



**An Integrated Energy Vision
Economic opportunity
Scotland and global**

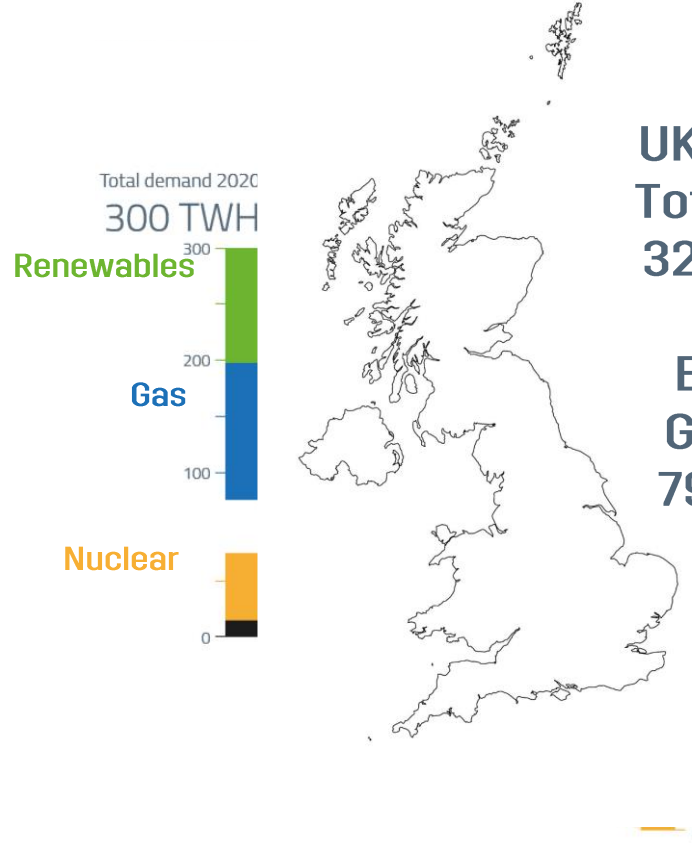
**Martyn Tulloch
Head of Energy System Integration**



2022 – 2045/50

The journey to net zero

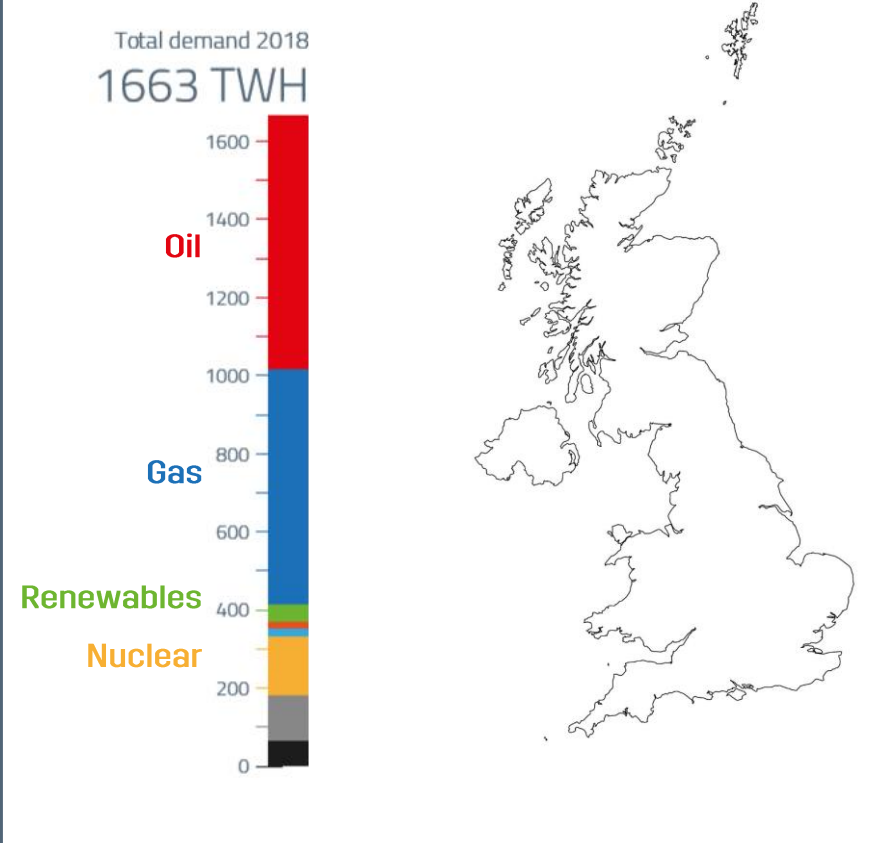
Electricity Demand



**UK Emissions
Total (2020p)
326 MT Co2e**

**Electricity
Generation
79 MT Co2e**

Power Demand



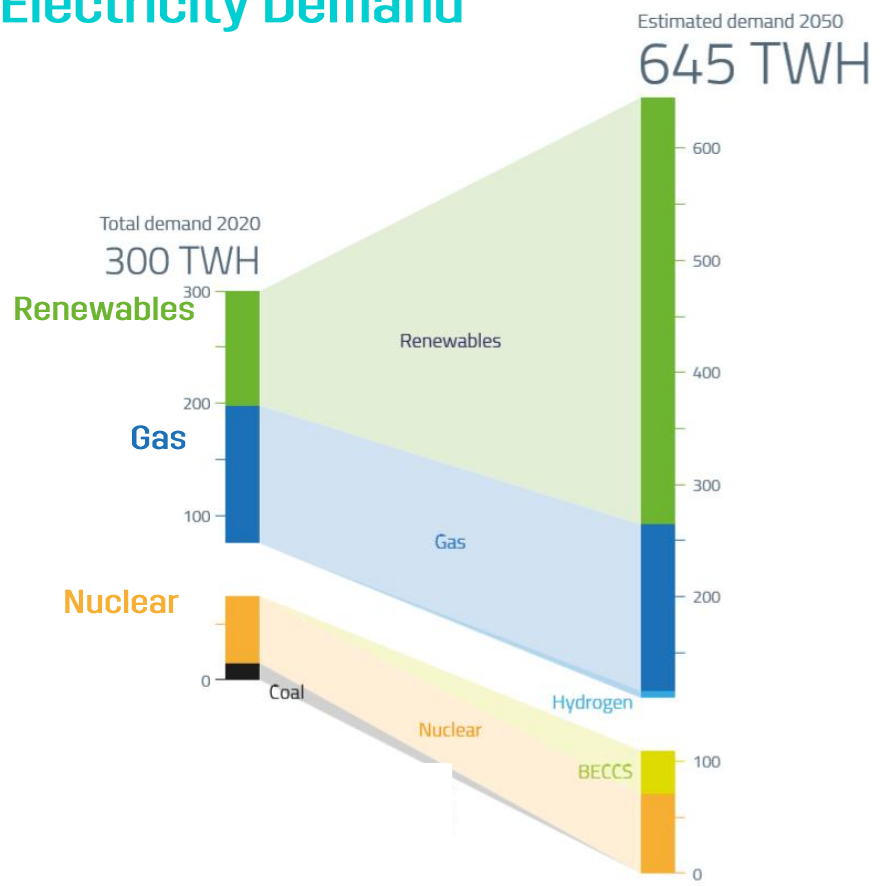
Resource	WIND	WAVE & TIDAL	SOLAR	OIL & GAS	HYDROGEN	CARBON CAPTURE
	95-250 GW	~ 100 GW	> 150 GW	1.7bn BOE Gas 3.8bn BOE Oil	> 270 TWH GH2 17 – 270 TWH BH2	78 Gtonne



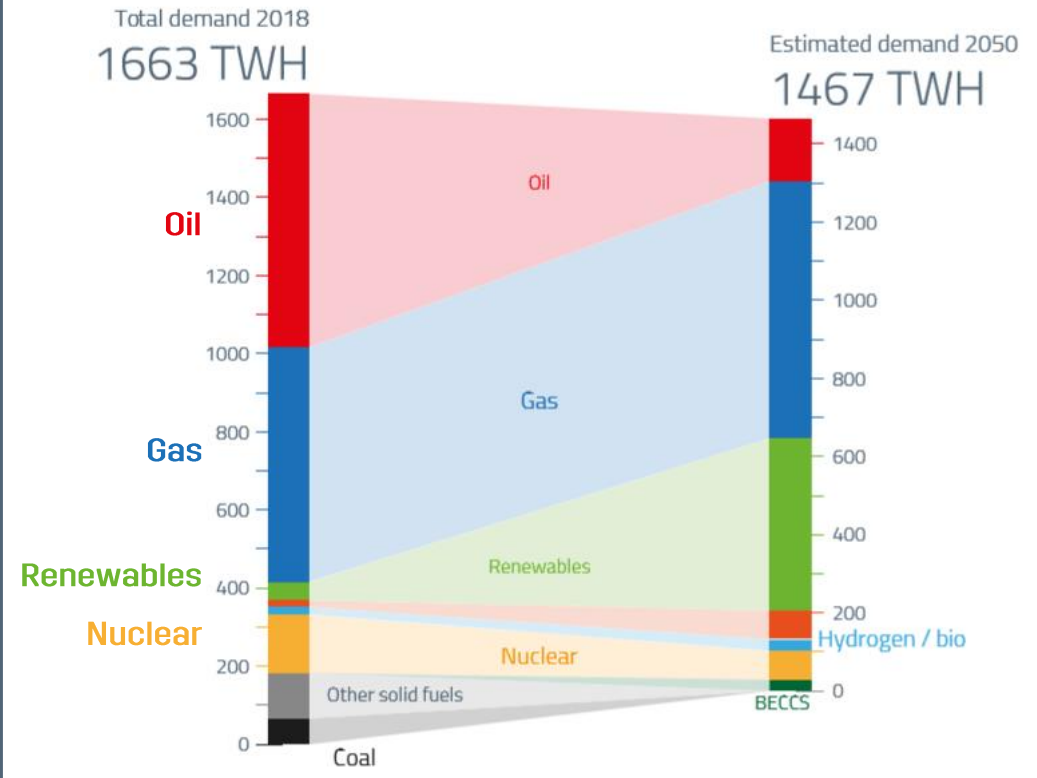
2022 – 2045/50

The journey to net zero

Electricity Demand



Power Demand



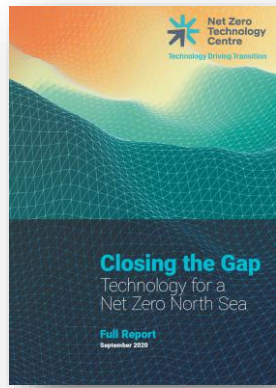
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Closing the Gap

Technology for a Net Zero North Sea



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Oil & Gas



Off. Wind



Hydrogen



CCS



Annual Revenue

£17Bn

2020

£15Bn

1

2030

£16Bn

£5Bn

2

2

£25Bn

2040

£12Bn

£7Bn

£12Bn

2

£33Bn

2050

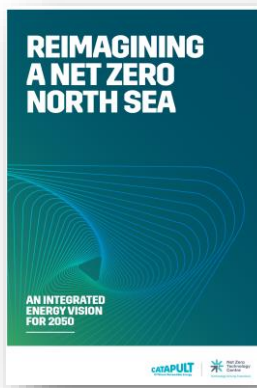
£9Bn

£11Bn

£14Bn

£4Bn

£38Bn



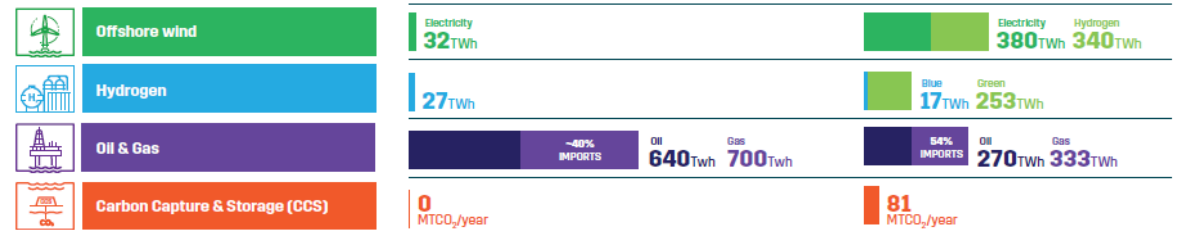
Reimagining a Net Zero North Sea

An Integrated Energy Vision for 2050



	TODAY 2020	TRANSFORMATIONAL 2050
Summary	<ul style="list-style-type: none"> > Blue and green hydrogen not commercially available > Gas import dependency rising year on year > Floating wind trials in UK waters > CCS under development but not operational 	<ul style="list-style-type: none"> > Green hydrogen plays a major role > Low reliance on imported gas > Crucial role for floating wind > Moderate requirement for CCS
Economy	£40bn Total Economic Impact	£125bn Total Economic Impact
Jobs	140,000 Direct & Indirect	232,000 Direct & Indirect
Imports	UKCS Imports ~45%	UKCS Imports ~10%
Investment	£10bn Average historic CAPEX p.a	£13.4bn Average CAPEX p.a

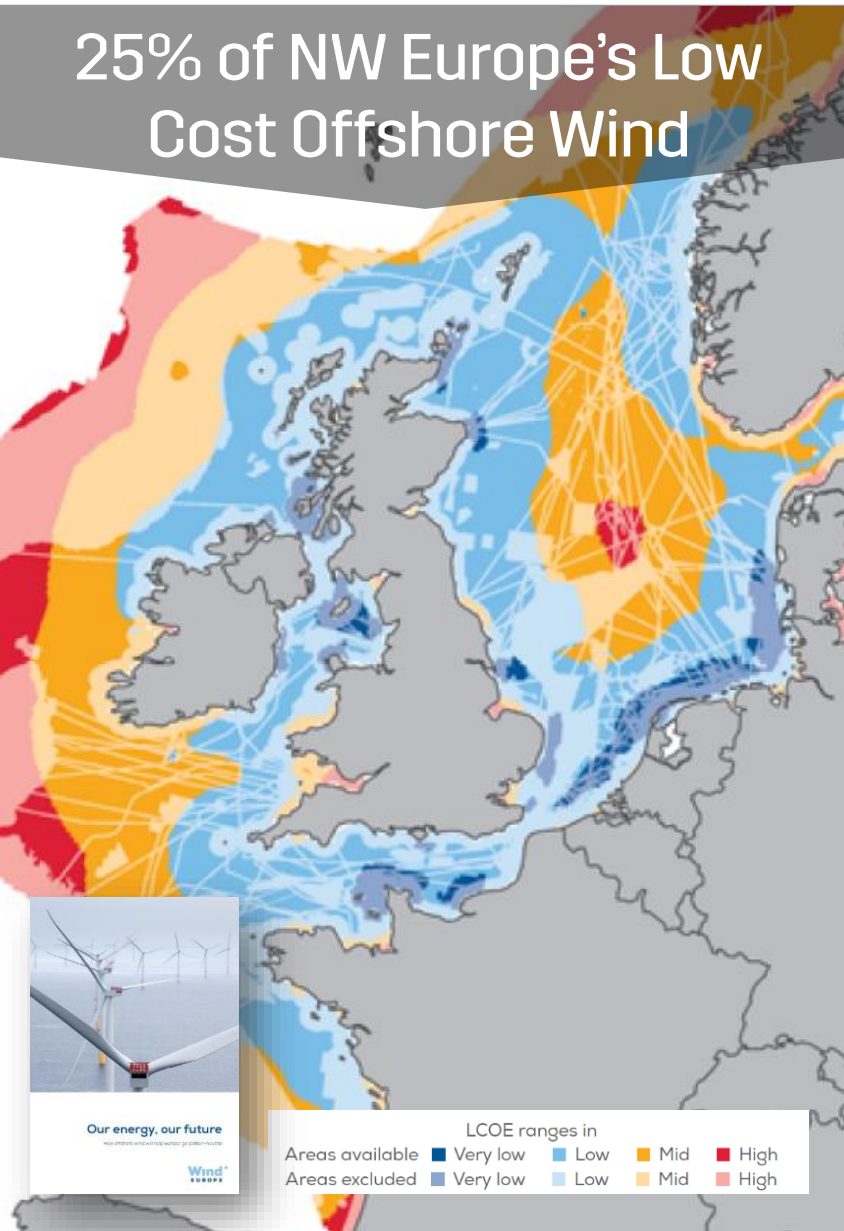
Offshore energy mix



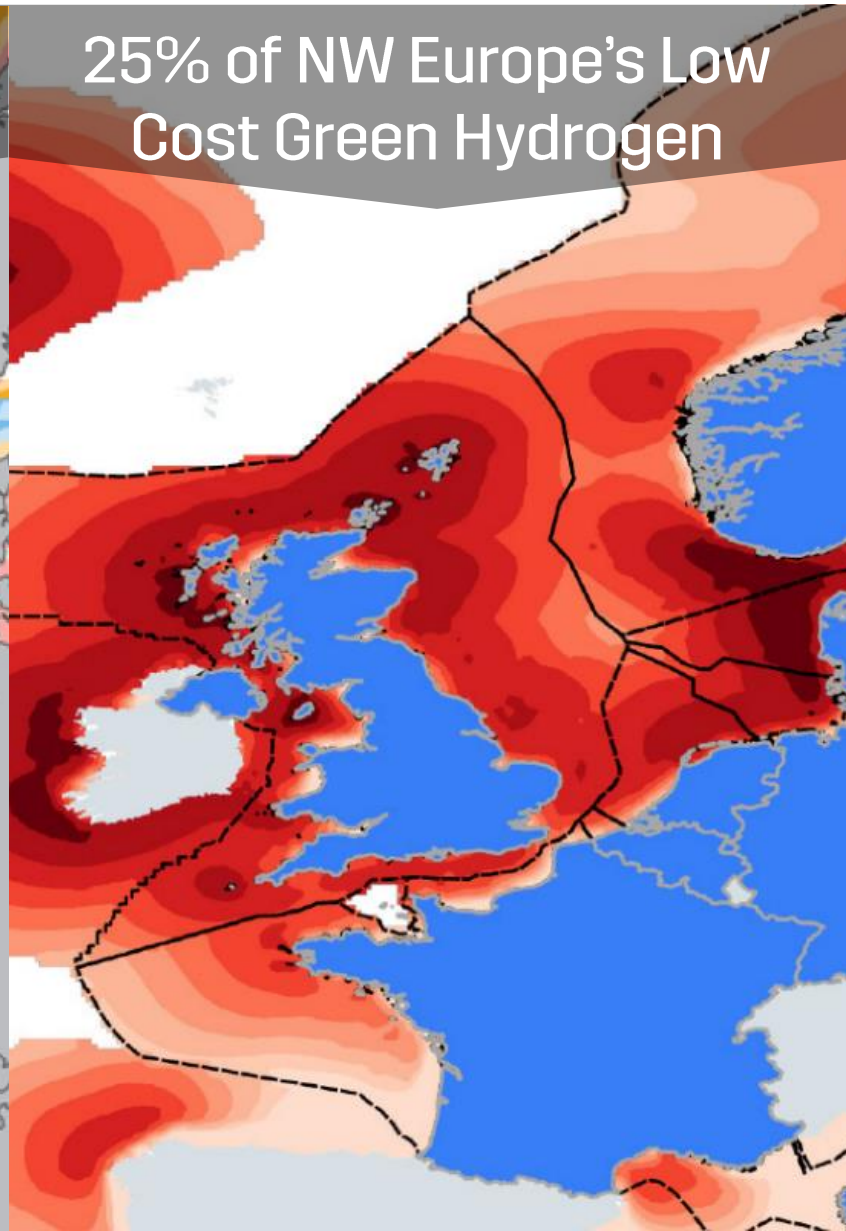
Hydrogen Demand and Supply



25% of NW Europe's Low Cost Offshore Wind



25% of NW Europe's Low Cost Green Hydrogen



Import 3X Dutch Energy Consumption

20 Mt

TOTAL HYDROGEN FLOW IN ROTTERDAM IN 2050

200 GW

WIND POWER NEEDED TO PRODUCE 20MT OF GREEN HYDROGEN

5,000%

INCREASE IN HYDROGEN FLOW THROUGH ROTTERDAM

Strong growth in hydrogen flow through Rotterdam due to imports

The coming decades will see the rise of blue and green hydrogen. In order to meet national and international demand, the lion's share will come from import in 2050.

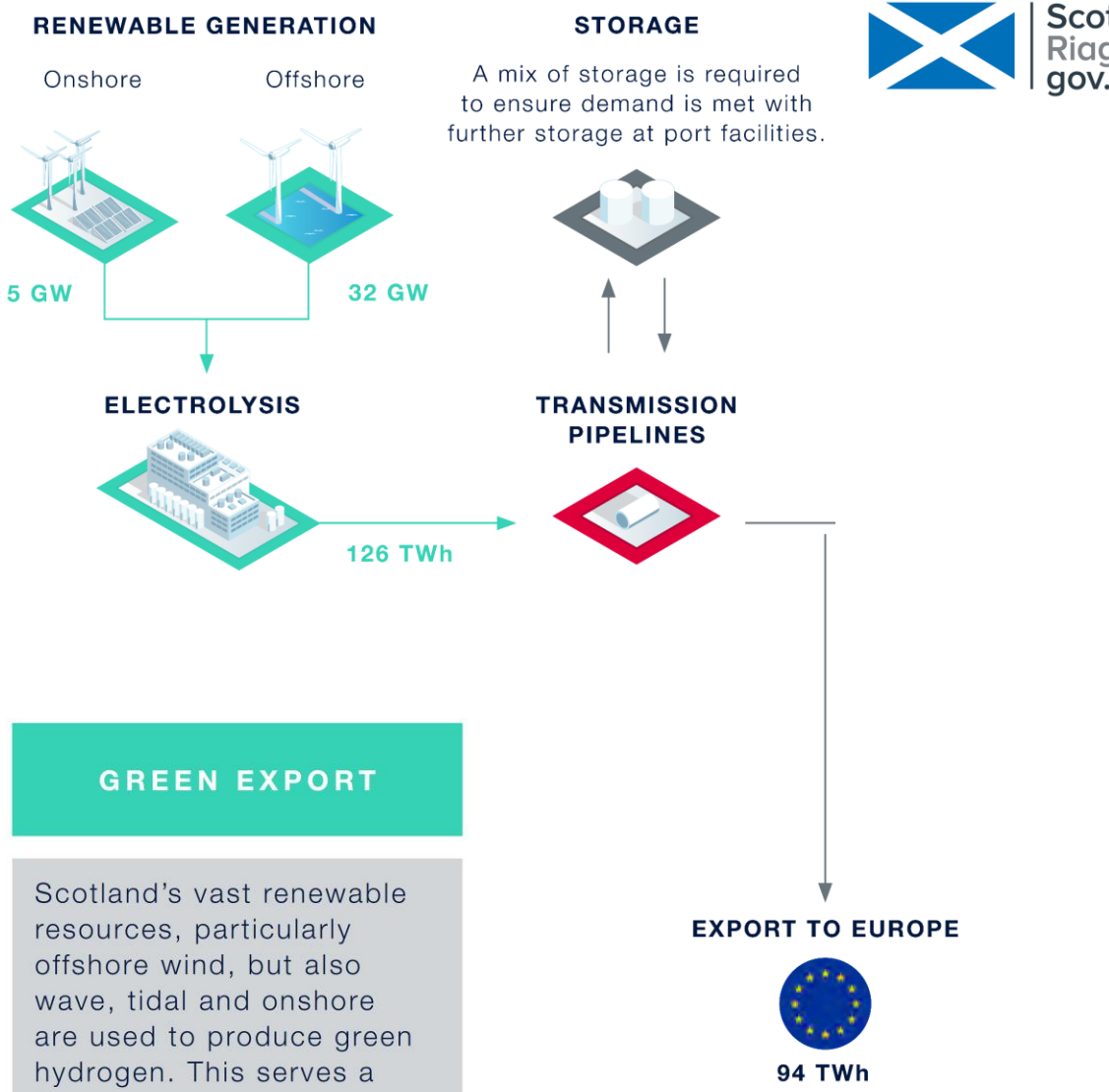
- Grey hydrogen
- Blue hydrogen
- Green hydrogen
- Imported hydrogen

2020 2030 2040 2050



20 Mt
15
10
5,0
2,0
1,0
0,0

Scottish Hydrogen Assessment

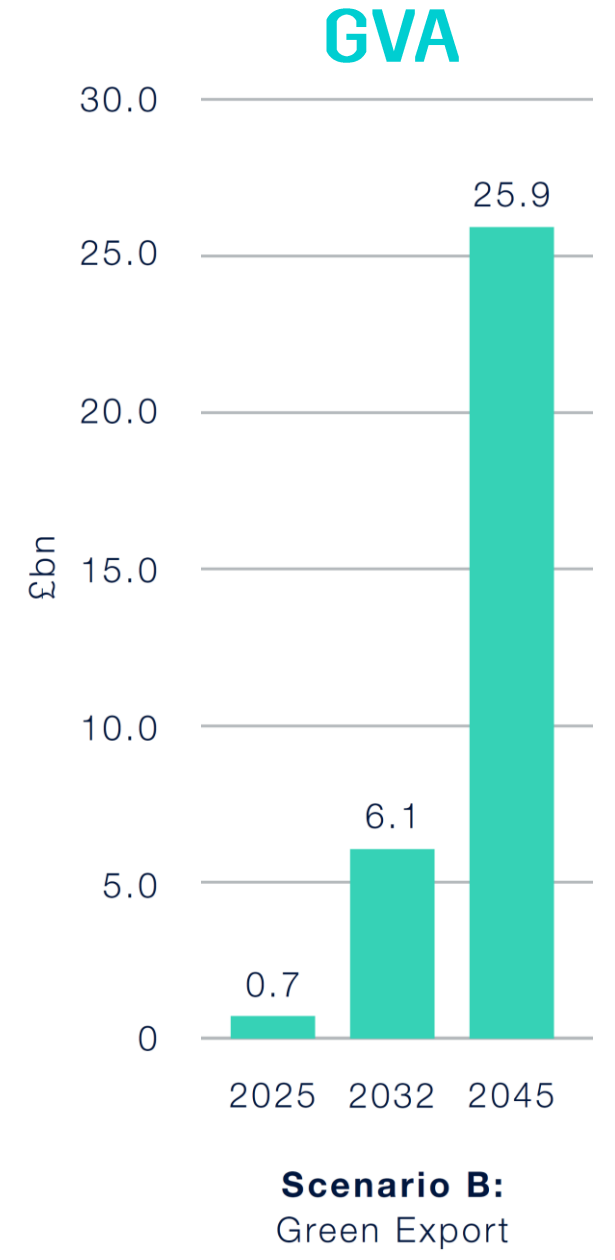
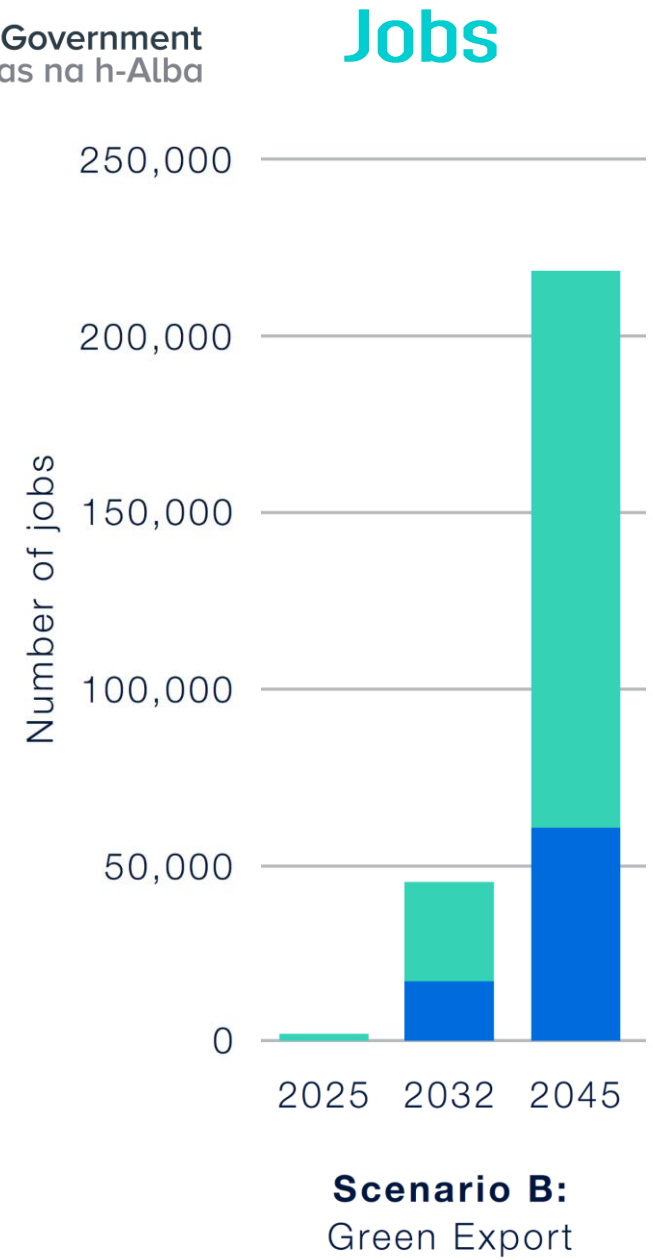



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GREEN EXPORT

Scotland's vast renewable resources, particularly offshore wind, but also wave, tidal and onshore are used to produce green hydrogen. This serves a European export market.

Scotland becomes one of Europe's major green hydrogen exporters driving green hydrogen production in Scotland.



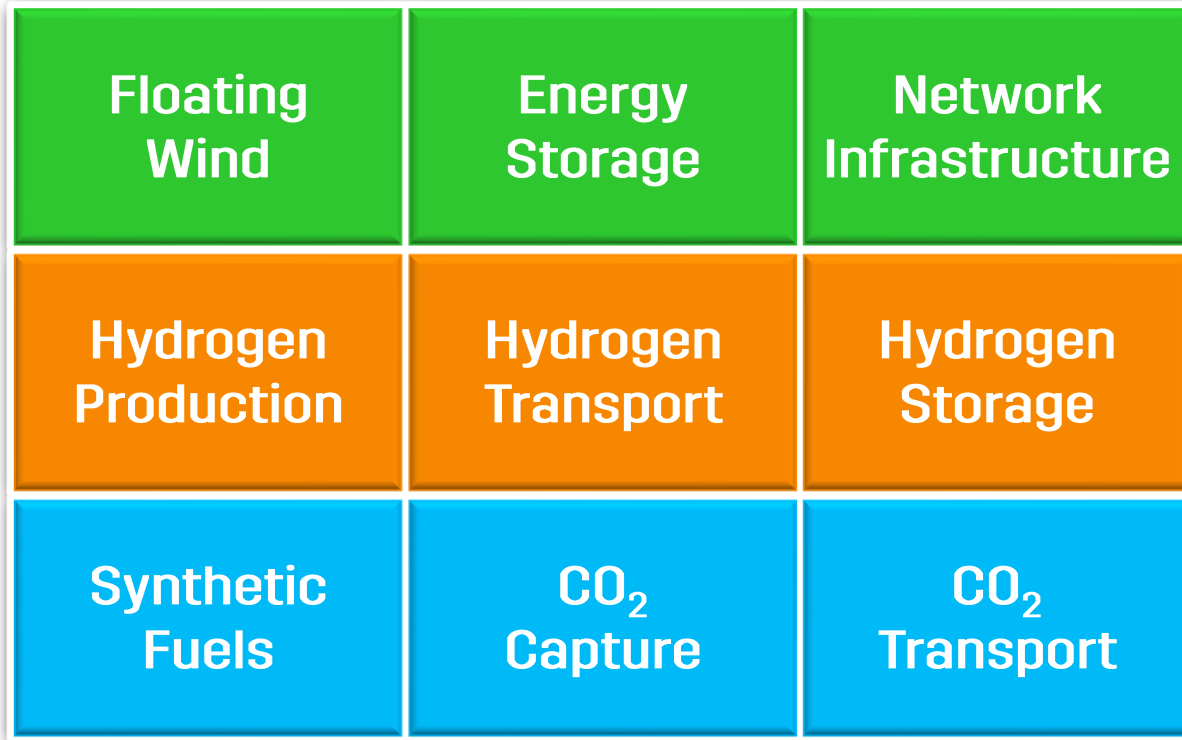
Energy Hubs & Offshore Hydrogen Backbone



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Technology Driving Transition



Onshore hydrogen production locations in Scotland for green, blue and pink hydrogen production, including scale of production



Onshore and offshore large scale windfarm locations (fixed and floating), including ScotWind awarded areas



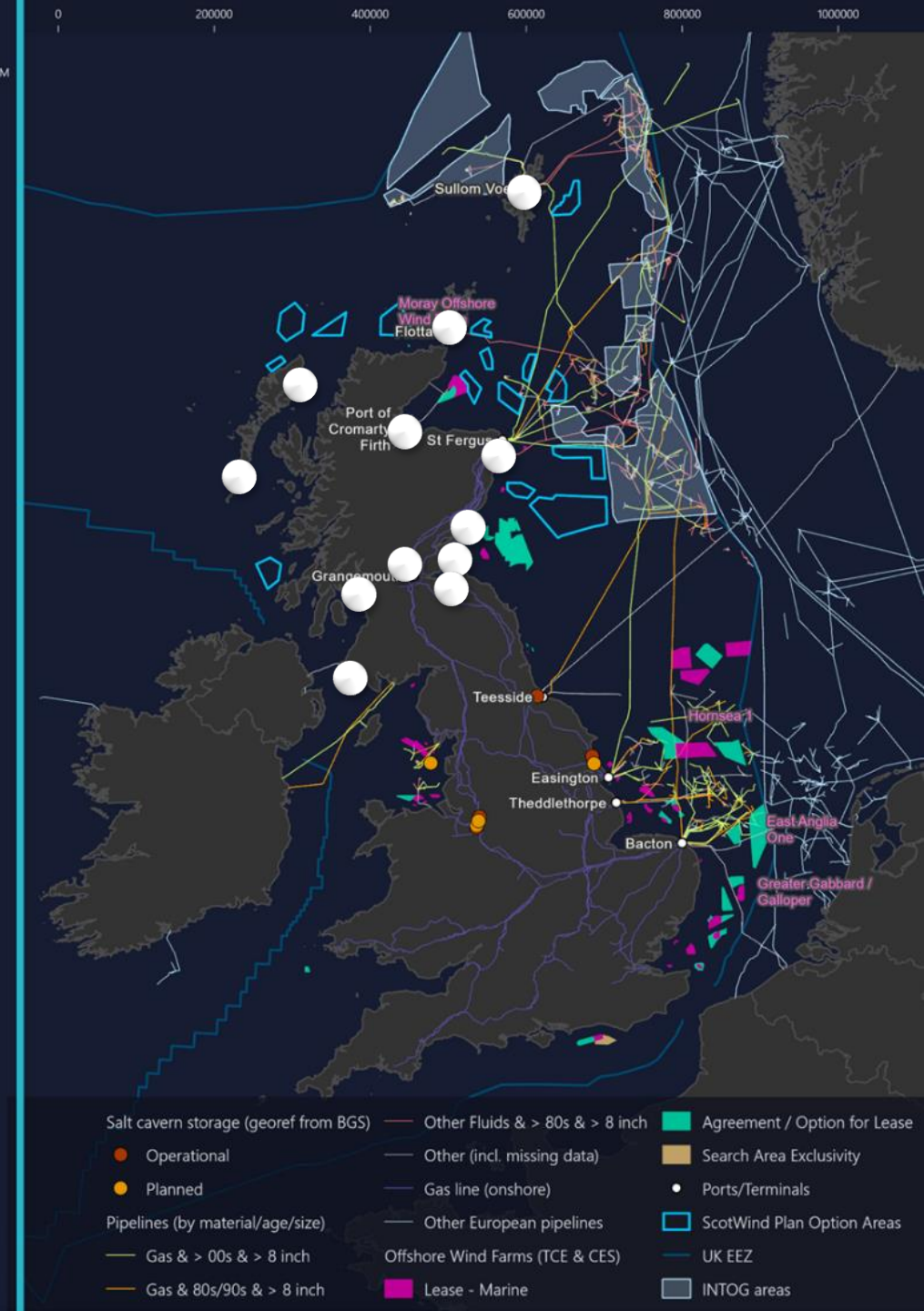
Existing pipelines (both onshore and offshore), harbours and other infrastructure that could be used to export hydrogen



Other offshore infrastructure (oil/gas platforms etc.) which could be re-purposed for hydrogen production



Sources and attributions:
BGS (2019), NG (2019), UKNDR (2019), TC/CEES (2019), Marine Scotland (2019).



Thank You



**Net Zero
Technology
Centre**

Technology Driving Transition