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Is CCS dead and if not how do we resuscitate it?

Jim Ward

IGEM Annual Conference, 2016

No, its not dead!

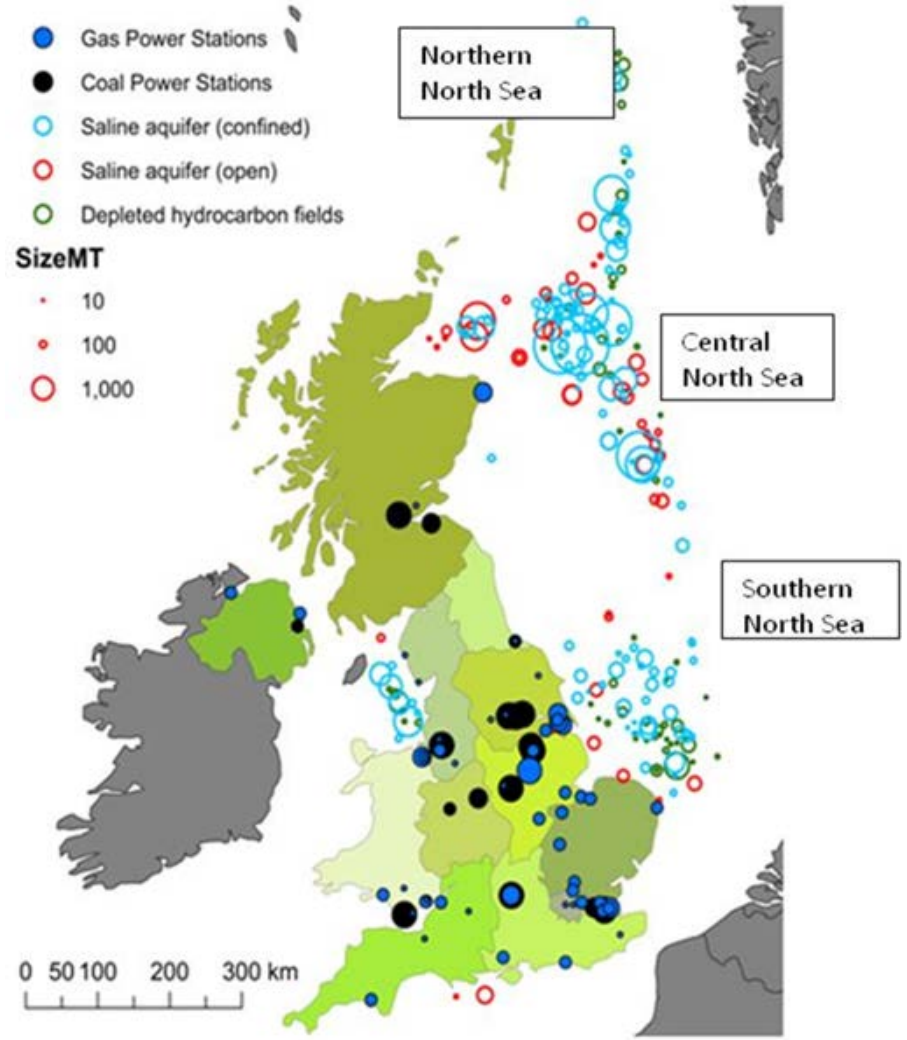
- The core elements of CCS are already in play
  - Transportation: pipeline costs, CO_2 compression and pipeline operations
  - Capture: amine plants (eg at gas terminals)
  - Storage: ex gas fields and saline formations are abundant in UK
  - Several detailed UK FEED studies; plants operational internationally (eg SaskPower, Shell Quest)

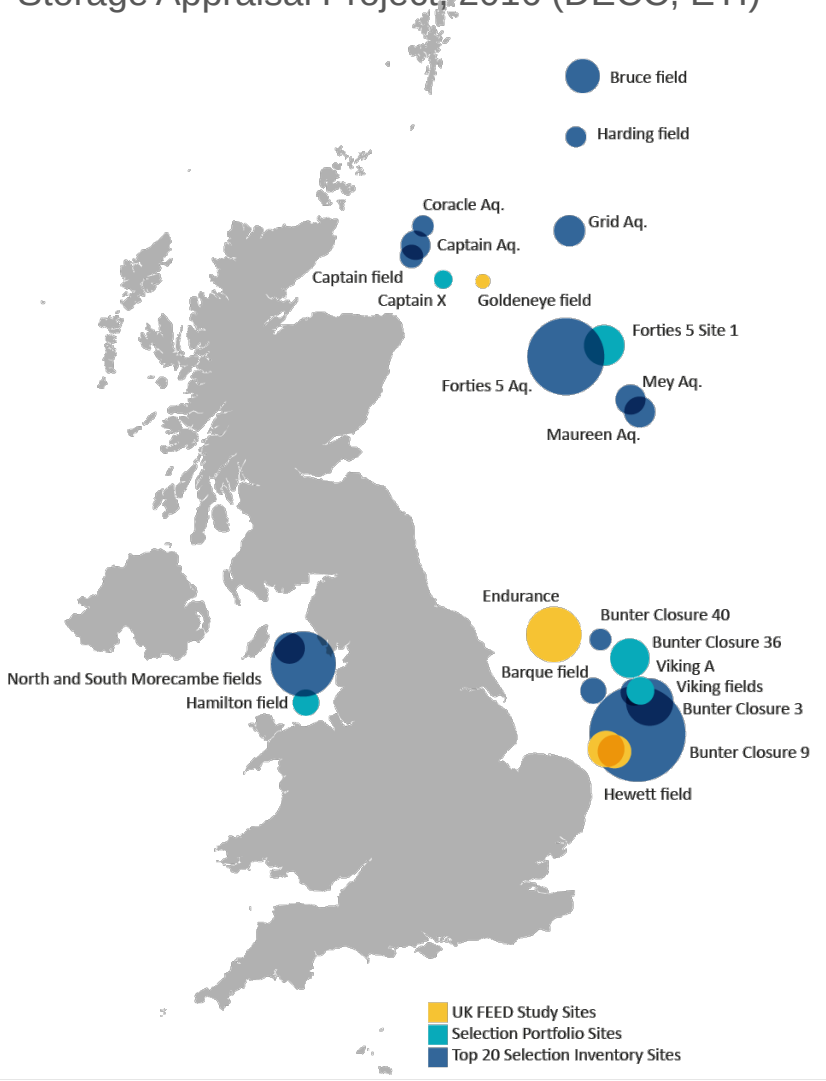
- Power generation with CCS provides multiple values
  - Dispatchable power
  - Provides both capacity and green electrons but only needs one subsidy
  - Provides diversity of energy mix and improved security
  - Lower capex than alternatives with short build time

The chain is complex though and we need some time to find the right model

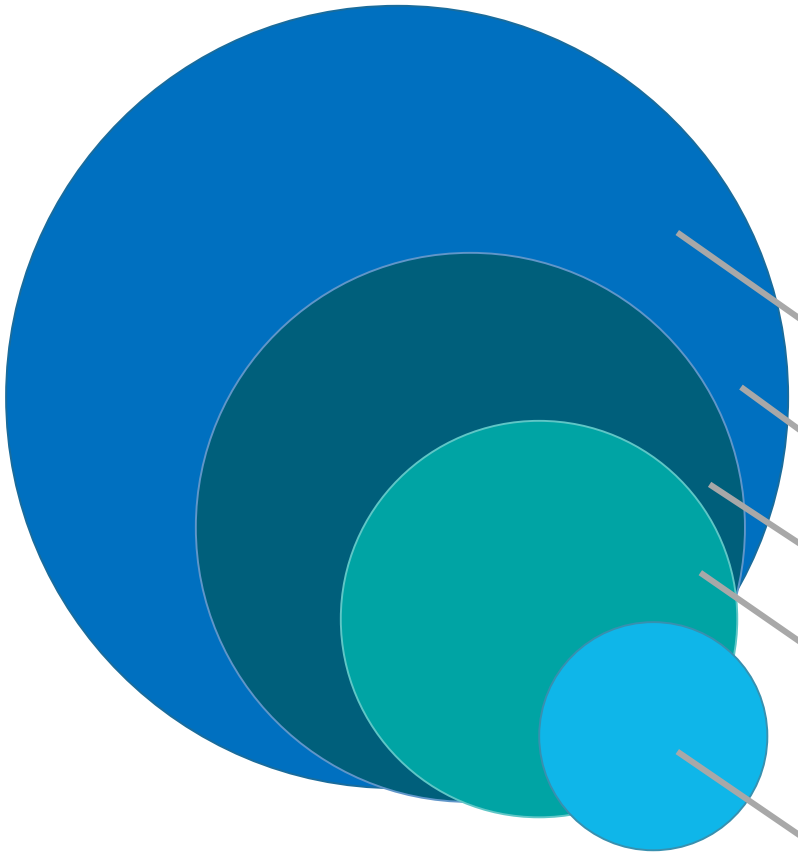
UK CO_2 Storage

Storage Appraisal Project, 2016 (DECC, ETI)





The UKCS is endowed with a rich and diverse national offshore CO_2 storage resource, key components of which can be brought into service readiness without extensive appraisal programmes thanks to decades of petroleum exploration and development activity.



78GT – UKCS potential

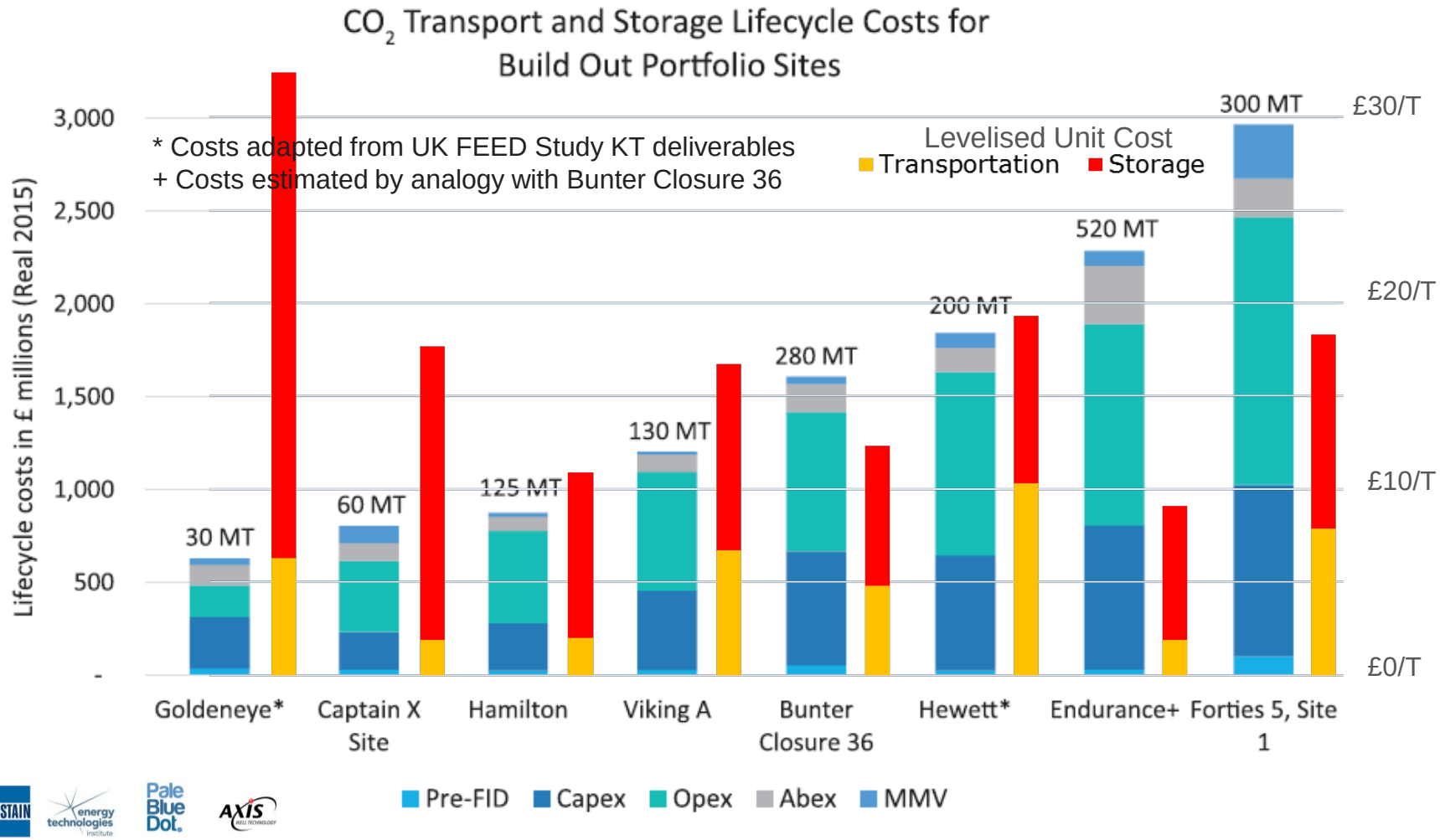
8.6 GT – All qualified sites

7.1 GT – Top 20 sites

1645MT – including ETI 2016 study

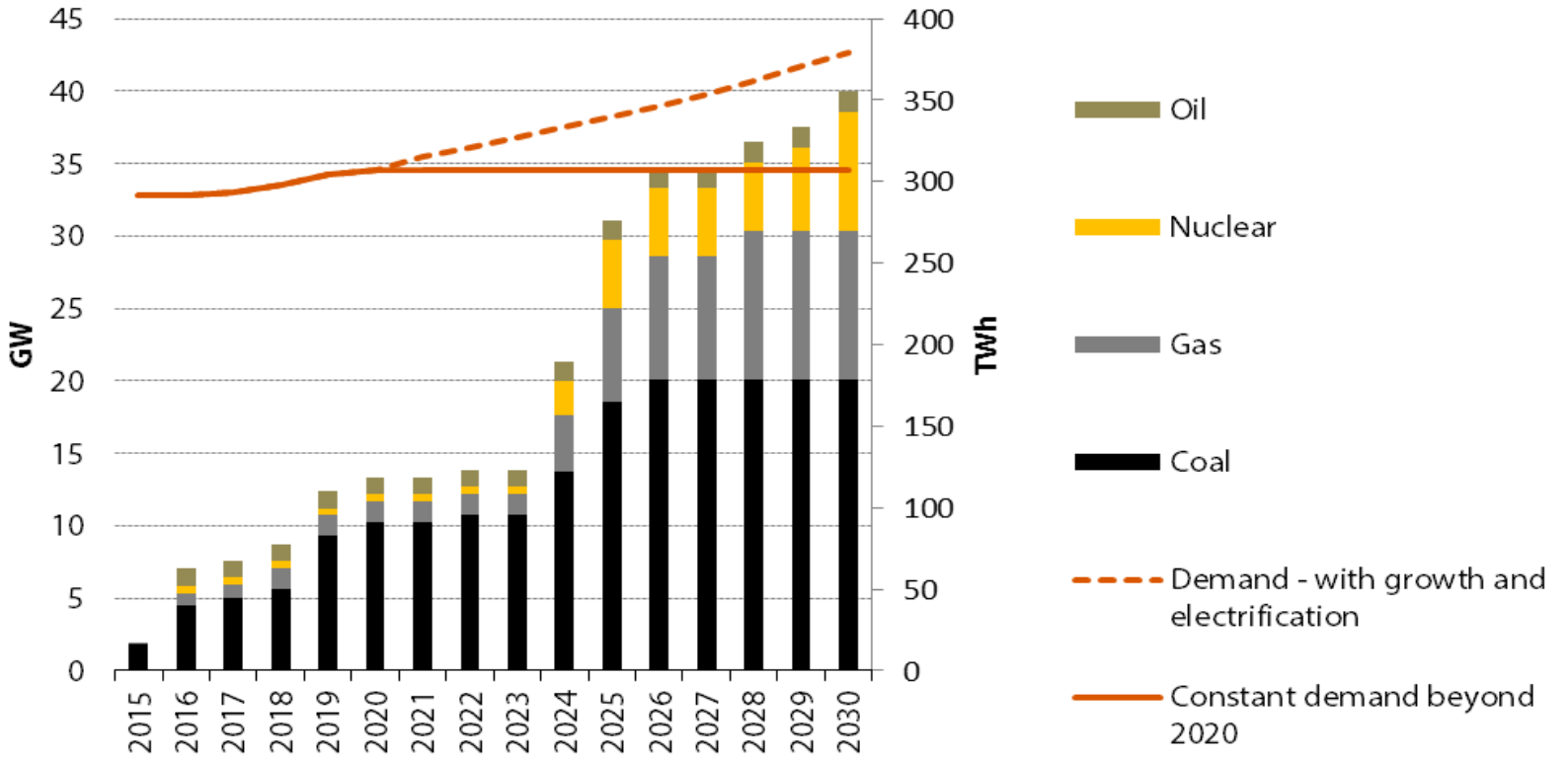
200MT – UK FEED Studies

Lifecycle costs and Unit costs



Not long before we have major decisions to make

Retirements by technology to 2030



* Source: Climate Change Committee

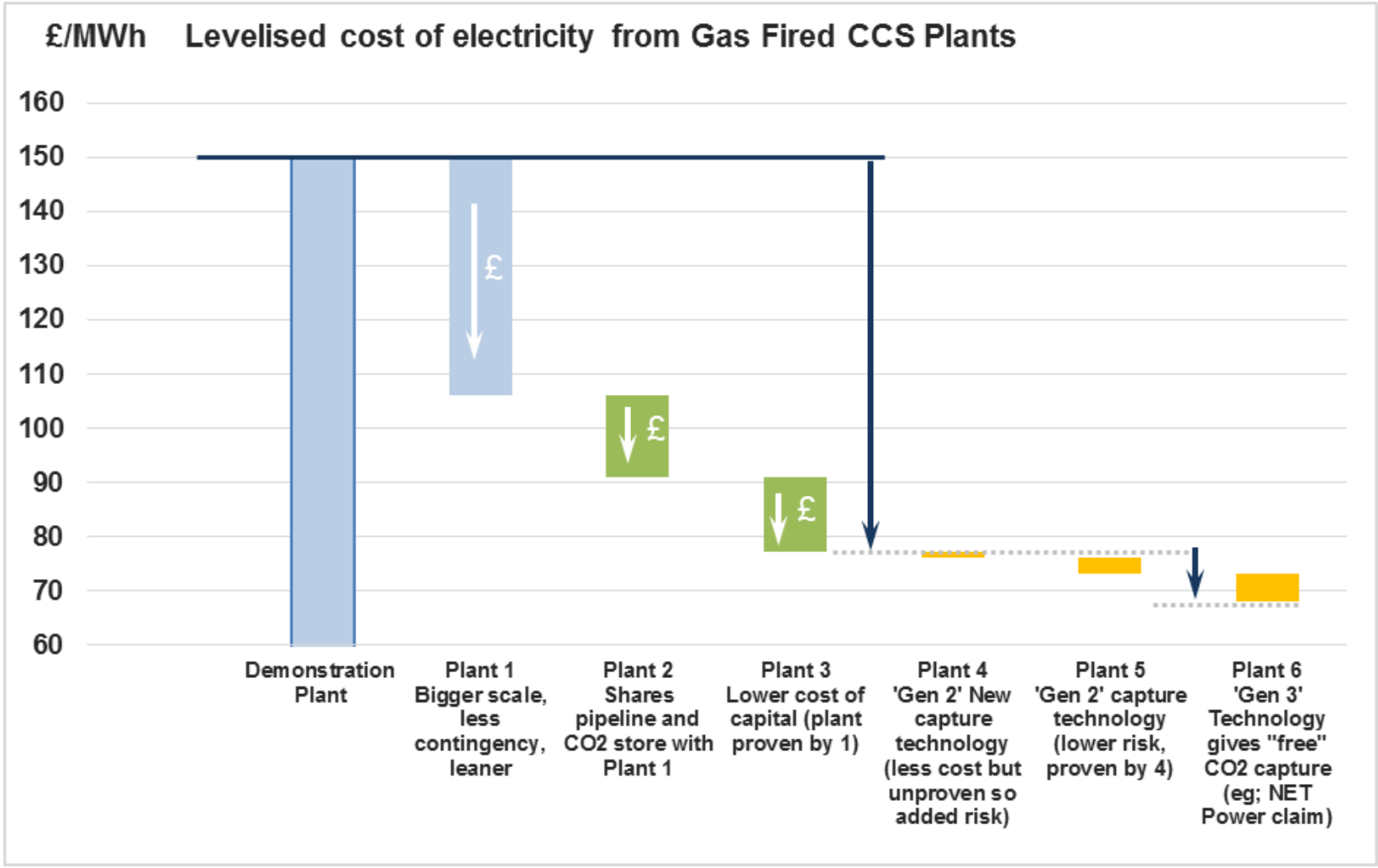
Gas Power + CCS

- could have several merits

Power Source	Capex	Nominal Capacity	Capex/MW	Strike Price (2016 rebase)	Availability*
	£ bn	MW	£m/MW	£/MWh	%
OSW (NNG)	~2.0	445	4.5	121	38%
Gas CCS	~4.0	3000	1.3		85%
Nuclear (HPC)	16.0 – 24.5	3300	4.8 – 7.4		76%

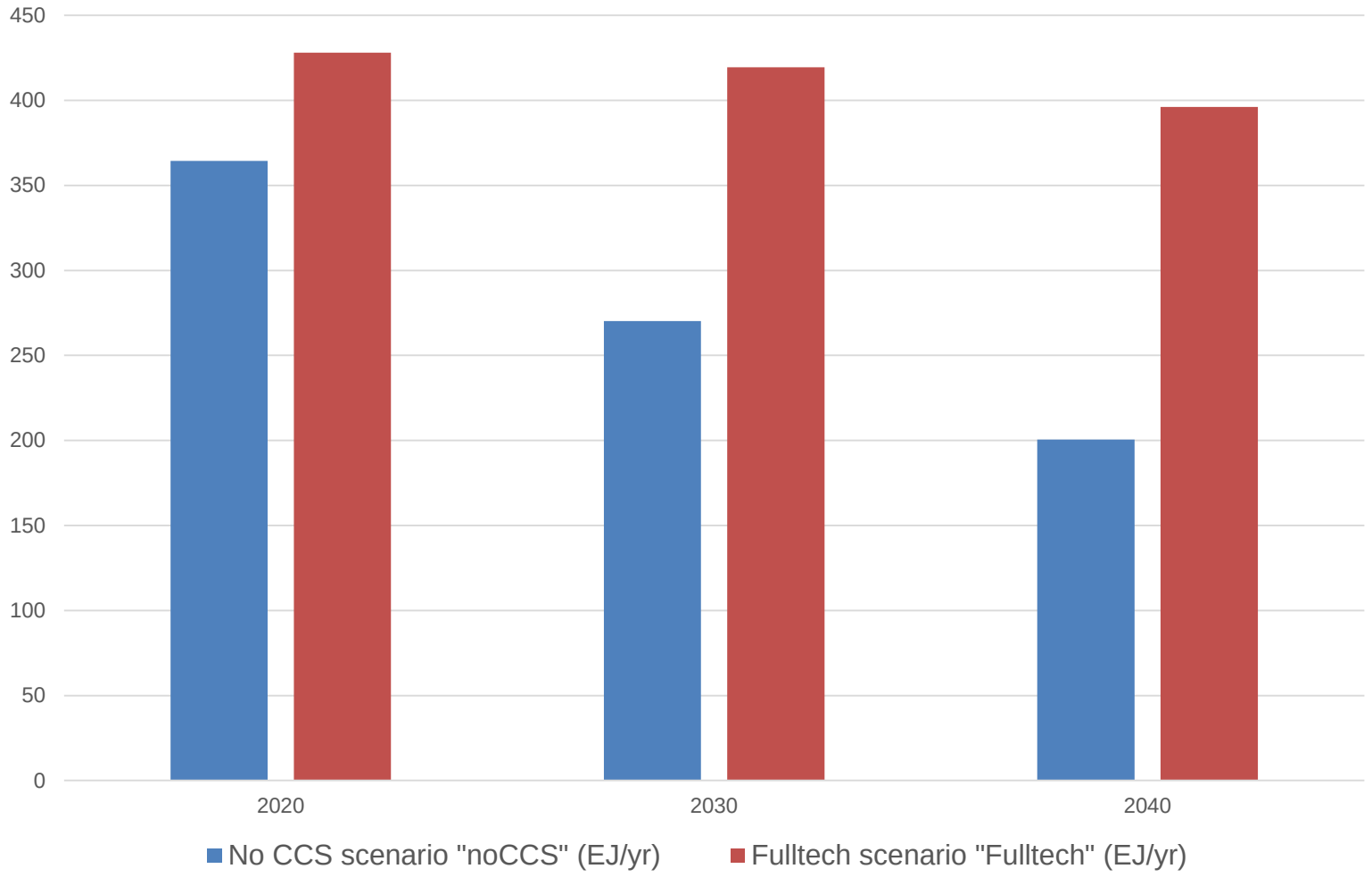
* Source: National Grid 2015 FES; other data from media reports and industry estimates

CCS Could Be Very Attractive



Levelised costs are in UK£ 2013, capital costs are +/- 40%(EPC *1.4), discount rates are adjusted for risk (range 9-16%). Gas £24/ MWht and CO2 emission £31/te. All plants other than first demonstration plant are 860MW net output.

Declines in Potential Annual Fossil Demand



Source: Sustainable Gas Institute data (Budinis, S., Krevor, S., Mac Dowell, N., Brandon, N. & Hawkes, A. (2016). Can technology unlock 'unburnable carbon'?, Sustainable Gas Institute, Imperial College London), redrawn timescale

Conclusions

- The UK has massive CO_2 storage potential; it also has tremendous gas infrastructure (assets and people) to support CCS
- The storage sites closely relate to existing gas industry and power generation locations
- Gas power plant is cheap and quick to build compared to its competition; CCS (on gas) is competitive
- Mid 2020's sees a need for significant new generation – the market should value reliable, despatchable power
- Gas companies may be sufficiently motivated to develop new long term customers that they may take new risks – storage, capture and transport are all existing gas company competencies
- Gas CCGT with CCS provides both capacity and green electrons – it avoids having to subsidise an OSW plant for green electrons and an OCGT for reserve
- High OSW penetration could be increasingly costly – having CCS as an option will be valuable

Source: Storage Appraisal Project 2016 (DECC, ETI)

Final thoughts - for a gas audience

- Even if the plants don't get built, CCS/gas can provide competition to other energy vectors, providing value to UK consumers – but we need to advance schemes
- Scale is important in getting the industry competitive; gas companies could usefully collaborate in establishing a market/industry
- By 2025, decisions will need to be made on Heat
  - We could see a move to electrify Heat – or to maintain natural gas – or to use H2; CCS can play a role in enabling more natural gas use by both a) gas-fired generation and b) providing emissions headroom for domestic Heat, especially if coupled with biomass
  - Continued natural gas use for Heat will rely on imports; having a larger gas demand (eg with Gas CCS) will lower unit costs and enable easier provision of the required swing, for example
- Enabling gas-fired power with CCS, with its CfD, provides long-term certainty of demand and improves the planning outlook for UK Gas – as well as long term commercial opportunities to exploit the know-how
- The gas industry has the capital, competence and people to enable initiation of CCS – what we need is to find the right model and get on with tackling the challenge

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