

AURORA

Hydrogen Conference

London 2023

SCALING UP THE EUROPEAN
HYDROGEN ECONOMY:

UNLOCKING
OPPORTUNITIES
& INVESTMENT



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London 2023



DEAR FRIENDS AND COLLEAGUES

It was my great pleasure to welcome you to the Aurora Hydrogen Conference 2023. Building on the success of our first Hydrogen Conference, the event attracted even more attendees, with a high level of engagement with the keynote and panel sessions, as well as energetic networking in between.

The significant progress being made in developing a hydrogen economy in Europe contextualised this conference. Since the Energy Crisis, the level of policy focus to bring hydrogen policy ambitions to reality has remained extremely high. Hydrogen standards are largely settled, enabling the European Commission, Member States, and the UK Government to advance with support schemes for hydrogen production and usage. The industry is also gearing up, with the pipeline of projects continuing to increase and the supply chain scaling up its capabilities.

The Aurora Hydrogen Conference focused on the barriers and enablers to delivering on the hydrogen opportunity—with a particular focus on how subsidy eligibility rules and offtaker requirements shape economic business models and project investibility.

I hope this highlights pack helps to distil our main takeaways from the day. It is impossible to do justice to the experience of being there and the richness of the questions and challenges in the room, but we hope this is a useful synopsis.

We were incredibly grateful to be joined by thought leaders from industry and government who provided their views on the challenges and solutions to deliver our hydrogen ambitions. Many thanks to the following speakers for bringing their insights to our panel sessions: Alexander Voigt, Bart White, Catherine Raw, Colin Hudson, Dalia Majumder-Russell, James Richardson, Jeremy Smith, Liliya Ivanova, Paro Konar, and Stefanie Hiesinger.

We are very grateful to our Premium Partner SSE, our Panel Partners CMS and HH2E, and our Branding Partner, Clarke Energy, for supporting the event and making it a success.

Finally, thank you to the team at Aurora, including the panel chairs and keynote speakers, but especially to Ángel Cervera, Ethel Chiodelli, and Narcisa-Camelia Danila for their commitment and hard work in bringing this major event to fruition.

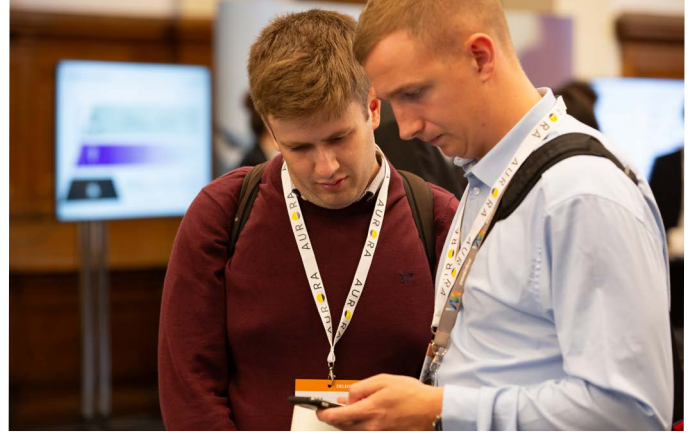
We look forward to welcoming you to future Aurora conferences, and let's keep the conversation going in the meantime!

Richard Howard,
Global Research Director, Aurora



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SOCIAL MEDIA

François-Xavier (Frank) Touzard • 2nd
 Head of Project and Infrastructure Finance EMEA | Sustainability & Inclusion...
 23m • 🌐

Thank you [Aurora Energy Research](#) and [SSE plc](#); [Clarke Energy](#); [CMS](#); [HH2E](#) for the very insightful Aurora Hydrogen Conference 2023 last week in Central Hall Westminster. Reflecting back to the 2022 edition the overall sentiment is that while behind-the-scenes progress is undeniably being made mostly with small equity-funded projects, there is a feeling that the situation has not changed much. As hydrogen is one of the pillar technologies of the solution for Net zero, a lot more needs to be done and a lot quicker, we really need to get on with building infrastructure. As with other technologies the truth is that we are falling way behind track for Net Zero.

Governments have a key role to play to jump start of the green hydrogen industry. In the UK the 250MWs and 750MWs for the first two rounds of CfDs for hydrogen are important steps in the right direction.

[#hydrogen](#) [#netzero](#) [#renewablefuels](#)



Sophie Crump • 3rd+
 Procurement & Commerical
 5d • 🌐

Great afternoon at the [Aurora Energy Research](#) - Scaling up the European Hydrogen Economy conference.

Insightful panel discussions surrounding the opportunities and challenges. Including the mechanisms and policies needed to make hydrogen a viable pathway to decarbonise the grid and carbon intensive industries.

[#hydrogen](#) [#hydrogeneconomy](#) [#netzero](#) [#decarbonisation](#)

Bart White • 2nd
 Managing Director, European Head of Energy Structured Finance at Santan...
 5d • 🌐

Thanks [Aurora Energy Research](#) for inviting me to speak - what an amazing venue to present in!

Great conversation. Overall a sense of the inevitable now as regulation and corporate ambition start to crystallise.

[#hydrogen](#) [#greenfinance](#)

Courtney Depala (She/Her) • 3rd+
 EngD, CEng, MIET, MEL, Research and Development Director at Mercia Powe...
 5d • 🌐

Home now after an afternoon in London at the Aurora Hydrogen Conference.

Great event with a good amount of perspective and data - some of the key points:

- ✔ Lots of talk about the need for systems thinking, whole system approach to allow for scaling and optionality. Key industries for hydrogen are decarbonising existing H2 production, high temp industrial uses and power sectors.💡
- ✔ Storage is going to be a key enabler to bring down costs of H2
- ✔ There is a strong case for an H2 transmission network in the UK as it is the most cost effective form of transporting H2, but other options like co-location could be interesting.
- ✔ There is a need for certainty and pace TODAY from government to allow for market development
- ✔ Subsidies will be important, both for capex and opex for viable business models.

It was also great to catch up with [Alan Beech](#) and [Huw Thomas](#) as well as meet [James Lythgoe](#).

Thanks to [Aurora Energy Research](#) for a great event!

Mark Hayward • 2nd
 Applications / Tendering Engineer at Edina
 5d • 🌐

Great afternoon down at Westminster for the [Aurora Energy Research](#) [#hydrogen](#) conference . Great panel discussions and key subject matters discussed over the hydrogen pathway and the mechanisms to make hydrogen production a viable pathway to net zero! All aboard the train (analogy) to net zero!

The size of the event really highlights the excitement of getting a hydrogen economy in place!



Katherine Elder • 3rd+
Data Analyst at Ofgem
4d • Edited •

Very interesting afternoon with [Aurora Energy Research](#) for their Hydrogen Conference 2023. Scaling up the European Hydrogen Economy: Unlocking Opportunities and Investment. Extremely interesting topic and the chance to listen to some incredible panelist discussions.



Dmytro Kuziak • 2nd
Connecting Projects with Funds - RES, BESS, Hydrogen, Novel Climate Soluti...
5d •

Just coming from [Aurora Energy Research](#) conference. Good organised with excellent speakers for [CMS UK](#), [SSE Thermal](#), [HH2E](#), [Santander UK](#), [Committee on Climate Change](#), [InfraRed Capital Partners Ltd](#)

Every time I am taking something from such events. This time among some things I previously had not thought about such as providing water to places with excess renewable energy but a deficit of water rather than H2 pipes from generation to off-takers.

But this time I have more questions. To start with

1. Is subsidizing [#hydrogen](#) projects instead of penalizing CO2 polluters, in general, a more productive way to discover better / the best decarbonization technology/ies (essentially subsidies vs. taxes).
2. Why the probable H2 prices are analyzed in the same way as electricity prices? Can H2 prices be defined in the way prices of commodities are defined? Are there other ways to price carbon-free energy supply?
3. Does the market expect retail customers to be the first in the line to use all the benefits of H2?

[#NetZero](#) [#Sustainability](#) [#Renewables](#)

BLUE Communications
2,526 followers
4d •

Earlier this week, BLUE's [Alisdair Pettigrew](#), [Emily Dove](#) and [Sam Jackson](#) attended the [Aurora Energy Research](#) Hydrogen Conference in Central Hall Westminster, London.

Our senior consultant Sam shared his thoughts on the key takeaways from the discussion:

"Getting hydrogen off the ground and building a market will require a different business model to the one that will dominate by the time green hydrogen becomes the molecule we all rely on for energy.

"Once we achieve a liquid market that turns hydrogen into a commodity like the oil we want it to replace, the business models that got green hydrogen off the ground in the first place could be a handicap for those companies - producers and off takers - that agreed to long-term supply contracts in order to pioneer the market for the rest of us.

"What came across listening to those business leaders thinking hard about hydrogen is that first movers may gain only small advantages over those that come afterwards. What is driving them? The same thing that they hope will drive off-takers to the market - a sense that they must do the right thing to make hydrogen the reality our climate challenged society needs it to be. Producers, off-takers, and their industrial and maritime customers, will need the support of government to make green hydrogen attractive.

"Listening to the speakers this week, the scale and urgency of the task makes building a hydrogen production, storage and supply sector undeniably daunting. But from the tone of the panellists, off-takers and others in the downstream market can take confidence that these obstacles will be overcome."

We're looking forward to continuing to be part of this ongoing and crucial discussion at our next energy industry event.

[#hydrogen](#) [#climatechange](#) [#energy](#) [#renewablefuels](#)

Verena Rathgeber • 3rd+
Director at Infracapital (M&G plc)
4d •

Fantastic Hydrogen Conference! Great discussions and networking in this fast growing sector. Thank you [Aurora Energy Research](#) !

[#hydrogen](#) [#energyconference](#) [#renewables](#) [#decarbonisingindustry](#)
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[CLICK HERE](#) to access a redacted HyMAR report

PROGRAMME HIGHLIGHTS



INTERVIEW AND Q&A:

A DEEP DIVE ON THE HYDROGEN POLICY IN THE UK

Dan Monzani, Managing Director, UK & Ireland, Aurora

Speakers:

Colin Hudson, Managing Director of Banking & Investments, UKIB

Paro Konar, Director for Hydrogen & Industrial Carbon Capture, DESNZ

Summary:

The future of the hydrogen economy is expected to be supported both by government policy and by private sector investment. Ambitious yet attainable government targets are expected to catalyse private investment in the hydrogen sector, addressing current challenges and advancing planned projects to Final Investment Decision (FID) stage. The Energy Bill, currently under consideration in Parliament, will play a pivotal role in shaping the UK's hydrogen and Carbon Capture Storage (CCS) economy, with a crucial emphasis on funding certainty.

Highlights include the following:

- Paro Konar of DESNZ stressed the government has no intention of changing its hydrogen ambition. The Prime Minister's recent speech aimed to clarify how these commitments would be realised. The government's immediate objective is to have the first round of electrolytic allocation projects (up to 250 MW) to reach FID by year-end.
- Additionally, the Energy Bill in Parliament will prioritise ensuring funding certainty. A funding mechanism that is further up the value chain is currently being considered, which will include applying a levy on energy producers in order to augment government funding.
- Colin Hudson highlighted the distinctions between conventional financial institutions and the UK Infrastructure Bank (UKIB), a state-owned development bank established to support the government's goal to reach Net Zero by 2050. Unlike traditional institutions, the UKIB offers a broader range of financial products, including bridge loans, mezzanine financing, pure equity, and senior debt. It maintains a strategy-agnostic approach and exhibits a greater risk appetite, allowing for lower hurdle rates in investments related to low-carbon projects.

Summarising Paro's remarks, the government's commitment to hydrogen remains unwavering, with a continued focus on successful delivery. The Prime Minister's speech aimed to provide clarity on how these commitments will be translated into concrete actions.

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AURORA KEYNOTE

ELECTROLYSER BUSINESS MODELS & SUBSIDY ELIGIBILITY

Speaker:

Dilara Caglayan, Lead Expert, European Hydrogen, Aurora

Summary:

“Compared to last year, we now importantly have a definition of green Hydrogen allowing dipping into subsidies which are required for hydrogen investment in most EU countries.”

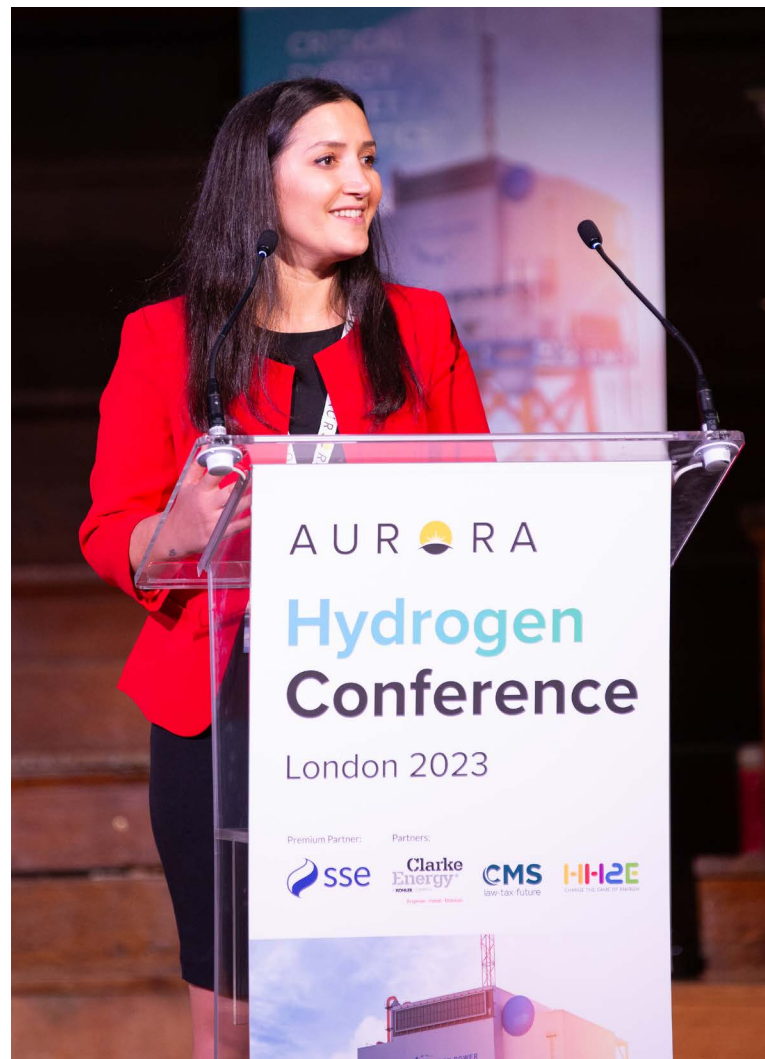
Like any investment, successful hydrogen projects hinge on three key factors: capital costs, operational costs, and revenues. While we have made significant progress in addressing the first two, revenue remains uncertain, primarily due to challenges with securing offtakers and the attraction of subsidies. Accessing subsidies requires hydrogen business models to meet standard criteria, which were somewhat unclear until the recent EU approval of a renewable hydrogen definition. This definition mandates that assets demonstrate additionality and establish temporal and geographic correlations.

These criteria are restrictive, but the delegated act explicitly defines four distinct business models that can bypass some of these criteria. These models include the co-located grid model, the 90% renewable grid model, the only curtailed power model, and the low carbon intensity model. Their suitability varies by country, depending on weather patterns and grid infrastructure. For instance, co-located grids are profitable in Spain due to high solar load factors, while 90% renewable grids are feasible in Sweden, Norway, and Denmark by 2030, offering tax exemptions for green hydrogen, creating a profitable scenario. The curtailed model is most cost-effective in Ireland due to substantial wind curtailment.

Key messages include the following:

- REDII compliance is mandatory for EU Hydrogen Bank subsidies and many national or import support schemes for renewable hydrogen.
- The most cost-effective REDII compliant electrolyser business model varies from one country to another. In Scandinavia, fully grid-connected electrolysers are projected to produce renewable hydrogen for less than 3 €/kg by 2030.
- Electrolyser projects in Denmark, Sweden, Norway, Ireland, and Spain can potentially be profitable without subsidies by 2030 if a pay-as-produced offtake agreement is secured. However, in other countries, up to 2.5 €/kg Hydrogen support may be needed to create economically attractive business models.

Click [HERE](#) to view the presentation





PANEL DISCUSSION

OPPORTUNITIES & CHALLENGES IN ELECTROLYSER ECONOMICS & FINANCING

Chair: **Adjmal Sirak**, Project Leader, Aurora

Speakers:

Alexander Voigt, Co-Founder & Board Member, HH2E

Dalia Majumder-Russell, Partner (Energy), CMS

Liliya Ivanova, Director, Origination & Execution, InfraRed Capital Partners

Stefanie Hiesinger, Head of Unit – Low Carbon Solutions, DG CLIMA, European Commission

Summary:

The session on “Opportunities and Challenges in Electrolyser Economics and Financing” featured experts in the field who discussed the investment climate for hydrogen electrolyser projects in Europe and the UK, along with the significance of long-term hydrogen off-take agreements. They also examined efforts to bridge the gap between production costs and willingness of offtakers to pay. The panel emphasised the necessity for a clear regulatory framework and economic incentives to support the growth of the hydrogen industry.

Highlights include the following:

- Liliya Ivanova emphasized the progress made in the hydrogen sector but also highlighted the importance of economics, subsidy support, and clarity in regulations.
- Dalia Majumder-Russel discussed the challenges of aligning producer costs with off-taker willingness to pay, as well as the need for market development.
- Stefanie Hiesinger highlighted the European Union’s Innovation Fund and pilot auctions as tools to reduce production costs and stimulate hydrogen projects.
- Alexander Voigt stressed the necessity of an integrated approach and compared the development of the hydrogen industry to the past development of the railway system. He called for greater support and incentives to drive demand.

In this discussion, experts delved into the complexities of hydrogen economics, the regulatory landscape, and the critical role of long-term contracts in underwriting electrolyser investments. Ultimately, they highlighted the need for a comprehensive and supportive framework to propel the hydrogen industry forward.



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AURORA KEYNOTE

HYDROGEN OFFTAKE AGREEMENTS: KEY CONSIDERATIONS FOR DEVELOPERS

Speaker:

Emma Woodward, European Hydrogen Market Lead, Aurora

Summary:

In the absence of a merchant market for low-carbon hydrogen, long-term Hydrogen Purchase Agreements (HPAs) with creditworthy counterparties are required to make hydrogen projects bankable and to enable access to available subsidies.

What are the key considerations when setting up a HPA?

Key commercial and legal clauses in a hydrogen purchase agreement will include the offtake price, volume, and quality of hydrogen. However, further legal terms will be required to manage other risks involved in construction, certification, operation, transport, and regulation.

What are the main drivers of HPA prices?

Offtake prices will be determined by the cost of producing, storing, and transporting hydrogen, and any subsidies that are available to the hydrogen producer. Analysing the levelised cost of hydrogen production from a co-located electrolyser with a grid connection in GB, Emma showed that, assuming the project receives a £3/kg subsidy, it would require an offtake price of £3.4/kg for an NPV = 0 business case in 2030.

HPA pricing structures include power-price-indexed Power Purchase Agreements (PPAs), fixed price PPAs, and less common 'tolling models' in which the hydrogen offtaker is responsible for purchasing the power required for hydrogen production.

Offtake profiles also impact prices, with baseload and regular daily offtake patterns coming at a significant premium compared to offtake-as-produced profiles.

How will HPAs interact with subsidies?

At present, most hydrogen projects are not economically viable without subsidy. While government support can transform project business cases and enable producers to offer hydrogen below production cost, HPAs need careful structuring to avoid undermining access to subsidy payments. Projects must ensure eligibility by meeting criteria such as carbon intensity thresholds and offtaker eligibility requirements.

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PANEL DISCUSSION

HYDROGEN USERS & OFFTAKE AGREEMENTS

Chair: Richard Howard, Global Research Director, Aurora

Speakers:

Bart White, Managing Director, Santander

Catherine Raw, Managing Director, SSE Thermal

James Richardson, Director of Analysis,
Climate Change Committee

Jeremy Smith, Head of Hydrogen Business
Development - UK, RWE Generation

Summary:

The vitality of the hydrogen market hinges on consumers, yet producers face hurdles, including the lack of offtakers, revenue support, certification issues, production-offtake mismatch and a deficiency in hydrogen storage and transport infrastructure. Encouragingly, there is momentum in bridging supply and demand through initiatives such as the double-sided H2Global auctions, contract for difference schemes to offset the cost of green premium, and the construction of production sites within an offtake cluster. The expert panel delved deeper into offtake sectors, agreements, buyer-seller dynamics, and financing.

Key takeaways from the discussion include the following:

The Climate Change Committee anticipates a 100 TWh demand by 2035 in the UK on its path to Net Zero. James Richardson emphasises three pivotal offtake areas: hydrogen's vital role in supporting renewable energy in the power sector during extended periods without sunlight, the urgent need for high-temperature heat industries to decarbonise, and the growing use of ammonia in the shipping industry. Looking further to 2050, there is an expectation of a substantial reinforcement of these targets.

Catherine Raw stressed the importance of storage, stating, "You'll require a buffer, not only to handle the intermittency of green hydrogen but also to manage the intermittent demand for green hydrogen." The value of storage in relation to the overall levelised cost of hydrogen is a critical consideration; these concepts remain untested in practice. Aligning offtake with production, initially through local networks and storage, will be vital, mirroring the gas system's approach.

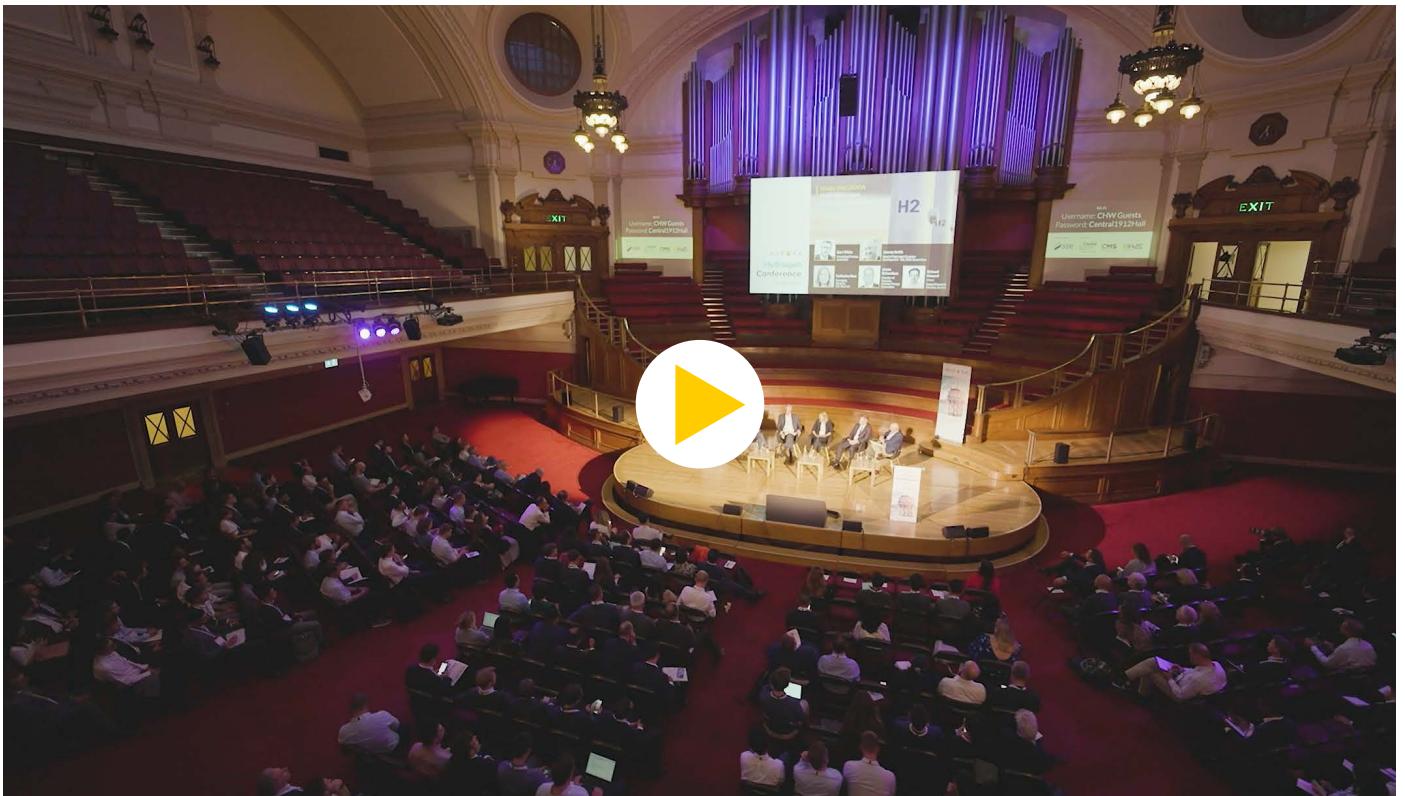
Bart White addressed the intricacies of financing with respect to offtake agreements, saying, "If you want debt, you have to navigate bankability." Evaluating a project's bankability in the nascent hydrogen market is complex. The outlook for various types of offtakers is exceptionally challenging, each presenting unique hurdles that banks must carefully evaluate.

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WATCH THE HIGHLIGHTS VIDEO



Chia Nwajagu
Regulatory Analyst, Orsted

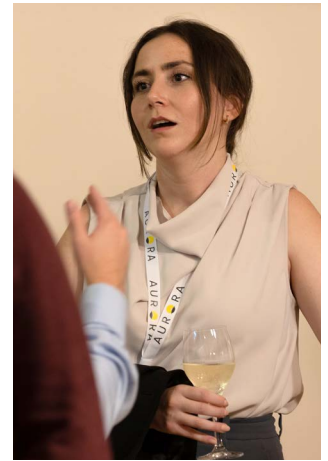
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Spring Forum

Oxford 2024

Tuesday 26 March

The Aurora Spring Forum will return for its 10th edition in 2024! This is the leading annual gathering of the European energy industry, bringing together thought-leaders from across the globe.

For more information about our events, please get in touch:

Ángel Cervera, Event Content Producer, Aurora
T: +44 1865 952700 ukevents@auroraer.com

Ethel Chiodelli, Events Logistics Coordinator, Aurora
M: +44 (0)78 53 195647 ukevents@auroraer.com

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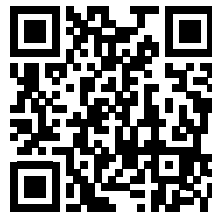


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