil, Counsel, Osborne Clarke, Spain

By comparison, the UK imposes stricter thresholds from the outset but offers no such interim support, creating a tougher environment for early-stage development. This may explain why the UK is already behind on its deployment targets. The UK can learn from the EU's attempt to support early movers while avoiding the regulatory ambiguity that risks deterring investment. Heavy-handed emissions targets, while future-focused, risk stifling the market before it gains momentum.

However, price alone cannot determine green hydrogen's place in the UK's energy mix. While regulatory challenges and emissions standards add cost and complexity, there are technical factors that must also be taken into consideration.

Electrification remains the most efficient solution for many end-use cases, but network and balancing costs can undermine its cost-effectiveness in certain applications. In such instances, hydrogen offers unique advantages, particularly in sectors that cannot easily be electrified. Identifying and prioritising these strategic use cases is crucial to ensuring that green hydrogen is deployed where it delivers the greatest value.

> **"The question isn't just about price. It's about where hydrogen truly fits. For sectors that can electrify, market forces will drive them to do so. The focus should be identifying the end-use cases where hydrogen is essential and working to reduce costs in those areas to ensure its role in the energy mix is strategic and impactful."**
>
> Emma Woodward — European Hydrogen Market Lead, Aurora Energy Research

Hydrogen's future, including the use of hydrogen derivatives including ammonia and methanol, will likely lie in heavy industry, back-up power generation, high-temperature processes and long-haul transport. Furthermore, there are sectors where hydrogen can complement renewables, such as interseasonal energy storage. As renewable energy grows, its near-zero marginal cost will most likely create larger seasonal swings in electricity prices. In low-demand periods during summer, cheap renewable power could drive electrolysers to produce hydrogen for use during high-demand winter peaks.

This approach helps balance the grid and positions hydrogen as a practical tool for interseasonal storage to complement batteries and other forms of short-term storage, even though price spreads may narrow with improved grid flexibility by 2050. The long-term nature of power projections will still leave some investors uneasy, and market developments — for instance a surge in battery installations or other power-intensive applications, such as heat pumps, EV chargers and data centres — could erode green hydrogen's economic edge well before 2050.

"Forecasts often underestimate how quickly market shifts can occur. If projects with a five-year lead time suddenly face a shortened payback period, say from 20 years to 10 years, it complicates the entire investment model. The challenge is figuring out where storage solutions fit into this rapidly evolving landscape."

Tom Williams — Partner, Downing

The transition to green hydrogen presents an immediate opportunity to reduce emissions for existing grey hydrogen users. At the same time, new use cases must be identified and supported through targeted policies and investment.

The UK government's challenge now is to focus on areas where hydrogen is viable while recognising that some anticipated applications may never materialise. This was the lesson from the debate on hydrogen's role in domestic heating, where it has ultimately proved to be more expensive and less efficient than alternatives such as heat pumps in most applications.

Strategic takeaway

Viability and strategic use: Green hydrogen's success will depend on balancing ambitious standards with pragmatic policies, while identifying where the fuel delivers the greatest value — in hard-to-electrify sectors, seasonal storage and industrial applications.

3.2 Strategic use of hydrogen blending

While hydrogen blending's potential as a buyer-of-last-resort mechanism has been briefly explored above, a deeper consideration reveals its broader implications and potential for shaping the hydrogen economy. As a backup mechanism, it provides a reliable outlet for excess hydrogen, smoothing market volatility and stabilising demand. At the same time, it creates a foundation for government-backed guarantees or revenue support mechanisms, such as CfDs, to encourage investment by ensuring producers have consistent offtake options.

"Blending is the easiest way forward in the UK because the demand is already there. It provides consistent offtake, and with government subsidies, it could go into the pipelines. Even hitting 3 to 4% blending in the next few years would support the transition, and realistically, there will always be an element of blending in the grid that the government can help drive."

Jake Martin — Business Development, Energy Transition Projects, Petrofac

With this in mind, it is even more important for the government to align decisions on blending percentages at both the distribution and transmission levels. Adopting a system-wide approach would ensure consistency and help hydrogen scale more efficiently across the network.

Beyond its role in addressing infrastructure issues, blending also holds significant potential for mitigating the financial risks UK hydrogen producers face. Developers have raised concerns about the government's approach to supporting demand and with subsidies currently conditional on the existence of offtake agreements, unsold volumes leave producers exposed to significant losses. Implementing a fallback solution, such as blending hydrogen into the gas grid, would provide a stable outlet and reduce dependence on individual offtakers.

"Hydrogen producers need a safety net. Right now, if they fail to sell their hydrogen, they're left with no subsidy for those volumes and very limited compensation — it's a loss. Having access to a network, like blending into the gas grid, could provide that critical fallback and reduce financial risk. This is particularly important as the production business model currently prohibits sales to risk-taking intermediaries who could otherwise provide this volume risk mitigation."

Jamie Mitchell — Head of Analysis, Hydrogen UK

While blending offers clear advantages, it has notable drawbacks. Many question whether blending green hydrogen — a costly resource — into the gas grid risks wasting its potential. Instead, it could deliver better returns and decarbonisation results in high-value sectors where, through direct application, it can replace grey hydrogen. Others point out that linking green hydrogen to natural gas demand, which is expected to enter long-term decline, risks creating transitional demand rather than fostering sustainable, scalable markets for the future.

"Blending green hydrogen into the gas grid isn't a good use case for such an expensive molecule. The focus should be on high-value sectors where hydrogen can replace grey hydrogen and deliver meaningful impact, rather than spreading costs across a system without clear accountability. Right now, anything outside of these established applications feels like an expensive science project."

Deniese Ramsundarsingh — Development Director, HYRO, Octopus Energy Generation

Strategic takeaway

Balancing blending with strategic priorities: While blending can stabilise demand and provide a safety net for producers in the short term, its role must be carefully balanced with the long-term goal of prioritising high-value applications that maximise green hydrogen's impact.

4. Additional considerations

4. Additional considerations

4.1 Supply chain risks

Demand uncertainty does not just jeopardise project development — it also poses significant risks to green hydrogen supply chain resilience. While supply chains have expanded their capabilities in response to years of government and industry hype around a hydrogen economy, uncertainty over FIDs has left them increasingly vulnerable. Without clear and consistent government signals, the risk of overinvestment or misaligned priorities grows, potentially destabilising the foundation needed to scale the industry.

Stranded investments are a significant concern for supply chain players that scale up capacity or develop specialised technologies, only to see projects delayed or fail to reach FID. At the same time, misaligned priorities — such as focusing on overly ambitious projects or technologies that lack market alignment — could lead to wasted resources and missed opportunities in areas with greater long-term potential.

"Over the past several years, supply chain companies have invested into hydrogen technologies, readying for the anticipated demand. Yet, despite their efforts, governments have been slow to provide the legislative framework required for growth in this industry, leaving these investments vulnerable"

Jake Martin — Business Development, Energy Transition Projects, Petrofac

Johnson Matthey, a UK-based leader in sustainable technologies, exemplifies this effort, having announced significant investments in new production facilities in 2022 and 2023. By mid-2024, however, the company scaled back its plans owing to slower-than-expected market growth.

Similarly, ITM Power, a prominent UK electrolyser manufacturer, has faced significant financial challenges. These issues stem not only from external market conditions but also from internal manufacturing delays and operational inefficiencies, particularly in scaling its new 2MW electrolyser units. While ITM has initiated strategic restructuring to address these challenges, its experience highlights another layer of risk within the hydrogen supply chain: the need for operational resilience alongside market alignment.

These cases underscore the precarious position of supply chain companies in the hydrogen economy. Whether due to market volatility or internal execution challenges, the supply chain's vulnerability reinforces the urgent need for consistent, long-term policy signals and actionable commitments to stabilise the sector and restore investor confidence.

Strategic takeaway

Stabilising the supply chain: Clear and consistent government signals are critical to stabilising green hydrogen supply chains. Without long-term policy commitments and realistic project prioritisation, supply chain investments risk being stranded, undermining the industry's ability to scale effectively.

5. Conclusion

5. Conclusion

The future of green hydrogen projects

Building foundational demand is central to the UK's ambition to develop a thriving green hydrogen economy. Without a strong demand base, the sector will struggle to overcome systemic challenges such as attracting investment, scaling infrastructure and strengthening supply chains. While the UK is making significant strides in green hydrogen supply, a fully integrated approach is essential to realise the sector's potential.

Diversifying demand across clusters is the first step towards creating a scalable market, and the UK is already embracing this approach through initiatives such as the East Coast Cluster. Industries with strategic use cases, such as heavy industry and ammonia production, offer immediate opportunities to anchor demand within these clusters, leveraging their concentrated energy needs and existing infrastructure. These use cases help stabilise demand within clusters, attracting investment and paving the way for a connected national network. This raises a fundamental question: How will the UK connect its hydrogen clusters?

In the short term, hydrogen blending offers a practical solution. By injecting green hydrogen into the existing gas grid, producers gain access to a pseudo-national hydrogen network that provides a demand floor and reduces financial risks. This transitional mechanism provides immediate relief, allowing clusters such as Teesside and Humber to balance surpluses and deficits, while avoiding the inefficiencies of isolated development. Furthermore, blending supports early investment by providing consistent offtake, enabling producers to scale operations and build momentum.

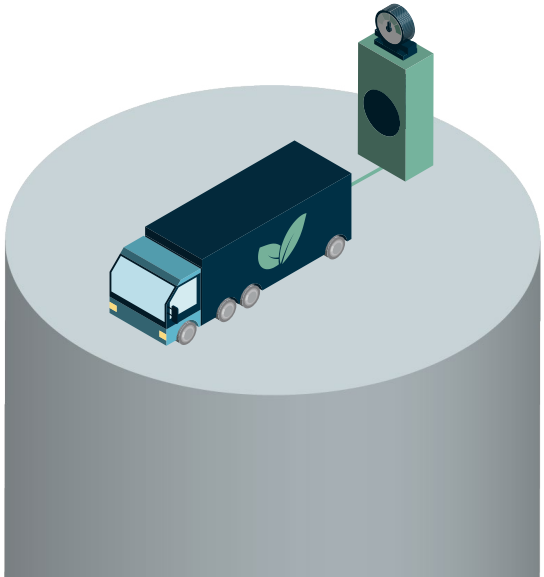
However, blending is not without limitations. Once green hydrogen is blended into natural gas, it cannot easily be separated, limiting its use to heating and power generation while excluding it from high-purity applications such as steelmaking or chemical production. Additionally, tying hydrogen demand to natural gas risks creating a transitional market that fails to scale sustainably as gas demand declines. For these reasons, blending must be viewed as a temporary tool to address immediate gaps, not a substitute for dedicated hydrogen infrastructure.

Long-term success requires a purpose-built hydrogen pipeline network to decouple hydrogen from natural gas and support high-value applications. Germany's hydrogen backbone offers valuable lessons in planning and investment, demonstrating how interconnected pipelines can reduce market risks and enable hydrogen to grow as an independent commodity. However, the German experience also highlights the challenges of delays and uncertainty, underscoring the need for clear timelines and funding mechanisms in the UK's approach.

Balancing energy security, decarbonisation, and industrial growth remains a complex challenge. While infrastructure forms the backbone of a hydrogen economy, it cannot deliver growth in isolation. Effective infrastructure must be paired with financial mechanisms that strengthen investment prospects and build market confidence. CfDs, mandates and government-backed guarantees are essential tools to de-risk investments and bridge the cost gap with incumbent fuels. Lessons from the EU, where transitional provisions have supported early movers, further underscore the importance of predictable revenue streams and clear regulatory frameworks. By adopting a balanced approach, the UK can create the stability needed to encourage private-sector confidence while maintaining ambitious emissions standards.

Equally critical is supply chain resilience. Supply chain stakeholders risk stranded investments and misaligned priorities that undermine scalability without consistent policy signals and demand stability. Coordinated efforts between government and industry are vital to stabilising the supply chain, aligning development priorities with growing demand and ensuring the hydrogen sector evolves sustainably.

The UK stands at a pivotal moment in its green hydrogen journey. Achieving a resilient, scalable hydrogen economy requires an integrated strategy that balances immediate needs with long-term goals. A demand-driven approach — supported by strategic use cases, clear policy signals and financial mechanisms — will create the conditions for investment and scalability. While short-term solutions such as blending can stabilise early markets, long-term planning for dedicated infrastructure is essential. Aligning this with supply chain resilience and financing incentives will position green hydrogen as a cornerstone of the UK's decarbonisation strategy, transforming it from a transitional tool into a driver of industrial growth and climate resilience.



6. Acknowledgements

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We extend our thanks to all contributors for their insightful input and dedicated efforts in the creation of this white paper, with special thanks to Andrew Kemp, Head of Content Advisory at Copy Curator.

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About Osborne Clarke

Osborne Clarke is an international legal practice with over 250 years of experience, offering strategic and on-point advice across Europe, Asia and the US. Our clients range from market leaders to high-growth start-ups.

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The energy sector is shifting towards a low-carbon economy, requiring significant investment in various technologies. Our energy team partners with investors, developers and network operators to support the transition to net zero. We assist with project development, financing, M&A, joint ventures and represent clients in cross-border litigation and risk mitigation.

We specialise in energy innovation, delivering strategies for growth and risk reduction across technologies like solar, battery storage, wind, carbon capture, green hydrogen, nuclear, EV charging and digital infrastructure.

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January 2025

Publication number OSB.CLA.454 E_2501071222