Data, Insight, Strategy & Communities

Panel: the bottlenecks blocking scale

WSA Open Forum

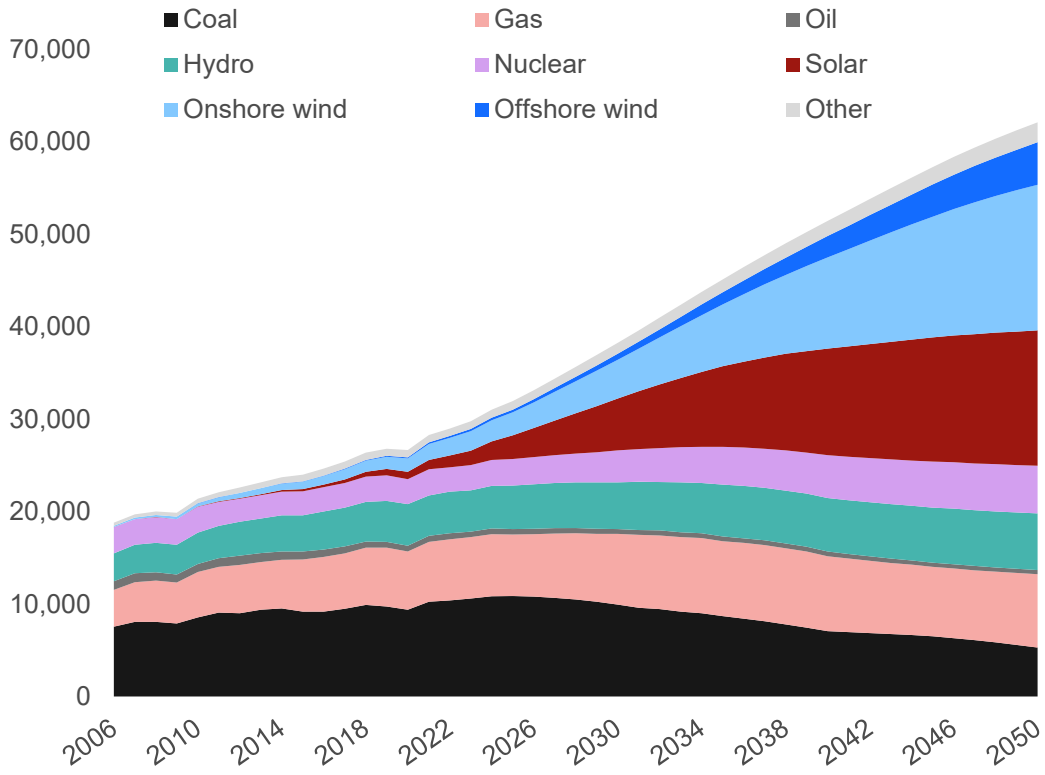
Brussels, 1–3 June, 2026

Paul Butterworth

Power demand is expected to double by 2050

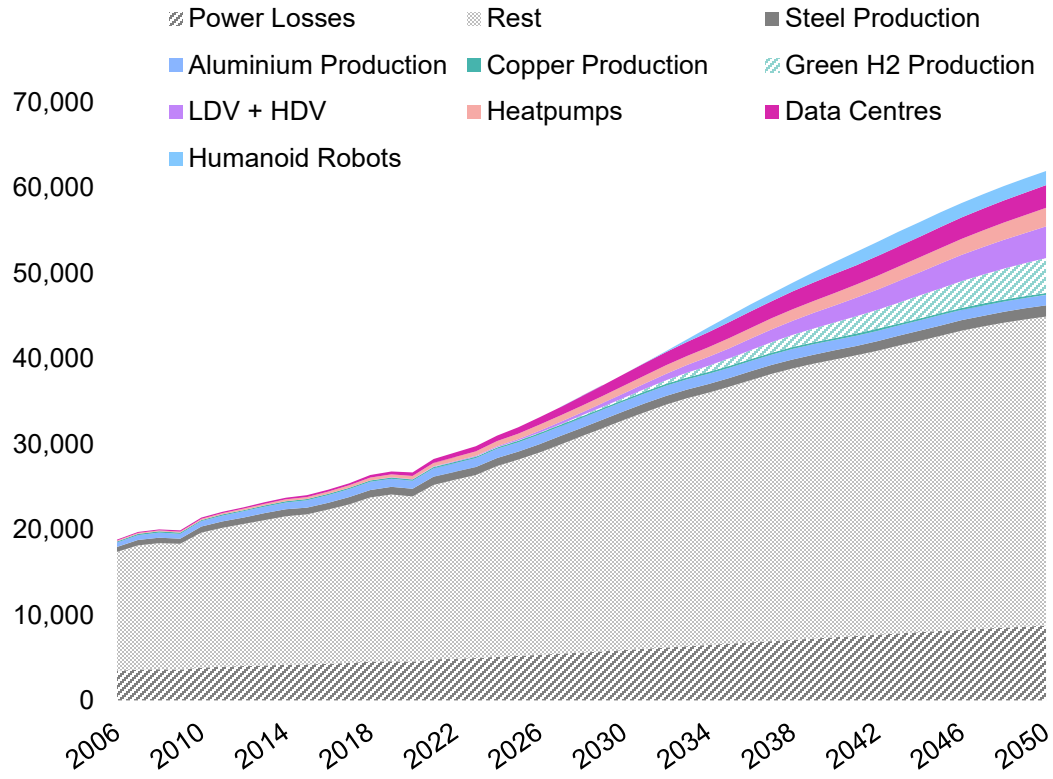
Fossil remains a key generation source...

Total world electricity generation, TWh



…given growth in power demand due to electrification

Total world electricity demand, TWh

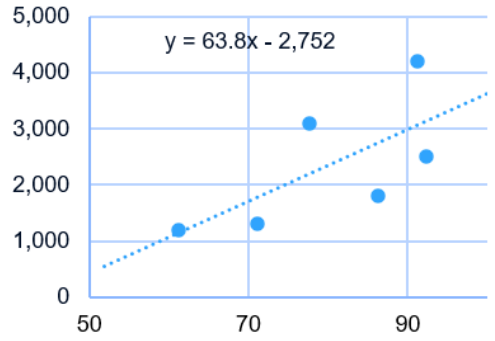


DATA: **CRU Energy Transition and Decarbonisation Service**

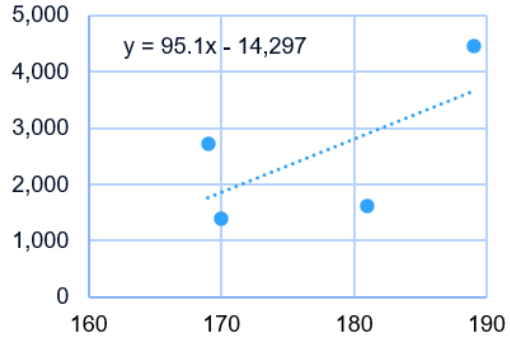
Grids are not properly configured for high levels of renewables

There are constraints on the system

y-axis: congestion cost, FY'19–FY'24, **UK**, £M
x-axis: RE output, TWh_{RE}



y-axis: congestion cost, '19–'22, **German**, €M
x-axis: RE output, TWh_{RE}



y-axis: congestion cost, '16–'23, **USA**, $M
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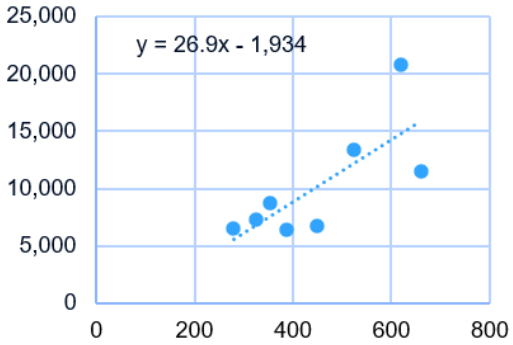

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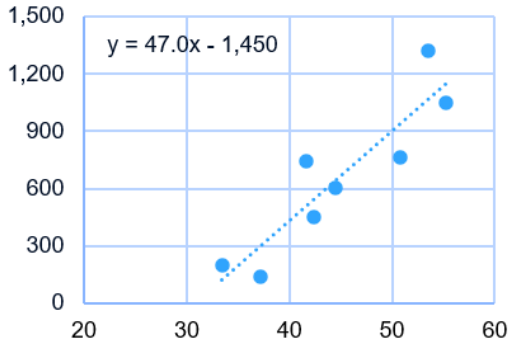
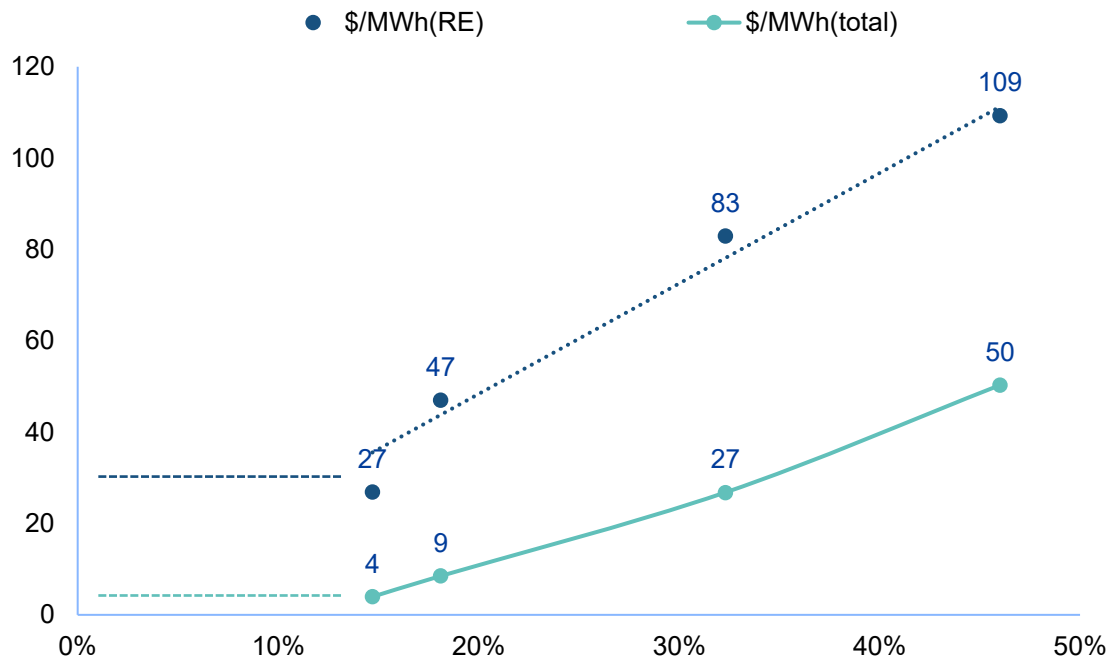


Cost of constraints increases with renewables penetration

y-axis: congestion cost, $/$MWh_{RE}$ and $/$MWh_{total}$
x-axis: RE penetration, % total generation

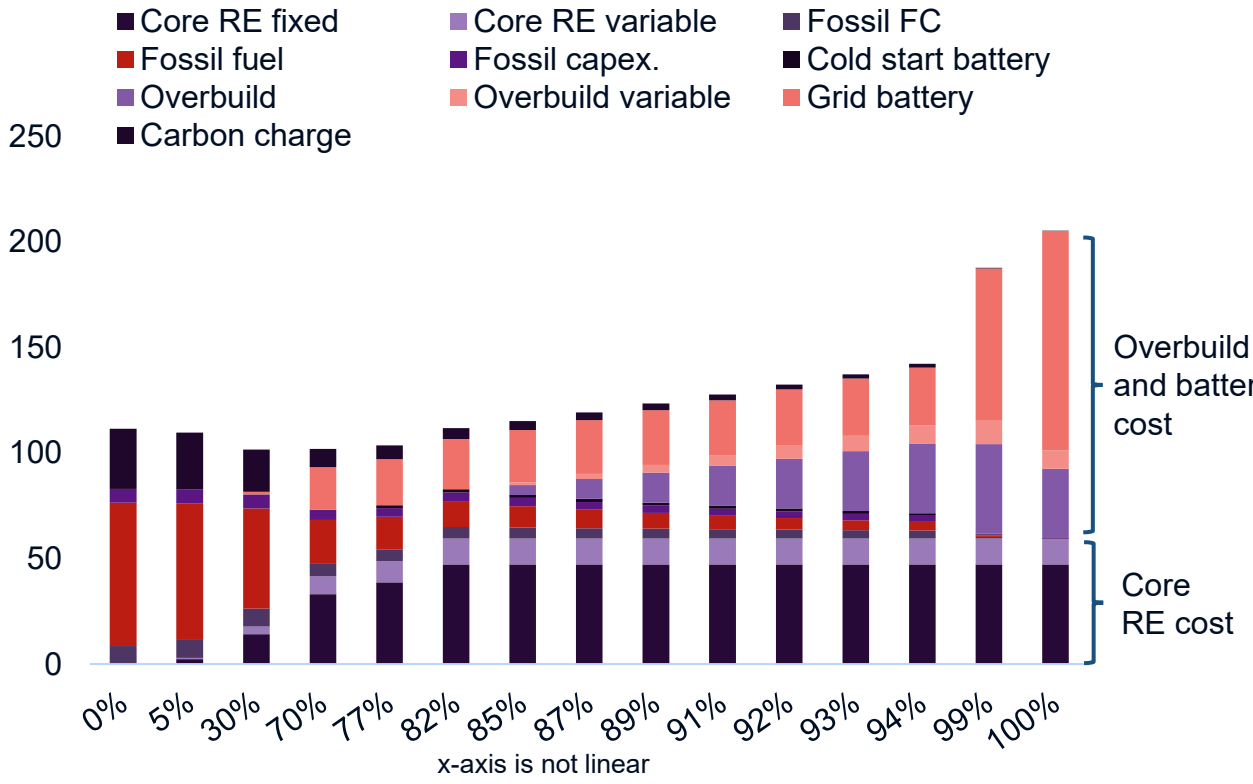


DATA: **CRU Energy Transition and Decarbonisation Service**

Renewables-heavy systems require overbuilding and storage

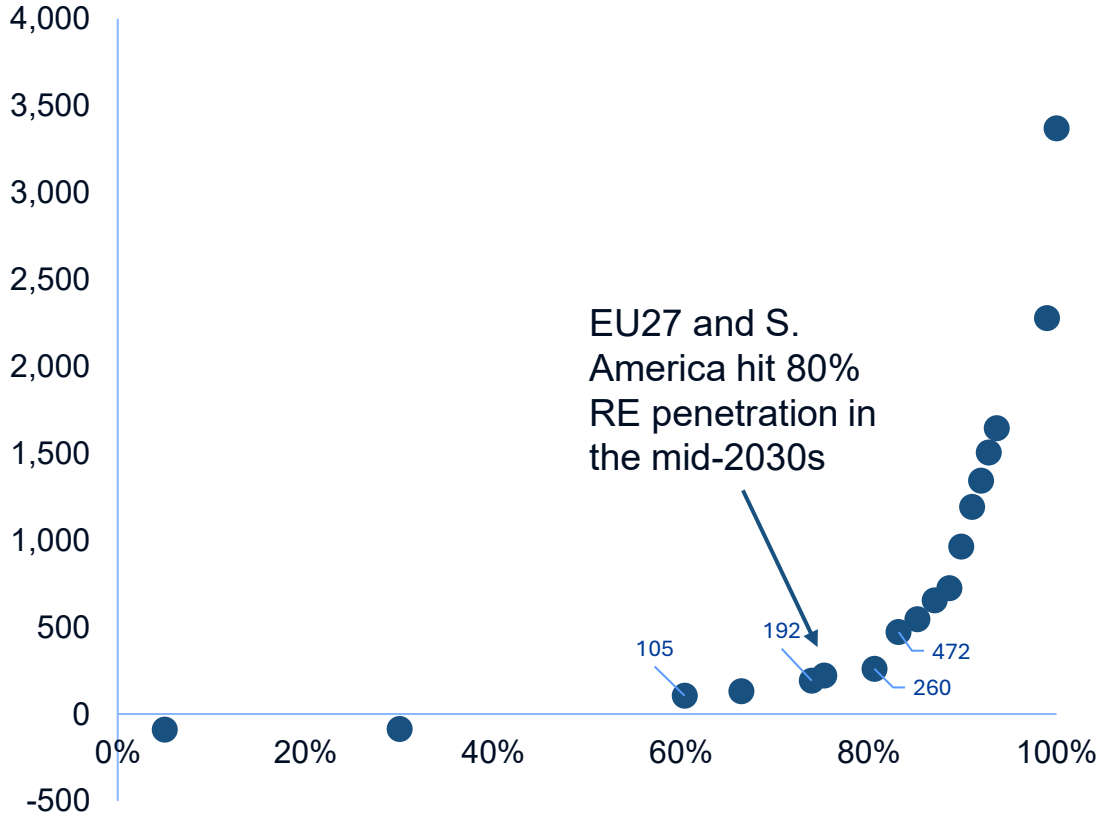
Underlying cost of renewables is only part of the cost

y-axis: breakdown of power costs, 2030 costs, N. Europe, real 2024, $/MWh
x-axis: renewables penetration on an RE-fossil grid, %



Marginal cost rises rapidly above 80% penetration

y-axis: marginal cost of decarbonisation, 2030 costs, real 2024, $/MWh
x-axis: renewables penetration on an RE-fossil grid, %



DATA: **CRU Energy Transition and Decarbonisation Service;** fossil power based on current gas and carbon prices in Europe

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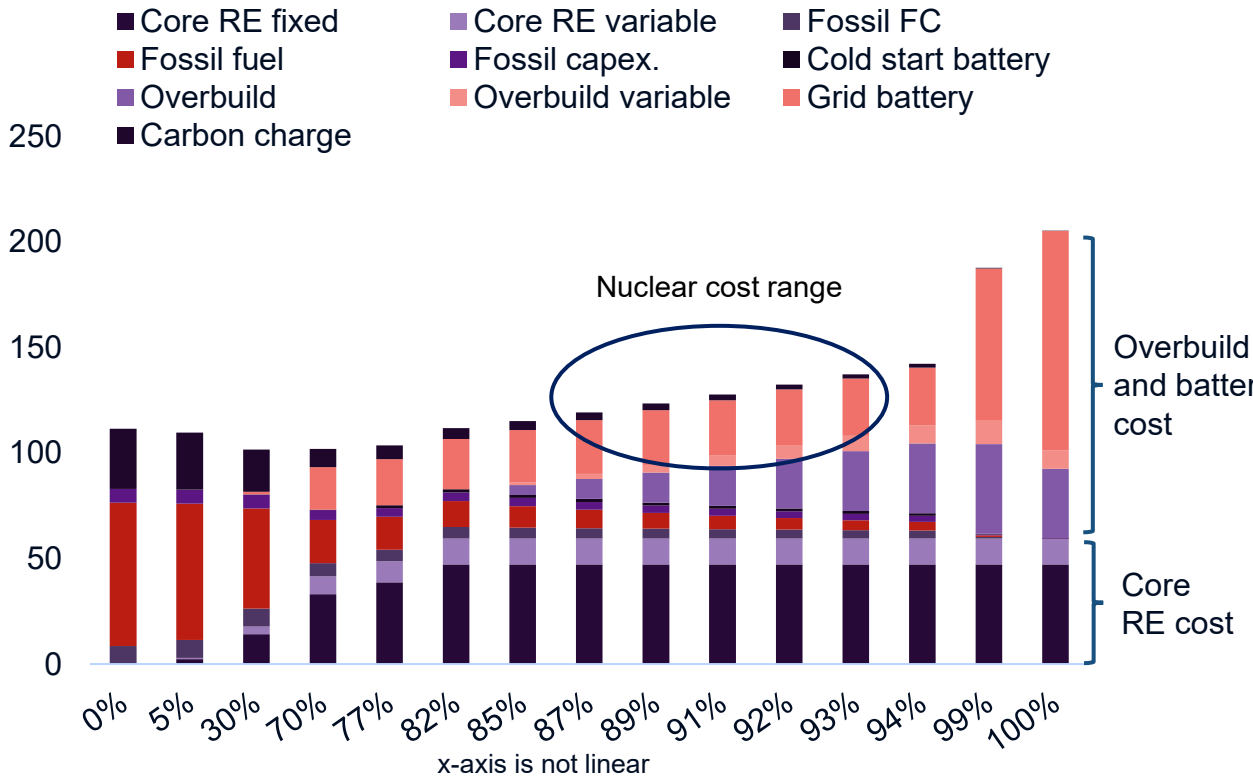

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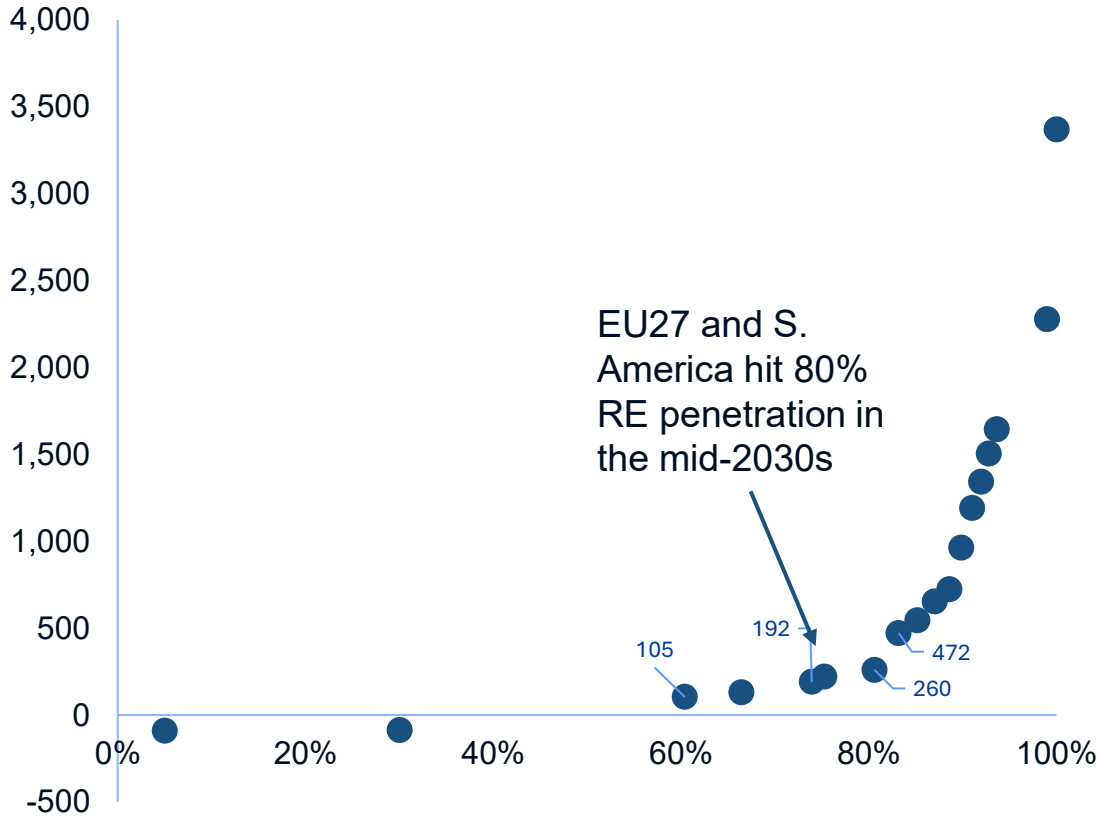
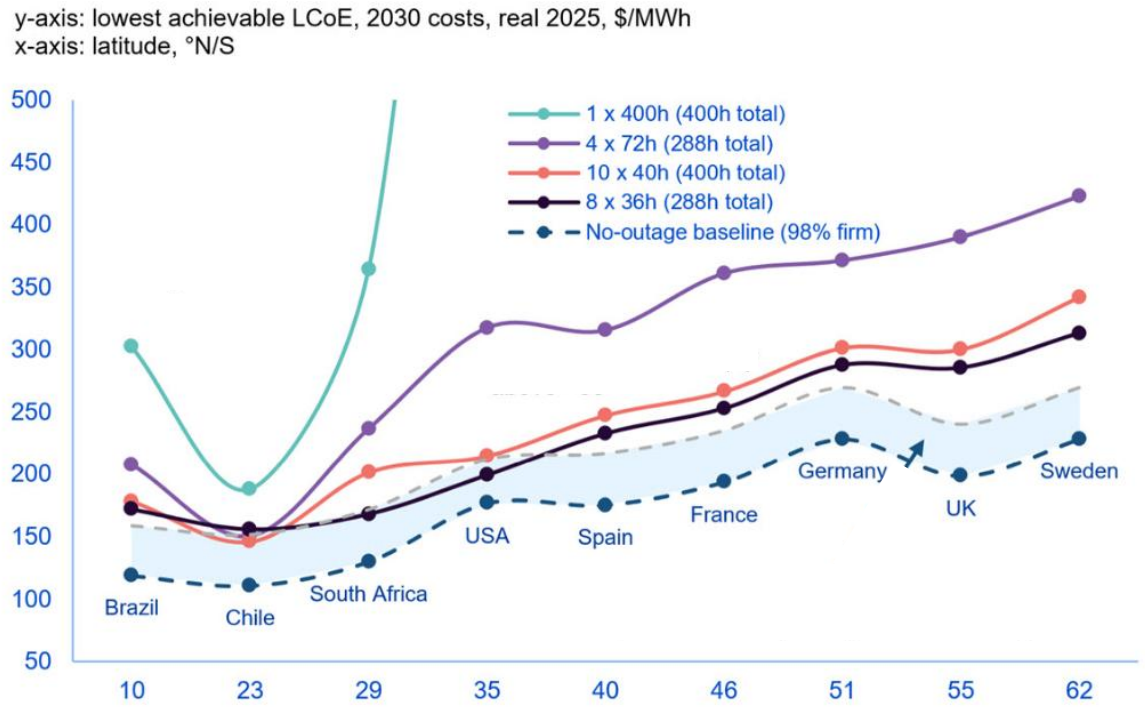


DATA: **CRU Energy Transition and Decarbonisation Service;** fossil power based on current gas and carbon prices in Europe

Structural power cost differences across renewable-heavy systems

Lowest costs achievable at lower latitudes



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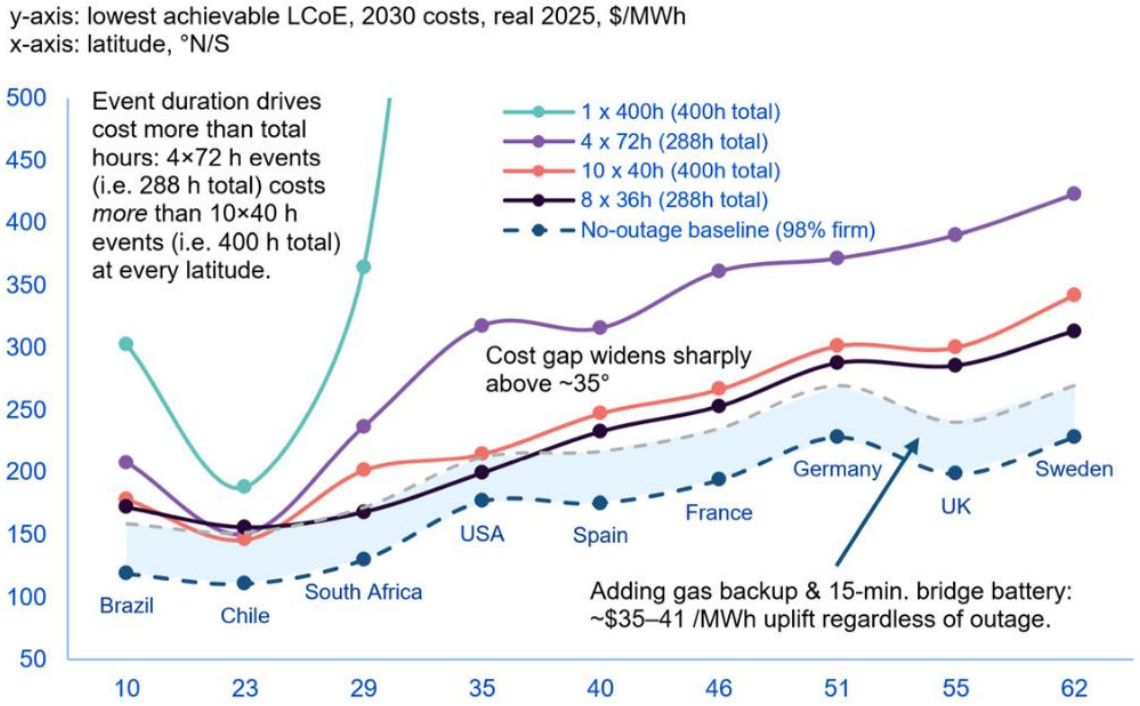
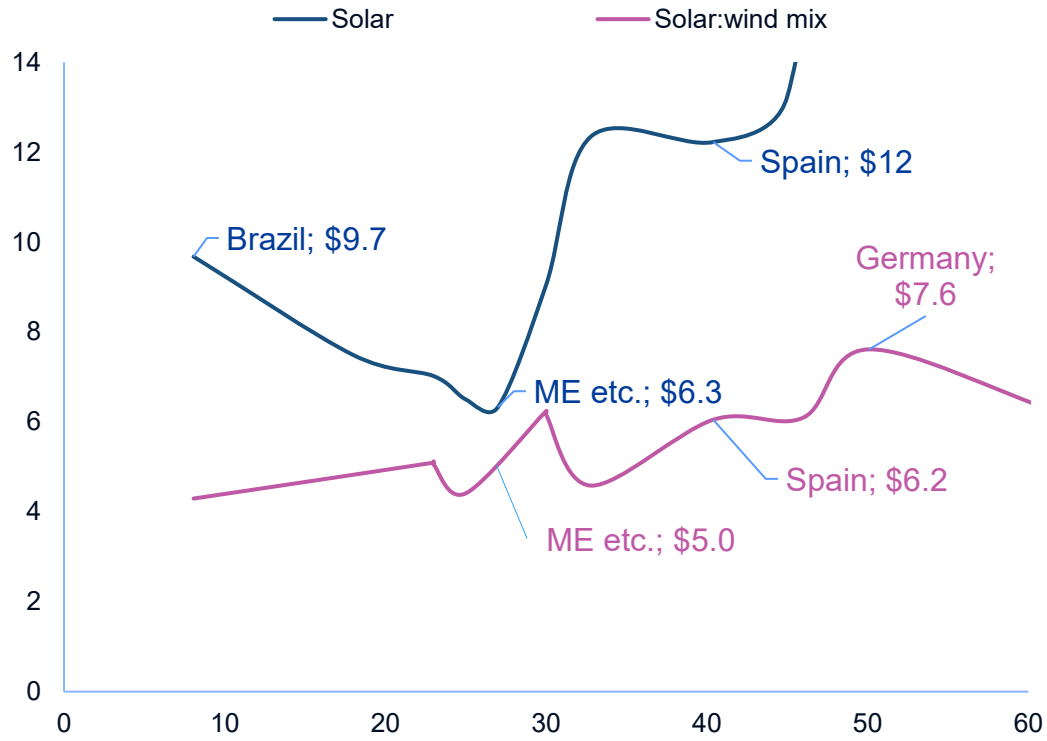
Structural power cost differences across renewable-heavy systems

Lowest costs achievable at lower latitudes…



…which impacts the cost of hydrogen achievable

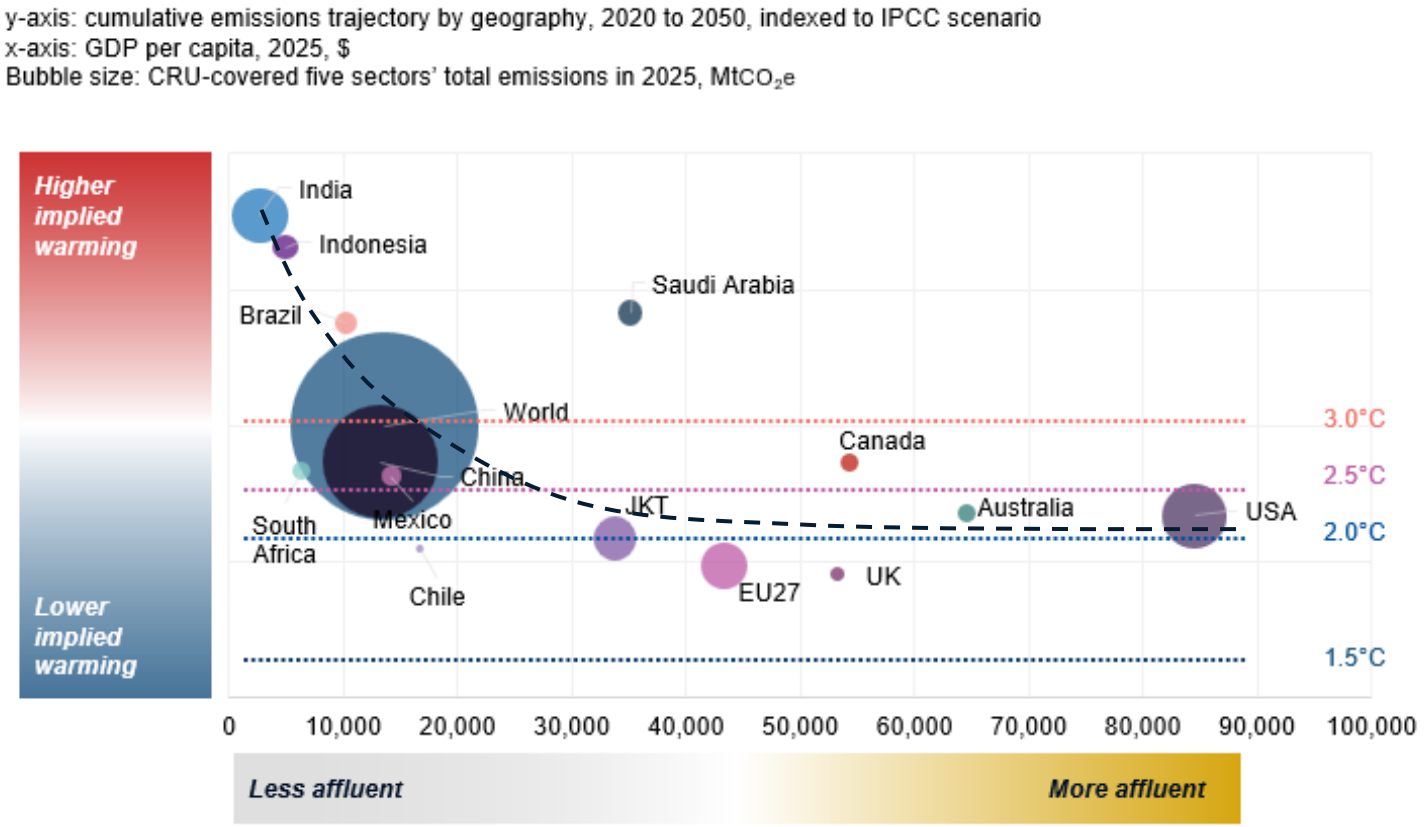
y-axis: LCoH, optimised for power source, 2030 costs, real 2024, $/kg
x-axis: latitude



DATA: **CRU Energy Transition and Decarbonisation Service**

EU27 is leading on decarbonisation intent

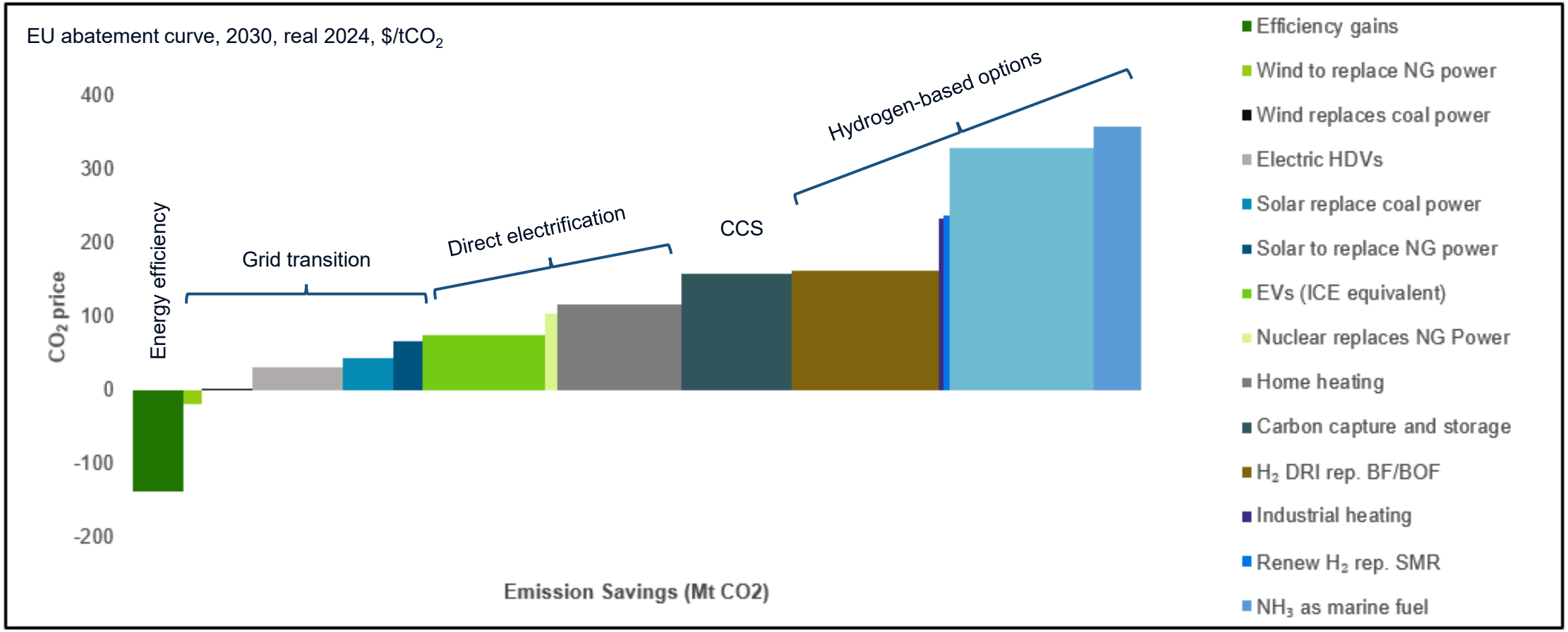
The EU steel industry is under greatest pressure to decarbonise



DATA: **CRU Energy Transition and Decarbonisation Service – Commodity Emissions Report**

Hydrogen-based decarbonisation options are the most costly

Any investment in hydrogen-based decarbonisation could have achieved >3x the carbon reduction invested in the grid

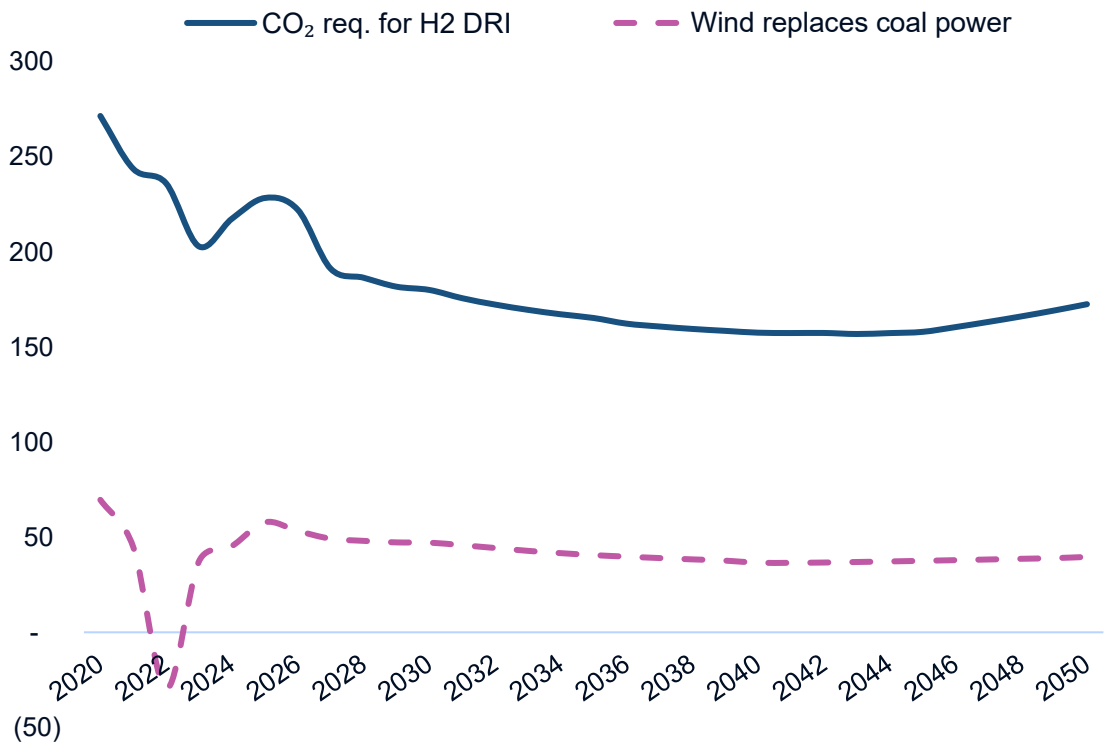


DATA: **CRU Energy Transition and Decarbonisation Service**

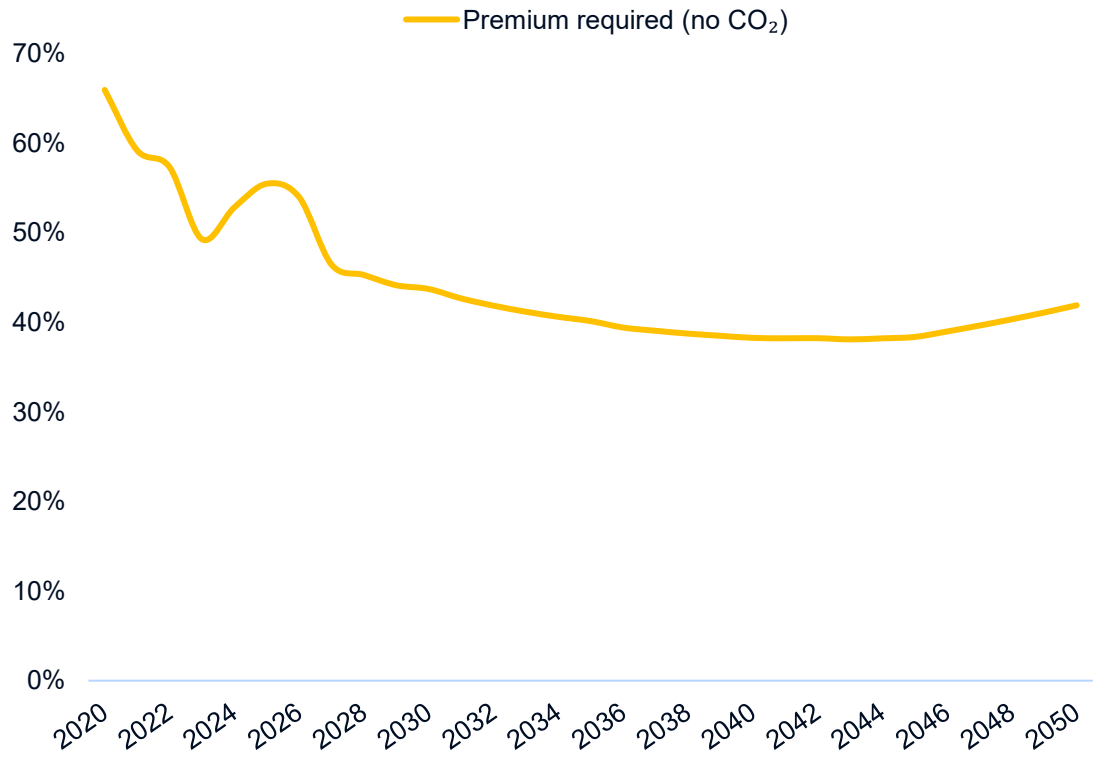
Hydrogen-based steelmaking is one of the more costly options

Global emissions remain on a <+3.0°C pathway

Carbon price needed to incentivise technology change, Europe, real 2024, $/tCO$_2$



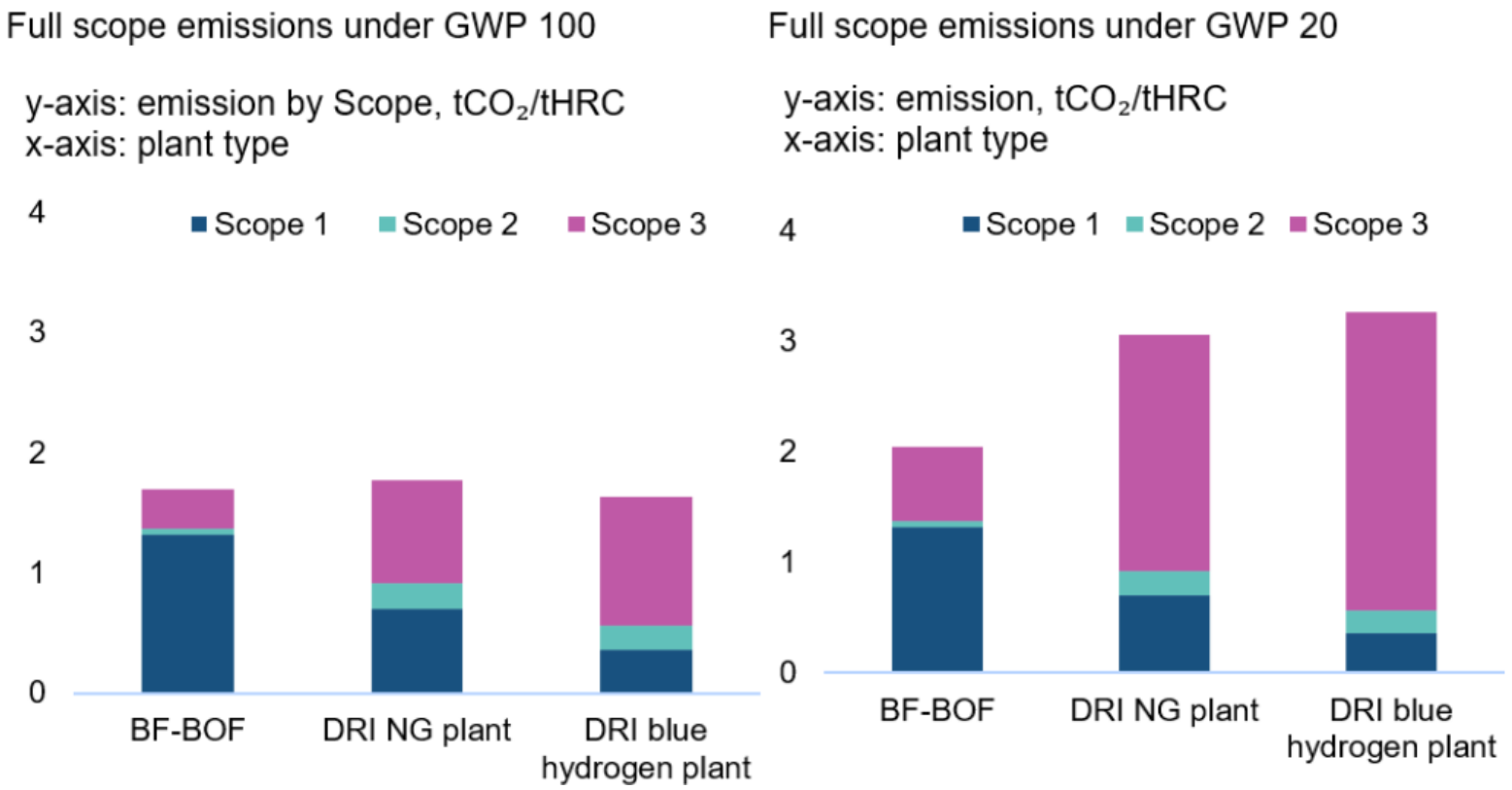
Steel premium needed to incentivise technology change, Europe, real 2024, $/tCO$_2$



DATA: **CRU Energy Transition and Decarbonisation Service**; analysis assumes no free allowances

Interim options for DRI might not provide the emission reductions expected

Under GWP20, blue hydrogen DRI becomes the highest carbon choice in Europe



DATA: **CRU Energy Transition and Decarbonisation Service**

Final comments

Grid decarbonisation is increasingly challenging and costly:

- decarbonised power will not be universally available by 2040
- higher latitudes will exhibit structurally higher power costs as grids decarbonise
- grids unlikely to decarbonise beyond ~80%; the cost is too high
- Europe and S. America will reach that level in the 2030s
- nuclear could match on cost, but speed of delivery hampers progress

Hydrogen-based options to decarbonise are the costliest:

- a $ spent of hydrogen steelmaking today could reduce emissions >3x if spent elsewhere

European steel is in a bind:

- EU is on a faster trajectory, pressure to decarbonise is high, but costs of hydrogen steelmaking are high, emissions impact of interim options is questionable

Thank you

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