Aurora Keynote:

Where are the opportunities for hydrogen in Europe?

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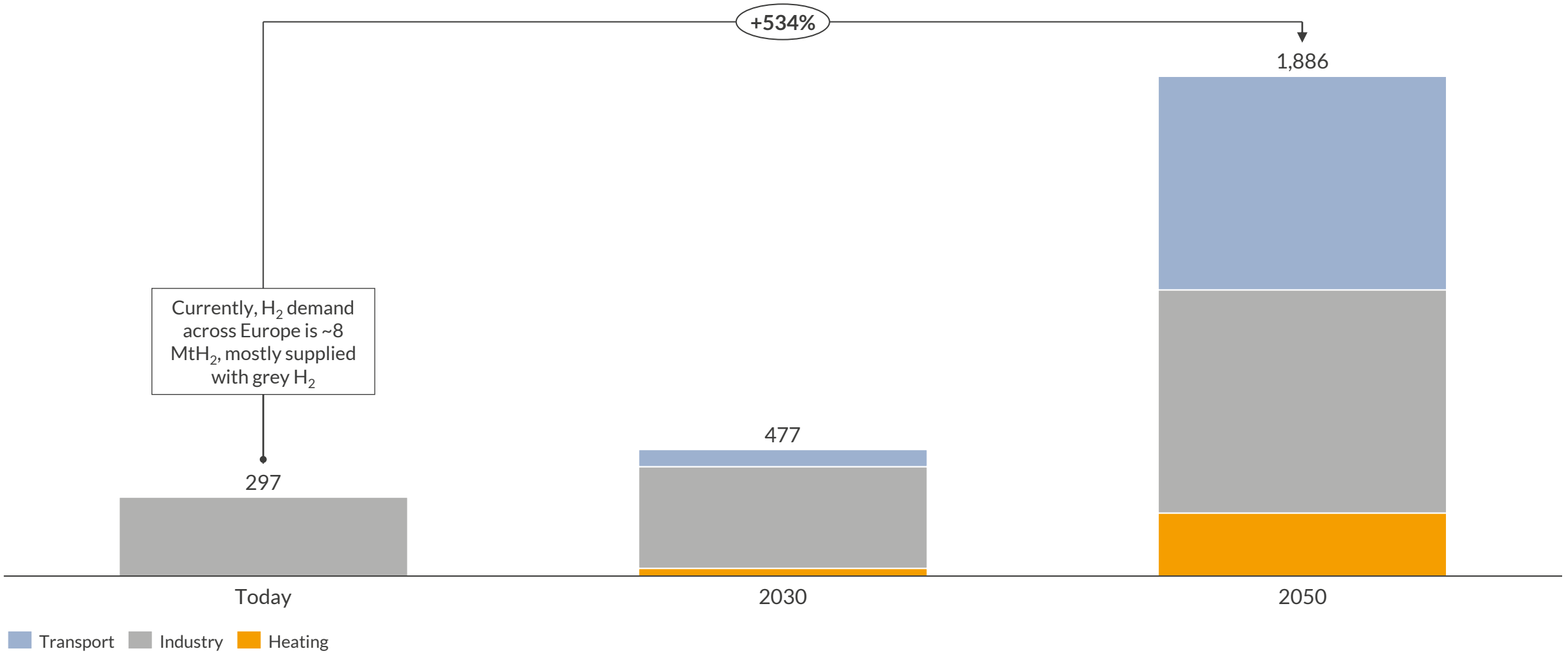
Panel Partners: CMS law·tax·future; H2E CHANGE THE GAME OF ENERGY!

European hydrogen demand will grow more than 500%, mostly by the transport and industry

European[1] H_2 demand by sector, including H_2 derivatives and imports[2]
TWh (HHV), final energy consumption



1) European countries include HyMAR countries analysed in this report. These countries include BEL, DNK, DEU, ESP, FIN, FRA, GBR, IRL, ITA, NLD, NOR, POL, PRT, ROU, and SWE. 2) Includes hydrogen required to produce derivatives such as ammonia or synthetic fuels. The hydrogen demand shown accounts for the total domestic consumption, including any potential imported hydrogen or hydrogen derivatives.
Source: Aurora Energy Research

While the announced European electrolyser pipeline exceeds 150 GW, only a small portion is operational or past final investment decision

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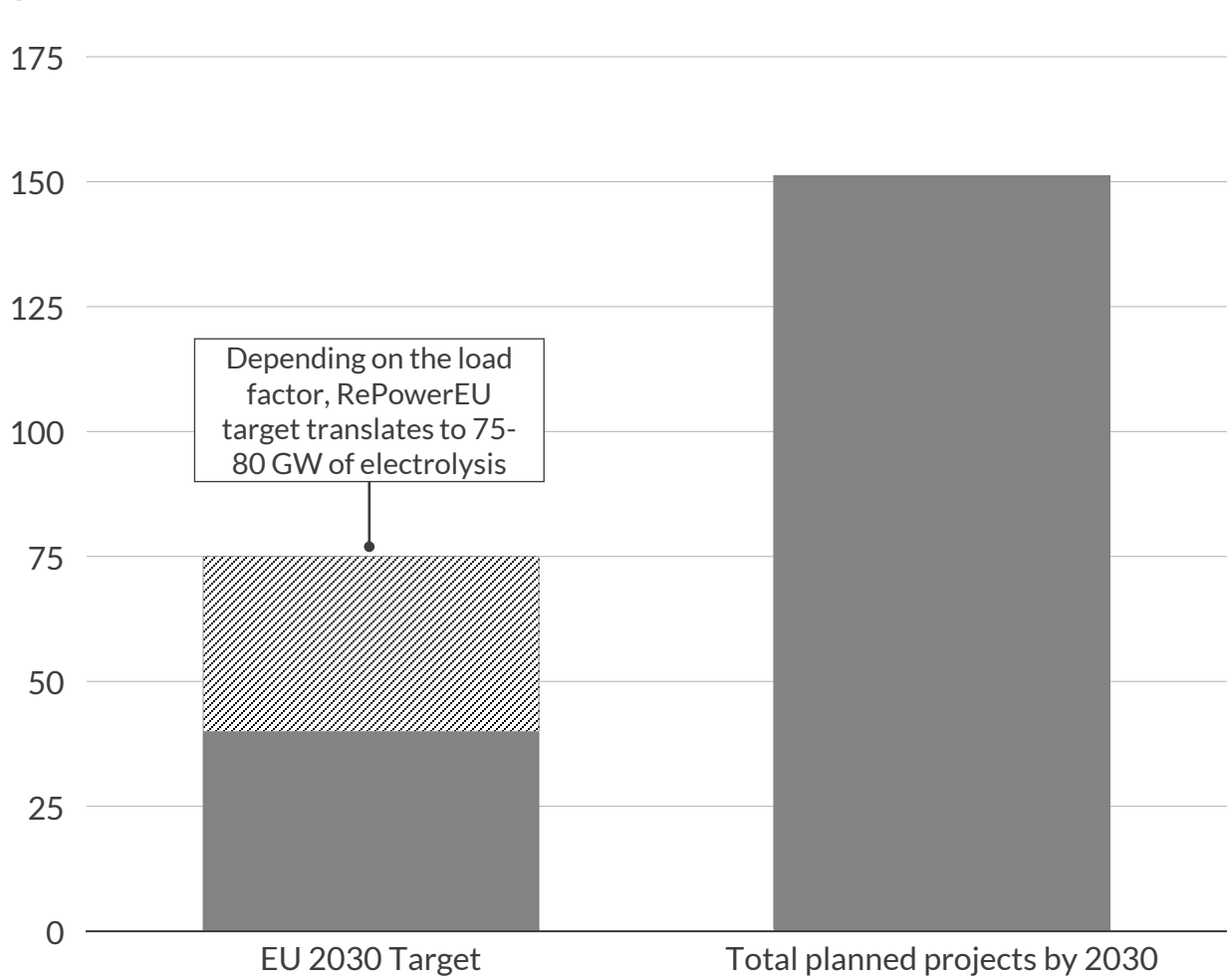
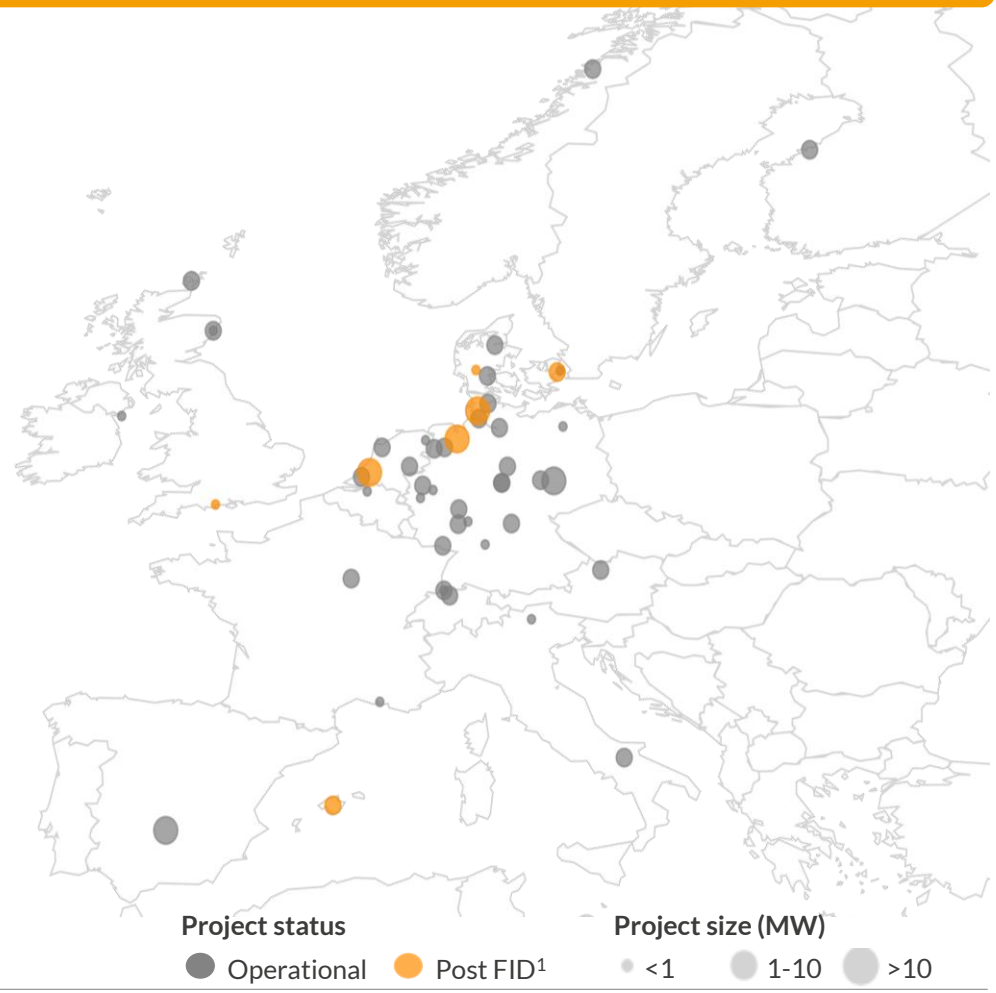
Current H_2 electrolyser capacity pledges and announced project pipeline by 2030



In Europe, there are currently 156 MW of operational electrolysers and only 8 projects (327 MW) that have publicly announced FID[1]



1) Final Investment Decision

Source: Aurora Energy Research

Government's role is crucial for a successful market roll-out by mitigating the regulatory and economic risks of H_2 projects at its infancy

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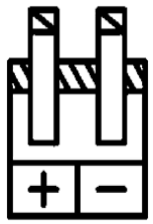
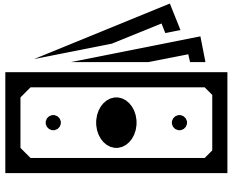
Technology

- **Operational risk:** Limited experience in commercial scale deployment
- **Value chain risk:** The complex value chain from securing green electricity to transporting the produced hydrogen



Economic

- **Competitiveness risk**: Green hydrogen's competitiveness against alternatives
- **Offtake risk**: The absence of a liquid hydrogen market creates uncertainty in the volume and price of hydrogen

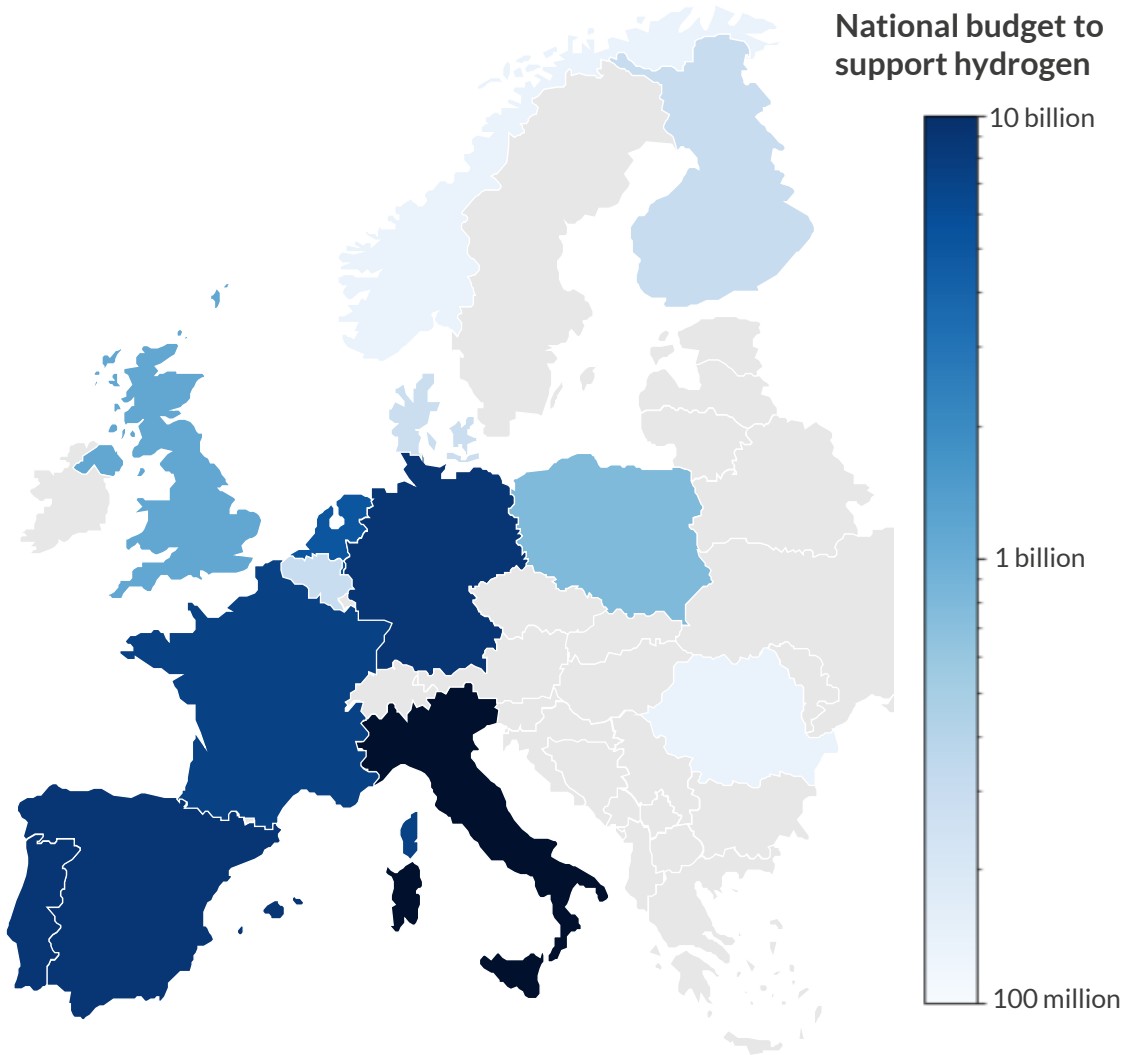


Policy & Regulation

- **Regulatory risk**: Uncertainty in the regulatory framework for hydrogen
- **Policy risk**: Lack of clarity in policy direction for large scale hydrogen infrastructure

Source: Aurora Energy Research

Many countries have grants in place for hydrogen, but not for contracts for difference



Country	CapEx grant	Contracts for difference
Belgium	●	○
Denmark	●	○
Finland	●	○
France	●	●
Germany	●	◑
Ireland	●	○
Italy	●	○
Netherlands	●	◑
Norway	●	○
Poland	●	◑
Portugal	●	○
Romania	●	○
Spain	●	○
Sweden	●	○
United Kingdom	●	◑

● Available ◑ Under consideration ○ Not available

Source: Aurora Energy Research

Contracts for difference potentially have a larger impact than capex grants due to the structure of hydrogen production cost

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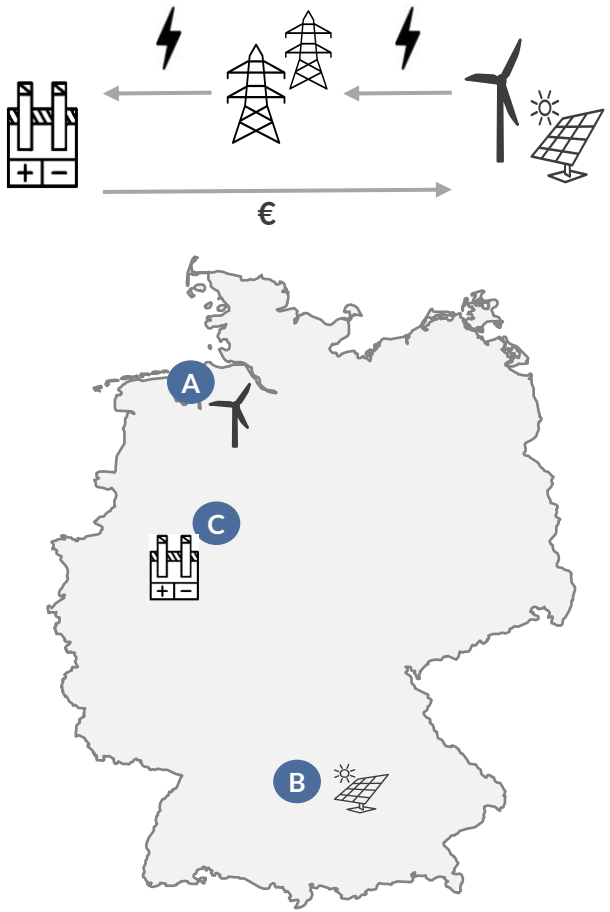
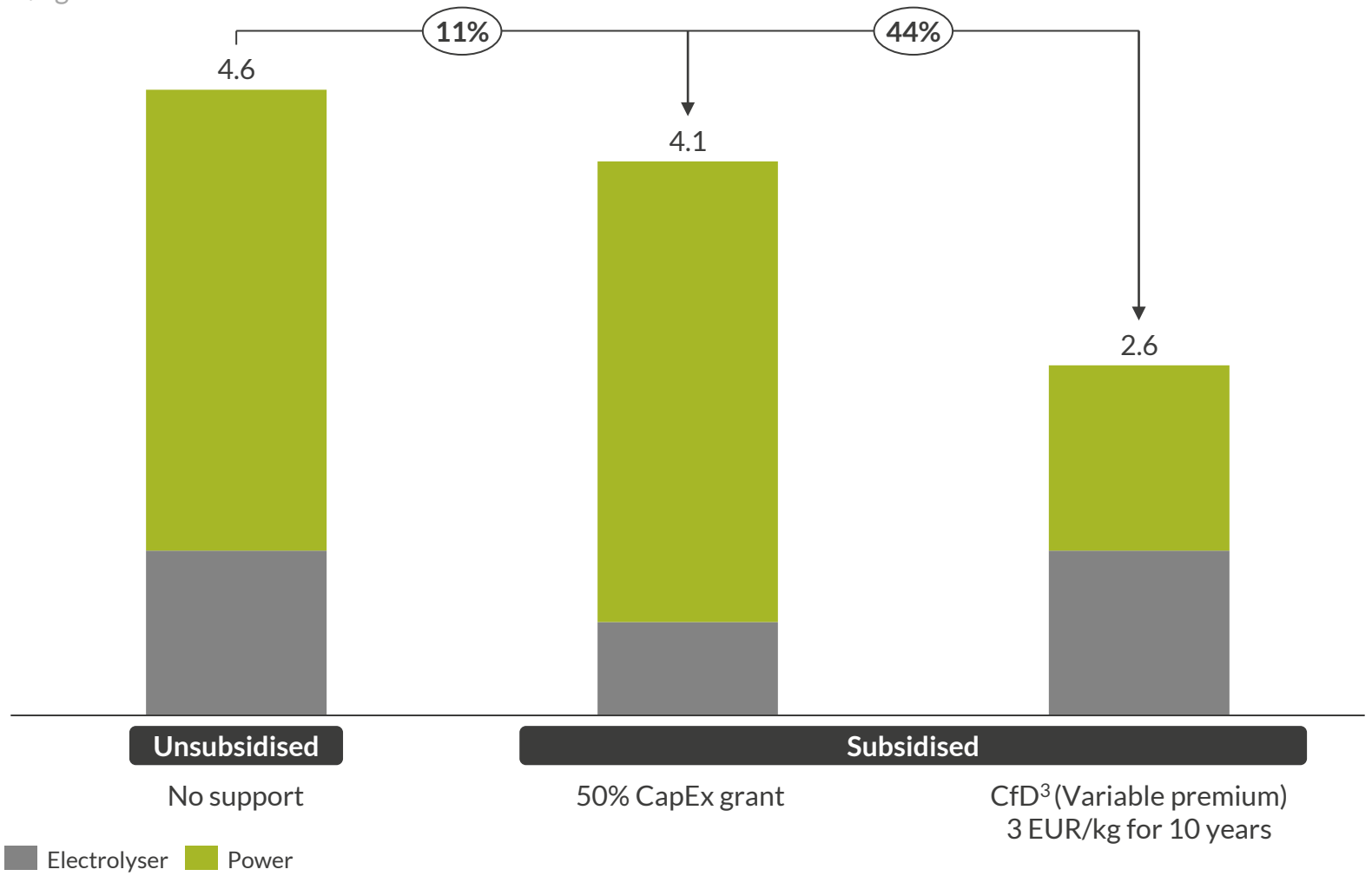
Case study: Colocation with PPA[1]



Levelised cost of renewable hydrogen production in 2030[2]

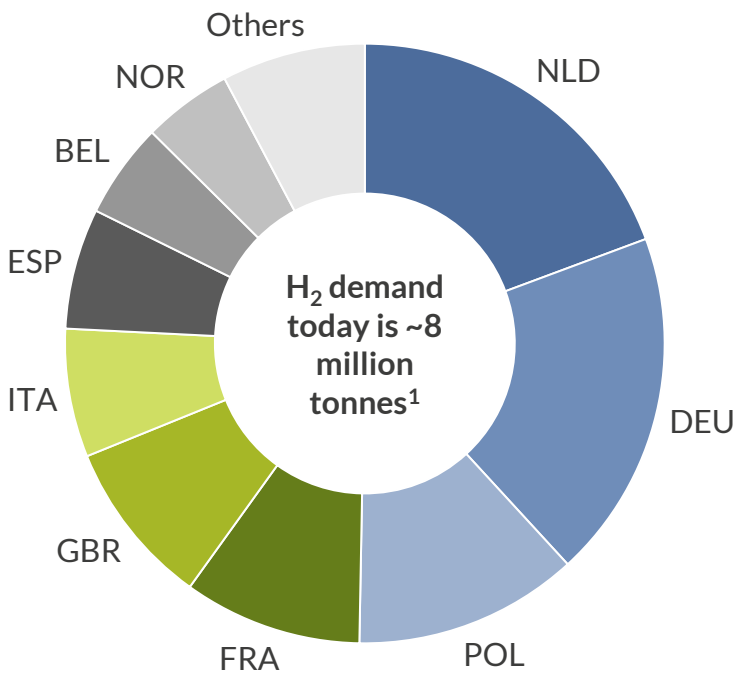
EUR/kg



1) PPA: Power purchase agreement 2) The levelised cost of production is calculated for a PEM asset that is commissioned in 2030 with 25 years of lifetime 3) CfD: Contracts for Difference

Source: Aurora Energy Research

Meeting today's hydrogen demand by fully renewable hydrogen requires over 20 billion EUR/year



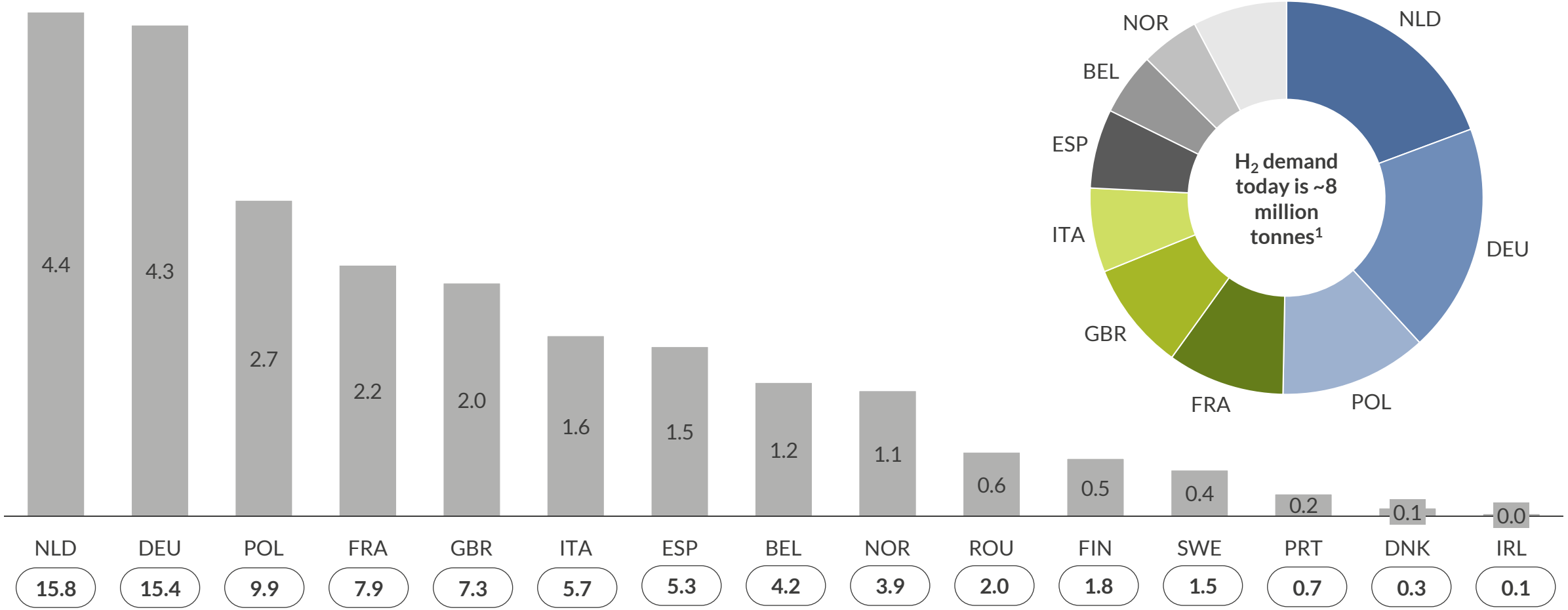
1) Aurora's hydrogen demand forecasts are available in European Hydrogen Service's HyMAR report

Source: Aurora Energy Research

Meeting today's hydrogen demand by fully renewable hydrogen requires over 20 billion EUR/year

Required support for electrolysers to meet today's hydrogen demand

Billion EUR/year



1) Aurora's hydrogen demand forecasts are available in European Hydrogen Service's HyMAR report

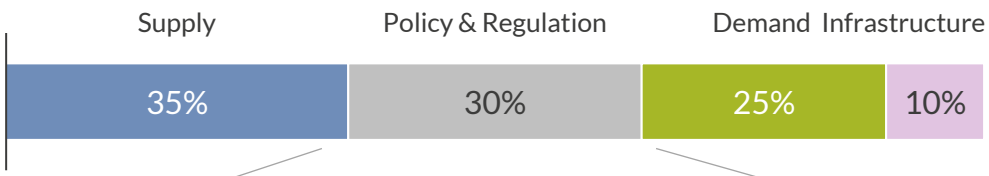
Source: Aurora Energy Research

Germany, the Netherlands and the United Kingdom are the front runners especially because of their demand and infrastructure potential

How do we score countries by their attractiveness?

Aurora's Hydrogen Market Attractiveness Rating (HyMAR) combines indicators to derive an overall attractiveness score

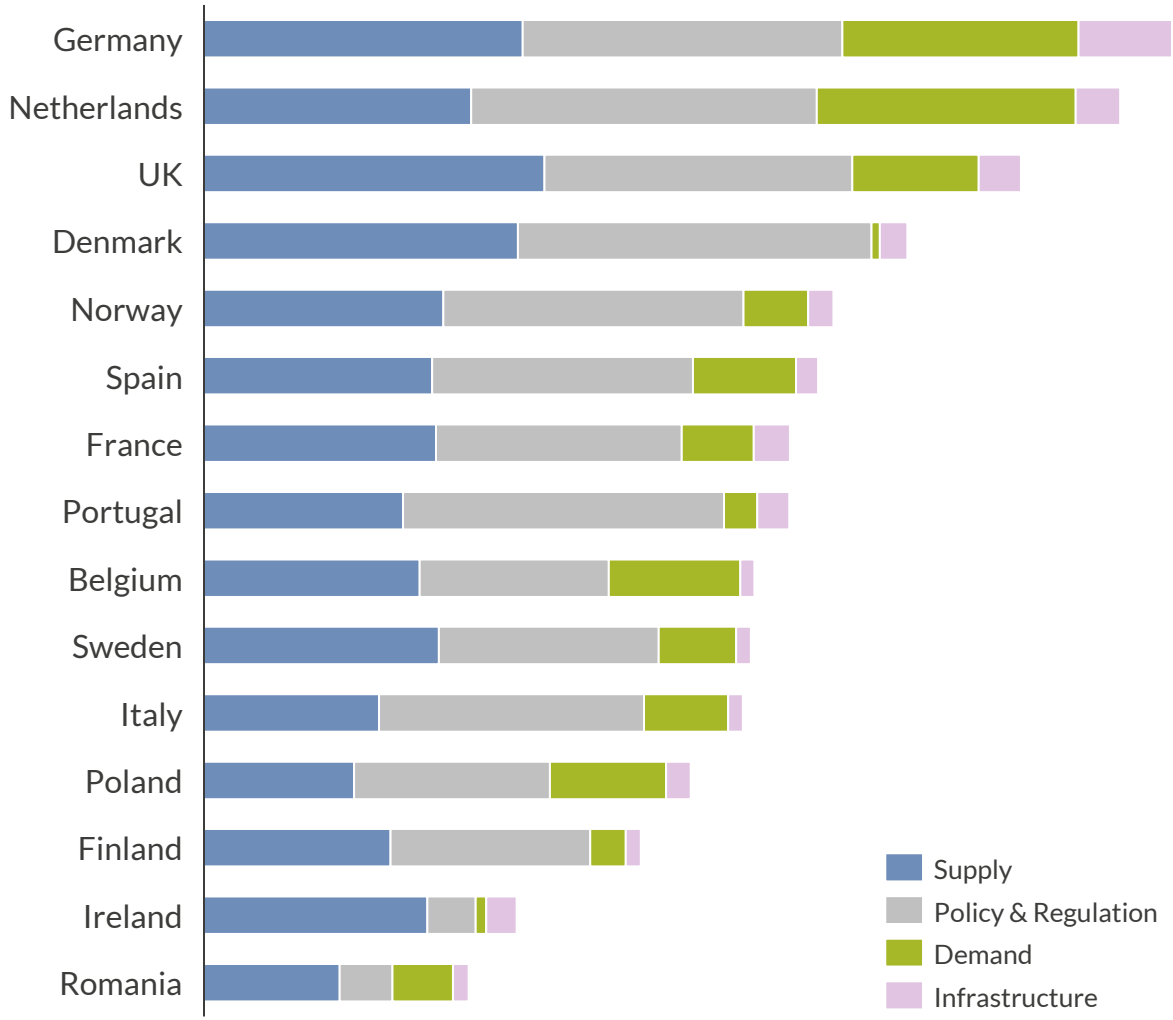
- We use 22 metrics for the assessment
- These metrics are structured around four top-level categories: Supply, Demand, Policy & Regulation and Infrastructure



Within policy & regulation we include five metrics

- National hydrogen strategy
- Policy incentives on supply side
- Policy incentives on demand side
- National budget
- Existing legal and administrative barriers

Overall scores of countries by major categories consider in the analysis



Source: Aurora Energy Research

Takeaways

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Aurora expects hydrogen demand to grow by more than 500% in 2050, within the mobility, industrial and heating sectors

A European support similar to Inflation Reduction Act (3 EUR/kg) could halve production costs. Nearly 20 billion EUR/year is required to meet today's hydrogen demand with renewable hydrogen

Germany, the Netherlands and the United Kingdom are the most attractive countries for hydrogen especially because of their demand and infrastructure potential

Source: Aurora Energy Research


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