



# HYDROGEN AMERICAS 2024 SUMMIT & EXHIBITION

11 – 12 JUNE 2024

RONALD REAGAN INT. TRADE CENTER,  
WASHINGTON D.C.

# 2024

## EXECUTIVE SUMMARY

THE HUB FOR THE GLOBAL  
HYDROGEN COMMUNITY  
IN THE AMERICAS

WRITTEN BY



argusmedia.com

PRODUCED BY

# WITH THANKS TO OUR 2024 SPONSORS

## LEAD SPONSOR



## HOST SPONSORS



## GOLD SPONSORS



## SILVER SPONSORS



## BRONZE SPONSORS



## KNOWLEDGE PARTNER



# WITH THANKS TO OUR 2024 EXHIBITORS







# SUMMIT DAY ONE

PRODUCED BY  
 **se**  
Sustainable Energy Center



# HYDROGEN AMERICAS 2024 SUMMIT & EXHIBITION

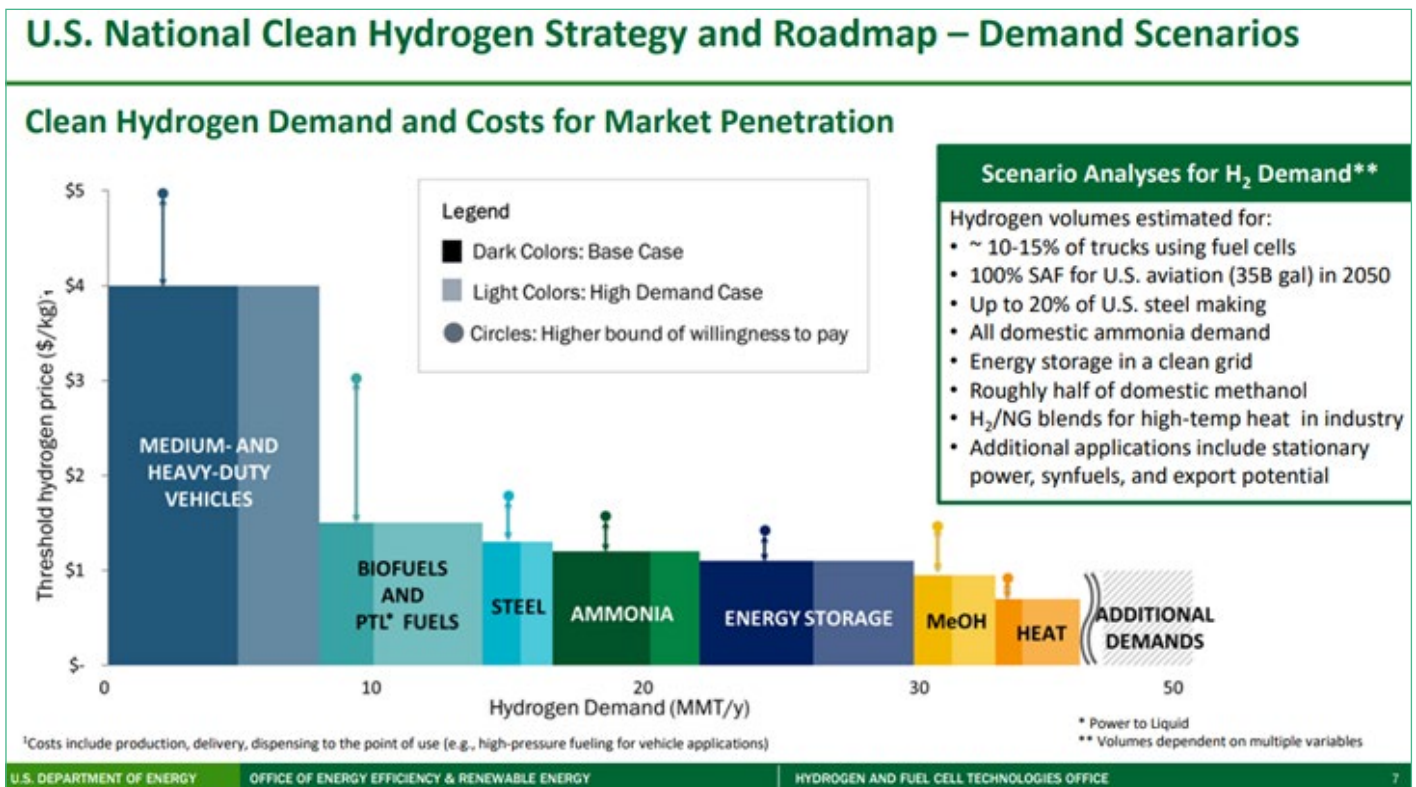


# OPENING KEYNOTE ADDRESS: U.S. CLEAN HYDROGEN STRATEGY OVERVIEW

The Hydrogen Americas Summit 2024 started with a presentation by the U.S. Department of Energy’s (DOE) Dr Sunita Satyapal. Dr Satyapal highlighted the massive challenges around ramping up hydrogen production and use and around the energy transition more generally – but she also outlined the steps taken by the U.S. towards tackling these.

**Dr Sunita Satyapal**  
Hydrogen and Fuel Cell Technologies Office  
Director and Hydrogen Program Coordinator at  
U.S. Department Of Energy

Among the key funding measures are the seven hydrogen hubs that were in October 2023 selected to receive a combined \$7bn in public funds and which involve projects for production, transport, storage and consumption. This funding is to be supplemented with \$1bn focused specifically on a demand-side mechanism for the hubs. Another key area are the 45V production tax credits included in the Inflation Reduction Act which will effectively provide subsidies of up to \$3/kg for hydrogen with the lowest emissions, although the final rules have yet to be determined and industry participants are urging decisionmakers to provide more clarity as soon as possible. Besides these measures, the government has also earmarked funds to support technology developments, especially around electrolyser efficiencies and costs.



# OPENING KEYNOTE ADDRESS: U.S. CLEAN HYDROGEN STRATEGY OVERVIEW

The U.S. wants to reach 10mn t/yr of clean hydrogen production by 2030, rising to 20mn t/yr by 2040 and 50mn t/yr by 2050.

By 2030, the initial demand could come from the ammonia and refining sectors, where existing grey hydrogen use could be replaced with cleaner sources, Dr Satyapal said.

But the DOE sees the highest willingness to pay for cleaner hydrogen in the road transport sector, with Dr Satyapal noting that the threshold price at which clean hydrogen use would be viable is around \$4/kg for medium- and heavy-duty vehicles, according to DOE estimates. Assuming 10-15pc of all trucks use fuel cells, this could provide around 8mn t/yr of hydrogen demand, based on the estimates.

Willingness-to-pay thresholds are much lower in other sectors, however, coming in at around \$1.50/kg for power-to-liquid fuels that could be used by aircraft. Use cases in steel, ammonia and as energy storage are lower still, coming close to \$1/kg.





# FIRESIDE CHAT: U.S. DOE CLEAN HYDROGEN PERSPECTIVES

Following Dr Sunita Satyapal’s opening keynote, she was joined by colleagues from other sections of the U.S. Department of Energy for the first session, shedding further light on the U.S.’ initiatives in the clean hydrogen space.

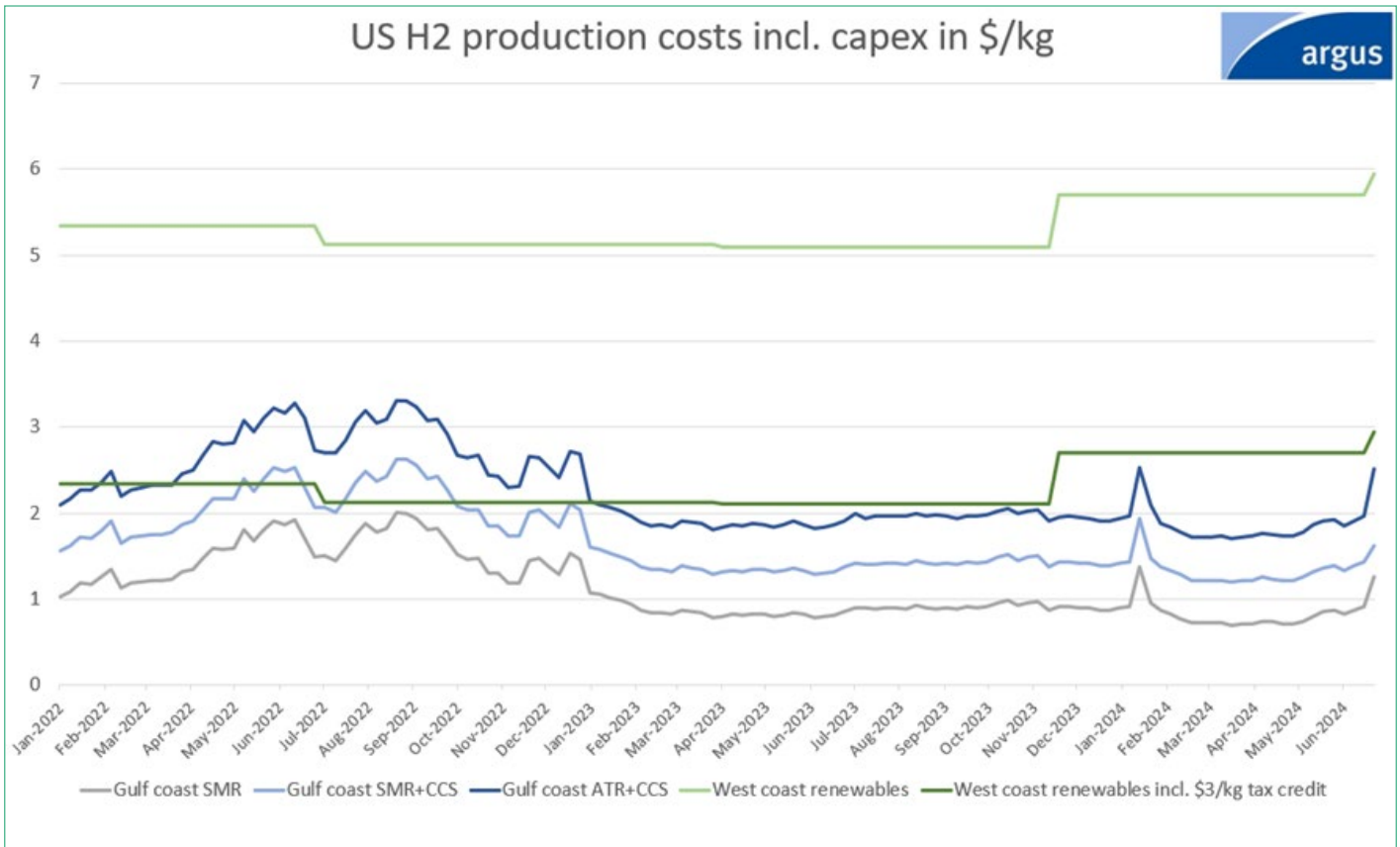
Representing the Office of Energy Efficiency and Renewable Energy, Jeff Marootian highlighted the substantial progress in clean hydrogen initiatives driven by significant federal investments in the U.S., emphasising in particular the pivotal role of inter-agency collaborations. Marootian’s office is focusing on supporting research and development in the hydrogen space. He pointed to \$750mn in federal funding that were recently allocated to companies advancing technology developments, including electrolyser and fuel cell manufacturers.

The department is also advancing programmes for international cooperation. Marootian announced the first two cooperations selected under the H2 Twin Cities programme which is aimed at sharing best practices and collaborating on feasibility assessments, regulatory challenges, infrastructure developments and other areas. Both selected cooperations involve the city of Houston, which will be partnering with Nuevo León, Mexico, and Barrancabermeja, Colombia.

**Dr Sunita Satyapal**  
 Director, Hydrogen and Fuel Cell Technologies Office and Hydrogen Program Coordinator, U.S. Department of Energy (Moderator)

**Jeff Marootian**  
 Principal Deputy Assistant Secretary, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy

**Kelly Cummins**  
 Acting Director, Office of Clean Energy Demonstrations, U.S. Department of Energy



## FIRESIDE CHAT: U.S. DOE CLEAN HYDROGEN PERSPECTIVES

Kelly Cummins detailed the \$8bn allocated for regional clean hydrogen hubs, which are designed to create coast-to-coast ecosystems that connect producers and end-users, but also support project financing and focus on workforce elements. She underscored the uniqueness of each hub, leveraging regional resources – with some based on renewable power for hydrogen production while others focus on gas-based or nuclear output – and addressing specific local needs. Cummins also discussed ongoing efforts to finalise cooperative agreements for these hubs and the launch of a demand-side program to enhance market transparency and investment.

Dr Satyapal emphasised the importance of international collaboration and standardisation to accelerate hydrogen deployment. The session concluded with a focus on the critical role of hydrogen in achieving clean energy goals and the collective effort required to drive market lift-off.





# FIRESIDE CHAT: VISION FOR A HYDROGEN ECONOMY IN THE AMERICAS

Beth Trask of the Environmental Defense Fund subsequently discussed the state of and outlook for the hydrogen sector, specifically in the Americas, with Air Products' Eric Guter.

**Beth Trask**  
 Vice President, Global Energy Transition,  
 Environmental Defense Fund (Moderator)


Air Products has been in the hydrogen space for 65 years and is operating more than 110 global hydrogen facilities as well as 700km of pipelines, Guter said. The company is now "leveraging" this experience into a clean hydrogen business and is investing \$15bn in decarbonised hydrogen facilities, he noted.


**Eric Guter**  
 Vice President, Hydrogen for Mobility,  
 Air Products

Guter also spoke about Air Products' supply deal with TotalEnergies that was announced in early June. From 2030, Air Products will deliver 70,000 t/yr of renewable hydrogen to TotalEnergies for cleaning up the French firm's European refining operations. The 15-year deal was signed on the back of TotalEnergies' tender for 500,000 t/yr of renewable hydrogen supply that the firm launched last year.

Guter highlighted Europe's "very strong policy signal around the decarbonisation of industrial processes and transportation fuels" that contributes to making such deals possible. Under the EU's revised renewable energy directive (RED III), 42pc of all hydrogen used in industry would have to be renewable, while there are also quotas for use of renewable hydrogen or derivatives in other sectors. That said, some elements, including the 42pc mandate, still need to be transposed into national law, a process that is taking too long in the eyes of many industry participants.

**EU renewable hydrogen targets set under REDIII and ReFuelEU Aviation**



 **INDUSTRY**

**42pc** of all hydrogen or derivatives used in industry to come from renewables by **2030**

**60pc** of all hydrogen or derivatives used in industry to come from renewables by **2035**

**Hydrogen is not factored into the calculations if it:**


- (a) is used in production of conventional transport fuels and biofuels
- (b) is produced by decarbonising industrial residual gases and used to reduce these specific gases from which it is produced
- (c) produced as a by-product in industrial installations

**A target reduction by 20pc is possible if**


- (1) The member state is on track towards its expected national contributions to the overall EU target on the share of renewables in gross energy consumption

**AND**

- (2) The share of hydrogen or derivatives from fossil fuels consumed in the member state is not more than 23pc in 2030 and 20pc in 2035

 **MARITIME**


**1.2pc** of all energy supplied to the maritime sector to be renewable hydrogen or derivatives in member states with maritime ports by **2030**

 **TRANSPORT**

**1pc combined share** for biofuels, biogas and renewable hydrogen and derivatives in fuels supplied to the transport sector by **2025**

**5.5pc** combined share for biofuels, biogas and renewable hydrogen and derivatives in fuels supplied to the transport sector by **2030**

**including a 1pc** share of hydrogen and derivatives in fuels supplied to the transport sector by **2030**


 **AVIATION**

Synthetic aviation fuels, such as renewable hydrogen and e-kerosene to make up the following shares of aviation fuel:

<b>2030</b>	<b>1.2pc</b>
<b>2032</b>	<b>2pc</b>
<b>2035</b>	<b>5pc</b>
<b>2050</b>	<b>35pc</b>

Source: Argus based on EU regulations

9 | Hydrogen Americas 2024 Summit & Exhibition Executive Summary

 #H2AMERICAS2024

## FIRESIDE CHAT: VISION FOR A HYDROGEN ECONOMY IN THE AMERICAS

Supporting policies are important to drive the hydrogen industry forward, the two speakers agreed. Mandates can be helpful tools in this, they noted. But in any case, priority use of hydrogen should be in hard-to-abate sectors, such as heavy industry and heavy-duty transport.

The two speakers also discussed how to manage hydrogen leaks in production and along the wider value chain, highlighting the importance of preventing a safety-related issue during the ramp-up of the hydrogen economy because any incident could harm public trust. Monitoring hydrogen leakage is also key, given that hydrogen could be a potent greenhouse gas, Guter said. Technology is not at a stage of discovering very low-level leakage yet, but it is progressing quickly, he added.





## SPOTLIGHT: GETTING HYDROGEN RIGHT: ALIGNING GROWTH AND CLIMATE GOALS

Amanda Leland of the EDF emphasised the importance of methane reduction and its implications for the hydrogen industry. Leland began by highlighting EDF's Methane SAT, a satellite dedicated to measuring global methane emissions, primarily from the oil and gas sector. She underscored methane's significant climate impact, noting that it is 80 times more potent than carbon dioxide over 20 years and stressing that methane emissions are often underestimated by 60pc.

**Amanda Leland**  
Executive Director,  
Environmental Defense Fund (EDF)

Leland also discussed hydrogen's potential in the clean energy transition. She noted that while hydrogen is not a universal solution, it is essential for decarbonizing hard-to-abate sectors like steel, cement, and fertilisers. However, she pointed out that 99pc of current hydrogen production is not clean and stressed the need for accurate data on hydrogen emissions to improve climate benefits.

Leland envisioned a future where hydrogen is produced, stored, and used cleanly, emphasising the importance of science-driven decisions and effective policy incentives like the U.S.' 45V hydrogen production tax credit. She stressed the need for community involvement, highlighting the significance of genuine community benefit agreements for the seven hydrogen hubs being developed across the U.S.

In conclusion, Leland identified three key takeaways: the necessity of getting policy details right to avoid unintended negative impacts, the importance of robust science in maximizing hydrogen's climate benefits, and the essential role of collaboration among industry, policymakers, scientists, and communities. She urged the audience to work together to ensure hydrogen fulfils its potential as a climate solution, emphasizing that this collaborative effort is crucial for achieving broader climate objectives.



# SESSION 1: COLLABORATION AMONGST CLEAN HYDROGEN LEADERS: CRITICAL PROJECTS & POLICIES DRIVING THE ENERGY TRANSITION

During this discussion, panellists shared their thoughts on steps forward for the sector as well as hurdles on the way to more industry maturity.

John Gunn of Bechtel pointed to the “explosion” of blue ammonia projects planned on the U.S. Gulf coast and the prospect of some of them potentially reaching final investment decisions over the next 12 months, closing in on execution. But at this stage the challenges also start to come in, Gunn noted, with questions around offtakers’ willingness to pay and lenders’ willingness to accept risks attached to projects.

Policy uncertainties – specifically around the 45V production tax credits – and questions around financing are holding projects back, panellists agreed. Iogen’s Brian Foody said it is “a great frustration” how long it is taking for the tax credit rules to be finalised. “There’s a broad concern that when we do get the rules, people are going to look at their projects and feel like they’re just a little too tight to push over the hump.”

Michael Ducker of MHI broadly agreed that the lack of clarity on the 45V and other factors have slowed down progress and are making project economics more challenges. But Ducker also looked on the bright side of this, noting that “we’re seeing who the real players are now.”

Electric Hydrogen’s Beth Deane agreed on this more positive take, noting that she is “very relieved that...the grandiosity of all the hype is...dissipating a little bit and we’re sort of rolling up our sleeves and getting down to what is really to get built first”. She also stressed that the early movers on projects might not necessarily be in the U.S. unless the country moves more quickly, as other governments are pushing ahead with incentives.

**Geoff Tuff**  
 U.S. Hydrogen Lead, **Deloitte** (Moderator)

**Shinichi Kihara**  
 Director General for Energy and Environmental Policy, **Ministry of Economy, Trade and Industry Japan**

**Michael Ducker**  
 President & CEO, **MHI Hydrogen Infrastructure**

**John Gunn**  
 Global Manager of Operations for Energy Transition, **Bechtel**

**Beth Deane**  
 Chief Legal Officer, **Electric Hydrogen**

**Brian Foody**  
 CEO, **Iogen**

**Rushabh Shah**  
 Director for Midwest Hydrogen & CCS, **bp**





## SESSION 1: COLLABORATION AMONGST CLEAN HYDROGEN LEADERS: CRITICAL PROJECTS & POLICIES DRIVING THE ENERGY TRANSITION

Japan’s Shinichi Kihara shed some lights on his country’s planned contracts-for-difference mechanism that is to help attract clean hydrogen and ammonia to the country. The bill on this was passed in May and the system will support selected “frontrunner projects,” Kihara explained. The scheme will have a budget of around \$20bn to bridge the cost gap between hydrogen and natural gas as well as ammonia and coal over a 15-year period. It will be open to supply from domestic projects as well as imports and could therefore work in conjunction with support mechanisms elsewhere such as the 45V credits or incentives granted by the Australian government. Projects would have to start by 2030 and offtakers could likely be in the power generation business or the mobility sector, Kihara said.

Rushabh Shah of bp stressed the importance of demand-side incentives and said that these could drive products to Europe and northeast Asia. Shah also sees a “big gap” around infrastructure, noting that government incentives might be necessary to get multiple companies to develop pipelines or other infrastructure together.





# FIRESIDE CHAT: ESTABLISHING KEY CROSS-BORDER MARKET MECHANISMS TO DEVELOP THE HYDROGEN ECONOMY

This session focused on establishing an environment for hydrogen imports and exports, with Japan’s Shinichi Kihara stressing his country’s focus on using hydrogen and ammonia to decarbonise its operations and its plans to incentivise imports, including through the planned contracts-for-difference scheme.

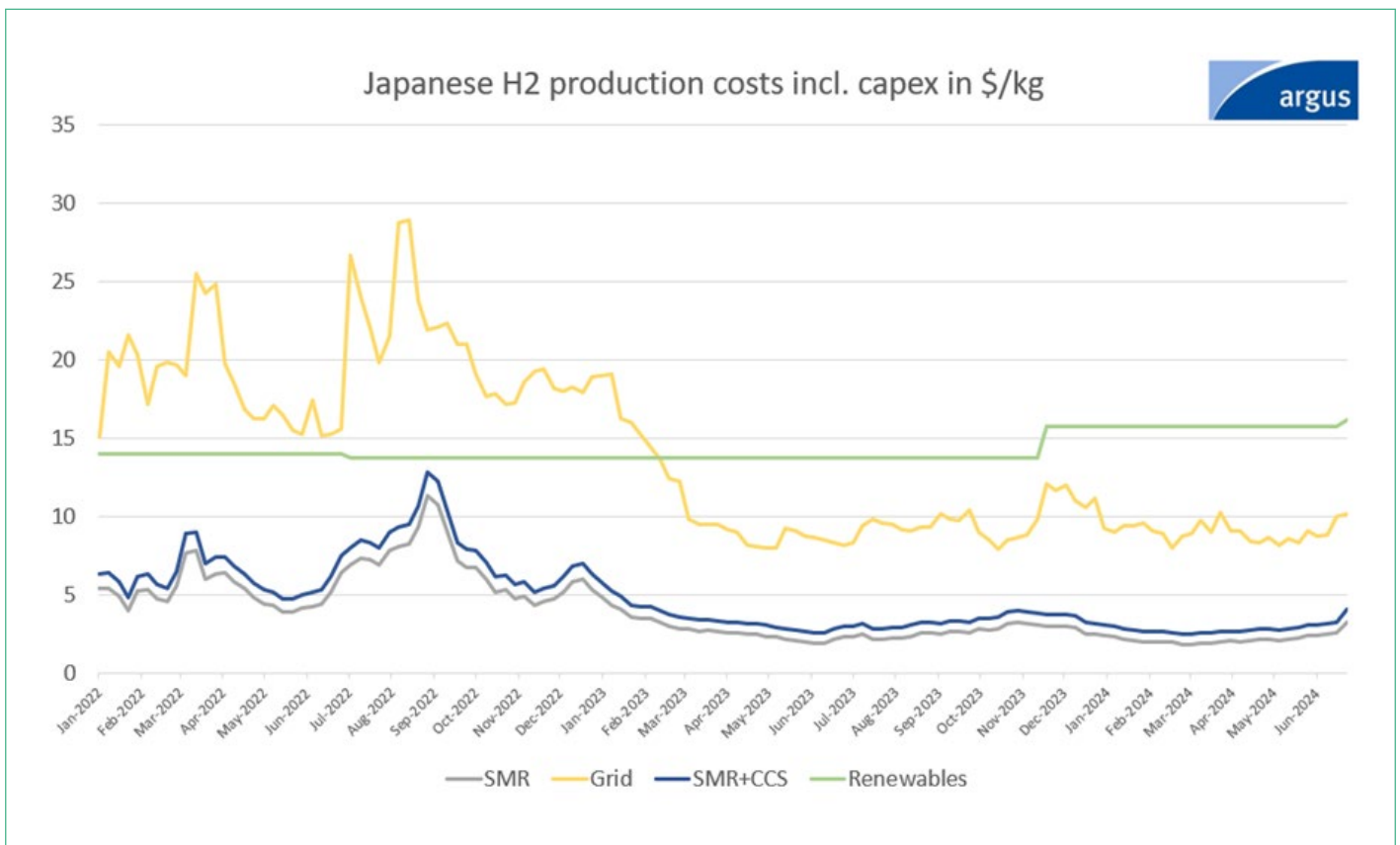
Dan Holton explained that a focus on hydrogen “flows naturally” from ExxonMobil’s existing operations and detailed the company’s plans for a large blue, or low-carbon, hydrogen facility, in Baytown which could become the biggest in the world. The facility will produce hydrogen that will be used internally by ExxonMobil, including to decarbonise refinery operations, but supply could also be turned into ammonia for exports. Among the potential offtakers from the plant is Japanese firm Jera which is mulling to take a stake in the project and to buy as much as 500,000 t/yr of ammonia from the facility, based on an announcement from March.

Japan and South Korea could become key offtakers for low-carbon ammonia from the U.S. Gulf coast as they seek to decarbonise their power sectors and other industrial operations. Argus’ Japan and Korea low-carbon ammonia benchmark, which represents delivered costs for U.S. Gulf coast low-carbon ammonia supplied to northeast Asia, was just over \$565/t on 25 June, factoring in 45Q tax credits for CO2 sequestration.

**Tim Hard**  
 SVP Energy Transition, **Argus Media** (Moderator)

**Shinichi Kihara**  
 Director General for Energy and Environmental Policy, **Ministry of Economy, Trade and Industry Japan**

**Dan Holton**  
 Senior Vice President, **ExxonMobil**



## FIRESIDE CHAT: ESTABLISHING KEY CROSS-BORDER MARKET MECHANISMS TO DEVELOP THE HYDROGEN ECONOMY

But Baytown and other projects in the region still have a way to go before producing their first molecules. Policy clarity will be key for getting the Baytown plant over the line, along with other prerequisites, Holton said. The main uncertainty is around the 45V production tax credits, especially with regard to clarifying the carbon intensity of natural gas used as a feedstock.

Besides policy clarity and support, developing key infrastructure for trade — such as larger ammonia import terminals — will be key, Holton said. Developing technology on the demand side will also be crucial, with specific burners for industrial heat applications one example, he added.

Kihara noted that it will be increasingly important to develop a system through which positive contributions from companies to providing “clean value” are rewarded. Related to this, Holton said that the U.S. will need a “market price for emissions reduction”.



## SESSION 2: HYDROGEN DECARBONIZING HARD TO ABATE SECTORS

Joshuah Stolaroff of MOTE opened the session, arguing that hydrogen production from biomass is an “overlooked opportunity”, especially in the U.S., but also globally. MOTE turns woody waste into hydrogen with carbon capture and sequestration, with the firm’s most mature project located near Bakersfield in California. The Bakersfield plant is due to supply heavy-duty port vehicles and provide storage for power generation.

Nippon Steel’s Taisuke Horimi highlighted the importance of decarbonising the steel sector, given that the industry accounted for around 8pc of the global greenhouse gas emissions in 2023. Nippon Steel will become a major consumer of hydrogen as it seeks to decarbonise its processes by replacing coal, Horimi said. The firm might require around 8mn t/yr of hydrogen by 2050 for this, he added. The company’s plans will lead to cost increases across three areas: expenses for research and development, capital investments for new facilities and operating costs for the feedstock supply. Government support will be crucial for countering the effects of this, Horimi said. He pointed to Tokyo’s plans for a contracts-for-difference scheme, although “we have to watch carefully” whether that is enough.

**Chris Hessler**  
 Founding Partner, **AJW, Inc.** (Moderator)

**Joshuah Stolaroff**  
 CEO, **MOTE**

**Steven Parente**  
 Hydrogen Infrastructure & Integration Specialist, **Caterpillar**

**Taisuke Horimi**  
 Executive Counsellor for Green Transformation Development, **Nippon Steel Corporation**

**Mack Hopen**  
 Senior Manager of Commercialisation, **Modern Hydrogen**





## SESSION 2: HYDROGEN DECARBONIZING HARD TO ABATE SECTORS

Mack Hopen introduced his company, Modern Hydrogen, which focuses on methane pyrolysis, with a view to “filtering out” CO<sub>2</sub> at the end of the gas grid and using it to produce “cleaner, cheaper, stronger asphalt”. The firm has two pilots underway with utilities in the U.S. and is looking for more customers to scale up.

Lots of demonstration projects are happening with regard to decarbonising hard-to-abate sectors with hydrogen, Caterpillar’s Steven Parente said. “But it’s a far cry from a customer coming forward and saying: ‘okay, I am ready to turn over my fleet to being powered on hydrogen,’” he noted. Hopen added that many companies are simply not ready yet as processes need to be switched, safety procedures must be overhauled and workers have to be retrained.

The panellists also addressed questions around how to secure investment for project plans. Stolaroff noted that “it’s generally a challenging market to raise money... especially challenging in hydrogen, especially challenging in climate tech”. But he added that “a challenging market to raise money means it’s the best deals for investors”. And Hopen added that there is a difference “between the sort of typical financial investors and then the strategics”. The “strategics are all in,” he said, adding that “they’re a lot more eager” and “less risk averse because they know they’re late to the game”.



## SESSION 3: ATTRACTING INVESTMENT INTO CLEAN HYDROGEN PROJECTS: SUCCESSES, CHALLENGES AND OPPORTUNITIES

This session featured key stakeholders discussing investment in clean hydrogen projects and the progression of plants across multiple stages of development.

The U.S. Department of Energy’s Crystal Farmer outlined the potential timeline for development of the country’s hydrogen hubs. The DOE expects the hubs to take around eight years to start operations. A first phase for the preliminary design is expected to take 1-2 years, followed by another two years to finalise the designs and getting projects to final investment decisions and “another few years” for construction, Farmer explained. She further stressed that the seven hubs should only be the beginning and that the government hopes that there will be lots more hubs going forward which will end up being interconnected.

Uniper’s Lance Titus highlighted the U.S. climate incentives which make it an attractive location for developing projects. Uniper hopes to leverage its experience with designing long-term transactions and contracts and stands to benefit from its access to key end-user markets in Europe, especially in Germany, Titus said. He also noted that Uniper is planning to build infrastructure beyond production projects to facilitate international trade. This includes an ammonia import facility with a planned capacity of 2.5mn t/yr at Wilhelmshaven in northern Germany. Supply could be delivered as ammonia to final customers but also cracked back into hydrogen for delivery into Germany’s planned hydrogen backbone.

**Bill Elrick**  
 Executive Director, **Hydrogen Fuel Cell Partnership** (Moderator)

**Crystal Farmer**  
 Program Manager – Hydrogen Hubs,  
 Office of Clean Energy Demonstrations,  
 U.S. Department of Energy

**Lance Titus**  
 Senior Managing Director, **Uniper North America**

**Tatsushi Amano**  
 Global Head of Energy & Natural Resources  
 Finance Group, **Japanese Bank for International Cooperation**

**Michael Hecht**  
 President & CEO, **Greater New Orleans Inc**





## SESSION 3: ATTRACTING INVESTMENT INTO CLEAN HYDROGEN PROJECTS: SUCCESSES, CHALLENGES AND OPPORTUNITIES

Many similar facilities are planned in Europe to facilitate seaborne imports of decarbonised ammonia for cracking. But while Argus is currently tracking 17 planned ammonia cracking facilities in Europe, progress on these plans has been slow and all large-scale terminals are still at early planning stages.

Representing the Greater New Orleans region, Michael Hecht pointed to some of the key projects under development in the area. These include a \$5bn low-carbon ammonia project in St Charles Parish. The plant could make around 3mn t/yr of ammonia and involves several companies, including Copenhagen Infrastructure Partners, Hecht said. Another project is developed by CF Industries in Donaldsonville and will combine renewable and gas-based low-carbon hydrogen production, he said. Hecht stressed the need for favourable local and federal policies, particularly around tax credits, to scale hydrogen production and make it economically viable.

Throughout the discussion, the panellists emphasised the importance of global collaboration, regulatory harmonisation, and leveraging government support to advance the hydrogen economy.





## SESSION 4: ELECTROLYZER TECHNOLOGY DEVELOPMENTS: SHOWCASING WORLD CLASS EXCELLENCE IN TECHNOLOGY

This discussion centred around the current state of and future outlook of the electrolyser market, emphasizing both global successes and regional challenges.

Key themes included the critical role of policy frameworks and technological advancements in helping to drive scale and lower costs. Looking ahead, the panellists expressed optimism about the industry’s growth trajectory, anticipating a significant uptick in demand for electrolysers and other technology, driven by evolving policy landscapes and increasing investments in renewable hydrogen projects. They pointed to modularisation and standardisation as key areas for enhancing production efficiency and cost-effectiveness across diverse geographical markets.

But the panellists also acknowledged challenges, such as prolonged lead times for essential components. Transformers and switchgears of substantial size can have long lead times, particularly in Western markets, while delivery schedules are shorter in Asia, ABB’s Matteo Fabbri said. Topsoe’s Nikolaj Knudsen said he does not see the actual electrolyser stacks as a potential bottleneck, even if some observers had expected this a few years ago.

**Tim Hard** (Moderator)  
 SVP Energy Transition, **Argus Media**

**Alex Savelli**  
 Managing Director for Electrolysers – Americas,  
**Accelerate by Cummins**

**Nikolaj Knudsen**  
 Head of Business Development, **Topsoe**,  
**Power-to-X**

**Arvind Datta**  
 Senior Business Development Manager,  
**thyssenkrupp nucera**

**Martin Hering**  
 Senior Business Development Manager,  
**Robert Bosch LLC**

**Matteo Fabbri**  
 Product Line Manager, **ABB**



## SESSION 4: ELECTROLYZER TECHNOLOGY DEVELOPMENTS: SHOWCASING WORLD CLASS EXCELLENCE IN TECHNOLOGY

Topsoe is already planning to scale up manufacturing of its solid-oxide electrolyser cells (SOEC) by adding a new 1GW/yr facility in Virginia, while its first site in Denmark is still under construction, Knudsen said. The impact of the support from the Inflation Reduction Act (IRA) on this decision was “huge” with the plans otherwise likely not on the table at all, Knudsen said, although he added that a final investment decision still hinges on demand developments.

Thyssenkrupp nucera’s Arvind Datta said that his company is executing on a project pipeline of over 3GW combined capacity, with projects ranging wildly in size from smaller 20MW installations to plants of over 2GW. Thyssenkrupp Nucera has bagged some of the largest electrolyser deals so far, including for the Saudi-Arabian Neom project.

Accelera by Cummins is also pursuing ambitious expansion plans, aiming to have 3GW/yr of manufacturing capacity up and running in a few years, according to Alex Savelli.



## SESSION 5: AMMONIA'S CLEAN ENERGY POTENTIAL

During this session, panellists from different sectors discussed the potential applications of clean ammonia, and the scale up required for this.

IHI's Toshihiko Awano said that his company is developing technologies to substitute ammonia for both coal and natural gas in power generation, and is also focusing on use of ammonia as a bunker fuel.

Fellow Japanese firm Jera is among the companies betting heavily on use of ammonia for power generation to clean up operations. The company has announced three hydrogen production facilities in the U.S. which could produce a combined 4mn t/yr of ammonia and is also looking at opportunities elsewhere through partnerships, Brad Williams said. Williams reiterated previous comments on the panel that ammonia will have a key role in decarbonising shipping. Compared with direct hydrogen transport, ammonia is more stable, more cost-effective and can be used as a fuel as well, Williams said. He also highlighted that "this is not a new technology" given that ammonia as such is already traded globally. "What we are doing is supersizing and using it as a new green fuel supply".

Representing the Transatlantic Clean H2 Trade Coalition, Nabil Bennouna outlined his organisation's plans to facilitate hydrogen trade between the U.S. and Europe. The group wants to connect U.S. producers with offtakers in Europe with the aim of having the "first molecule traded across the Atlantic by 2026 and working towards scaling up to a liquid market by 2030," Bennouna said. Ammonia will likely have a role to play in this as a key vector.

**Trevor Brown**  
 Executive Director, **Ammonia Energy Association** (Moderator)

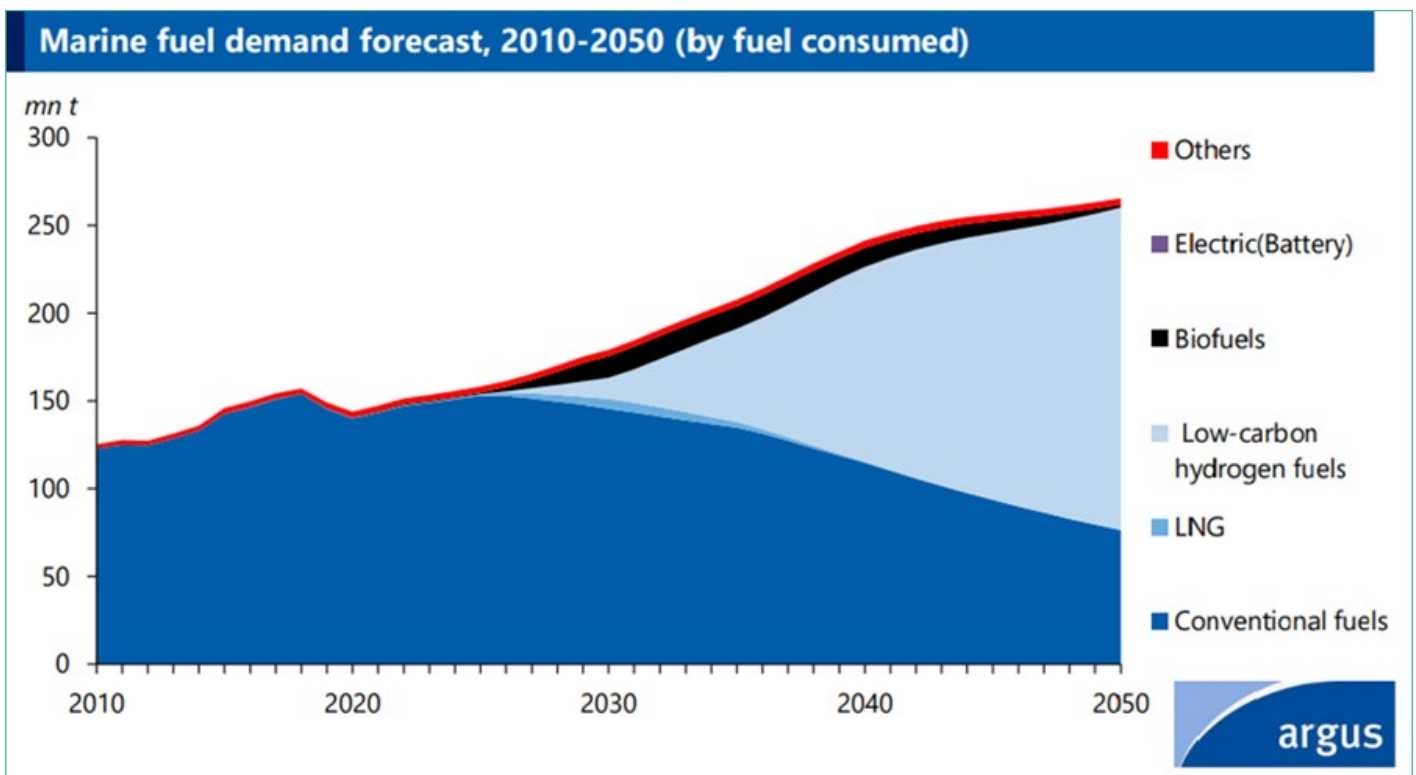
**Toshihiko Awano**  
 Deputy General Manager, **IHI Corporation**

**Silvia Carolina Lopez Rocha**  
 Energy Regulatory Specialist, **World Bank**

**Brad Williams**  
 Executive Advisor Energy Infrastructure, **JERA Americas**

**Nabil Bennouna**  
 Principal, **Transatlantic Clean H2 Trade Coalition**

**Selim Cevikel**  
 Principal Consultant for Finance, **Global CCS Institute**



Source: Argus Consulting



## SESSION 5: AMMONIA'S CLEAN ENERGY POTENTIAL

For the same reason, many countries in the “global south” are looking at ammonia, the World Bank’s Silvia Carolina Lopez Rocha said. She sees three main reasons why countries in that part of the world are pursuing opportunities in decarbonised ammonia: its potential as a vector for hydrogen exports, the greening of products currently exported, such as fertilisers, and the creation of new business opportunities, especially in shipping.

But the different end uses come with different challenges and the willingness to pay for cleaner products will differ, Rocha said. Shipping companies are willing to cover a bigger price gap between cleaner fuels and conventional supply because extra costs can be distributed among all the containers and products they are carrying. With fertilisers, the situation is a bit more delicate because one consumer must absorb the cost. These considerations are especially crucial in countries which do not have the budget to subsidise use of cleaner supply, Rocha noted. The World Bank is leveraging its funds and other support mechanisms to address technology and offtake risks, Rocha said, pointing to specific examples of support provided to India and Chile.

The panellists also talked about the role of carbon tax and emissions trading systems in supporting the transition away from fossil-based into green fuels, as well as the need to harmonise certification systems around the world in order to facilitate trade.



# SPOTLIGHT: DEVELOPING FUTURE HYDROGEN LEADERS: PAVING THE WAY FOR THE NEXT GENERATION

The Clean Air Task Force’s Maggie Field outlined how considerations around labour and workplace development are factored into the U.S.’ hydrogen hubs programme. All applicants to the plan had to submit a community benefits plan (CBP) which constituted 20pc of the overall score. Four core policy areas were identified for this: engaging communities in labour; investing in America’s workforce; advancing diversity, equity, inclusion and accessibility; and finally, implementing the government goal to have 40pc of overall benefits from the federal funds to flow to disadvantaged communities. These requirements should also increase the acceptance of the hydrogen hubs among the communities, Field said. That said, only the Arches hub in California has so far published its CBP.

Considerations around how to maximise benefits for local populations, including through job creation, are also central to hydrogen policies in smaller countries. Franklin Chang Diaz and Noelia Medina Alfaro highlighted the approaches to this in Costa Rica and Uruguay, respectively, two countries with big ambitions in the hydrogen sector. “Who builds, who operates, who maintains [and] who inspects” are key questions when developing the sector and there is a “tremendous gap in the availability of trained personnel,” Chang Diaz said. In Costa Rica, a “hydrogen school” was opened through a partnership between different organisations, with the aim of developing specialised technicians. Uruguay’s National Energy Leaders Programme is part of a global initiative from the World Energy Council that is similarly aimed at making sure your professionals in the energy sector can develop the skills needed to be part of the workforce on hydrogen in the coming years.

**Betony Jones** (Moderator)  
 Labor Advisor to the Secretary; Director, Office of Energy Jobs, **U.S. Department of Energy**

**Maggie Field**  
 Hydrogen Hubs Manager, **Clean Air Task Force**

**Franklin Chang Diaz**  
 CEO, **Ad Astra Rocket Company**

**Sashe Annett**  
 Founding Director, **Northeast Hydrogen Alliance**

**Noelia Medina Alfaro**  
 Secretary of National Future Energy Leader Program (World Energy Council/AUDER),  
**Hydrogen Advisor to the Secretary of Energy, Uruguay**





## SPOTLIGHT: DEVELOPING FUTURE HYDROGEN LEADERS: PAVING THE WAY FOR THE NEXT GENERATION

Sashe Annett argues that education is “the only way to start derisking” the \$570bn of funding planned for hydrogen development worldwide. Education is needed for all aspect of hydrogen development, Annett said. This includes working against fears and misconceptions surrounding the industry, she said, noting that there has been a lot of opposition from port authorities against hydrogen infrastructure plans because of safety concerns.







# SUMMIT DAY TWO

## OPENING KEYNOTE ADDRESS:

Representing the government of Brazil, Maria Luiza Viotti highlighted her country's long-standing ambitions in the hydrogen space and its potential to make hydrogen via a range of different pathways, including from renewable power, biomass and biofuels.

She stressed that hydrogen provides vast export opportunities, but also noted that Brazil could use it for clean domestic manufacturing, such as of fertilisers based on green ammonia which could replace imports.

Projects worth a combined \$30bn of hydrogen projects at varying development stages have been announced across the country, Viotti said, and the government is working towards establishing key infrastructure to support these.

Ports have been a major focus areas for the development of hydrogen projects, with the northeastern locations of Piauí and Pecém standing out in particular.

Brasília in June committed 18bn Brazilian reals, equivalent to around \$3.3bn, to tax credits for clean hydrogen production and consumption. This budget is set to be available from 2028 until 2032 and tax credits available to individual projects could amount to as nearly \$1.30/kg. The support could help Brazil attract even more investors looking to capitalise on the country's favourable renewables conditions. That said, the exact rules, including the definitions for eligible supply, have yet to be finalised.

Argus currently calculates renewable hydrogen production costs in Brazil at just over \$6.50/kg, including recovery of capital costs.

### Maria Luiza Viotti

Ambassador of Brazil to the United States,  
Embassy of Brazil in Washington





## FIRESIDE CHAT: HYDROGEN'S REGULATORY ROADMAP

The session examined the status of hydrogen regulation in the U.S. and whether current rules are adequately supporting the nascent sector.

The U.S. administration has set strong policy drivers in its 45V hydrogen production tax credit and hydrogen hub programme and has put the onus onto hydrogen project developers to respond, according to the EPA's Joseph Goffman. "We just volleyed the ball over the net to industry," Goffman said. "We've put out at least two major regulations that create if not an inevitable demand for hydrogen, then certainly soft demand or a strong opportunity for the use of hydrogen," he added.

**Leia Guccione** (Moderator)  
U.S. Program Managing Director, **RMI**

**Joseph Goffman**  
Assistant Administrator for the Office of  
Air and Radiation, **U.S. Environmental  
Protection Agency (EPA)**

**Allison Clements**  
Commissioner, **U.S. Federal Energy Regulatory  
Commission (FERC)**



## FIRESIDE CHAT: HYDROGEN'S REGULATORY ROADMAP

The EPA has recently changed its position as it now expects supply constraints will mean hydrogen will not likely play a major role in decarbonising power, but it expects hydrogen may play a role in heavy-duty transport. The EPA has left the door open for both options, but it has stopped short of prescribing hydrogen use in any sector, he said. Goffman said over the next 2-7 years the EPA will benefit from the hard data from the first tranche of projects and will take note of which areas project developers and investors allocate resources to, and this will inform EPA decisions about which use cases to support.

Allison Clements of the Federal Energy Regulatory Commission (FERC) said congress needs to clarify which body will regulate hydrogen pipelines in the U.S.: whether it could be FERC as the interstate pipeline regulator of the U.S. or possibly some other federal agency. Clements urged the hydrogen industry to engage with the five-person commission, especially it's three incoming members, to help them understand where and when hydrogen transport infrastructure will be needed and the logistical challenges of repurposing old gas pipelines.





## SPOTLIGHT: SOUTH AUSTRALIA CLEAN ENERGY POWER HOUSE

The Government of South Australia’s Rebecca Knights presented her state’s ambitions and potential in hydrogen.

Knights pointed to the rapid build-out of renewable power capacity in South Australia and noted that decarbonising copper and steel production in the state could be key applications for hydrogen. Existing port facilities could facilitate exports of these cleaner products going forward, she added.

South Australia has sought to “underpin” this opportunity with a clear regulatory framework, most notably the Hydrogen and Renewable Energy Act from 2023. This is intended to provide “a clear licensing framework for the concurrent development of renewable energy, hydrogen, mining and green iron projects,” Knights said, adding that the government will release the first areas for licensing later this year.

**Rebecca Knights**

Executive Director for Strategic Policy & Delivery, Department for Energy and Mining, Government of South Australia



## SPOTLIGHT: SOUTH AUSTRALIA CLEAN ENERGY POWER HOUSE

Knights also pointed to the state’s “hydrogen Jobs Plan” which involves construction of a 250MW electrolysis plant, storage facility and hydrogen-based power plant at Whyalla. The government last year selected a consortium of ATCO and BOC to carry out the plans and hopes that the facilities can be online by 2026.

There are major plans for green steel production in various places, most notably Cape Hardy, where Iron Road and Amp Energy are working together on a project that is to initially entail 1GW electrolysis but could be built out to 10GW in the long run, Knights said. But the government is also launching a green steel strategy and has invited expressions of interest from companies looking to get involved in the sector.





## SESSION 6: HYDROGEN’S MOBILITY AND DISTRIBUTION APPLICATIONS ON LAND AND SEA

During this panel, delegates talked about the different applications of hydrogen across mobility sectors, either as a feedstock for future fuels or as a fuel in itself.

The U.S. could see 4mn t/yr of hydrogen demand for heavy and medium trucking by 2040, increasing to 8mn t/yr by 2050, based on DOE estimates, Campbell Howe said.

But Phinia’s Todd Anderson noted that the U.S. is behind Europe and some other regions in terms of refuelling infrastructure and will need to add more stations to its network to help the sector’s hydrogen use take off. Globally, the number of hydrogen refuelling stations could rise from less than 1,000 today to “more than three or four thousand,” Anderson said. “We’ll need the best of every technology to achieve our global decarbonisation goals,” he said. “Some of that is battery vehicles. Some of that might be hydrogen fuel cells, some of it might be hydrogen internal combustion engines.”

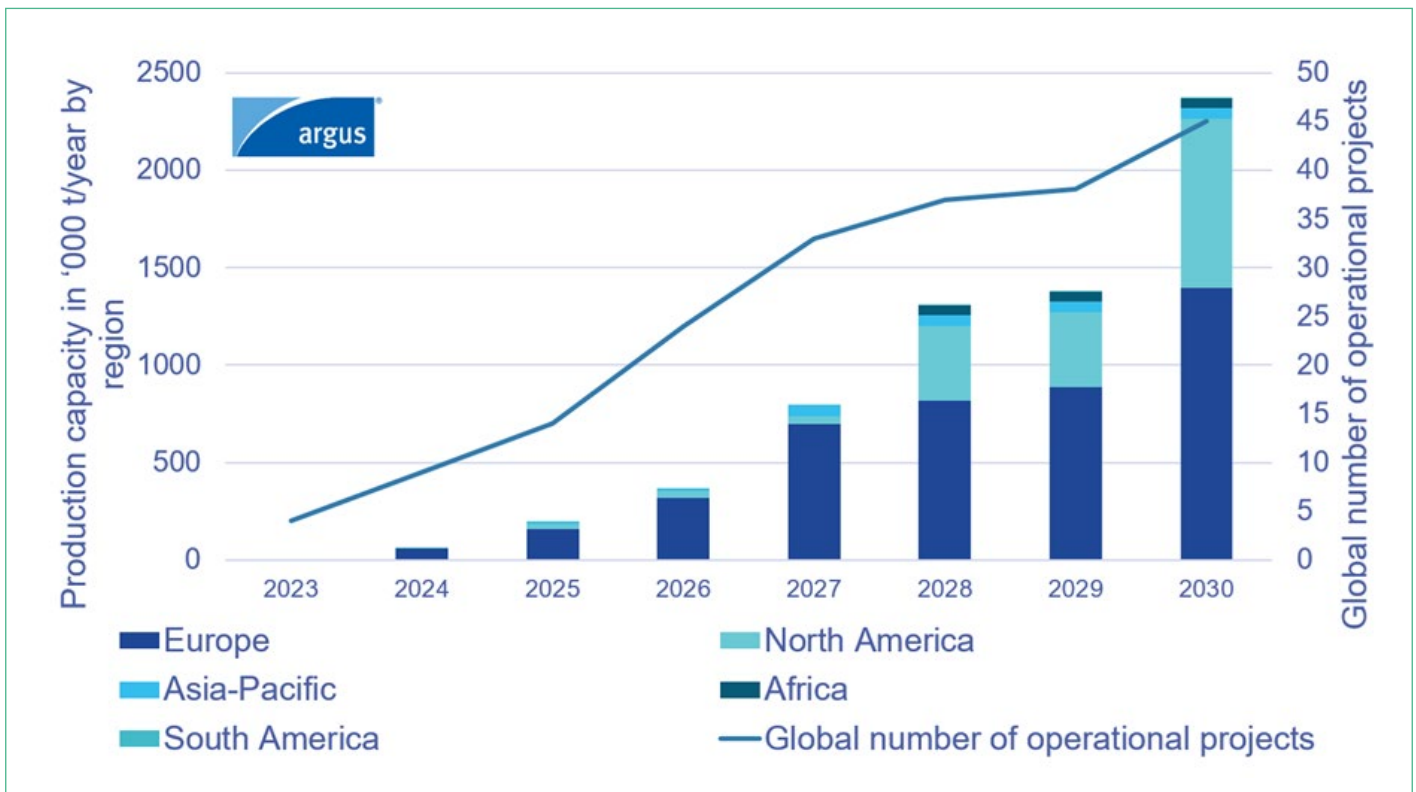
**Brett Perlman**  
 CEO, **Center for Houston’s Future** (Moderator)

**Steve Beyer**  
 Director Business Development, **Re:Build Manufacturing**

**Campbell Howe**  
 Senior Advisor at the Loan Programs Office, **U.S. Department of Energy**

**Todd Anderson**  
 Chief Technology Officer, **Phinia**

**Pierre Poulain**  
 President and CEO, **Powertech Labs**



## SESSION 6: HYDROGEN’S MOBILITY AND DISTRIBUTION APPLICATIONS ON LAND AND SEA

Canada’s British Columbia is the second most active H2 mobility market in North America, with around 300 hydrogen-powered cars being used in Vancouver, according to Pierre Poulain of Powertech Labs. Poulain said his company expects “great growth” for hydrogen use in public transport, specifically buses, from 2030.

Going beyond road transport, sustainable aviation fuels (SAF) based on power-to-liquid will be “really exciting” for the hydrogen sector, Howe said. Many hydrogen industry participants have recently pointed to e-SAF being a particularly interesting derivative, partly because the EU has set specific mandates for its use, clearly defining obligated parties and penalties for non-compliance. The pipeline of e-SAF projects has grown steadily recently, especially in Europe. More than 2.5mn t/yr of e-SAF production capacity could be online by 2030, Argus data show, although the vast majority of announced projects are still at a very early stage.





## SESSION 7: SCALING RENEWABLE HYDROGEN PROJECTS: COSTS, RISKS & CHALLENGES

Panellists tackled questions around how the costs associated with making renewable hydrogen can be brought down from a technology and plant optimisation perspective.

RWE Clean Energy’s Laura Bergedieck argued that having a grid connection for an electrolysis plant is crucial for risk mitigation. Some developers are planning “island projects,” but Bergedieck sees this as a “very risky investment proposal because the offtake and demand...is still a very nascent market”. “We always want that option to be able to supply that power into the power grid and just sell the power,” she said. Bergedieck also stressed that a combination of solar and wind is key for lowering the cost of making green hydrogen. “If we are in locations like Texas or Oklahoma, we get to a utilisation rate of the electrolyser of between 60 and 70pc....If we are in the southwest where we have limited to no access to wind, you stay around 35pc and that assumes hourly matching.”

Bergedieck and the Pacific North West Hydrogen Hub’s Chris Green agreed that securing offtake is crucial for getting project’s off the ground. The hub involves 17 projects along the hydrogen value chain in Washington, Oregon and Montana – focusing on green hydrogen– and is currently working out the contract terms and conditions with the Department of Energy, Green said. It hopes to get all these projects online within the next eight years, he said. A “significant amount” of the \$1bn in government funds that the hub is slated to get will “go toward volumetric production” meaning “companies that are gonna get hydrogen supply onto the market”.

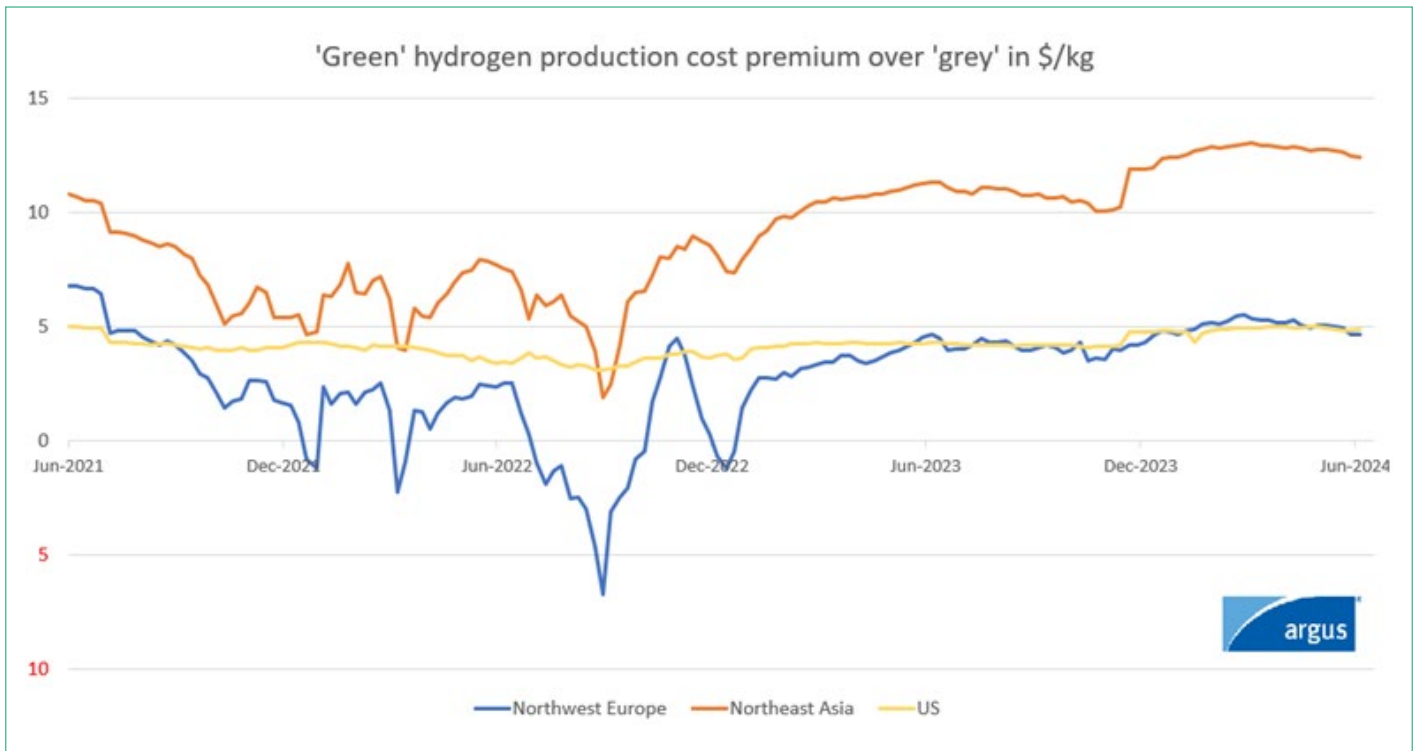
**Leigh Collins**  
 Editor, **Hydrogen Insight** (Moderator)

**Magnus Thomassen**  
 Chief Product Officer and Co-Founder, **Hystar**

**Chris Green**  
 Chair, **Pacific North West Hydrogen Hub**

**Laura Bergedieck**  
 SVP for Hydrogen Development,  
**RWE Clean Energy**

**Jaryd O’Brasky**  
 VP for Sales & Service, **H-Tec Systems**



## SESSION 7: SCALING RENEWABLE HYDROGEN PROJECTS: COSTS, RISKS & CHALLENGES

H-Tec’s Jaryd O’Brasky emphasised his company’s approach of focusing on automation and having “as little manual labour as possible” for its electrolyser production. For this, the firm benefits from being a subsidiary of automaker VW, he said. H-Tec has sold close to 50 electrolysers in Europe of which 25 have been deployed in the field and the company has already learned a lot in the process, helping it to optimise its products, O’Brasky said.

Hystar’s Magnus Thomassen agreed that such field tests are key for optimising products and also for project developers to gain trust in a specific technology. Thomassen further stressed the importance of standardisation in the construction of renewable hydrogen production plans to eventually bring down costs.





# SPOTLIGHT: HYDROGEN SAFETY: ENABLING SUCCESS THROUGH EFFECTIVE MINDSET MANAGEMENT

Panellists talked about the importance of focusing on safety aspects in hydrogen projects. Any incidents at this stage could severely hamper the sector’s future development, they agreed.

Discussions about new standards need to happen right now because the current requirements in the international code are outdated since “we haven’t used this technology in the buildings we live and work in,” the International Code Council’s Mark Fasel said. “Typically, in North America, products have safety standards,” which “incorporate a wide variety of performance-based testing requirements,” he said. But “that really doesn’t exist for the hydrogen industry currently”.


**Nick Barilo**  
 Executive Director, **Center for Hydrogen Safety** (Moderator)

**Mark Fasel**  
 Director of PMG Technical Resources,  
**International Code Council**

**Jonathan Cristiani**  
 Bioenergy and Hydrogen Technology Manager,  
**Black & Veatch**

**David Farese**  
 Member, **Hydrogen Safety Panel**

## Regulations, Codes and Standards




**Hydrogen regulations, codes and standards (RCS) are maturing quickly for many mainstream fuel cell applications. RCS:**

- Provide the information needed to safely build, maintain, and operate equipment, systems, and facilities
- Ensure uniformity of safety requirements
- Provide inspectors and safety officials the information needed to approve systems and installations
- Bolster public and stakeholder confidence
- Help protect investments


**Example codes and standards**

- Vehicle Standards  
 GTR-13  
 SAE J2579  
 HDV 2-2014  
 HDV 3.1-2015  
 CSA MPD 1-2013  
 ANSI/CSA FC 3-2004
- Fueling and Communications  
 SAE J2601  
 SAE J2799  
 SAE J2600
- Separation Distances  
 NFPA 2/55
- Fuel Quality  
 SAE J2719




**BUT... just following codes and standards is not enough**

## CHS Hydrogen Incident Response Activities




**Hydrogen Incident Occurs**




CHS reaches out through established channels to gather all relevant information

**CHS Holds Member Meeting**




CHS convenes members to discuss incident and share information

**CHS-HSP Participates in Fact Finding**




CHS and the Hydrogen Safety Panel are available to help determine cause

**CHS Develops Incident Record**



CHS creates members-only incident report to track latest information and lessons learned

**CHS Publishes Lessons Learned**



CHS translates information into public lessons learned and publishes on H2Tools.org

**Other resources CHS may use for responding to an incident:**

- Education Materials – new courses, revised course content, etc.
- Technical Bulletins – members only and public safety bulletins developed and disseminated
- Working Groups – to address important safety issues and develop learnings for community and industry
- Conferences & Workshops – share incident information and learnings
- Incident Management Guide

## SPOTLIGHT: HYDROGEN SAFETY: ENABLING SUCCESS THROUGH EFFECTIVE MINDSET MANAGEMENT

Representing the Hydrogen Safety Panel, David Farese shared some of the lessons learned from previous incidents. He pointed to common themes and areas that deserve a particular focus, including vent system design and operation — since that is where hydrogen meets air and could potentially explode — as well as a design for fire resistance and explosion overpressure. Human factors need to be taken into account as they “almost always play a role if you dig deep enough during investigation,” Farese said. One always needs to seek the truth of what happened to create a safety culture, Farese said.





## SESSION 8: HYDROGEN’S ROLE IN THE FUTURE OF GLOBAL DECARBONIZATION

During this session, panellists shared their outlook on the role for clean hydrogen in decarbonising various different sectors in the future.

Microsoft is looking at hydrogen fuel cells as an alternative to provide backup power, a role that is currently filled by diesel generators, the firm’s Sonia Maleky said. The company has trialled proton exchange membrane (PEM) fuel cells for 10 years and recently deployed a 3MW installation from Plug Power at a data centre, while also working with Caterpillar on a separate project, Maleky said, adding that both of these pilots were “successful”. Microsoft is now looking further along the hydrogen value chain to also ensure that it has sufficient supply in the future.

SLB’s Rafael Fejervary stressed that his company is “colour agnostic” when it comes to hydrogen, noting that “what we really care about is the carbon intensity and the cost of that hydrogen”. Despite remaining challenges, Fejervary sees ample progress. Japan was the only country to have a hydrogen strategy in 2017, while 52 countries had one in 2023, he said.

**Janice Lin** (Moderator)  
 Founder & President,  
 Green Hydrogen Coalition

**Rafael Fejervary**  
 Hydrogen Director, SLB

**Sonia Maleky**  
 Director of Hydrogen Technology, Microsoft

**Makini Byron**  
 Director, Clean Energy Business Development,  
 Linde

**Beth Trask**  
 VP for Global Energy Transition,  
 Environmental Defense Fund



## SESSION 8: HYDROGEN'S ROLE IN THE FUTURE OF GLOBAL DECARBONIZATION

For Linde, current annual sales in hydrogen amount to around \$3bn, making up approximately 10pc of the company's total sales, the firm's Makini Byron said. The existing natural gas-based assets – and the experience of operating them – could be leveraged “in the transition to a cleaner and more sustainable future,” Byron said. Linde has pledged to invest some \$50bn in clean energy investments over the next 10 years, she added, pointing to a project in Texas where the firm intends to produce 1.1mn t/yr of low-carbon ammonia for OCI. Many of the company's planned low-carbon projects are focusing on ammonia currently as Linde sees ample opportunities for this, especially with regard to decarbonising power production in northeast Asia.

Incentives and mandates will eventually be key to stimulate wider uptake of hydrogen, given that cost differences between conventional supply and cleaner alternatives are still large, Byron argued. Fejervary agreed with this and pointed to the EU's planned mandates for renewable hydrogen use in industry.

The Environmental Defense Fund's Beth Trask highlighted the importance of getting the “emissions counting” right. “For all hydrogen, we have to manage hydrogen emissions themselves, those leaks, the venting, the releases that all contribute to an erosion of hydrogen's climate benefits if we allow them to. So we need data across all those dimensions”.

The panellists also discussed necessary transport infrastructure developments. Not only hydrogen infrastructure will be key, but also CO<sub>2</sub> pipelines and wells to sequester the carbon captured when decarbonising existing gas-based plants.





## SESSION 9: STANDARDISATION, CERTIFICATION AND REGULATION FOR GLOBAL EXPORT

Panellists during this session widely agreed on the importance of creating efficient standards and certification, especially to facilitate global border trade.

Trevor Brown of the Ammonia Energy Association outlined a number of challenges with this, particularly when the aim is to develop a certification system that should be cross-sectoral and applicable globally. This was backed by Zane McDonald, who represented the Open Hydrogen Initiative, which also aims to develop a single methodology for understanding what the carbon intensity of a product is. Achieving this target will be “the bedrock of how markets will form,” McDonald said. There is a lot that can be learned from incumbent commodities, he added, noting that one possible comparison is between crude oil and its sulphur content vis-à-vis hydrogen and its carbon intensity.

While there are challenges, global alignment is still a possibility, Brown said. Regulations will likely not be identical in this decade “when we get certification systems off the ground,” Brown said. But there will be more visibility on how a move towards greater alignment can be facilitated. Brown also said that voluntary markets are likely to get off the ground quickly than government-imposed requirements. Voluntary schemes will be particularly important for cross-border trade to help provide transparency to buyers with regard to the product they are acquiring, Bureau Veritas’ Rajiv Sabharwal said.

**Clare Jackson** (Moderator)  
 CEO, **Hydrogen UK**

**Rajiv Sabharwal**  
 Vice President of Business Development –  
 Energy, **Bureau Veritas**

**Zane McDonald**  
 Executive Director, **Open Hydrogen Initiative**

**Trevor Brown**  
 Executive Director, **Ammonia Energy  
 Association**

**Neha Rustagi**  
 Systems Analysis and Codes & Standards  
 Program Manager, **U.S. Department of Energy**



## SESSION 9: STANDARDISATION, CERTIFICATION AND REGULATION FOR GLOBAL EXPORT

The U.S. is trying to align certification and standards globally via several partnerships, Neha Rustagi of the DOE said. One of them is the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE), which currently comprises 22 countries and the European Commission. So far, much of the focus has been on developing best practices associated with how to do emissions analyses, Rustagi said. These discussions have now informed a code by the International Standards Organisation (ISO), that will be put forward for another round of comments later this year. This standard is something that companies can align on, Rustagi said. But the DOE is also liaising with the International Energy Agency across different working groups, including on certification of emissions associated with hydrogen production, she added. Meanwhile, the DOE is trying to further its understanding on a range of different topics, including emissions associated with renewable natural gas and with upstream methane.





# SPOTLIGHT: ADVANCEMENTS IN HYDROGEN STORAGE TO ACHIEVE A SUSTAINABLE, LOW CARBON FUTURE

Panelists discussed the opportunities and challenges for hydrogen storage and specific transport technologies.

According to the DOE's Dr Asha-Dee Celestine, the main challenge for hydrogen storage and transport is the low density, especially when compared to fuels such as diesel and gasoline. The lower density requires maximising the amount of hydrogen in store, which means large tankers, tube trailers and pipelines are needed compared with more conventional products.

Dr Celestine stressed that subsurface hydrogen storage will be critical for the ramp up of hydrogen deployment. Traditionally this type of storage has been done in salt caverns, but that comes with geographic limitations. DOE is looking into hydrogen storage at depleted oil and gas fields, while some firms are also exploring other solutions such as "lined rock caverns" and "borehole technologies," Dr Celestine said.

**Dr Monterey Gardiner** (Moderator)  
 Chief Engineer Hydrogen Strategy and Partnerships, **National Renewable Energy Laboratory**

**Owen Hopkins**  
 Sales Manager, **Hexagon Purus**

**Aaron Villareal**  
 Sales and Global Hydrogen Director, **Taylor-Wharton**

**Dr. Asha-Dee Celestine**  
 Hydrogen and Fuel Cell Technologies Office, **U.S. Department of Energy**

**1 CORPORATE UPDATE**

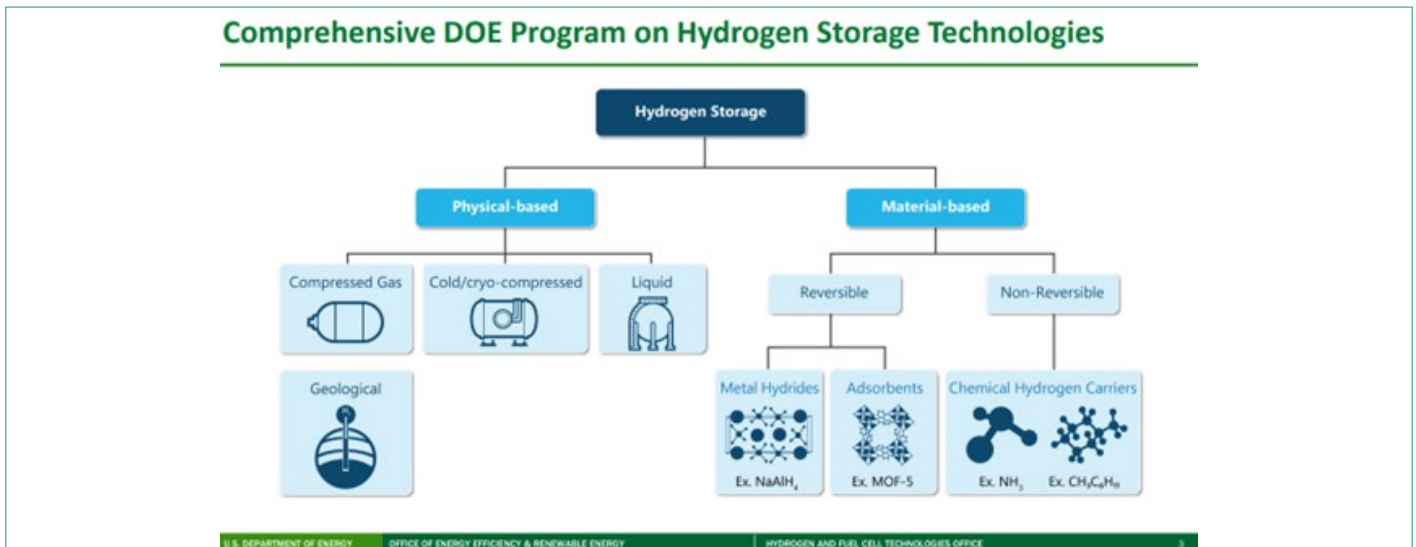
## Hydrogen and batteries are complementary zero-emission technologies across segments

**COMPLEMENTARY TECHNOLOGIES**

- Efficiently utilizing green energy to improve resource usage
- Faster decarbonization building momentum towards zero-emission transportation
- Highly complementary infrastructure

**HEXAGON PURUS**

Source: IEA ETP, IHS, A Portfolio of Powertrains for Europe (2010), Thiel (2014), Hydrogen Council.  
 1) Refers to hydrogen-based fuels (i.e. ammonia, methanol, synfuel) for large ships, e.g. container ships, tankers; 2) Mid-size maritime vessels such as ferries are not included, but hydrogen vehicles in this segment are expected to use liquid or compressed hydrogen; 3) Excluding rail on electrified tracks



## SPOTLIGHT: ADVANCEMENTS IN HYDROGEN STORAGE TO ACHIEVE A SUSTAINABLE, LOW CARBON FUTURE

Dr Celestine emphasised that “there’s still a lot of fundamental R&D [research and development] that is needed” for getting the hydrogen economy of the ground “in terms of the storage vessels, in terms of the refuelling infrastructure”. Along the way, a focus on safety will be key. “I’m excited about the developments, but I also want to see safety and codes and standards that’s across the board and everybody’s kind of bought into.”

Owen Hopkins of Hexagon Purus and Aaron Villareal of Taylor-Wharton introduced their respective companies as part of the discussion.

Hexagon Purus is focused on storage and transport of hydrogen, working on cylinders and systems, including for hydrogen mobility applications. Hopkins noted that hydrogen and electric batteries are complementary technologies across different mobility segments, with batteries being favourable for light-duty road mobility applications, while hydrogen has an edge for medium- and heavy-duty trucks.

Taylor-Wharton is a cryogenic manufacturer, focusing in particular on liquid hydrogen trailer tanks and mobile refuelling equipment. The U.S. is the company’s “predominant focus” but is also working in Malaysia where it has manufacturing capabilities, and in other countries, Villareal said.

As usual, panellists agreed on the importance of establishing global standardisation as the market grows and becomes more international.

For context, European companies have made progress recently on developing underground hydrogen storage with operators in France, Germany and the UK moving forward with plans to inject hydrogen underground.







# HYDROGEN AMERICAS 2025

SUMMIT & EXHIBITION

3 – 4 SEPTEMBER 2025

WASHINGTON D.C

## SEE YOU NEXT YEAR

We look forward to welcoming you again  
next year in September to **#H2Americas2025** -  
Your Gateway to Unlock Hydrogen Potential  
in the Americas.

Contact **Gurpreet Hayre** **+44 20 7978 0034**  
Email: **Americas@sustainableenergycouncil.com**

With thanks to our Knowledge Partner Argus Media

