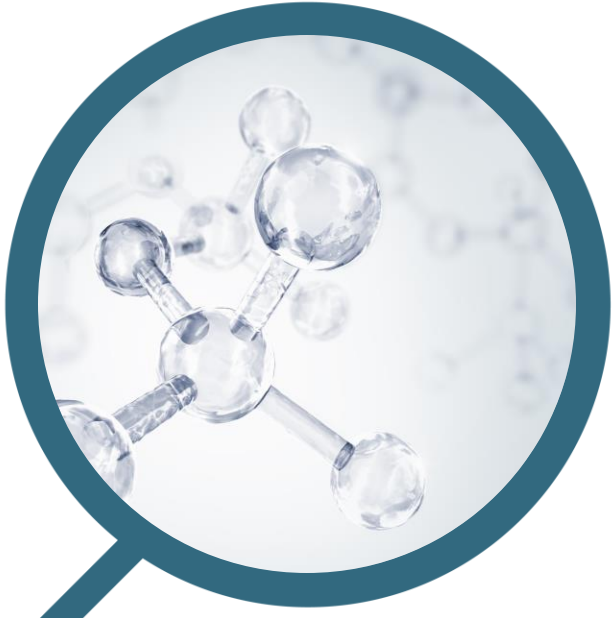
2024 PORTUGAL RENEWABLE ENERGY SUMMIT



Anise Ganbold

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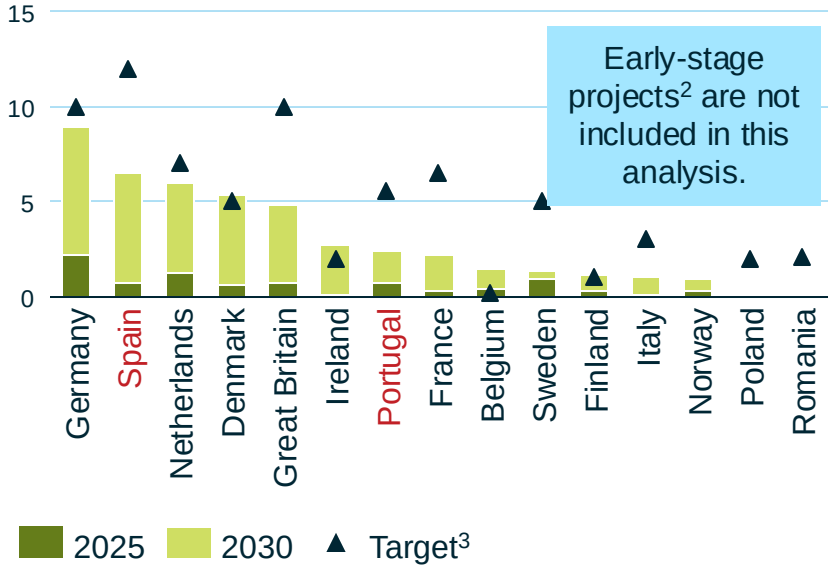
The Economics of Green Hydrogen in Iberia

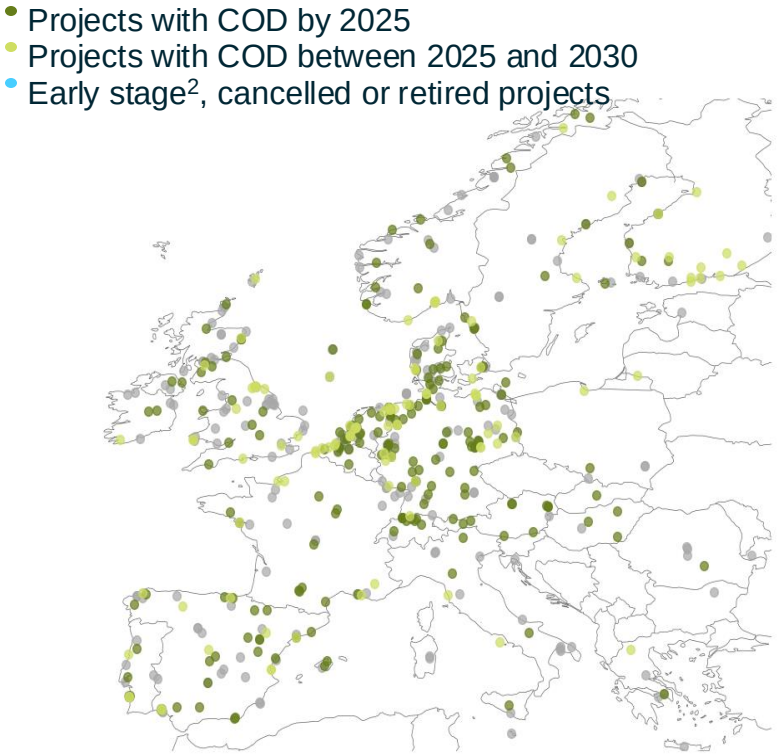
AURORA ENERGY RESEARCH

Electrolyser projects in Iberia are progressing albeit slowly, similar to the rest of Europe

European cumulative electrolyser project capacity pipeline in 2025 & 2030[1]

GW





1) The capacities are from Aurora's global electrolyser database. The timeline and capacities may not be achieved fully; 2) Early-stage projects are in planning or discussion stages without clear timeline or capacity plans or projects that are planned to be commissioned in +8 years; 3) BE target is for 2026. Where the target is a range, the midpoint is shown.

Source: Aurora Energy Research

Public support is a key driver for green hydrogen economics; in Iberia, subsidies focus on the production side

Overview of current and upcoming key hydrogen support

Supply support mechanisms[1]

	Scheme	Auction type	Support	Budget	Contract
	EHB[2] Round 2	Fixed premium	4 €/kg	1.2 bn €	10 years
	H2Global	Double-sided	Double-sided	600mn € (300mn € / country)	10 years
	PRT RRF	CfD[3]	127 €/MWh	140mn €[10]	10 years
	ESP RRF	CAPEX support	-	120mn €	Upfront

Infrastructure

H2Med

Demand

No demand support mechanisms specifically in Iberia

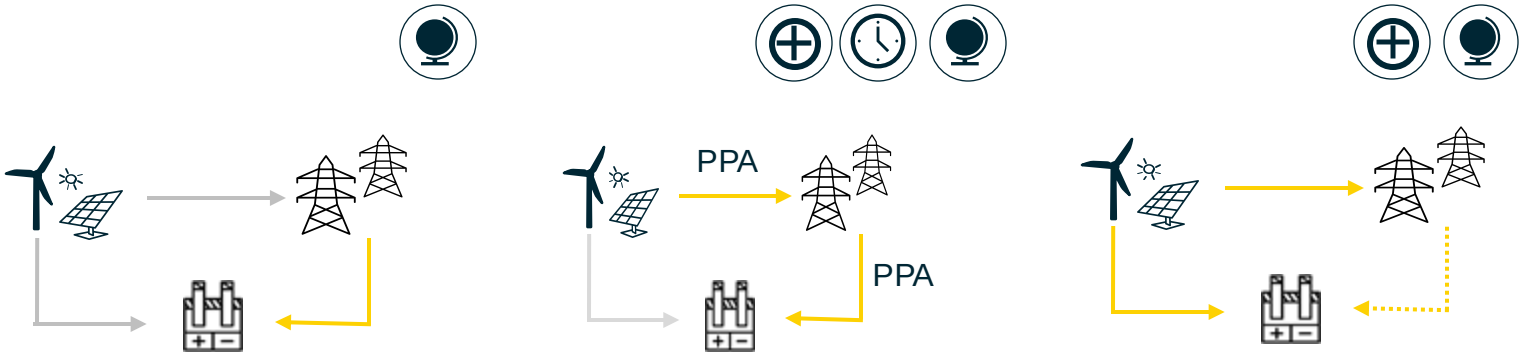
1) Only officially announced auctions. 2)EHB: European Hydrogen Bank 3) Contract for Difference. 4) Include budget for biomethane, allocation between biomethane and H2 is not specified

Sources: Aurora Energy Research, Hydrogen Insights

The set up of the electrolyser is another key driver for economics, leading to a range of options and considerations

General assumptions for the three electrolyser business models

Grid-only	PPA[1]	Co-located grid



Key considerations:

Grid-only
1. Access to grid
2. Grid costs
3. Wholesale power price

PPA
1. Access to grid
2. Grid costs
3. PPA price
4. Renewables costs

Co-located grid
1. Access to grid
2. Grid costs
3. Wholesale power price
4. Renewables costs

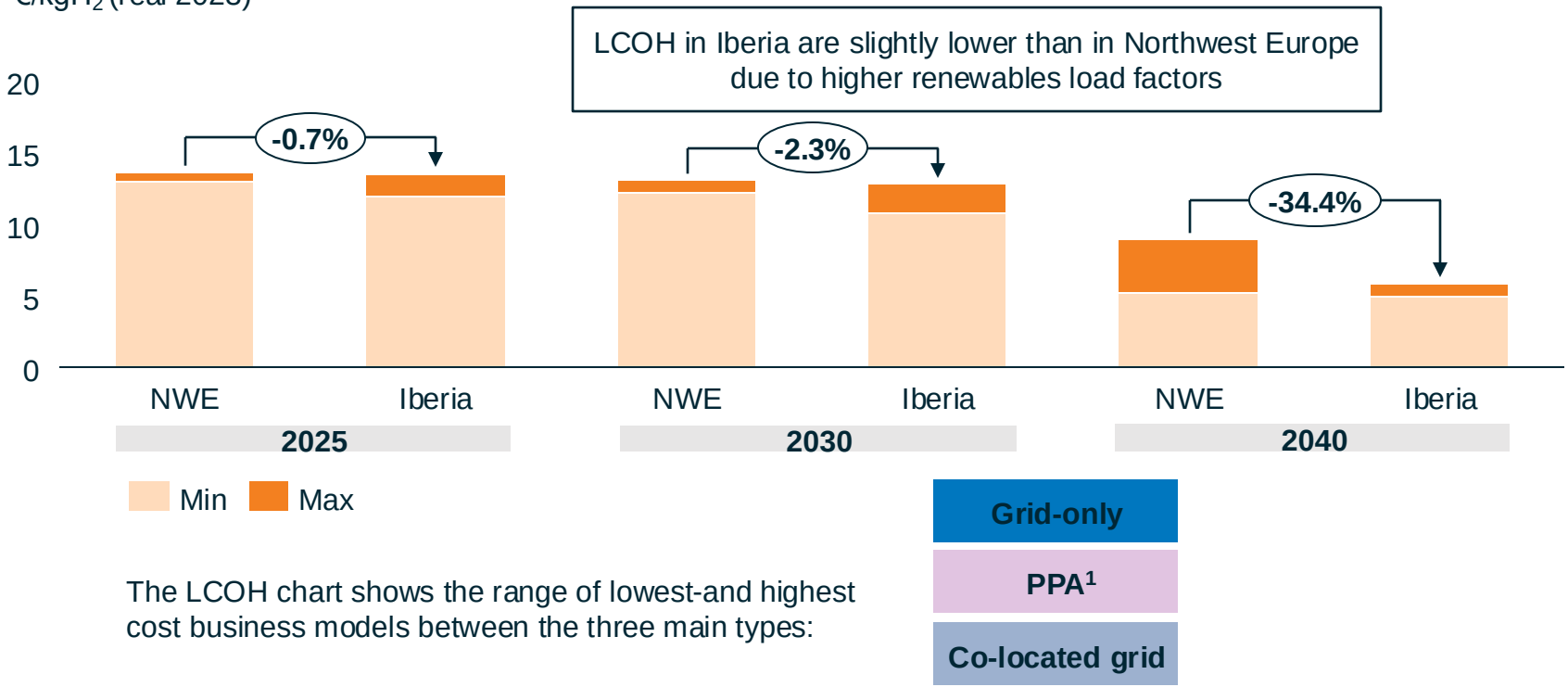
RED II[2] criteria Additionality | Temporal correlation | Geographical correlation

1) Power purchase agreement. 2) As described in the Renewable Energy Directive II

Source: Aurora Energy Research

The levelised cost of hydrogen production in Iberia is typically lower than in Northwest Europe (DE, FR, NL), and falling faster

Levelised cost of H2 production across business models by region and COD[1], PEM electrolyser)
€/kgH_2 (real 2023)



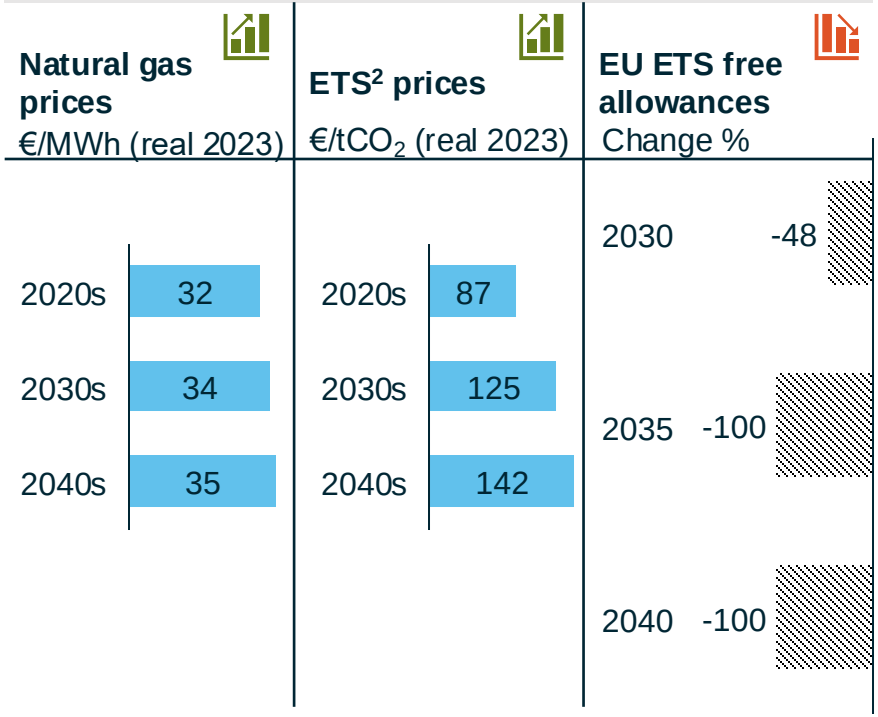
The LCOH chart shows the range of lowest-and highest cost business models between the three main types:

1) COD: Commercial Operation Date. RED: Renewable Energy Directive; 2) LCHS: Low carbon Hydrogen Standard;

Source: Aurora Energy Research

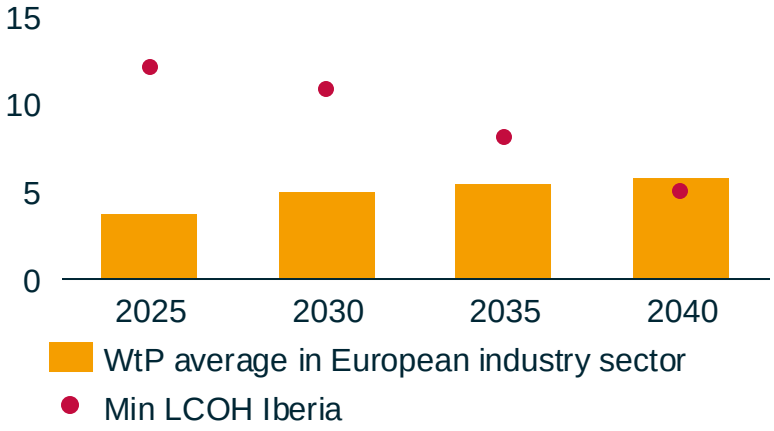
On the offtaker side, willingness to pay will fall short of LCOH until the late 2030s; the gap would be filled by public support

Key drivers of hydrogen WtP[1] in industry in Europe



Willingness to pay for renewable hydrogen in industry[3] by COD

€/kgH_2 (real 2023) levelised



RED III uncertainty

A key uncertainty for WtP is the penalties under RED III. RED III introduces a mandate of 42% hydrogen consumption in industry by 2030. For the graph above, we assume the penalty is equal to the EU-ETS price.

1) WtP: Willingness to pay. 2) ETS: Emissions Trading System. 3) This is one specific case, the range around Europe and industry will vary.

Source: Aurora Energy Research

Key Takeaways

- Electrolyser projects in Iberia are progressing albeit slowly, similar to the rest of Europe
- Public support is a key driver for green hydrogen economics; in Iberia, subsidies focus on the production side
- Green hydrogen production costs in Iberia are slightly lower than in Northwest Europe, and falling over time at a faster rate
- Willingness to pay for green hydrogen in industry is low today but rises to meet production costs in the late 2030s, until then the gap could be met with subsidies

Thank you!
Please speak to us today if you want to know more

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