

Business Breakthrough Barometer 2024

Hydrogen



World Business
Council
for Sustainable
Development

BAIN & COMPANY 

29 October, 2024

Key messages

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- **Businesses' confidence in the hydrogen transition is among the highest across all sectors, but few expect that the 2030 Breakthrough Agenda goal will be met**
 - 21% thought the sector was “mostly” on track” for a Paris aligned transition
 - Two-thirds of businesses do not expect the 2030 Breakthrough Agenda goal of 'Affordable renewable and low-carbon hydrogen globally available by 2030' to be met
- **Targets aside, there is a growing investment momentum in the sector**
 - The number of announced low carbon hydrogen projects increased by 40% from June 2023 to August 2024
 - Sector leaders are also increasingly optimistic about the market's potential - 75% reporting increased capex commitments over the last three years, as over half of companies now report that more than 20% of their CapEx envelope is net-zero aligned
- **Alongside the project pipeline, projects reaching financial approval also doubled this year, with companies largely crediting a step change in government policy**
 - FID capacity doubled across geographies between June 2023 and August 2024
 - China led this momentum, contributing 45% of new capacity additions with six +100kt projects securing financial approval, driven by strong demand stimulation and renewable deployment
 - North America got 1 Mt passed FID, of which ~70% was blue projects as CCS tax credits increased viability of deployment
 - India drove 80% of Asian (excl. China) additions, driven by launch of auction schemes to subsidise ammonia and hydrogen production
 - In Europe, the hydrogen auction was a game-changer, through guaranteed strike prices, supporting over 1 GW of European capacity, however it has yet to impact FIDs as European FID additions only accounted for 4% of total
- **In the short term, some companies are targeting high-margin, consumer-facing industries to cover cost premium**
- **But overall, supply side development continues to undershoot government targets**
 - In theory, 2030 pipeline capacity represents ~2x IEA assessed need, businesses are sceptical that more than 20% or 38Mt of the project pipeline will actually get built
 - At the same time, the majority of the ~740 new projects announced in the last year are below 100 ktpa in capacity, with few suppliers yet willing to consider large scale investments into projects

Key messages

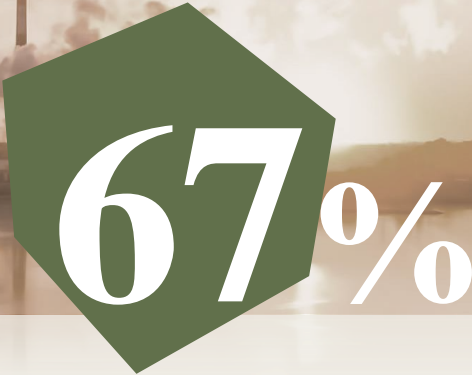
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- Most industry players view green hydrogen as the stronger solution compared to blue, though many are still seeing blue hydrogen deploying faster in the short-term
 - As of August 2024, there is a 10/90 split in favor of green hydrogen in the pipeline
 - However, the blue hydrogen pipeline is progressing faster, with operational blue supply more than triple that of installed green capacity driven by early North American CCS hydrogen projects.
 - And some producers would like to see increased incentives for blue hydrogen in the near term, while green hydrogen continues to scale
- Business see the role of government as critical for the foreseeable future as costs will be too high for voluntary demand to support supply
 - ~60% of low-cost hub volume in the European Hydrogen auction came in around 6 \$/kg
 - Producers saw broad increase in costs since 2022 instead of expected decrease, with companies citing up to 50% inflation in plant CapEx and renewable electricity prices
 - As a result, the green premium remains too high for voluntary demand to drive supply, making policy support essential for bridging the gap to willingness to pay
 - Without it, investment levels will be insufficient to meeting breakthrough targets as more than 60% view government policy as having a significant impact on company investment levels of which 9 viewed this as transformational
 - Longer term, business expect costs to come down, but the vast majority of business do not expect 2030 cost to fall below \$4/kg and state higher likelihood of landing on a range between \$4-8/kg, far from the stated offtake, with steel major requiring hydrogen prices between \$1.5-2.0/kg to accelerate offtake
- Business repeatedly points to high financing costs, uncertainty around voluntary demand and lack of enabling infrastructure as top barriers for increasing deployment
- Companies see the key unlock for FID in demand support, further pricing support and international coordination on standards and trade

Businesses' confidence in the hydrogen transition is among the highest, but few expect that the 2030 Breakthrough Agenda goal will be met



21% thought the sector was “mostly” on track” for a Paris aligned transition

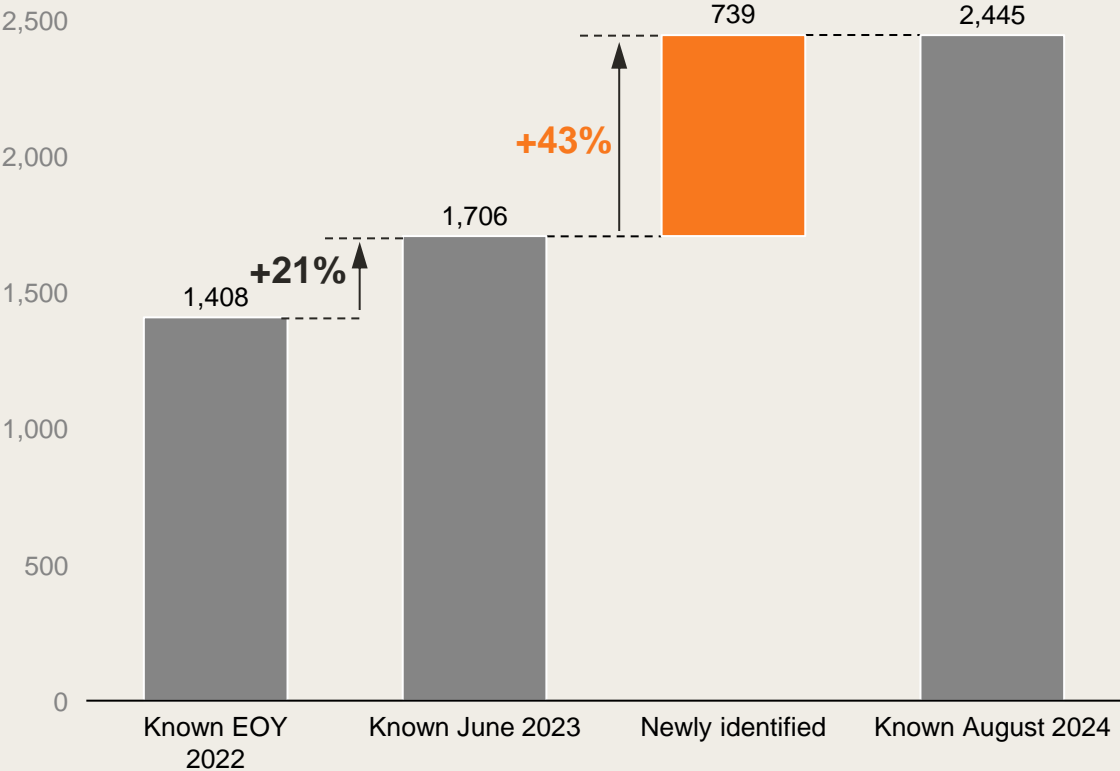


Two-thirds of businesses do not expect the 2030 Breakthrough Agenda goal of 'Affordable renewable and low-carbon hydrogen globally available by 2030' to be met

Source: Business Breakthrough Barometer Sector Survey (N=250)

Targets aside, there is a growing investment momentum in the sector

Global low carbon hydrogen projects (count)



- The number of announced low carbon hydrogen projects increased by 40% from June 2023 to August 2024
- Sector leaders are also increasingly optimistic about the market's potential: 75% reporting increased capex commitments over the last three years, as over half of companies now report that more than 20% of their CapEx envelope is net-zero aligned

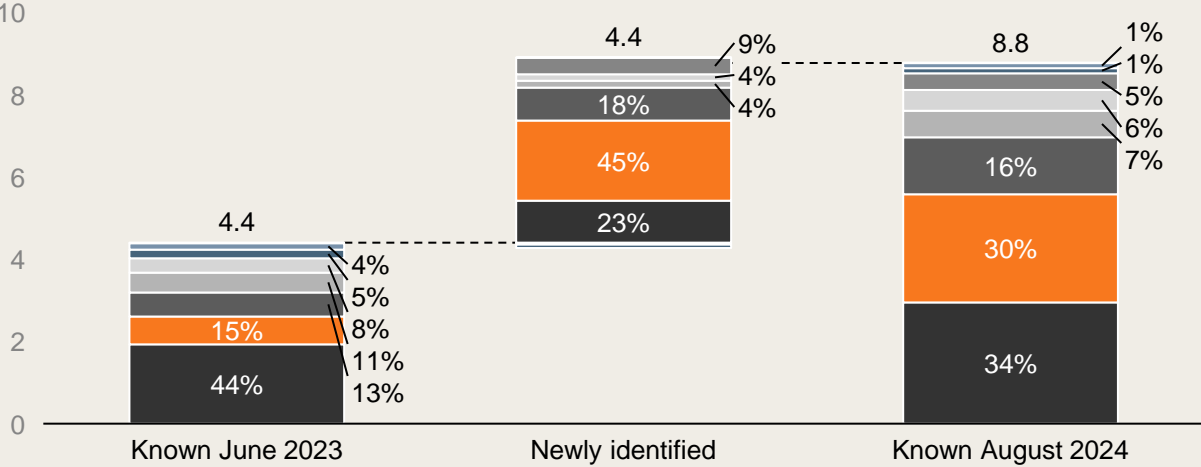


Source: GlobalData Hydrogen Plant database (August 2024 update); HEIPA; Company websites; Business Breakthrough Barometer Sector Survey (N=250); Business Interviews; Bain analysis

Alongside the project pipeline, projects reaching FID also doubled this year, with companies largely crediting a step change in gov. policy

Global low carbon hydrogen project capacity passed FID¹

(Mtpa, June '23 - August '24)



% of IEA 2030 need ²	6.8%	13.5%
% of total pipeline	2.5%	4.9%



- China led this momentum, contributing 45% of new capacity additions with six +100kt projects securing financial approval
- North America got 1,000 kt passed FID - ~70% was blue projects as CCS tax credits increased viability of deployment
- India drove 80% of Asian (excl. China) additions through auction schemes for ammonia and hydrogen
- In Europe, the hydrogen auction was a game-changer, with guaranteed strike prices supporting over 200kt of new European capacity – though European additions only accounted for 4% of total

We have seen significant amount of ammonia and hydrogen projects passing FID due to the 45Q, providing clear tax credits for carbon sequestration, bridging gap to willingness to pay for what is essentially commodities

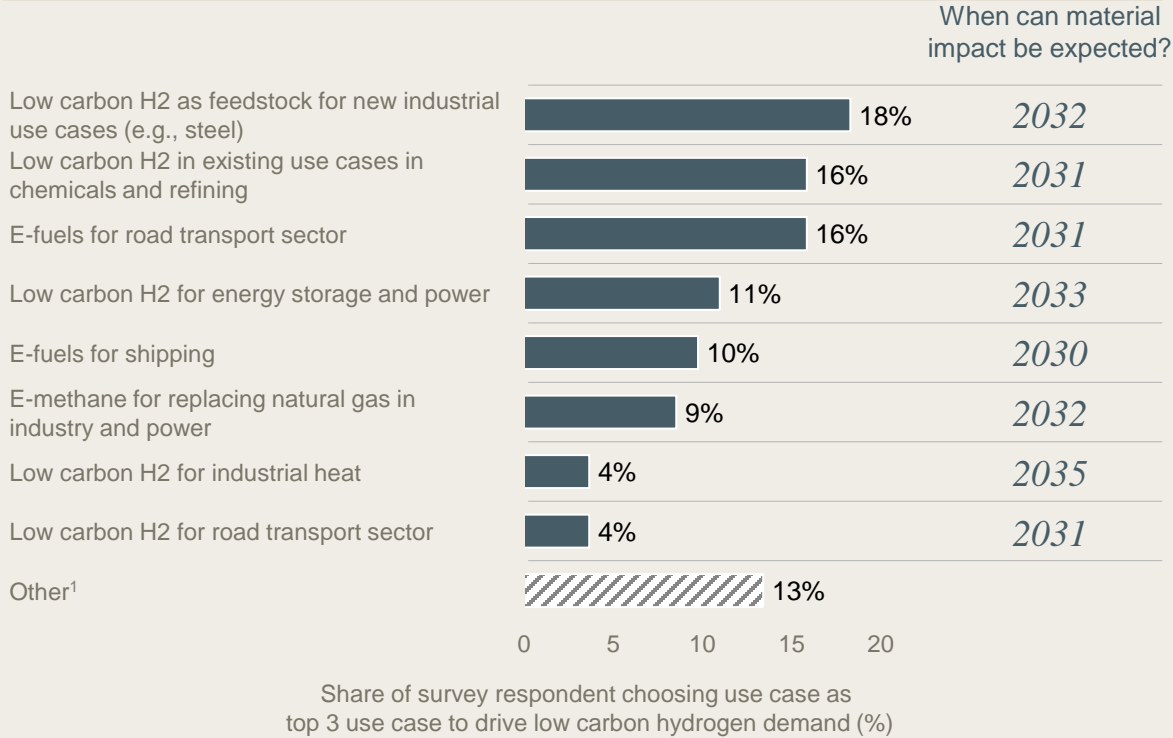
VP PUBLIC AFFAIRS,
CHEMICAL PRODUCER

Note: 1) Includes projects completed, commissioning and in construction; 2) 65 Mt IEA assessed need

Source: GlobalData Hydrogen Plant database (August 2024 update); HEIPA; Company websites; Business Breakthrough Barometer Sector Survey (N=250); Business Interviews; Bain analysis

In the short term, some companies are targeting high-margin, consumer-facing industries to cover cost premium

Please select the top 3 main use cases listed below according to which do you expect to see driving low carbon (green and blue) hydrogen demand?
Please select up to 3



Note: 1) Other includes Low carbon H2 for shipping, E-fuels for aviation, Low carbon H2 for aviation and other use cases;
Source: IEA; Hydrogen Insights; Business Breakthrough Barometer Sector Survey (N=250); Business Interviews; Bain analysis

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Regulators are targeting price-sensitive sectors like fuel production, but green steel is gaining traction thanks to early offtake from high-end automakers with the margin to absorb price premiums. **Hydrogen producers should follow suit by partnering with premium brands to offset current cost premiums**

CEO, END-TO-END HYDROGEN PRODUCER

For us the main use cases for ammonia has been **food producers**. The cost increase of around 10 cents of for example a beer made using clean wheat that has been grown with our clean ammonia is so **low it does not make a difference to our end customers**

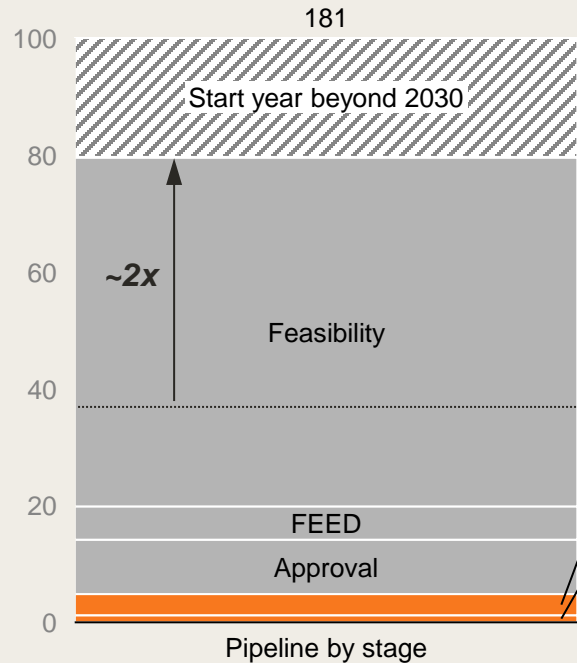
SVP CLEAN FUELS, SUSTAINABLE FUELS PRODUCER

Projects that are getting through FID are smaller... they also come at much higher premium than you could expect, up to even 20 €/kg, but at 2-3 years offtake decreasing risk for offtakers.

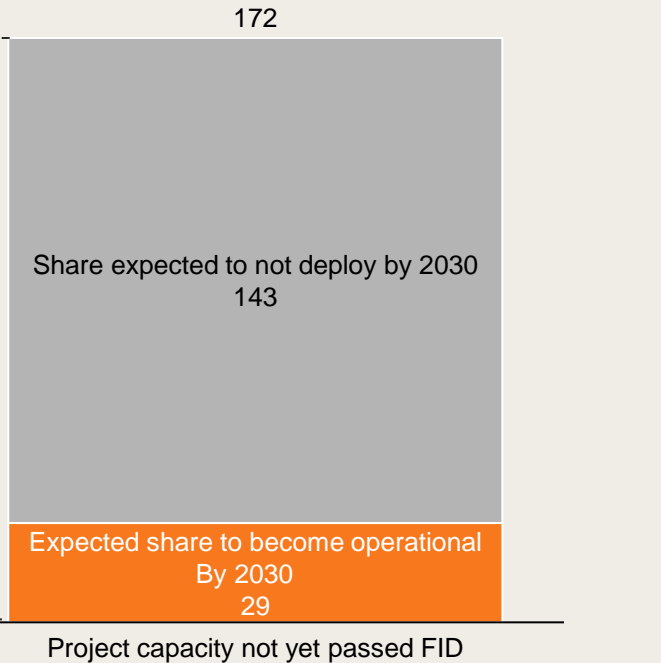
CEO, END-TO-END HYDROGEN PRODUCER

But overall, supply side development continues to undershoot government targets

Global low carbon hydrogen projects (Mtpa, as of August 2024)



Share of remaining low carbon hydrogen pipeline to become operational (average %)



- In theory, while 2030 pipeline capacity represents ~2x IEA assessed need, **businesses are sceptical that more than 20% or 38Mt of the project pipeline will actually get built**
- Companies on average expect only **17%** of projects not passed FID to **become operational by 2030**
- At the same time, **the majority of the ~740 new projects announced in the last year are below 100 kt in capacity**, with few suppliers yet willing to consider large scale investments into projects

2 years ago, the sentiment was that set [low carbon hydrogen deployment] targets for 2030 would be met, that has changed, **deployment forecasts for 2030 are down 50-60% now vs 2022**

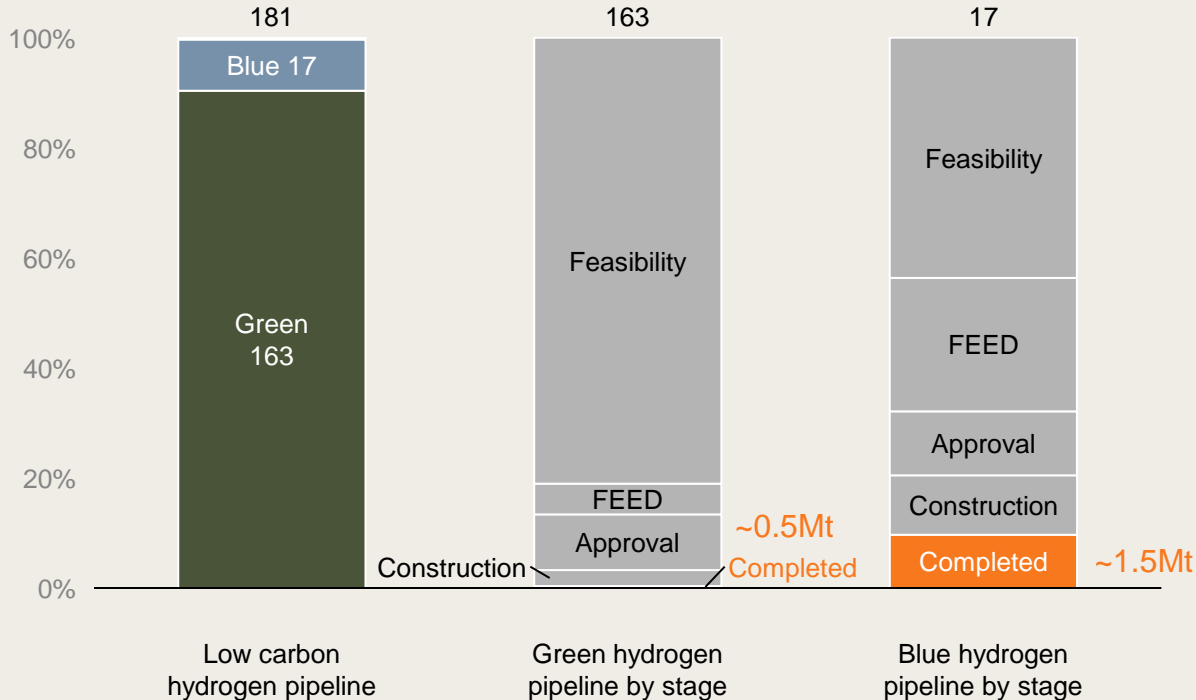
HEAD OF STRATEGY, ENERGY TRANSITION BUSINESS, HYDROGEN PRODUCER

Business expect only around 38 Mt of low carbon hydrogen to be deployed by 2030

Source: GlobalData Hydrogen Plant database (August 2024 update); HEIPA; Company websites; Business Breakthrough Barometer Sector Survey (N=250); Business Interviews; Bain analysis

Most industry players view green as the stronger solution compared to blue, though many are seeing blue deploying faster in the short-term

Low carbon hydrogen pipeline (as of 2024-08, Mt)



- There is a 10/90 split on blue vs. green hydrogen in the pipeline
- However, blue pipeline is seeing faster time to deployment, as deployed and producing blue capacity is more than triple of installed green production, driven by early North American CCS hydrogen projects
- Some producers would like to see increased incentives for blue hydrogen in the near term, as green hydrogen continues to scale

Large volumes in the short term will be blue while electrolyzers are developed in size, cost come down etc , ... regulators needs to have openness to use blue while green is scaling.

VP MARKET DEVELOPMENT,
SUSTAINABLE FUEL PRODUCER

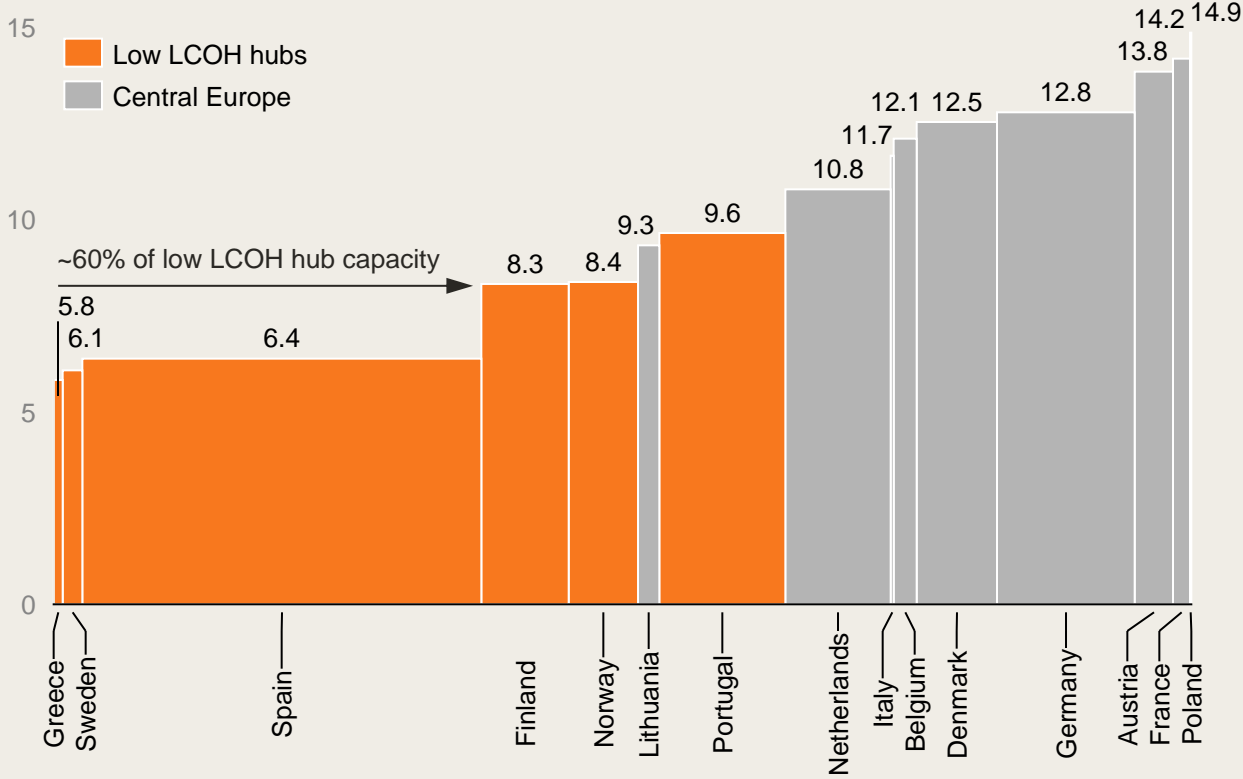
Green fuels not going to scale quickly, we need CCS to decarbonize grey fuels in the short term. Regulation does not incentivise that as of now.

CEO, HYDROGEN TECHNOLOGY PROVIDER

Source: GlobalData Hydrogen Plant database (August 2024 update); HEIPA; Company websites; Lit. search; Business Breakthrough Barometer Sector Survey (N=250); Business Interviews; Bain analysis

Business see the role of gov. as critical for the foreseeable future – the green premium will be too high for voluntary demand to support supply

Supply curve of LCOH of bids for the EHB auction (\$/kg, 2024)



- Costs for first of a kind projects are higher than the market had hoped - companies cite up to 50% inflation in plant CapEx and renewable prices since 2022
- Suppliers believe prices will remain above offtake expectations for some time to come – the majority of low-cost hub bid volume in the EU Hydrogen auction came in around 6 \$/kg
- Longer term, costs will come down. But the vast majority of businesses do not expect 2030 costs to fall below \$4/kg, and many see a higher likelihood of landing closer to \$8/kg.
- This compares to a target price of \$1.5-2.0/kg to make the green steel business case work under current market conditions, making policy essential for bridging the gap to willingness to pay.

You need some very strong tailwinds in interest rates to get below 4 \$/kg by 2030.

HEAD OF ENERGY TRANSITION STRATEGY,
HYDROGEN PRODUCER

You won't see a massive change in cost of hydrogen [in 2030] from what is being announced now as most of those projects won't come online until 2028

HEAD OF ENERGY TRANSITION STRATEGY,
HYDROGEN PRODUCER

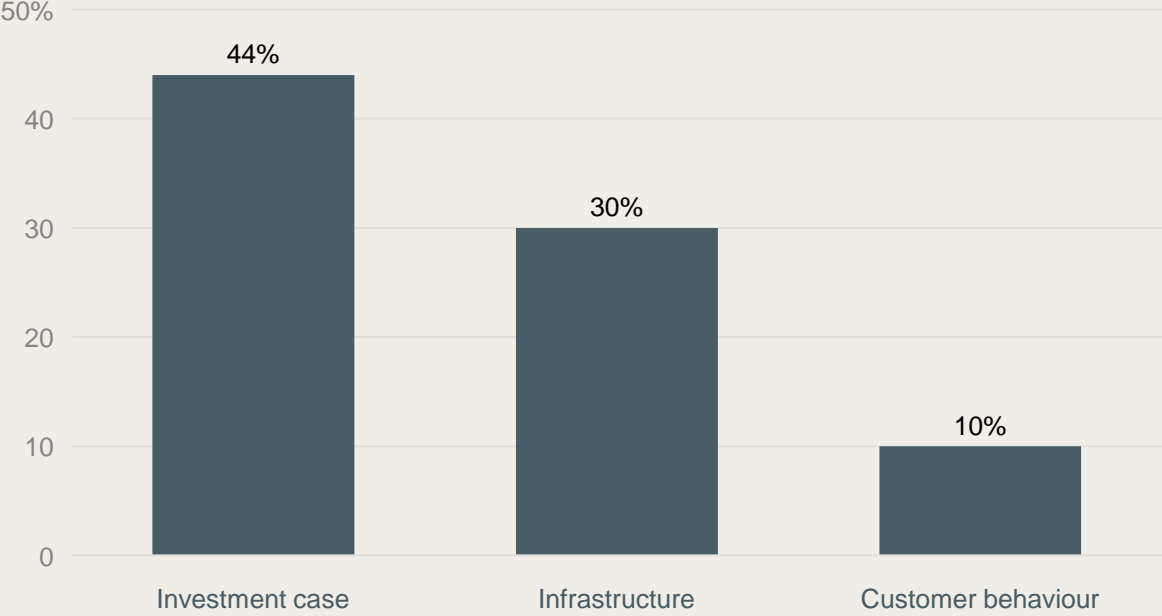
Note: 1.1 EUR to USD (Google, 240814)

Source: EU Hydrogen Bank; Business Breakthrough Barometer Sector Survey (N=250); Business Interviews; Bain analysis

Business repeatedly points to high financing costs, uncertainty around voluntary demand and lack of enabling infrastructure as top barriers

Which of the following do you view as the sector's largest barriers for accelerating investment in the development and production of low carbon hydrogen & derivatives?
 Please select the top 3 most impactful barriers

Share of survey responses selecting barrier in the top 3 (%)



INVESTMENT CASE

- Companies cost cite high-cost inflation sensitivity as plant CapEx and renewable electricity prices increased by 50% in some cases, worsened by immature value chains and high risk profile of first-of-a-kind projects
- Companies see limited voluntary demand, with less than 1% of announced low-carbon hydrogen capacity having a binding offtake agreement as offtakers are waiting for prices to drop, with insufficient policy pushing for adoption



INFRASTRUCTURE

- Companies point to infrastructure as especially lagging, being short by \$175B to meet IEA assessed need in 2030 as investors await certainty on scale of future need
- Companies also point to a lack of aligned international standards of low carbon hydrogen, limiting their ability to capture a green premium



CUSTOMER BEHAVIOUR

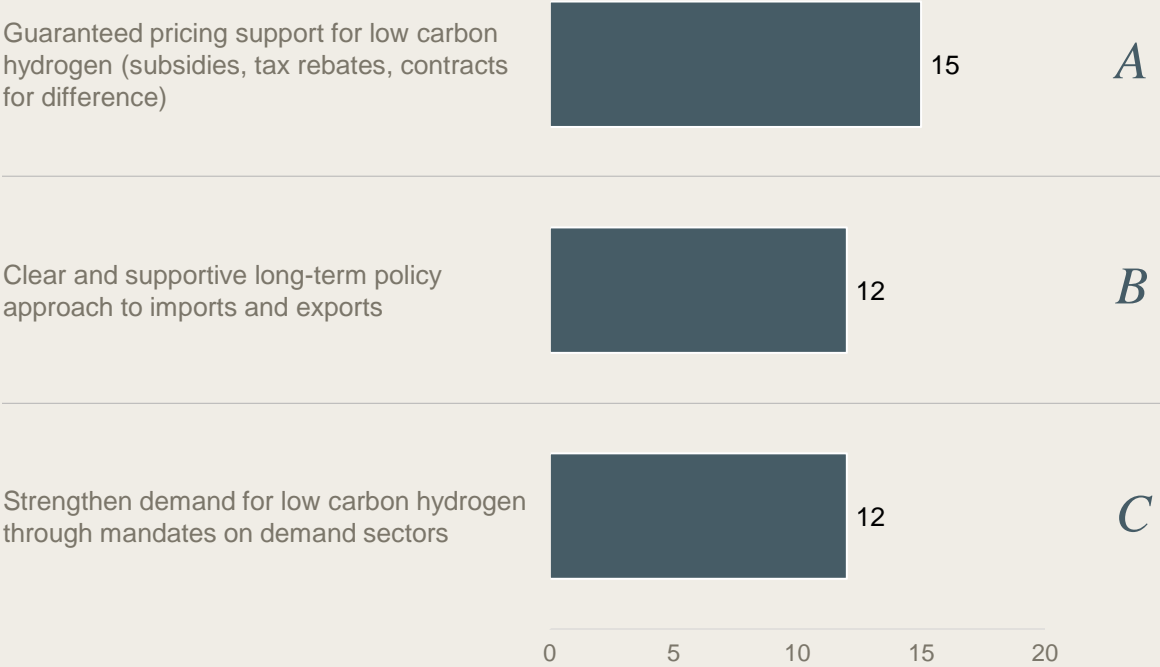
- End-users prefer shorter-term offtake contracts instead of the long-term agreements needed by producers to get financial backing from investors to take projects to FID

Source: Business Breakthrough Barometer Sector Survey (N=250); Business Interviews; Bain analysis

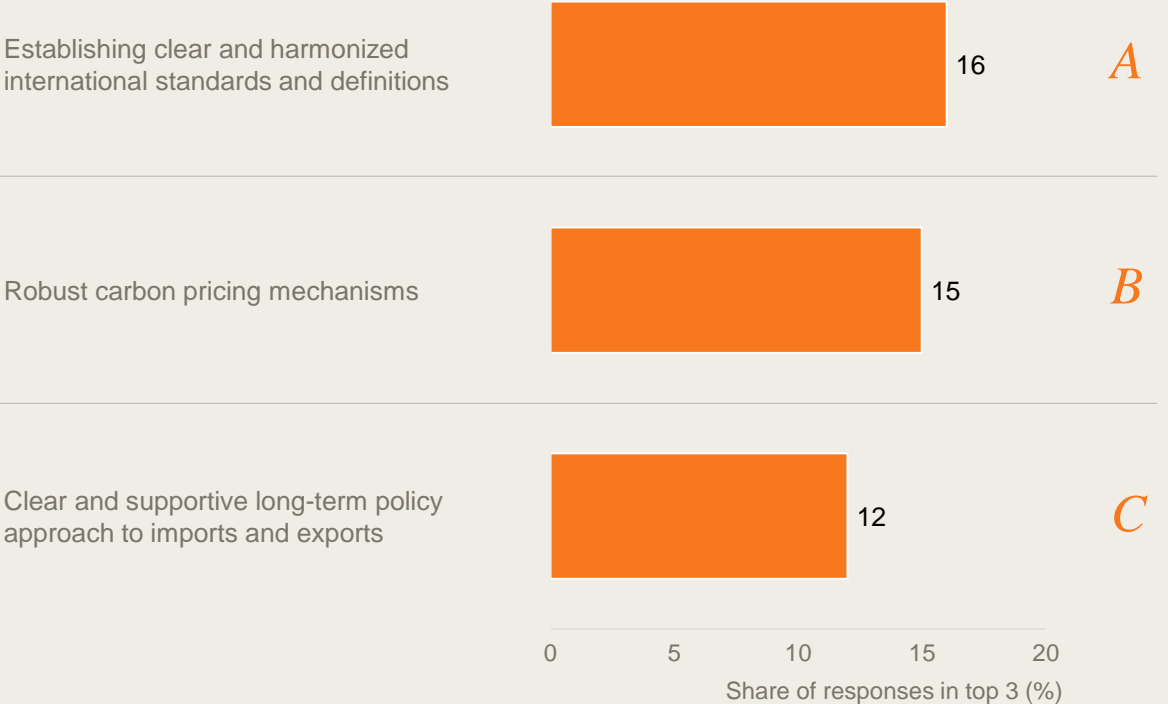
Sector sees key policy focus in pricing support, standard collaboration, trade policy, carbon pricing, infrastructure planning, and demand support

WHAT ARE THE TOP THINGS REGULATORS SHOULD FOCUS ON IN THE NEXT 12 MONTHS TO ACCELERATE INVESTMENT IN THE DEVELOPMENT AND DEPLOYMENT OF KEY TECHNOLOGIES AND SOLUTIONS TO ENABLE THE NET ZERO TRANSITION WITHIN THE HYDROGEN SECTOR?

NATIONAL



INTERNATIONAL



Source: Business Breakthrough Barometer Sector Survey (N=250)





Companies see the key unlock for FID in demand support, further pricing support and international coordination on standards and trade


Policy focus


National  International 



 Establish demand certainty by **mandating specific sectors to utilize low-carbon hydrogen or its derivatives**, either through traded certificates or production volume obligations, depending on regional contexts

 Create price certainty with **guaranteed strike prices** through mechanisms such as Contracts for Difference (CfDs) or hydrogen auctions

 **Clear international coordination on green product trade** is needed to establish the most rational trade environment, determining the optimal locations for producing hydrogen and its derivatives, as well as the most efficient methods for transportation

 **Establish mutually recognized international standards, definitions and certification schemes** for hydrogen facilities and low carbon hydrogen to enable efficient international markets

Thank
You



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