

# Outlook for electrolyser supply and demand in Europe

# Guidehouse at a glance

## Our Company



**12,000+**  
employees



**50+**  
locations  
globally



**4** consecutive  
years on Forbes  
Top Employers



GovCon 2020  
Contractor of  
the Year, Over  
\$300 Million



Malcolm Baldrige  
National Quality Award  
2014 Award Recipient

## Our People



**33** languages  
fluently spoken



**46%** hold  
professional certifications



**38%** have  
advanced degrees

2021 Military Friendly® Program



**11x** KLAS #1 Rankings



Public Sector



SMITHERS  
QUALITY ASSESSMENTS

## Our Communities



**7,000+** pro bono and  
volunteer hours



**\$1,400,000+** in employee  
and corporate donations



Purchased **100%** Renewable Electricity for  
most of our global offices



Committed to **Science Based Targets**  
to reduce our greenhouse gas emissions

## Commitment to Inclusion, Diversity and Belonging



**37%**  
racially diverse



**6** generations  
of professionals



**49%** female  
**51%** male



**7** employee  
affinity groups



**5%**  
Veteran and  
Active Duty

**11** consecutive  
perfect scores  
with HRC



## Our Clients



**Healthcare:**

**7** of the top 10 hospital  
systems (by Member  
Hospital Beds)\*



**Life Sciences:**

**38** of the top 50  
pharmaceutical  
companies\*\*



**Public Sector:**

**15** (all) executive  
departments of the U.S.  
Federal Government



**Financial Services:**

**8** of the 10 largest  
U.S. banks



**Energy:**

**60** of the world's  
largest electric and  
gas utilities\*\*\*



**State & Local  
Government:**

**30** out of 50  
States

\* Data Source: Definitive Healthcare

\*\* Data Source: based on 2019 data from PharmExec

\*\*\* Data Source: 2019 S&P Global Platts Top 250 Global Energy Company Rankings®

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# Market Intelligence is at the core of what we do

Our global team of analysts provide ongoing monitoring of macroeconomic and industry trends

Guidehouse Insights is a premier market intelligence brand globally recognized as among the most trusted cleantech research organizations. Hundreds of global clients rely on our proprietary forecasts, data, and market insights to assess emerging market opportunities and threats, shape go-to-market strategies, and anchor market-facing messaging with objective insights.



30  
50  
150  
1,000

Emerging technology verticals covered

Dedicated subject matter experts on staff globally

Reports published annually

Industry interviews conducted annually





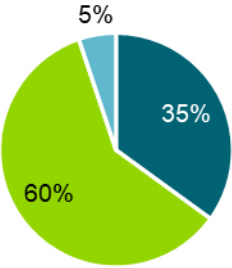
# Key questions

- What is the current outlook for electrolyser manufacturing in the EU?
- Is Europe on track to meet its targets for electrolyser capacity and LCOH reduction?
- How much of a risk do overcapacity and Chinese imports present to EU manufacturers?
- What can we learn from the initial European Hydrogen Bank auction results?
- Where should the industry focus its efforts to accelerate green hydrogen adoption?

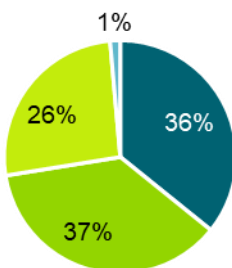
# European electrolyser manufacturing capacity

4.6 GW of nameplate manufacturing capacity was operational in Europe by the end of last year, and more than 20 GW has been announced by 2030

Capacity operational by Q4 2023

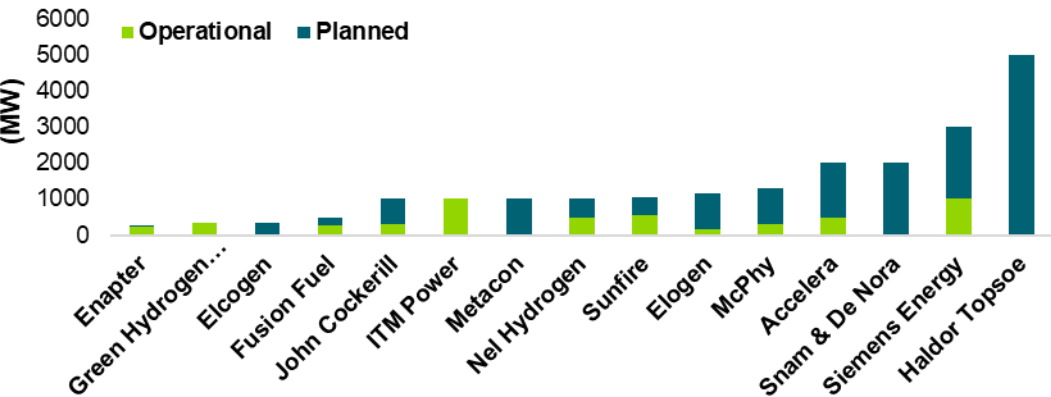


Announced Capacity by 2030

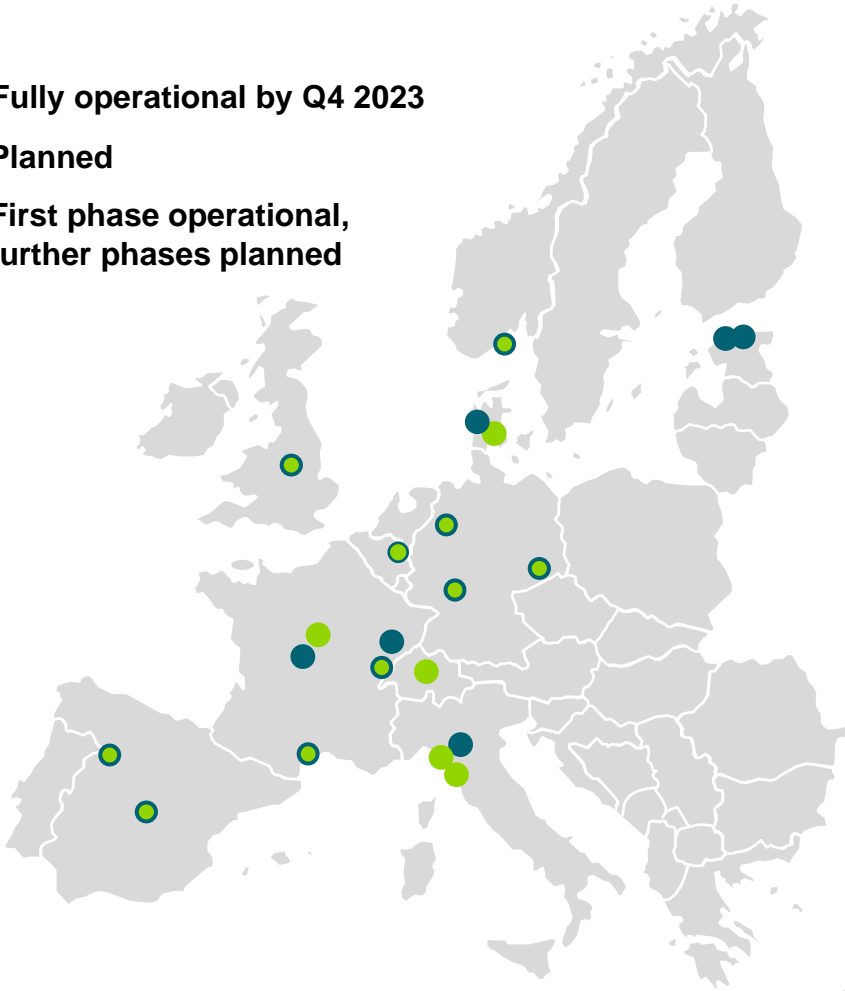


- ALK
- PEM
- SOEC
- AEM

Planned and operational electrolyser manufacturing capacity by company, Europe



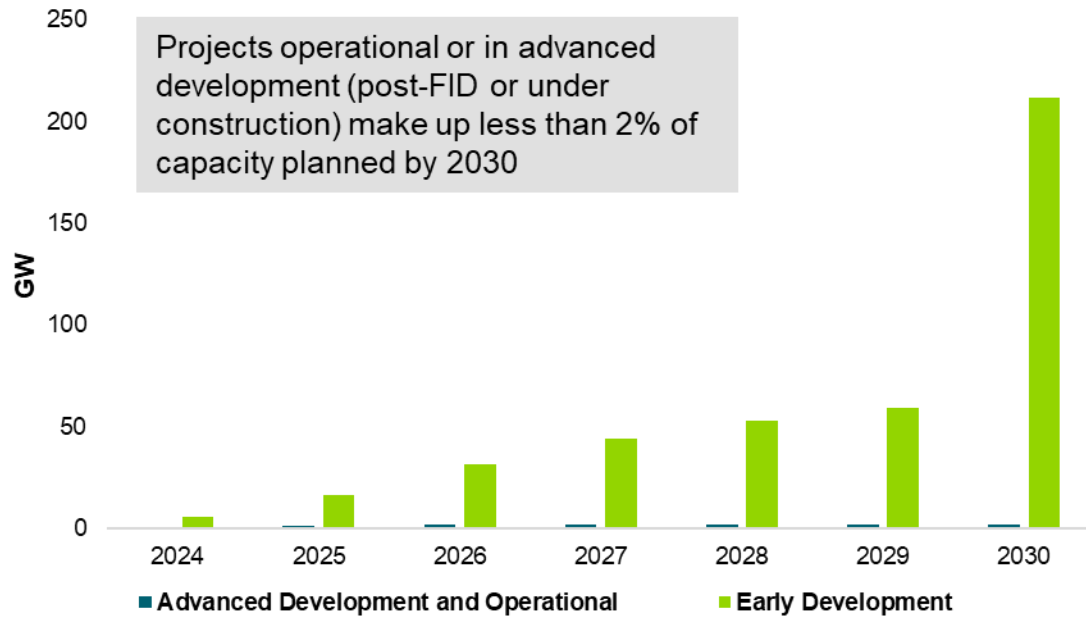
- Fully operational by Q4 2023
- Planned
- First phase operational, further phases planned



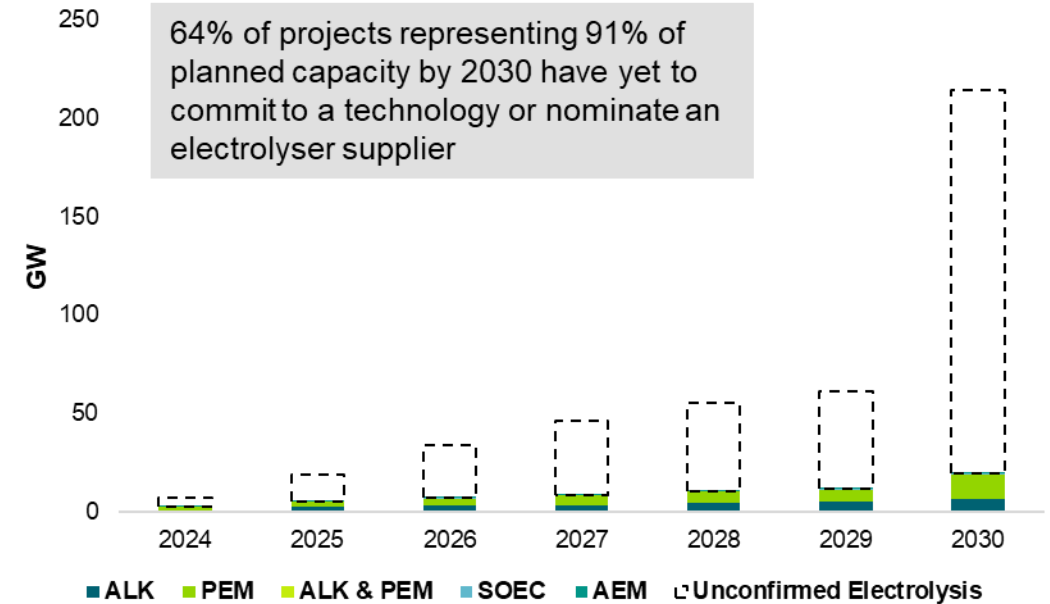
# European project pipeline

More than 200 GW of green hydrogen production capacity is planned by 2030, the majority of which is a handful of large-scale projects targeted for the end of the decade

European green hydrogen projects by development stage



European green hydrogen projects by technology



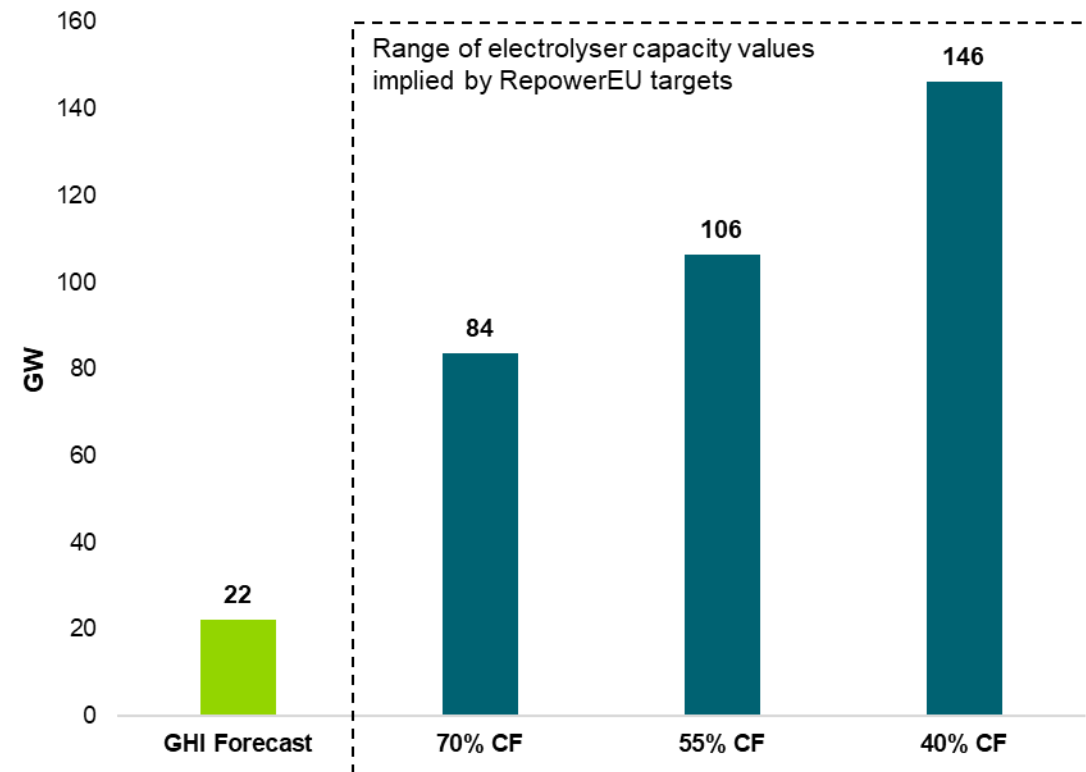
# Green hydrogen production targets

The European Commission's target for 10 million tonnes of domestic green hydrogen production by 2030 is likely out of reach

## Unpacking RepowerEU Targets

- Under RepowerEU the European Commission is targeting 10 million tonnes of domestic green hydrogen production.
- The amount of electrolyser capacity required for the target is strongly determined by the average capacity factor of production sites. Potential values range from 84 GW under a high capacity factor scenario to 146 GW under a low capacity factor scenario. This compares to a previous 40 GW target set under the European Hydrogen Strategy.
- Guidehouse Insights' most recent forecast for electrolyser deployments in Europe (published Q3 2023) indicates a cumulative capacity of 22 GW, well shy of the capacity needed to deliver RepowerEU.
- An additional 10 million tonnes of imports are also targeted, which would be still more difficult to meet.

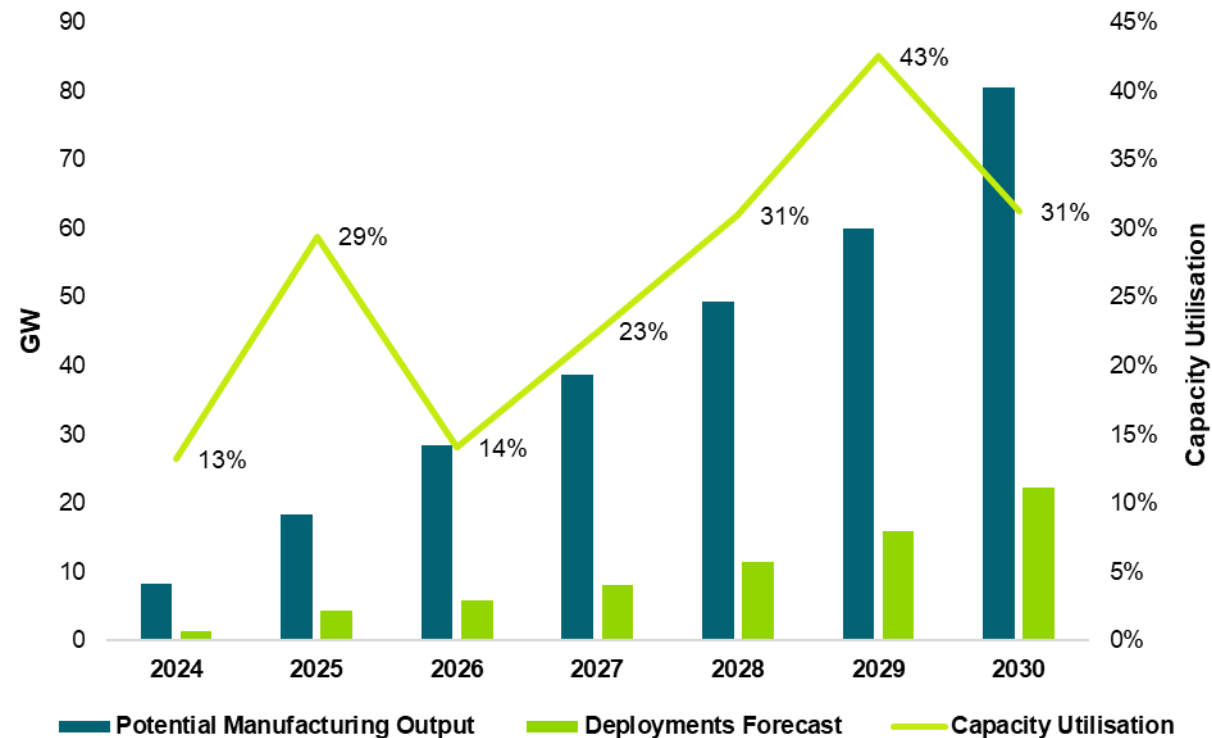
## RepowerEU 2030 targets translated into GW of electrolyser capacity at varying average capacity factors



# Is there a risk of electrolyser oversupply?

**Oversupply risk is less pronounced in Europe than at a global level, but accelerating deployments are needed to justify continued manufacturing capacity expansion**

**Comparison of potential manufacturing output and current electrolyser deployment forecast in Europe**



## Outlook for Capacity Utilisation

- If all announced manufacturing capacity is delivered on schedule, Guidehouse Insights' most recent deployment forecast indicates an average European capacity utilisation of 26% through 2030 (assuming no net imports).
- However, nameplate manufacturing capacity figures overestimate manufacturers' capability to deliver. Many manufacturing projects also include a long ramp up period to a targeted capacity, which provides flexibility in response to market conditions.
- Some excess capacity should also be expected – manufacturers are positioning themselves to be able to deliver large volume orders, but don't expect to operate at full utilisation over sustained periods.
- Nevertheless, continued project delays and non-European electrolyser imports both present risks.



# Comparison of funding instruments

The European Hydrogen Bank provides lower overall funding than the US approach and lower funding per unit hydrogen than the UK's CfD-style scheme

	United States	United Kingdom	European Union
<b>Scheme</b>	IRA 45V Tax Credits	Hydrogen Allocation Rounds	European Hydrogen Bank
<b>Instrument Type</b>	Fixed premium production tax credit	Contracts for difference style scheme linked to natural gas price	Fixed premium determined through competitive bidding process
<b>Subsidy Rate</b>	Up to \$3/kg	No upper limit for first round (emphasis on price discovery), average £9/kg	Initially up to €4.5/kg, reduced to €3.5/kg for upcoming auction
<b>Total Funding Amount</b>	Uncapped (total IRA funding estimated at \$300-\$400 billion)	First allocation round £2 billion	First auction round €0.8 billion, second auction round €1.2 billion, capability for member state funding
<b>Funding Duration</b>	10 years	15 years	10 years
<b>Awarded Capacity</b>	N/A	125 MW	1502 MW
<b>Emissions Criteria</b>	Under review	Implemented	Implemented (under RED)

**High certainty of funding amount.**  
Emissions accounting criteria delaying uptake and tax credits less attractive for financiers.

**Well suited to first of a kind projects.**  
Awarded capacity limited at current subsidy rates.

**Low overall funding amount, relies on member state participation.**  
Competitive auction process requires offtaker willingness to pay.

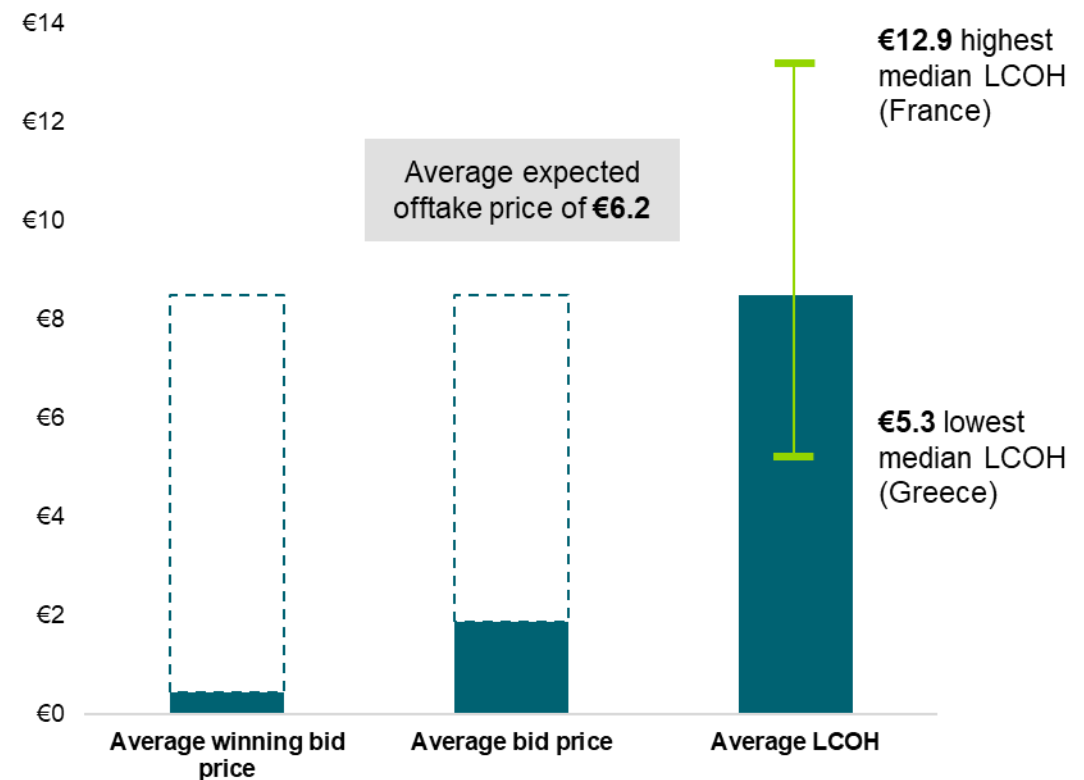
# European Hydrogen Bank (EHB) auction results

The success of the EHB auction process relies on offtakers with high willingness-to-pay, which could pose risks to some low bidding projects

## Willingness to Pay

- The average bid price across all submitted projects was €1.86 per kg. The average bid price of the selected projects was only €0.44.
- This compares to an average LCOH expectation of €8.49. There was substantial variation in expected LCOH between member states, ranging from €5.3 in Greece to €12.9 in France.
- In order for winning projects to progress to FID, offtakers will need to pay an average of €6.2 per kg for green H<sub>2</sub>.
- Member state participation in the EHB's auctions-as-a-service model may help to drive down the burden on offtakers by enabling a higher bid ceiling.
- However, the design of the instrument will continue to reward the lowest bidding projects.

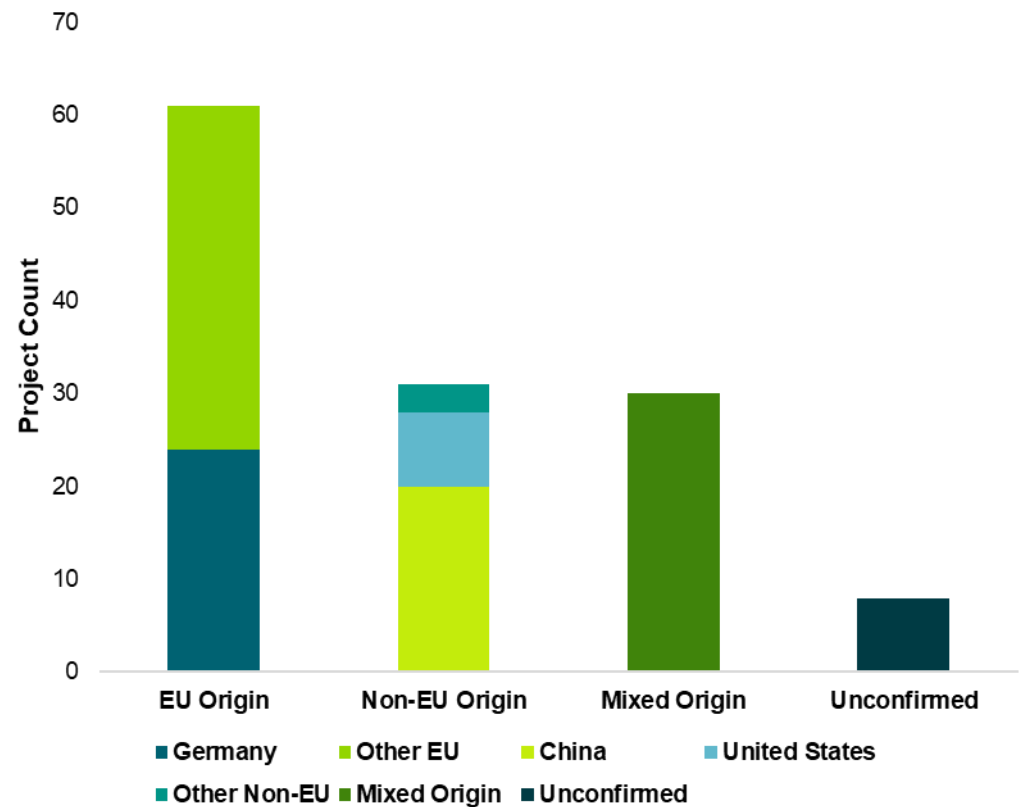
## Comparison of bid prices and expected LCOH in EHB auction submissions



# Does international competition present a risk?

Germany is the largest source of electrolyser supply in first round EHB bids, but is closely followed by China

Electrolyser country of origin in the first EHB auction round



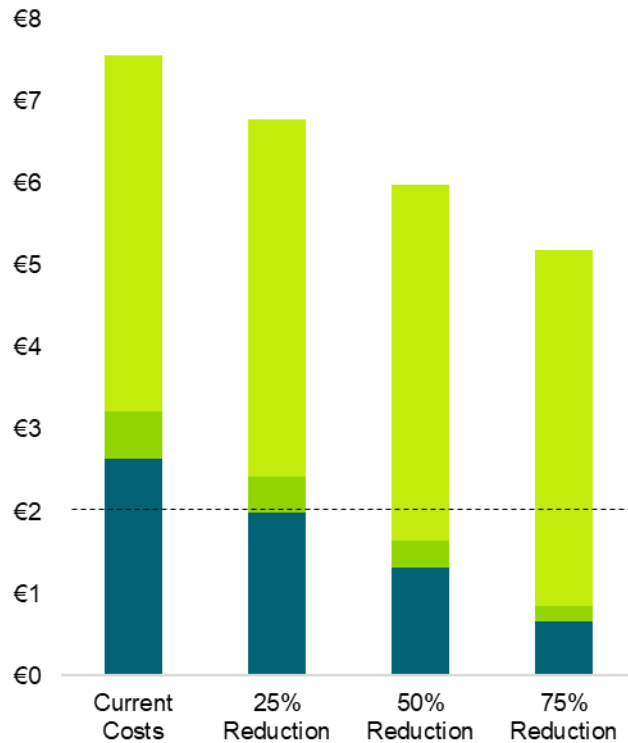
## EHB Supply Sources

- Germany is the largest EU supplier, accounting for 24 bids, followed by France, Denmark and Belgium (3 bids each). China is the largest non-EU supplier with 20 bids followed by the US with 8.
- Chinese manufacturers are currently able to deliver alkaline electrolysers at 2-3x lower cost than western manufacturers. However, these costs are for domestic Chinese projects and only include the stack and balance of stack.
- European manufacturers have repeatedly called for the inclusion of domestic content requirements to prevent undercutting by imported Chinese equipment. A 40% domestic content requirement for European projects is proposed within the EU's Net Zero Industry Act but has not been implemented.
- However, the second EHB auction round will require suppliers to demonstrate compliance with EU standards, which will raise costs for Chinese manufacturers and delay timelines by 2-3 years.

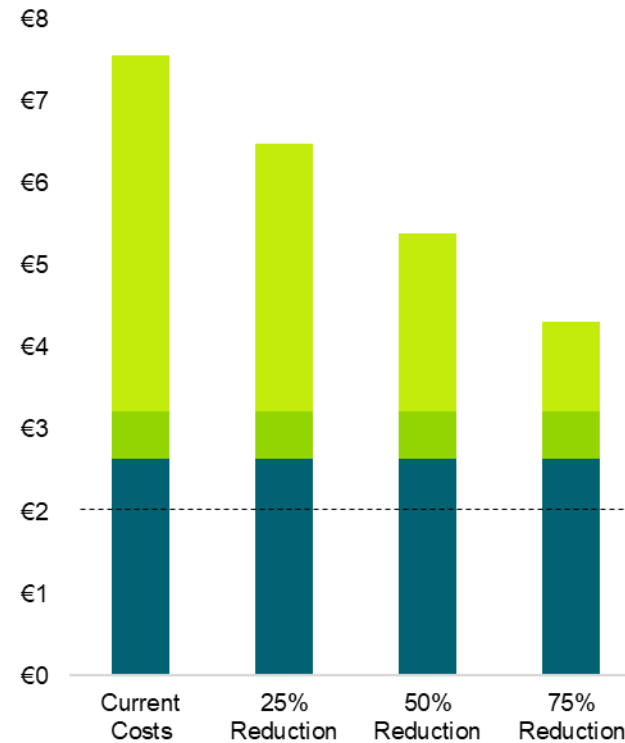
# Prospects for LCOH reduction

**Achieving cost competitiveness with grey hydrogen would require project CAPEX and electricity cost reductions that are unlikely this decade**

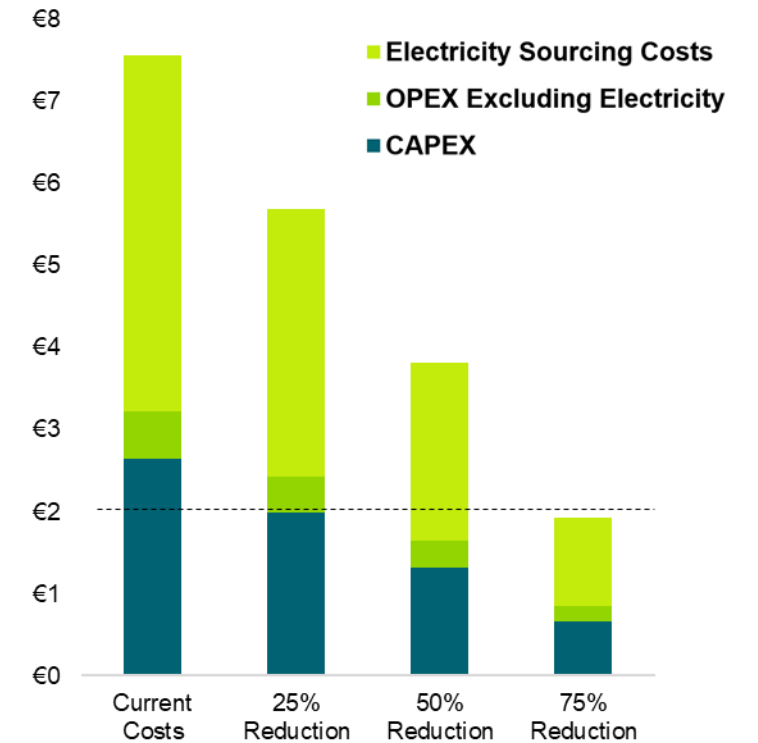
**Steep reductions in project CAPEX result in marginal LCOH decreases**



**Electricity cost reductions are more impactful but still insufficient**

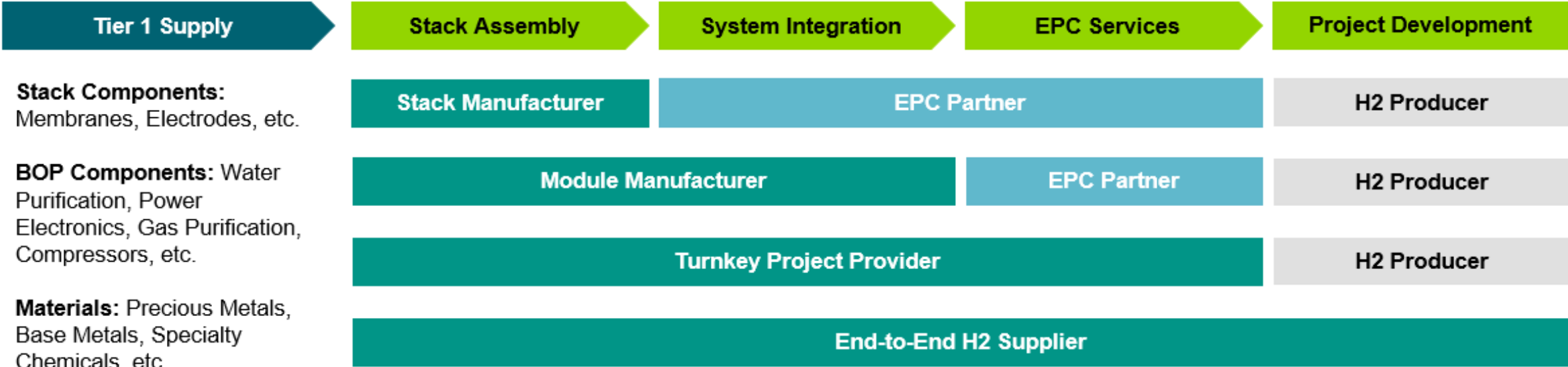


**€2/kg would require a 75% reduction in both CAPEX and electricity costs**



# Electrolyser manufacturer business models

Standardisation and system level optimisation at the manufacturer level or in combination with an EPC partner are critical to capital cost reduction



Stack Manufacturers	Module Manufacturers	Turnkey Project Providers	End-to-End H2 Suppliers
Supply electrolyzer stacks with minimal BOP subsystems	Supply integrated electrolyzer modules, often in containerized form. Many module manufacturers also supply stacks independently.	Supply stacks and BOP and perform onsite integration activities.	Intend to own and operate green hydrogen production facilities developed using their own technology offering.



# Success factors for electrolyser industry scale-up

**Successful scale-up of electrolyser capacity requires strong coordination between policy makers, manufacturing players, project developers and offtakers**



## Policy Makers

- Adequate funding support (both per unit and in terms of overall funding allocated) with clear and transparent selection criteria.
- Member state participation in European hydrogen initiatives.
- Clear emissions accounting rules.
- Combination of supply side and demand side incentives.
- Capability to set domestic content requirements if non-European imports rise above acceptable levels.



## Manufacturers

- Ability to provide turnkey solutions or close EPC relationship.
- Differentiated technology offering and high equipment performance on key metrics: efficiency, system reliability, etc.
- Low capital costs.
- Sufficient manufacturing capacity to deliver industrial scale projects.
- Track record of successful equipment delivery and reliable operation.
- Creditworthiness and balance sheet capacity.



## Project Developers

- Ability to deliver a competitive LCOH.
- Existing offtaker relationships (e.g. for industrial hydrogen suppliers) or ability to self-consume (e.g. for industrial energy consumers).
- Strong understanding of the trade-offs between different technology or supplier selections.
- Experience with developing renewable energy projects or sourcing renewable energy.
- Appropriate balance between ambition and realism in project scope.

# Key messages

1

Deployments are increasing more slowly than initially anticipated in Europe, but the industry is making strong progress on addressing barriers to project financing and delivery.

2

The risk of electrolyser oversupply is less pronounced in the EU than at a global level – however global oversupply may increase the risk of international competition later in the decade.

3

Competitive auctions may not be the most suitable instrument for supporting first of a kind projects, and high offtaker willingness-to-pay will be key to progressing EHB projects through to FID.

4

LCOH reduction requires a combination of business model optimisation on the part of electrolyser manufacturers, and effective electricity sourcing strategies on the part of project developers.

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# Thank You

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