

AURORA
Hydrogen
Conference

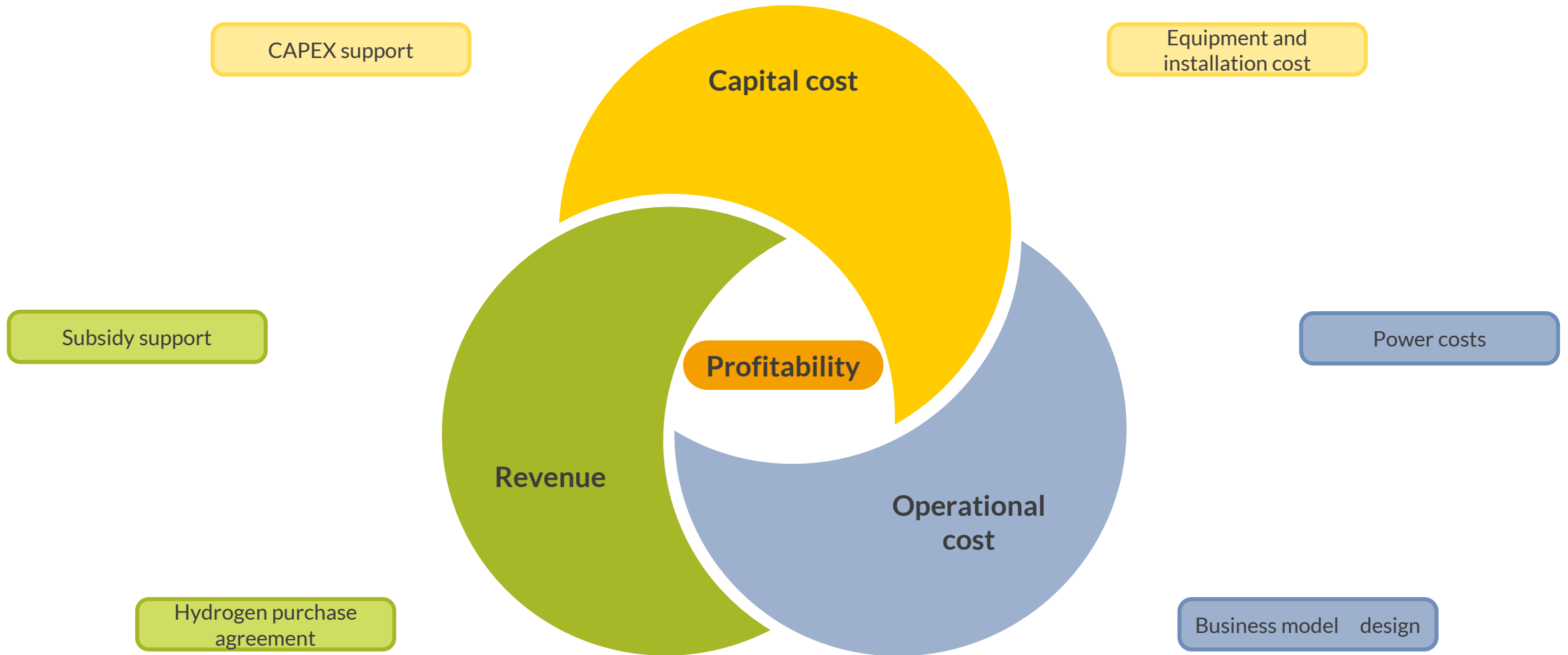
London 2023

AURORA KEYNOTE
Electrolyser business
models & subsidy
eligibility

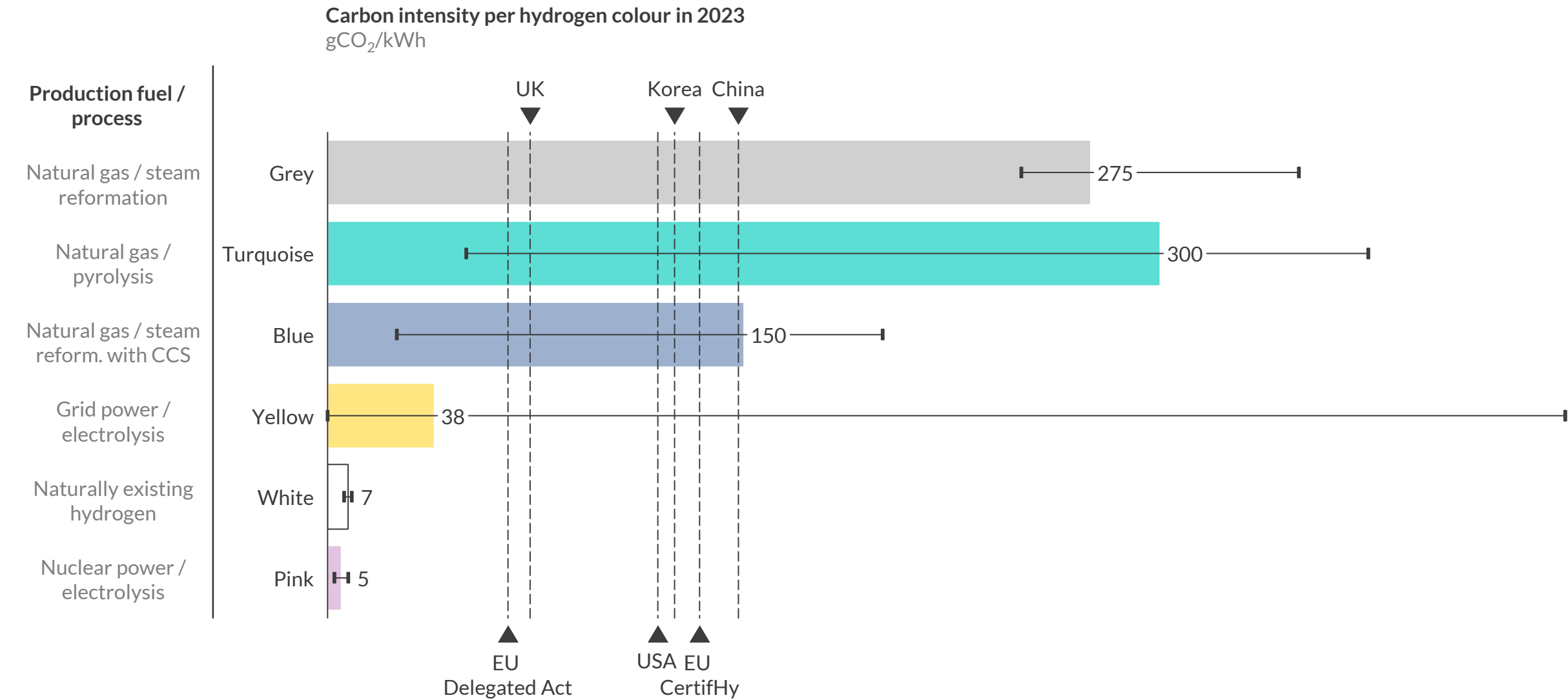
Dilara Caglayan
Lead Expert, European
Hydrogen, Aurora



The profitability of a hydrogen production project depends on three key components: capital cost, operational cost and revenue



Hydrogen producers must navigate a variety of standards to attract subsidy support and ensure project viability



The EU's definition for green (renewable) hydrogen is the most complex; the criteria and exemptions make a number of business models possible



Additionality



Temporal correlation¹



Geographic correlation

Business models that are exempt from one or more criteria

Avoided Criteria



Co-location (islanded)



>90% RES in power grid²



Curtailed and/or <20 €/MWh power



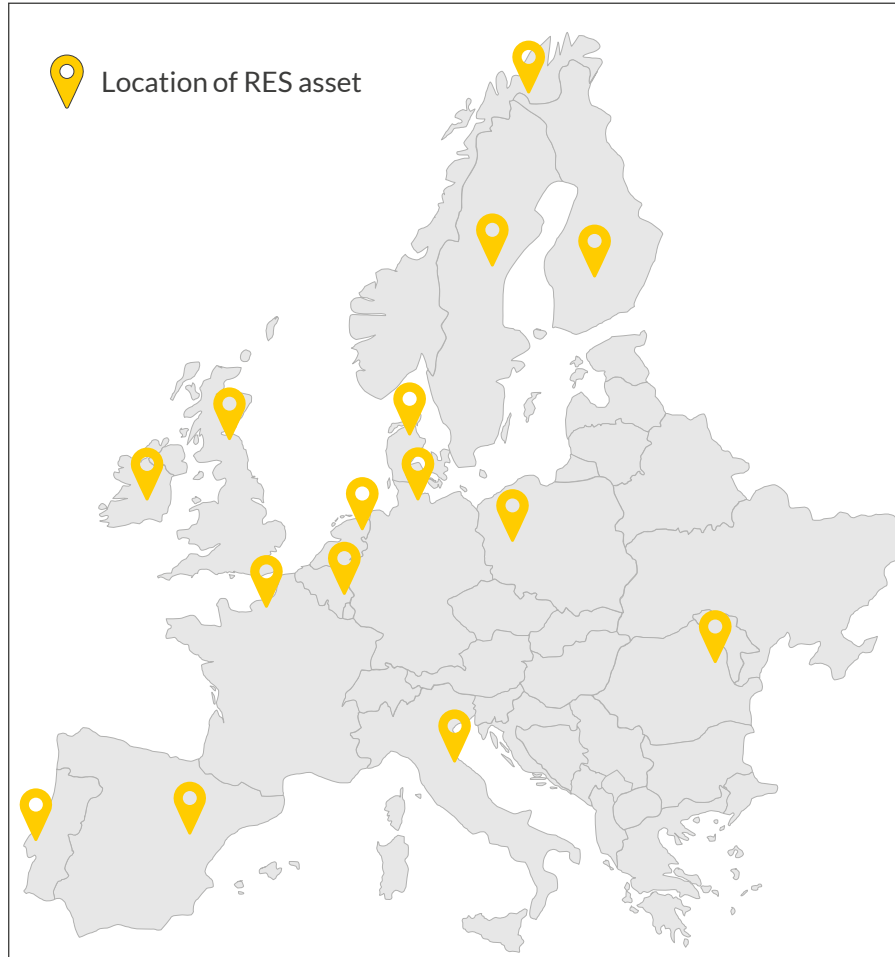
Grid carbon intensity <64.8 gCO₂/kWh



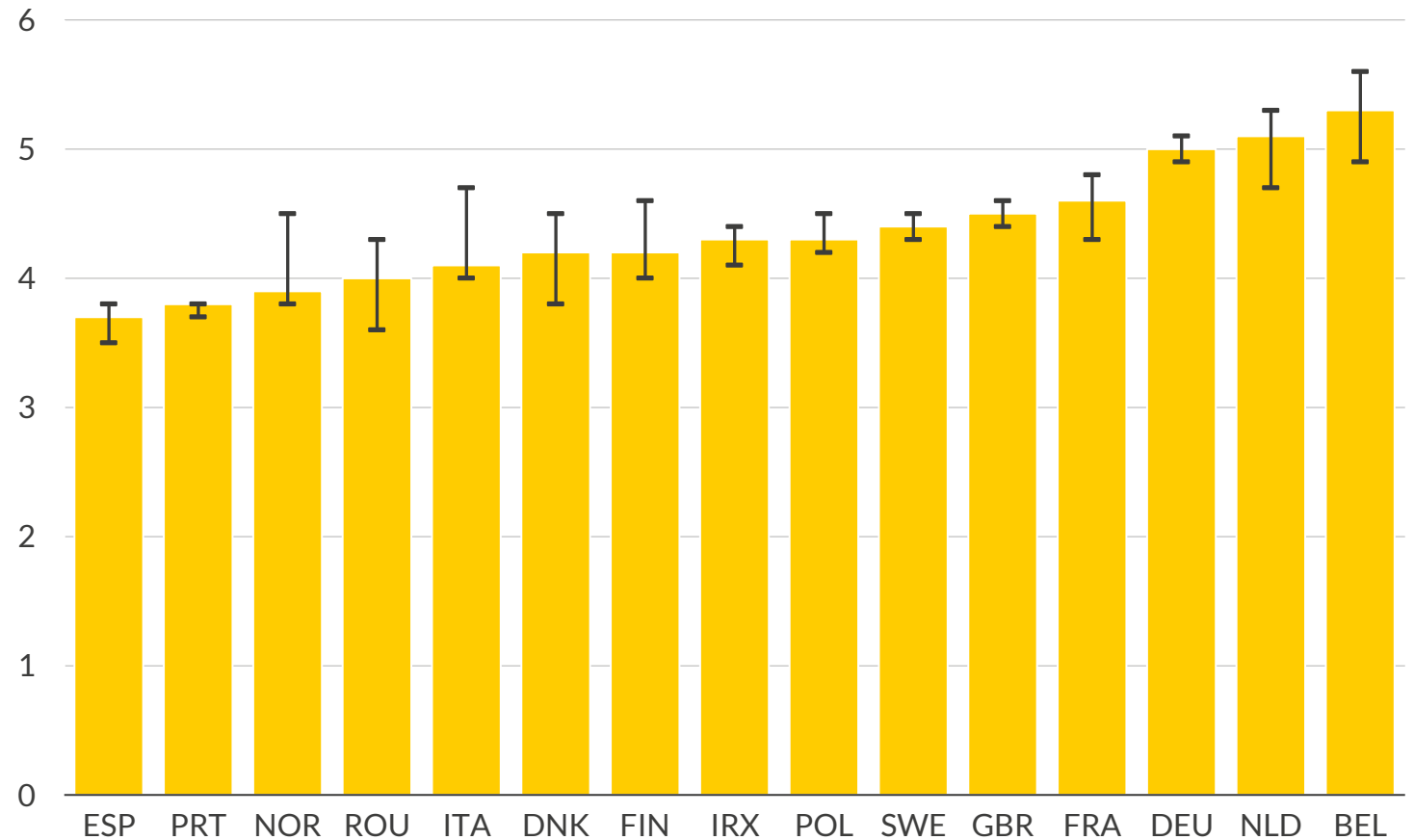
1) Temporal correlation is complied in an hourly period when the clearing price is <20 €/MWh or 0.36 times the price allowance to emit one tonne of CO₂ equivalent at the time of hydrogen production. 2) Defined by gross RES consumption divided by total demand.



The cost of islanded production varies greatly across Europe due to renewable potential of each country



Levelised cost of hydrogen production for COD 2030, PEM electrolyser¹
€/kg H₂

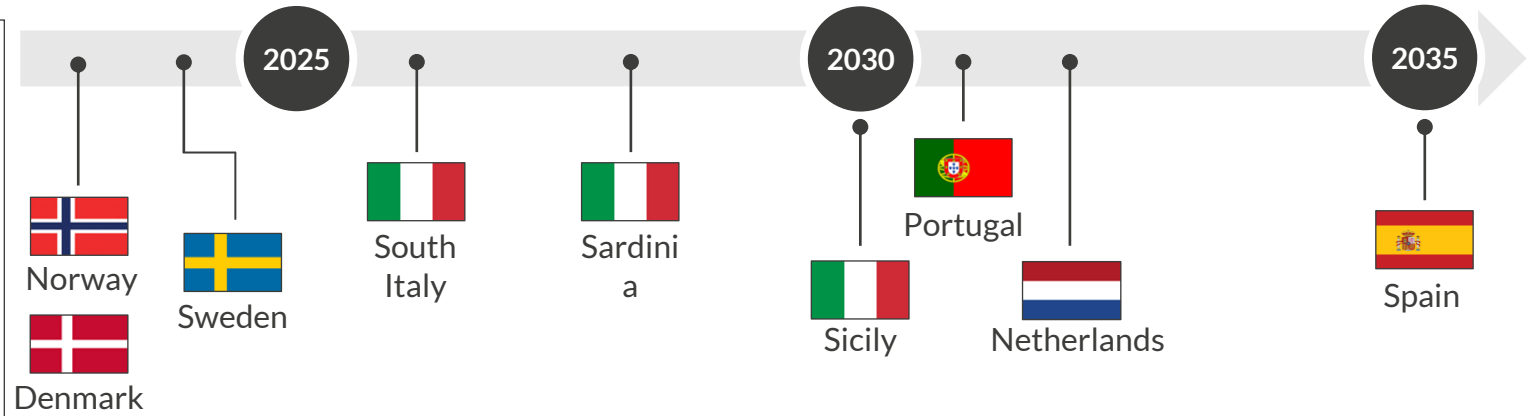
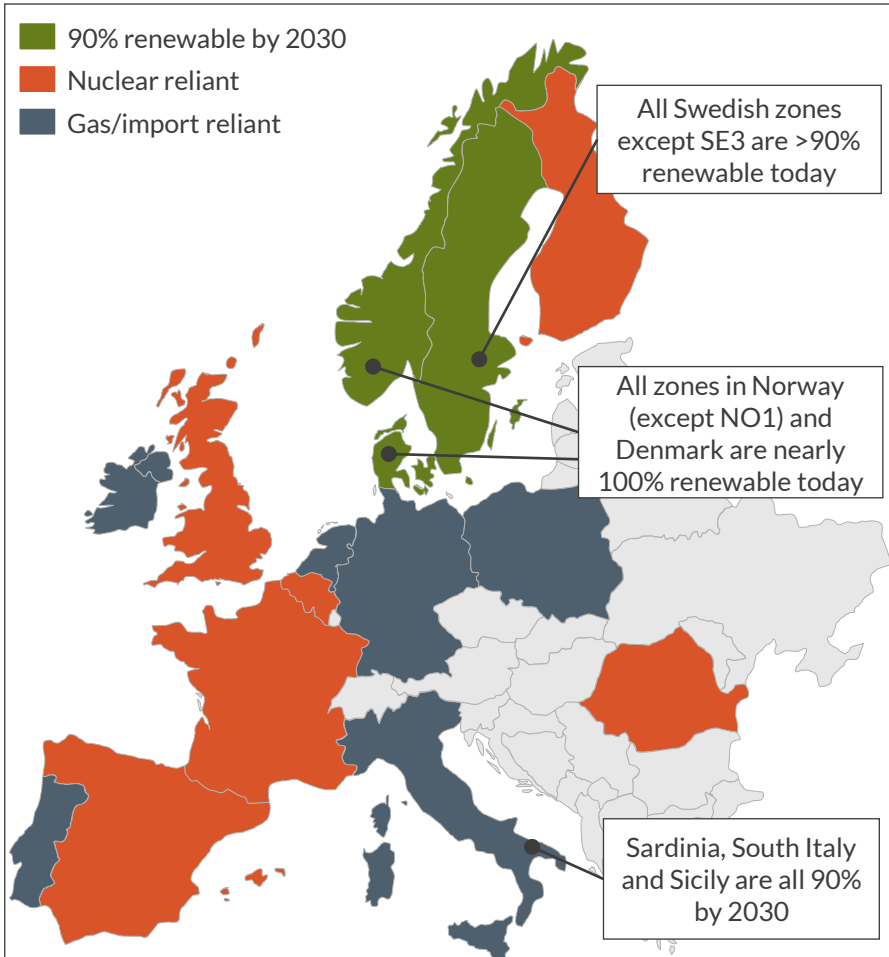


1) Lower and upper LCOHs are calculated for an average fleet performance of today and future, respectively.



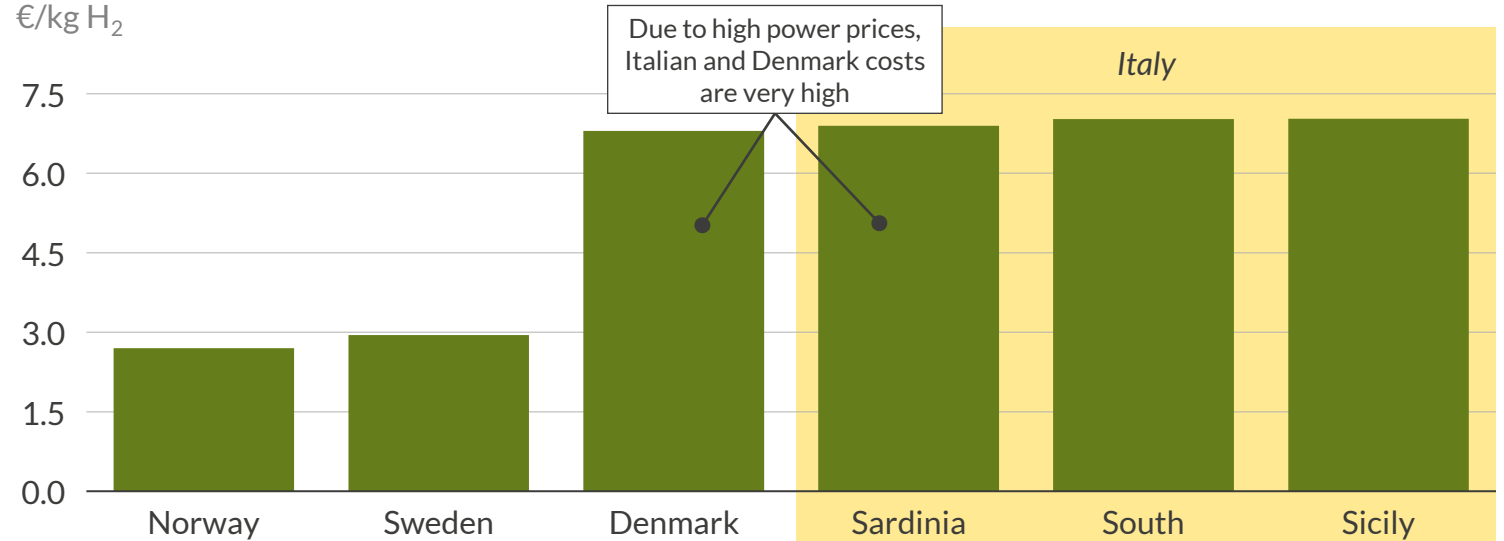
Electrolysers can produce REDII compliant hydrogen via highly renewable grids in Scandinavia and Italy by 2030

2030 snapshot of RES mix



Levelised cost of hydrogen production for COD 2030, PEM electrolyser (Flexible >90% RES)¹

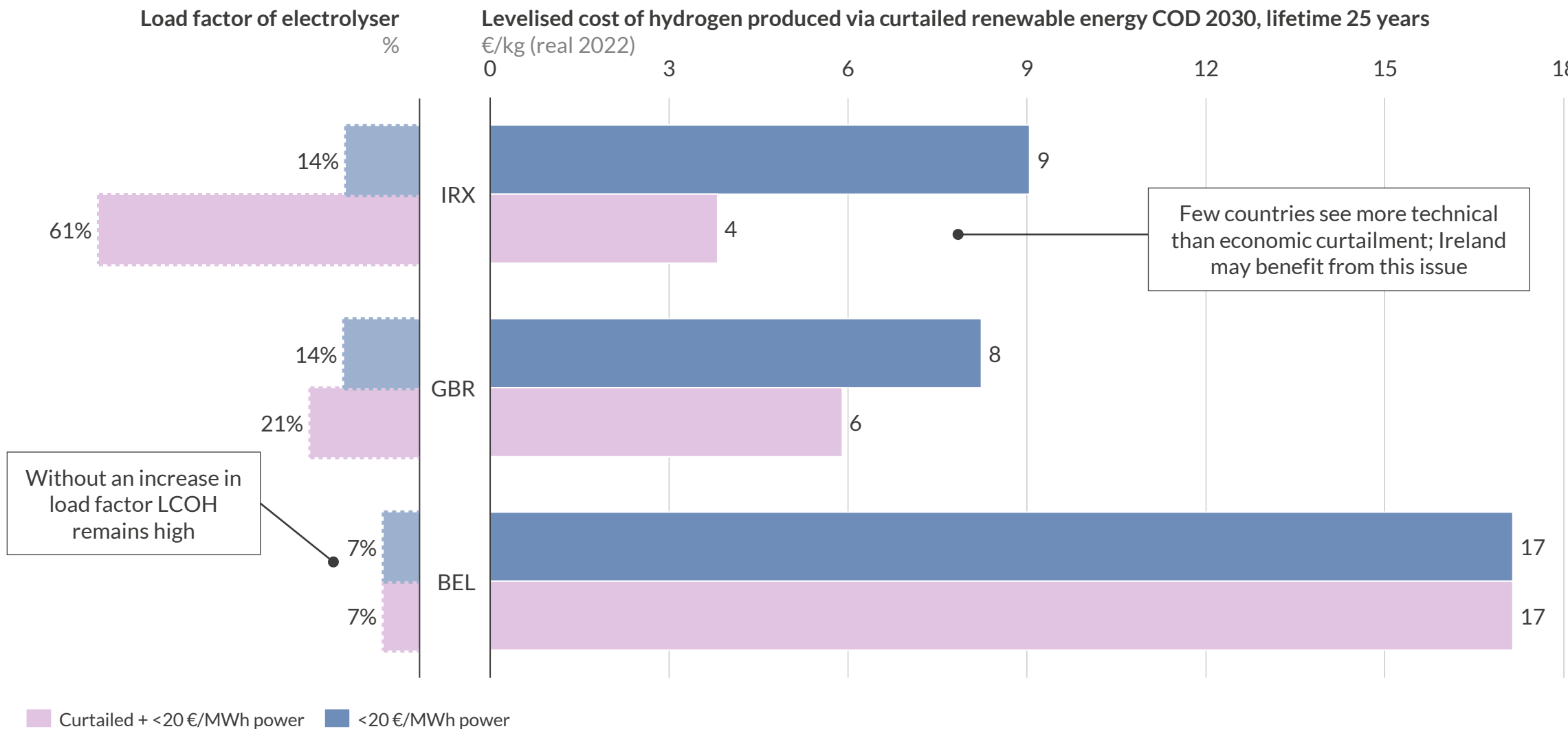
€/kg H₂



1) LCOHs in Denmark, Norway, and Sweden are reported for the bidding zone each country has the lowest cost. These zones are DK2 in Denmark, NO2 for Norway, and SE2 for Sweden.

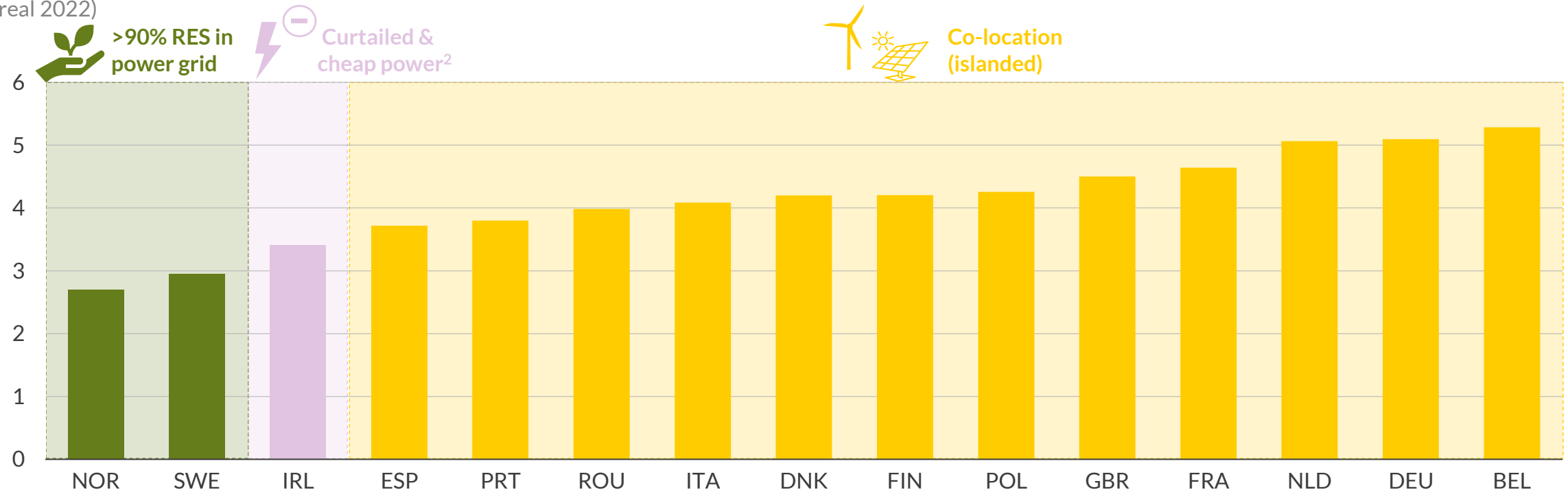


Use of curtailed power is not viable in any country other than Ireland where increased load factor significantly reduces LCOH



The lowest cost business model varies by country; although off-grid co-location is the most popular one across many countries

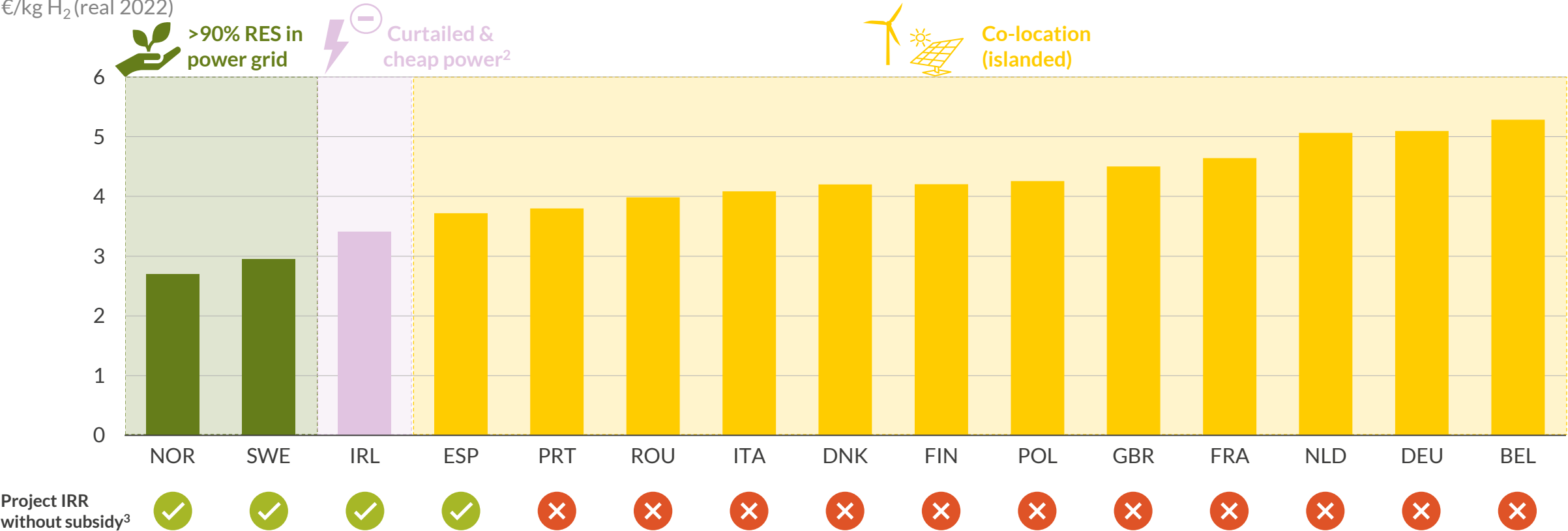
Levelised cost of hydrogen production for COD 2030, PEM electrolyser (cheapest business model)¹
€/kg H₂ (real 2022)



1) LCOHs are calculated with 8% WACC. 2) Grid connected electrolyser that is powered with curtailed energy or when power prices <20 €/MWh.

European Hydrogen Bank enables >10% IRR in all countries; maximum subsidy is not needed everywhere

Levelised cost of hydrogen production for COD 2030, PEM electrolyser (cheapest business model)¹
€/kg H₂ (real 2022)

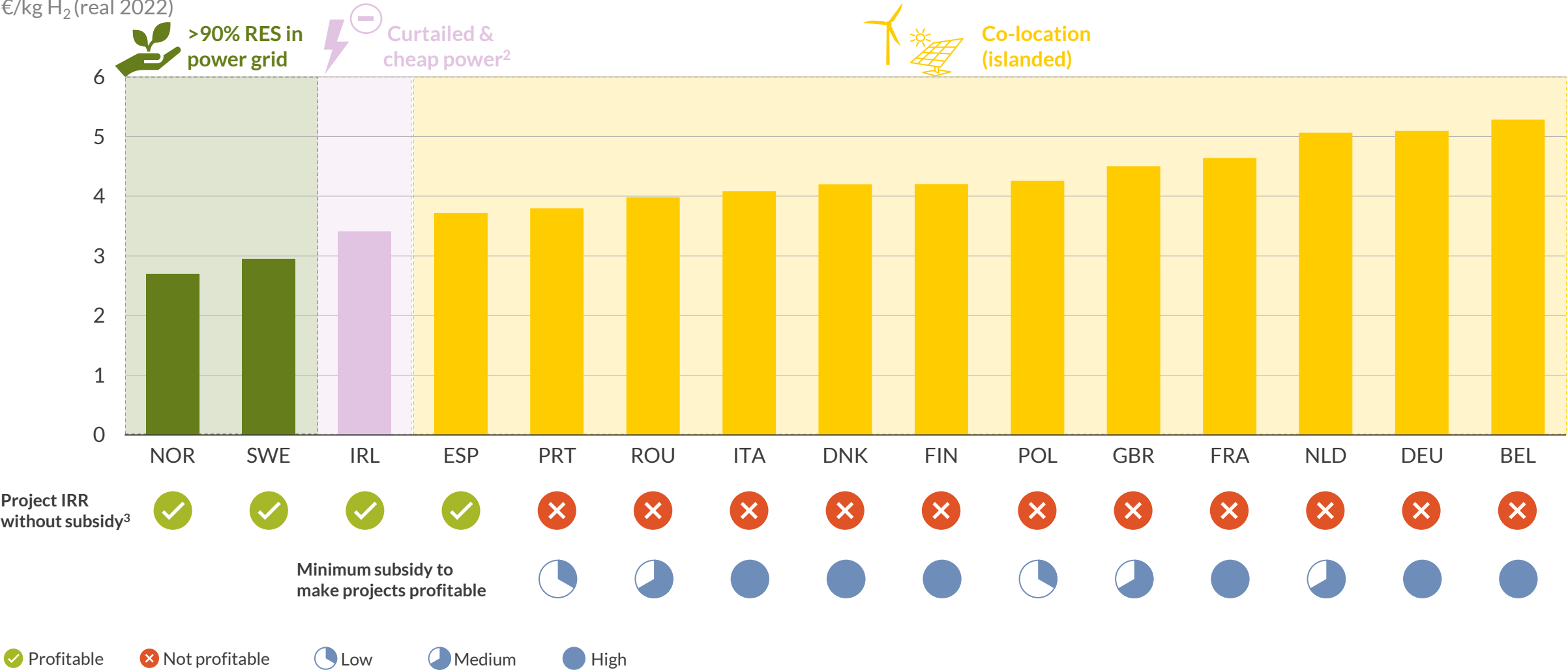


✓ Profitable ✗ Not profitable

1) LCOHs are calculated with 8% WACC. 2) Grid connected electrolyser that is powered with curtailed energy or when power prices <20 €/MWh. 3) IRRs are estimated by Aurora's in-house national low-carbon hydrogen price forecast (Oct-23 Central).

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€/kg H₂ (real 2022)



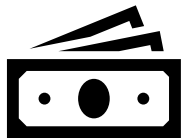
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REDII compliance is required for EU Hydrogen Bank subsidies as well as many national or import support schemes for renewable hydrogen.



The cheapest REDII compliant electrolyser business model differs in each country. Fully grid connected electrolysers in Scandinavia produces renewable hydrogen less than 3 €/kg in 2030.



Electrolyser projects in Sweden, Norway, Ireland, and Spain can be profitable without a subsidy by 2030 if a pay-as-produced offtake agreement is secured. Other countries need up to 2.5 €/kg H₂ support to have economically attractive business models.

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