



Next Generation Fuels – BioSNG/Hydrogen

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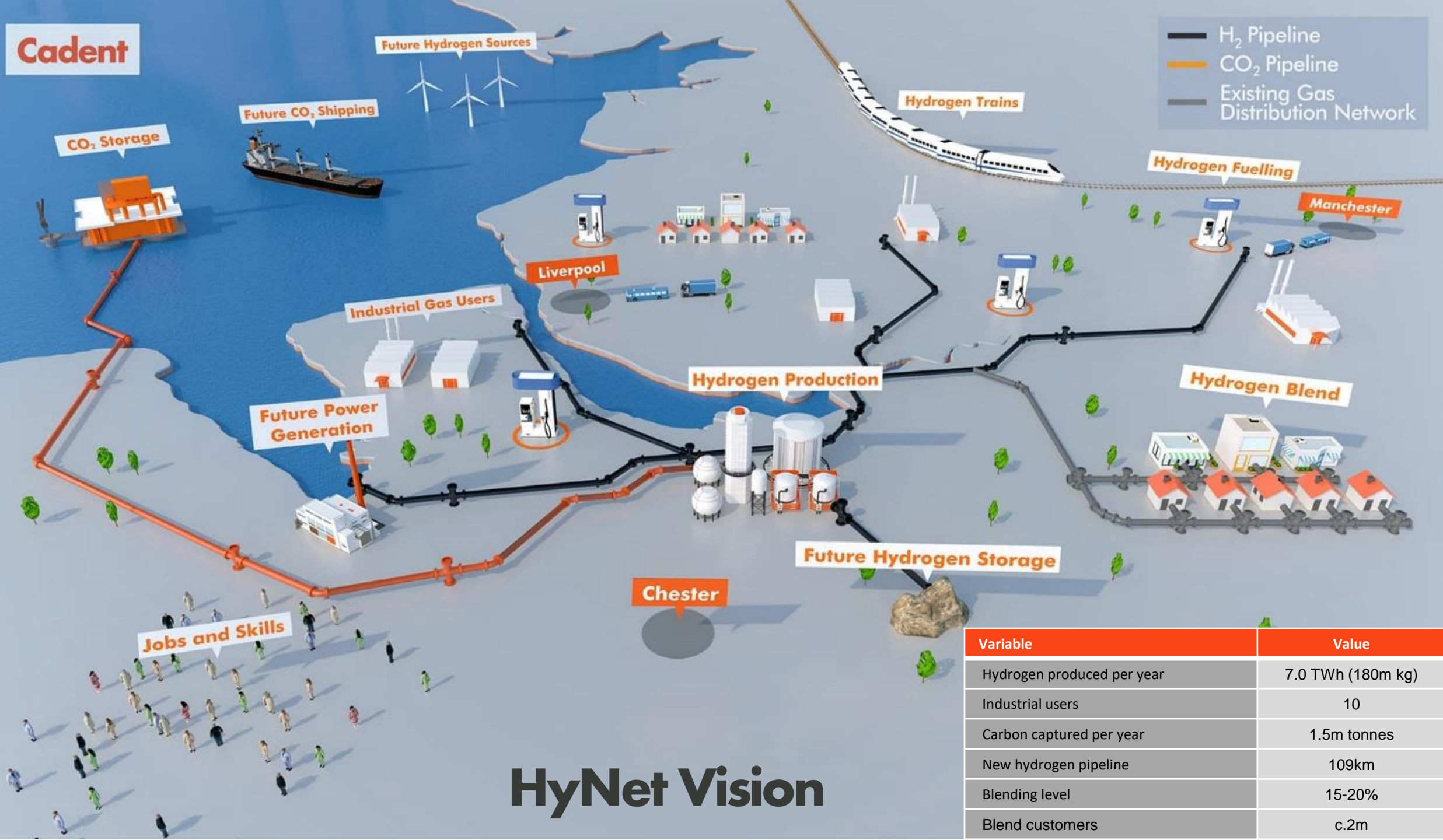
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Variable	Value
Hydrogen produced per year	7.0 TWh (180m kg)
Industrial users	10
Carbon captured per year	1.5m tonnes
New hydrogen pipeline	109km
Blending level	15-20%
Blend customers	c.2m

HyNet Vision



Variable	Value
BioSNG produced per year	0.3 TWh
Waste processed	130ktpa
Carbon savings per year	0.1m tonnes
New pipeline	None
Blending level	100%
Potential availability	20-50%

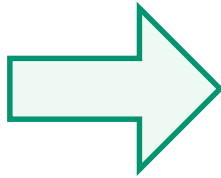
BioSNG Vision



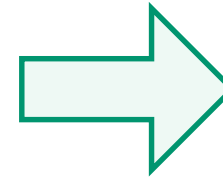
ATR+CCS Technology



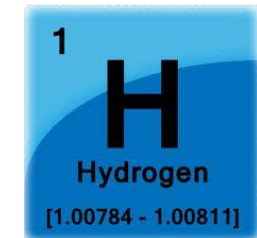
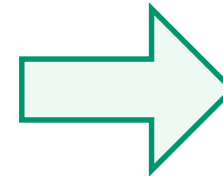
Fossil natural gas



Autothermal reformer



CO₂ to long term storage



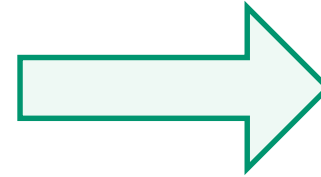
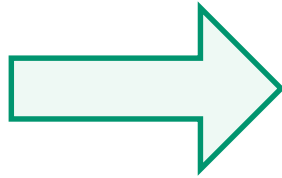
H₂ to transport, heat or power

Large number of successful projects – contractors will offer bankable guarantees



BioSNG Technology

Fluidised bed gasifier and catalytic conversion



BioSNG

Waste feedstocks

Large number of failed projects – major challenge securing performance guarantees.



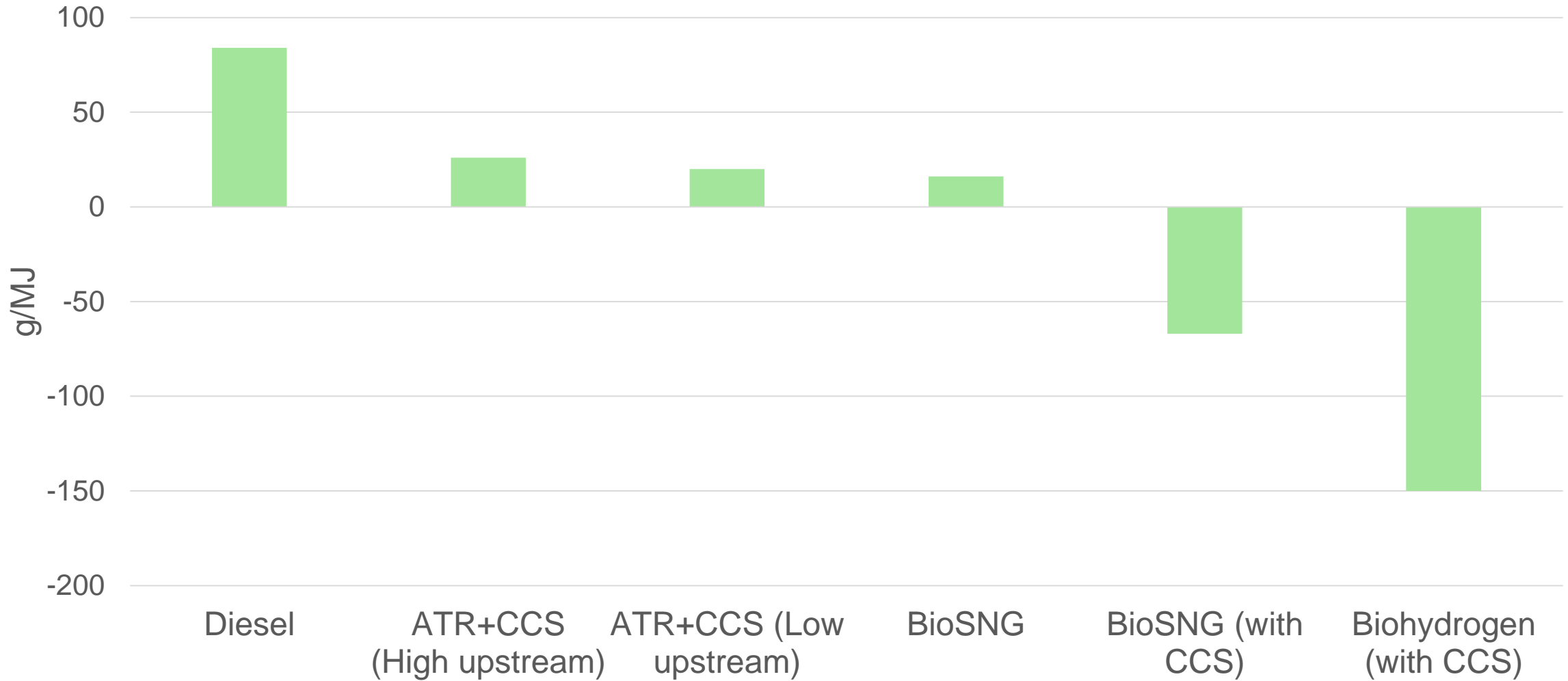
BioSNG Demonstration Plant

- Demonstration plant converting 10,000 tonnes per annum of waste into 22GWh of BioSNG.
- Designed to prove commercial viability of technology.
- BioSNG to be sued in transport to generate dRTFCs. CO₂ liquified for use in industry.
- £27m spent to date but project suspended for last 12 months due to lack of funding.



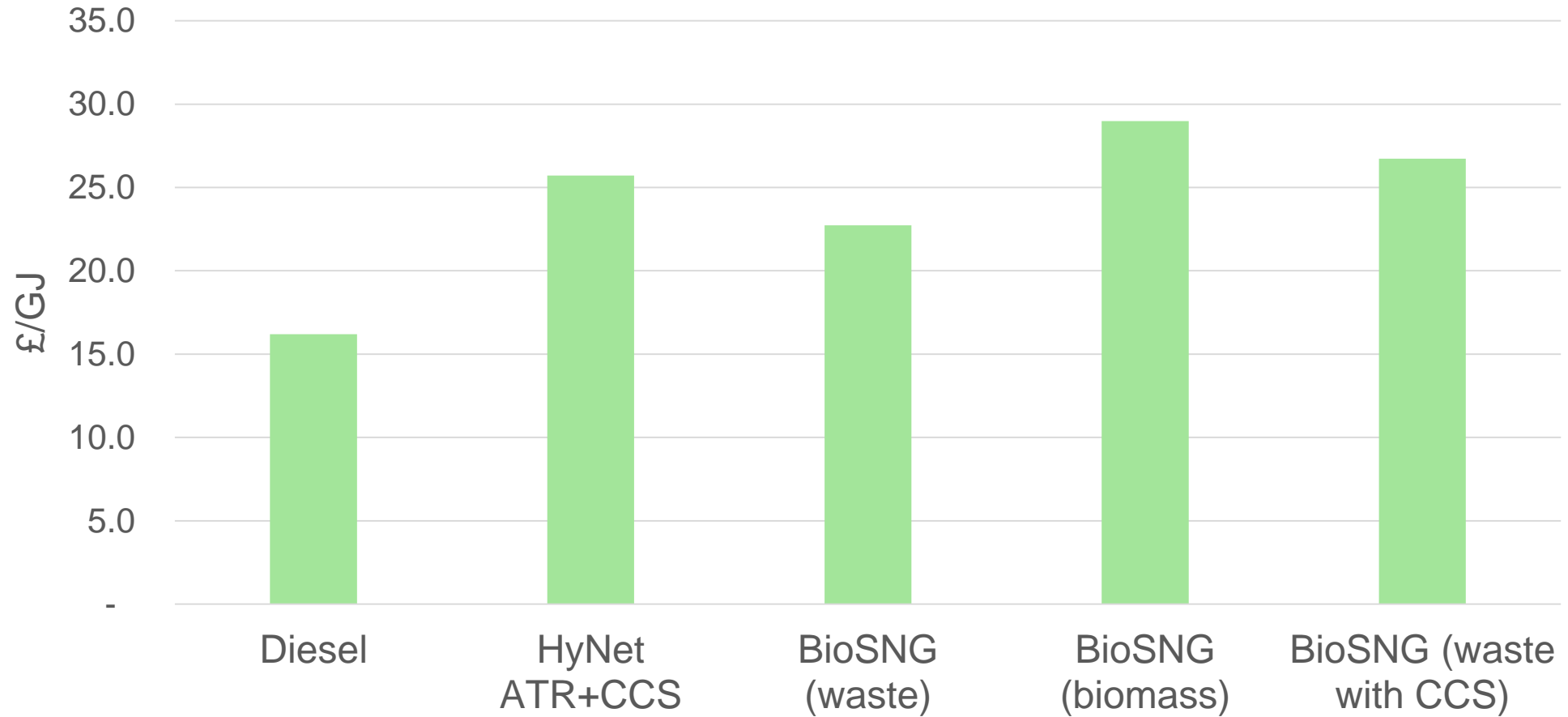


GHG Emissions – Well to Tank





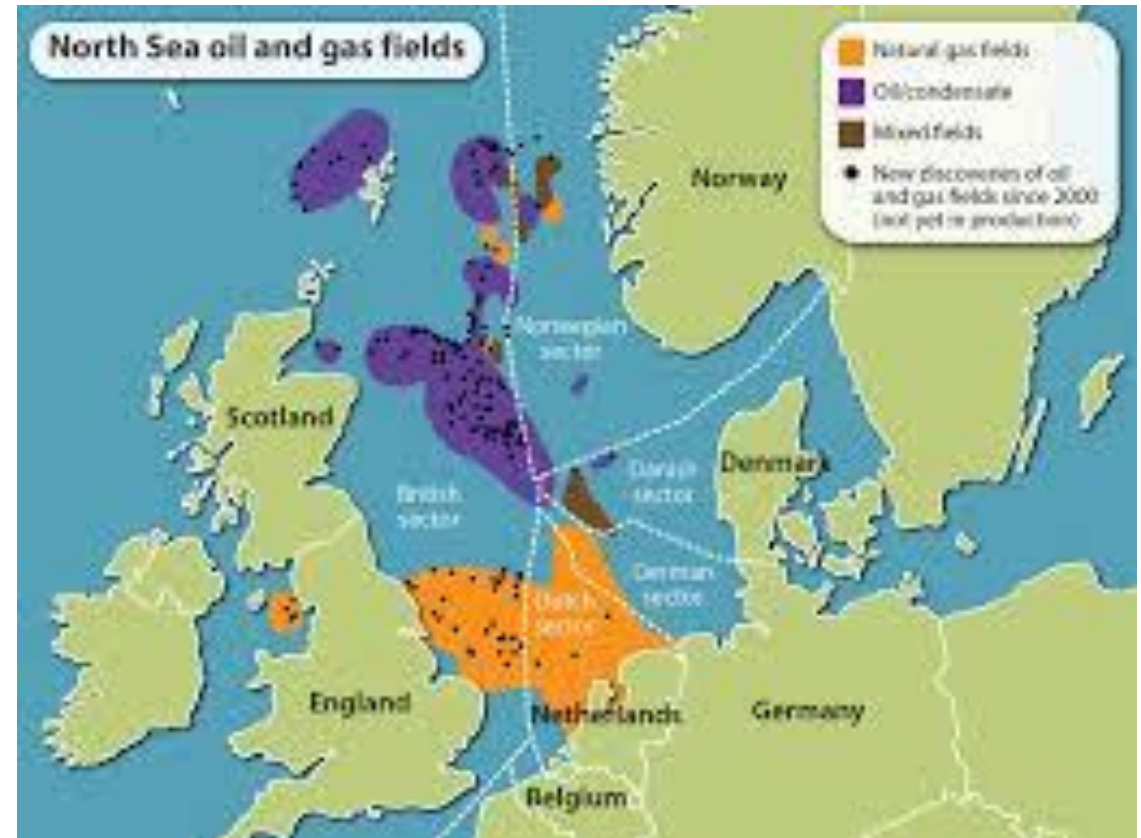
Fuel Cost - At Pump excluding Duty and VAT





ATR CCS Hydrogen Availability

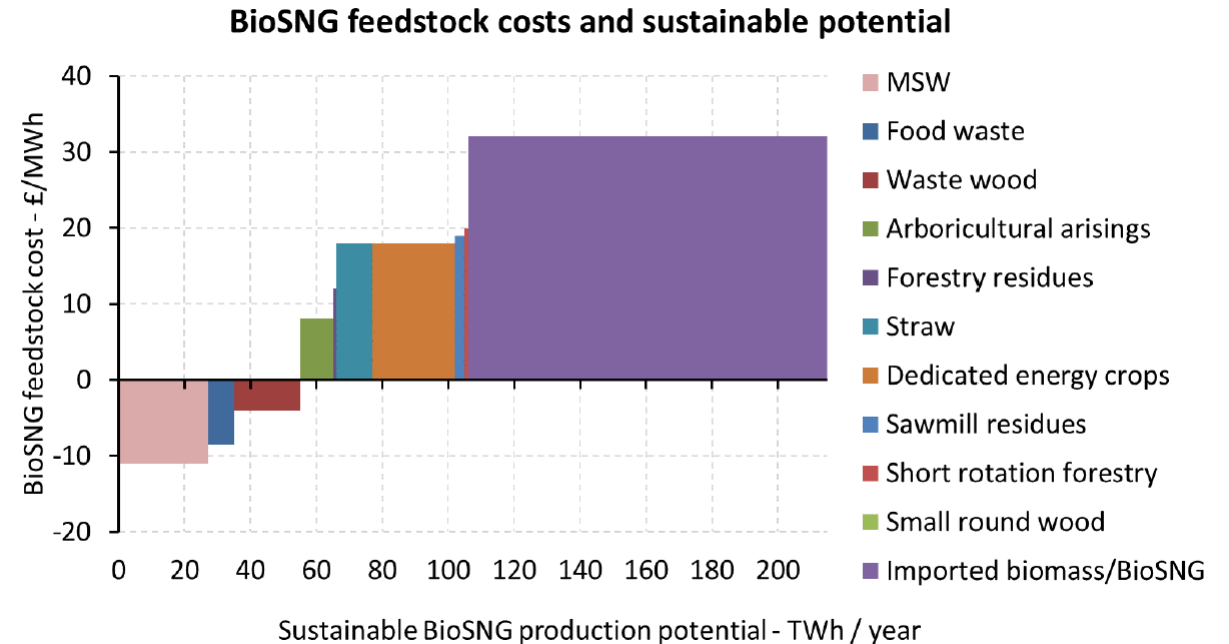
- Availability constrained by availability of natural gas with low upstream emissions.
- North sea is best source plus possibly UK fracking.
- Challenging to reduce upstream emissions from LNG or long distance pipelines.
- Low carbon reserves good for 50-100 years of supply, enough time to commercialise other sources of low carbon hydrogen.





BioSNG Availability

- Availability constrained by availability of sustainable low carbon feedstocks.
- Waste is highly sustainable and offers best economics.
- Large volumes of sustainable imported biomass are available but cost is high.
- Around 100TWh of affordable biomass available – enough to power UK HGVs and buses.



Vehicles

- Fuel cell electric cars and buses are available to UK market in small numbers. Trains and ferries are under development. No HGV solution at present.
- CNG vehicles are an established technology in all sectors. CNG HGVs from Iveco and Scania are performing well.





Conclusions

	ATR+CCS Hydrogen	BioSNG
Vision	Solution for heat, transport and peak electricity.	Solution for heat, transport and peak electricity.
Technology	Established and commercially available.	Under development.
GHG	Low carbon if upstream emissions are low.	Low carbon. Negative emissions possible.
Cost	60% higher than fossil diesel mitigated by higher FCEV efficiency.	Similar cost from waste feedstocks but no efficiency gains.
Availability	Constrained by availability of gas with low upstream emissions.	Constrained by availability of sustainable feedstocks.
Vehicle market	Developing	Established



Thank You

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