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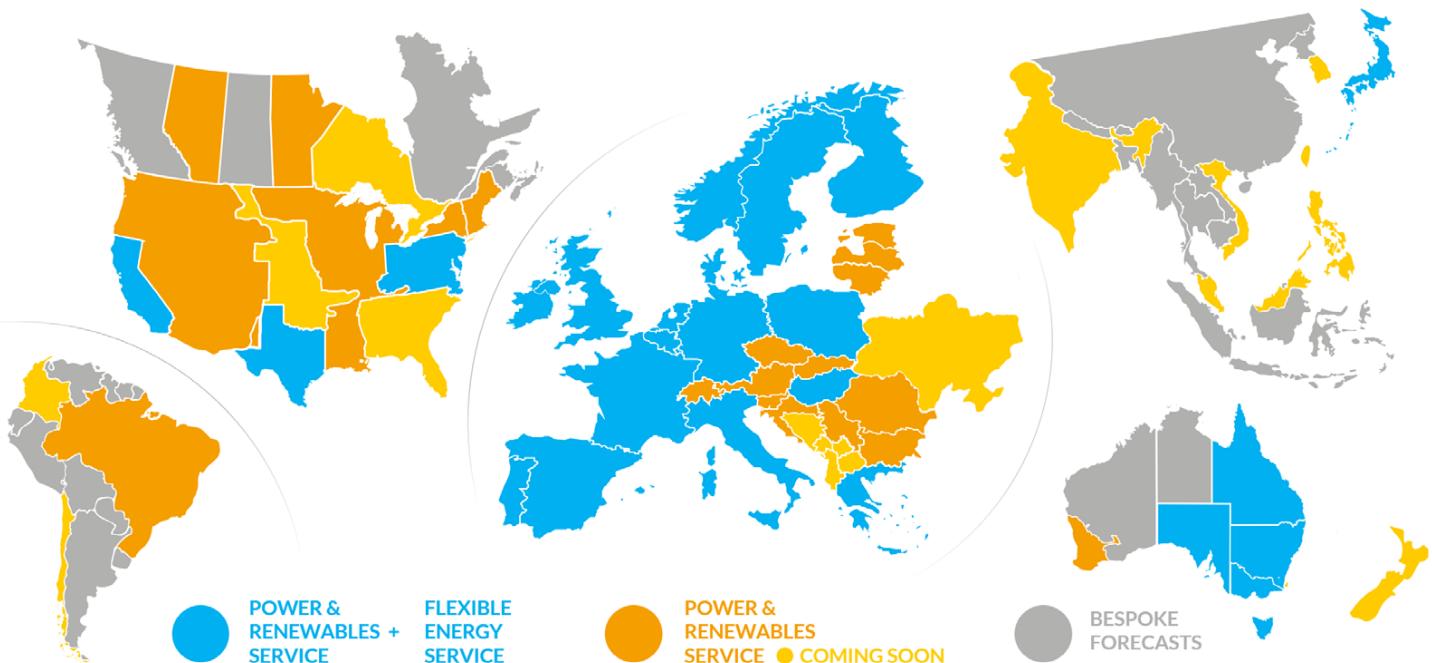
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DEAR FRIENDS AND COLLEAGUES

It was my pleasure to welcome you to London for the Aurora Hydrogen Conference 2024. I hope you enjoyed it as much as we enjoyed the energy and eagerness from everyone there on the day.

In a context of growing realism about the sectors where hydrogen can and should be used, the Conference focused on understanding how and when demand will develop in these sectors. The difficulty to align production costs with the willingness to pay for hydrogen, and the role of policy and subsidies in helping to bridge the gap between them, completed an afternoon filled with insightful content.

I hope this pack helps to give a good summary of the Aurora team's main takeaways from the day. It is obviously not feasible to do justice to the experience of being there—the excellent quality of the discussions in the room and the value of the new connections made in the drinks reception—but we hope this serves as a useful synopsis.

Many people merit thanks for the critical role they played in delivering the Aurora Hydrogen Conference 2024.

All of our guest speakers were brilliant, insightful, and engaging. A big thank you to Alexander Voigt, André Pina, Dalia Majumder-Russell, Deniese Ramsundarsingh, Johanna Schiele, Nathalie Lemarcis, Nick Winser, Pierre-Germain Marlier, and Rajesh Kedia.

Our generous Partners, CMS and HH2E, as well as our Branding Partner, Clarke Energy, deserve particular appreciation. We would like to thank them for their contributions to the success of the event!

Finally, thank you to the team at Aurora, including our panel chairs Anise Ganbold, Dilara Caglayan, and Alexander Esser and our keynote speakers, Frederik Beelitz and Emma Woodward. Special recognition also goes to the Events and Marketing teams, who delivered another seamlessly organised event, for their commitment, expertise, and good humour.

We look forward to welcoming you to future Aurora conferences, and let's keep the conversation going in the meantime!

Dan Monzani

Managing Director, UK & Ireland,
and European Hydrogen, Aurora



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MEDIA MENTIONS

THE TIMES Home UK World Comment Business & Money Sport Life & Style Culture Puzzles Magazines

Power-line planning reform could cut time to build by nine years

The government's independent adviser says a strategic plan could reduce the construction period to half a decade in the push to achieve 'net zero'

Emma Powell

Thursday October 03 2024, 12.01am, The Times

UK news

The government has set out a stretching target that includes quadrupling offshore wind energy by 2030 with a view to delivering a net zero electricity network.

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Green steel is heavily subsidised

Letter from London: Hydrogen hits peak hype

A new realism is shaping the ambitions of the clean hydrogen industry after years spent overstating its decarbonisation potential

End use

Stuart Penson
27 September 2024

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Hydrogen pipeline dwindles as "realism" hits – Aurora

(Montel) Hydrogen's anticipated role in the green

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UK's strategic energy plan banks on hydrogen storage

By Ed Reed 27th Sept 2024, 12.09pm

The mood is very much in favour of the strategic spatial energy plan (SSEP). But what impact will this have on hydrogen's prospects?

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26/09/2024, 3:01 pm By Mark Selby and Ed Reed

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Green hydrogen has become a "premium clean fuel" due to the high cost of production, with the nascent fuel "energy intensive but expensive" and increasingly valuable as an energy store, according to UK National Infrastructure Commission commissioner Nick Winser.

Speaking at the Aurora Hydrogen Conference in London on Wednesday, Winser said

ISSUE 25 / 30 SEP 2024

Kallanish Power MATERIALS

Industry to lead European green H2 offtake: Aurora

By: Reethu Ravi, UK

Industry and mobility are set to become the key offtakers for planned European electrolyser projects according to power analytics provider Aurora Energy Research.

The pipeline covers 117 projects with a total capacity of 9.9 gigawatts for the mobility sector, and 115 projects and a combined capacity of 13.5 GW for industrial use.

"The volume of capacity of electrolyzers for the industrial sector is significantly higher," explains Frederik Beelitz, principal at Aurora. "That signals and shows that industry is the main off-taker for this early stage development of the hydrogen economy."

Beelitz was speaking at the Aurora Hydrogen Conference 2024 held in London last week, attended by Kallanish.

EXPECTED OFFTAKE SECTORS IN EUROPE

Sector	Number of projects	Total capacity (GW)
Mobility	117	9.9
Industry	115	13.5
Power	24	1.3
Grid balancing	21	1.3
Synthetic fuels	11	1.7
Heat	11	0.3

SOURCE: AURORA ENERGY RESEARCH

Barriers to securing demand

Yet, the principal cautions that perhaps "we've reached peak hype in the hydrogen segment, and we're now at a point of realism."

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SOCIAL MEDIA MENTIONS

HH2E • 2nd
MH2E
8,519 followers
1w • Edited • 5

The **Aurora Energy Research** Hydrogen Conference never disappoints. Fantastic expert speakers delivered updated insights and fact-based research with remarkable clarity to an audience of around 500 energy sector professionals.

Here are some key takeaways:

- 👉 In the last 12 months, at least 4.7 GW of electrolyser capacity has reached FID, marking a significant increase from previous years.
- 👉 By 2030, Germany is projected to lead Europe in hydrogen demand, with estimates ranging between 53-70 TWh.
- 👉 The new 13k legislation strengthens the competitiveness of green hydrogen production in Germany, positioning it against regions with a higher share of renewable electricity in their grids, such as Iberia and the Nordics.
- 👉 The initial hype has faded, shifting from the belief that hydrogen would solve all of the energy sector's problems, to the emergence of a market grounded in much-needed reality: The demand is there, and the means to develop production are beginning to take shape.

The panel, moderated by **Alexander Esser** from Aurora, featured **Nathalie Lemarcis Société Générale**, **Alexander Voigt HH2E** **André Pina EDP Renewables** and **Pierre-Germain (PG) MARLIER Hy24**. Together, they explored how to make hydrogen projects financially viable.

💡 After the panel, **Alexander Voigt** expressed his excitement about the historic moment unfolding before us. A new energy market is emerging, and in a few years, society will likely forget these early stages—just as solar, wind power, and batteries are now taken for granted despite the initial doubts. He believes the green hydrogen sector will evolve faster than any previous development in the energy industry.

A huge thank you to the Aurora Hydrogen Conference organization team members, moderators and all the speakers!

David Hunter • 2nd
Investment Actuary @ Renewity | Co-Founder, CIO
6d • 5

Had a great innovation day in the world's greatest city (London, I'm biased) last Wednesday with two provocative events. First up, **Aurora Energy Research's** excellent #hydrogen event, "Europe's Hydrogen Economy: Policy, Demand, and Investment Insights", presented great content alongside insightful discussions. Tremendous data on demand, offtake pricing, willingness to purchase targets, and key refining and user demand indications. Some key messages:
 - the early hydrogen hype curve peak has passed; disappointing those who overestimated transition speeds and timeframes. An increasingly common broader refrain, implying eg that both government subsidy and political capital are at risk of being wasted.
 - mobility demand growth in particular is now thought likely to become less impactful going forward - in parallel (?) with overblown expectations for electric vehicle penetration and a premature death foretold of the internal combustion engine.
 In all, some encouraging and overdue realism now bedding down. My response to provocation #1 for the day on how to invest in the H2 commodity? Still (usually always) best to avoid subsidy-driven strategies (NB electrolyzers don't volume-scale like solar panels or turbine blades) and focus on lowest production cost truly sustainable long term winners.
 Some great contributions from **Nick Winser CBE FREng**, **Emma Woodward**, **Pierre-Germain (PG) MARLIER**, **Johanna Schiele**, **Deniese Ramsundarsingh (藍允懷)**, **B.Eng, C.Eng, MBA**, **Dan Monzani**, **Dalia Majumder-Russell**, **Alexander Voigt** and others.

Dan Keenan • 2nd
Business Development Manager at Terra Firma Energy Limited
Visit my website
1w • Edited • 5

Yesterdays hydrogen conference hosted by **Dan Monzani** and his team at **Aurora Energy Research** provided us with a number of realistic viewpoints into the role hydrogen will play in Europe's energy transition.

What was made clear from a number of the guest speakers present are the challenges these projects face including, high production costs, lack of infrastructure, requirements of both incentives and penalties at national levels, storage and transportation and most importantly access to offtakers.

Speaking to colleagues after the event at Central Hall Westminster last night the general consensus, although optimistic, was that there is still a long way to go for hydrogen projects to gain a competitive advantage in Europe.

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Ryan Fraser • 2nd
Director - Renewable Energy - Lombard
1w • 5

More local this week and it was the Hydrogen Conference at the beautiful Central Hall Westminster. Another day of learning about the solutions that can power our future as well as meeting more people that can support in making it happen!

Kathryn Emmett (She/Her) • 2nd
Senior lawyer and Head of infrastructure, energy and natural resources Knowl...
1w • 5

Congratulations to **Aurora Energy Research** on a great #Hydrogen conference yesterday.

Some great discussion and insights - my highlights:

💡 **Nick Winser CBE FREng**, Commissioner of the National Infrastructure Commission, highlighted the importance of hydrogen in industry and as an inter-seasonal storage vector, and the role of government in enabling production, transport, storage and hydrogen-to-power

💡 **Dan Monzani**, Aurora Energy, observed that we have passed peak hype about hydrogen and the market has now moved to realism

💡 **Johanna Schiele**, EU Commission, DG CLIMA, discussed the first EU Hydrogen Bank auction and how approaches to managing electricity price risk helped the successful projects to bid low prices

💡 **Deniese Ramsundarsingh (藍允懷)**, **B.Eng, C.Eng, MBA**, HYRO, noted that offtake is crucial for production project economics. But offtaker willingness to pay will depend on whether higher costs can be passed on, as well as the incentives and penalties applicable to offtakers - here the price for carbon is important but shouldn't bring offtakers to their knees

💡 Pierre-Germain Marlin, Hy24, commented that the cost of hydrogen must also be viewed in the context of the other offtake agreement terms - this means we are likely to see a broad spread of prices per kg of H2



Giulia Bottaro (She/Her) • 2nd
Americas reporter at Kallianyi Power Materials | Podcaster at Shaken Not Bur...
1w • 5

What a great day yesterday at the Aurora Hydrogen Conference organised by **Aurora Energy Research**.

I learn a lot about auctions in the UK and the EU, how to increase offtakers' willingness to pay, and what investors seek in a hydrogen project. And what a stunning venue, too!



Alexander Voigt • 2nd
Vorstand und Gründer bei HH2E
1w • 5

It is so wonderful to learn how the future is paving its way and to see how the hydrogen business is evolving in front of our eyes..we are all witnesses of a historic moment...the birth of the new energy age..in a few years, nobody will remember these early days as it was with batteries and PV, but much faster this time with green H2! **Aurora Energy Research**, thank you for creating these annual snapshots for us that enable us to realize what Change is. A big thank you to the community, and let's #changethegameofenergy together 💪😊

Malcolm McQuat • 3rd+
Renewable Energy Resources
5d • 5

Last week I attended the 2024 **Aurora Energy Research** Hydrogen Conference at Westminster Hall in London. I am grateful to have been apart of this critical conversation surrounding the UK and Europe's decarbonization strategy. Panelists from **European Commission** and **UK Infrastructure Bank** provided clarification of ongoing policy work, while sector leaders shared insight on engineering challenges and breakthroughs.

Most important on the agenda was identifying the key industries and sectors that will have the heaviest end-use demand for hydrogen. It is clear that electrification alone cannot meet the unique needs of a decarbonized industrial society, and that hydrogen is a promising alternative.



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PROGRAMME HIGHLIGHTS

INTERVIEW AND Q&A

Speakers:

- **Nick Winser**, Commissioner, UK National Infrastructure Commission
- **Anise Ganbold**, Head of Research for Hydrogen and Global Energy Markets, Aurora

Summary:

According to the NIC's Second National Infrastructure Assessment, the carbon emissions of GB's six industrial clusters must halve by 2035 to deliver Net Zero by 2050; unsurprisingly, hydrogen is expected to play a major role. In this session, Winser drew on the report's findings to explain how hydrogen can help deliver decarbonisation.

Fundamentally, hydrogen will be a premium clean fuel with highly specific applications where there are no cheaper clean alternatives—in the hard-to-electrify industries and as an interseasonal storage vector in the power system.

"Building out the capacity for hydrogen to deliver these functions will require at least 8 TWh of H₂ storage capacity and 30 TWh/year of electricity generation from H₂ or methane with CCS by 2035."

How can this be delivered?

1. Government support: Winser explained that subsidies will need to be provided in four key areas: green hydrogen production, storage, transportation, and hydrogen-to-electricity conversion.
2. Infrastructure investment: The construction of a 'core transmission network for hydrogen' would connect the most likely initial sites of hydrogen demand, production, and storage. Winser emphasised that this would be a transmission system rather than a distribution system and could integrate the CO₂ network that will be required for effective CCS.
3. Spatial planning: Rather than producing hydrogen near existing industrial clusters, Winser recommends using large, and often constrained, renewable resource in Scotland to produce green hydrogen and then transporting this via the core network to demand centres in England and Wales. Winser highlighted the trade-off between building hydrogen transport infrastructure and expanding the electricity transmission system: while the build-out of hydrogen pipelines will be expensive, it would alleviate the constraint on the electricity transmission system, thus reducing electricity grid expansion costs. This holistic system cost analysis could ultimately bring the cost of green hydrogen into line with that of blue hydrogen.

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AURORA KEYNOTE

SECURITY OF DEMAND: A ROADBLOCK FOR THE HYDROGEN ECONOMY?

Speaker:

Frederik Beelitz, Advisory Principal, Aurora

Summary:

The hydrogen hype has turned to realism as projects have started coming online. When comparing willingness-to-pay (WtP) for hydrogen and projected hydrogen offtake agreement prices, there is a gap. This disparity has contributed to a decline in hydrogen project announcements in 2024 compared to previous years, signalling challenges in the planning and development of hydrogen projects.

The mobility and industrial sectors show the most promise, particularly because they attract larger-scale projects. According to Aurora's analysis, the refinery industry, chemical industry, and, subsequently, steel industry are likely to be the first to transition to hydrogen. Refineries and ammonia production already use grey hydrogen, making the switch to green hydrogen more straightforward. Green steel, on the other hand, has attracted substantial subsidies, indicating political momentum behind it.

In Germany, Aurora estimates the hydrogen purchase agreement (HPA) price to be 11.3 €/kg by 2030. For ammonia production, only a financial penalty resembling that of the RefuelEU initiative in aviation can raise the WtP above the HPA price. For refineries, a greenhouse gas (GHG) certificate cost of 600 €/t of CO₂—the maximum certificate cost—is required. In steel production, even with Aurora's high carbon price scenario, the WtP remains below the HPA price. While the necessary tools and mechanisms to close this gap exist, more time is needed for their effective implementation.

Key takeaways from the keynote include the following:

- Industry will be the main early adopter of bulk hydrogen demand. Refineries and ammonia production, already major users of grey hydrogen, can transition more easily, with steelmaking to follow by adopting DRI-EAF technology using hydrogen.
- The main barrier to securing demand is the gap between willingness-to-pay and the projected costs of production; additional incentives are needed to accelerate the switch to green hydrogen.
- Willingness-to-pay can also originate from avoiding penalties, such as carbon prices and the GHG quota in Germany.

Click [HERE](#) to view the presentation



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PANEL DISCUSSION

DRIVING DEMAND – WHAT'S WORKING, WHAT'S NOT: SOLVING THE CHICKEN AND EGG DILEMMA FOR A SUCCESSFUL HYDROGEN MARKET RAMP UP

Chair: Dilara Caglayan, Research Lead, Aurora

Speakers:

- Dalia Majumder-Russell, Partner (Energy), CMS
- Deniese Ramsundarsingh, Development Director HYRO, Octopus Energy Generation
- Johanna Schiele, Policy Officer, EU Commission, DG CLIMA
- Rajesh Kedia, Director, Banking & Investments, UKIB

Summary:

This panel discussion addressed the “chicken and egg” dilemma in the hydrogen market, focusing on demand-side challenges. The EU’s pilot auction, attracting 132 bidders and 1.5 GW of electrolyser projects, demonstrated strong interest but also raised concerns about the low clearing price of 0.50 €/kg H₂. The UK’s subsidy-driven approach has resulted in more offtaker engagement, but high production costs remain a hurdle. Both regions acknowledged the critical need for robust hydrogen transport and storage infrastructure. Financing challenges for large-scale projects and the complexities of temporal correlation and green hydrogen certification were also key discussion points.

The UK and EU are pursuing different strategies. While UK subsidies have incentivised projects, long-term cost competitiveness is a concern. The EU’s “carrot and stick” approach, using mandates and penalties alongside incentives, faces challenges in setting appropriate penalty levels and ensuring price transparency.

Highlights from this panel include the following:

- The EU pilot auction demonstrated strong demand but raised concerns about low clearing prices.
- The UK’s subsidy approach has spurred project development but needs to address high costs.
- Transport and storage infrastructure is a major bottleneck for hydrogen market growth.

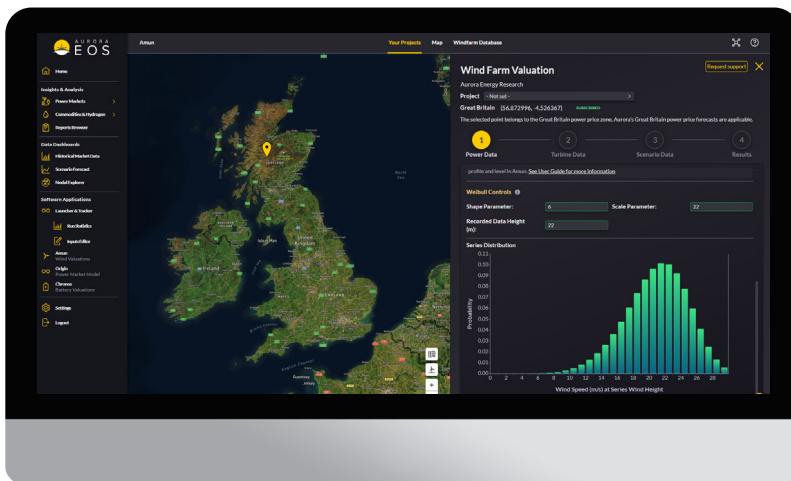
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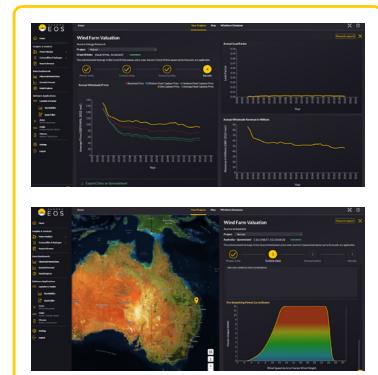


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AURORA KEYNOTE

THE EMERGING EUROPEAN INVESTMENT LANDSCAPE

Speaker:

Emma Woodward, European Hydrogen
Market Lead, Aurora

Summary:

"A robust transport and storage infrastructure is a necessary part of allowing the overall market to develop."

European hydrogen regulations present an opportunity for countries with high renewable penetration as electrolyzers can connect directly to the grid, allowing them to be located closer to hydrogen demand and to operate at higher load factors. These factors, along with the fact that high renewable penetration results in cheaper electricity, allow countries with higher renewable penetration to access lower Levelized Costs of Hydrogen (LCOHs). Currently, only regions of the Nordics and Italy can meet this requirement for 90% renewable power, with Spain, Portugal, and the Netherlands expected to join before 2040. As a result, the Nordic and Iberian regions are expected to be the cheapest regions to produce hydrogen in Europe in 2030.

However, countries which are willing to integrate electrolyzers into their power systems could also benefit from lower LCOHs. Germany's 13k mechanism, for example, allows electrolyzers to purchase renewable energy that would have otherwise been curtailed at a discounted price. Under this mechanism, the transmission system operators (TSOs) determine the volumes available, at the latest, two hours before the close of the spot market auction on the day before delivery. Despite this, a robust transport and storage infrastructure would still allow imports from countries with high renewable penetration to outcompete domestic hydrogen production in Germany.

Highlights from this keynote include the following:

- The 13k mechanism in Germany could reduce the LCOH produced via a PPA business model by 12–17%.
- By 2030, industry will drive 84% of hydrogen demand, primarily from ammonia and refineries, with Germany being the largest demand centre in Europe.
- The cost of hydrogen transport makes up just 5–11% of the total cost of delivered hydrogen, meaning that countries with higher renewable penetration could still outcompete local production.

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PANEL DISCUSSION

TURNING HIGH RISKS INTO HIGH REWARDS: PRINCIPLES FOR SUCCESSFUL HYDROGEN INVESTMENTS

Chair: Alexander Esser, Head of Nordics & Baltics, Aurora

Speakers:

- **Alexander Voigt**, CEO, HH2E
- **André Pina**, Global Associate Director, Hydrogen Strategy & Origination, EDPR
- **Nathalie Lemarcis**, Managing Director & Head of Origination and Advisory for Europe, Société Générale
- **Pierre-Germain Marlier**, Investment Director, Hy24 & Co-founder, FiveT Hydrogen

Summary:

The session covered the key criteria needed for success in financing new hydrogen projects. Drawing on real project experience referenced throughout, including the H2 Green Steel project in Sweden, the panel discussed power procurement strategies, transport and storage options, and different offtake contract structures.

Nathalie Lemarcis (Société Générale) noted the limited precedent of completed hydrogen projects in Europe makes debt financing challenging. She emphasised that many projects, being first-of-a-kind, face regulatory, technology, construction, and offtake risks.

André Pina (EDP Renewables) highlighted how hydrogen could be an attractive route-to-market for new renewable projects. However, as the sector is still developing, developers are still looking for projects with a grid connection to provide a safety net and reduce the value at risk.

When discussing power procurement strategies, Alexander Voigt (HH2E) highlighted how electricity market reform could benefit hydrogen project economics. He pointed to the case of the possible bidding zone split in Germany, where northern areas, benefiting from significant offshore wind capacity, could be an attractive location for new electrolyser capacity.

Pierre-Germain Marlier (Hy24) noted that the success behind the financing of the H2 Green Steel project was due to its access to 24/7 renewable hydropower, the blue-chip off-takers, and limited dependence on complex transport infrastructure.

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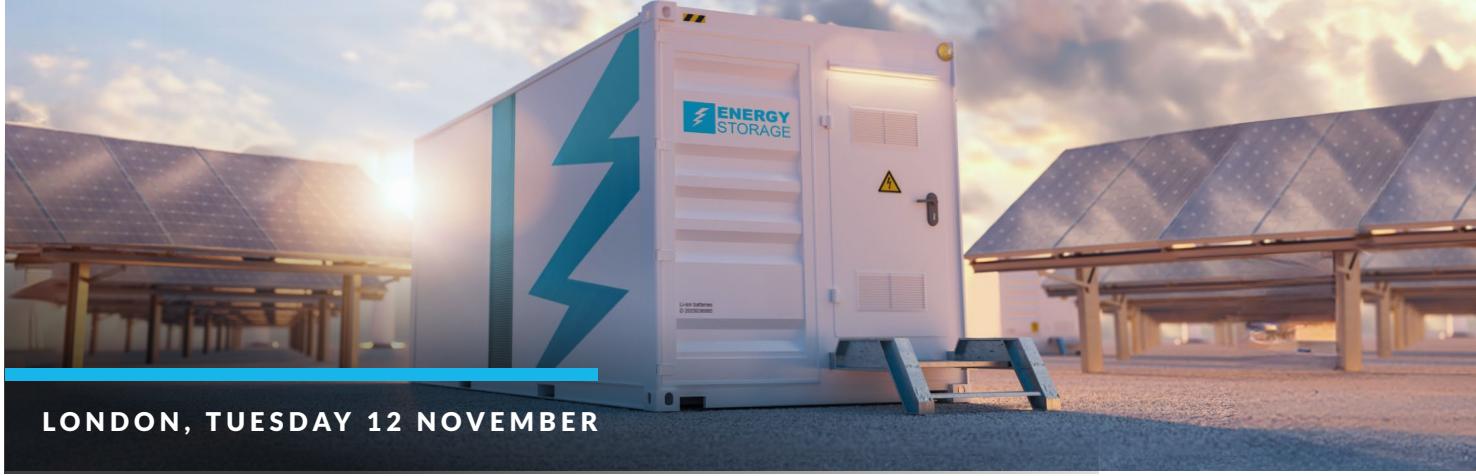
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