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CCS, absolutely essential for the UK and the Rest of the World

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The Carbon Capture & Storage Association

Minerals Engineering Society
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What is CCS?

Carbon Capture and Storage (CCS) is a technology that can capture around 90% of the carbon dioxide (CO_2) emissions produced from the use of fossil fuels in electricity generation and industrial processes, preventing the CO_2 from entering the atmosphere.

The CCS chain consists of three parts;

1.Capturing the CO_2 produced in electricity generation and industrial processes

- pre-combustion capture
- post-combustion capture
- oxyfuel combustion

2.Transporting the CO_2

- by pipeline or by ship

3.Storing the CO_2 emissions securely underground in depleted oil and gas fields or deep saline aquifer formations.

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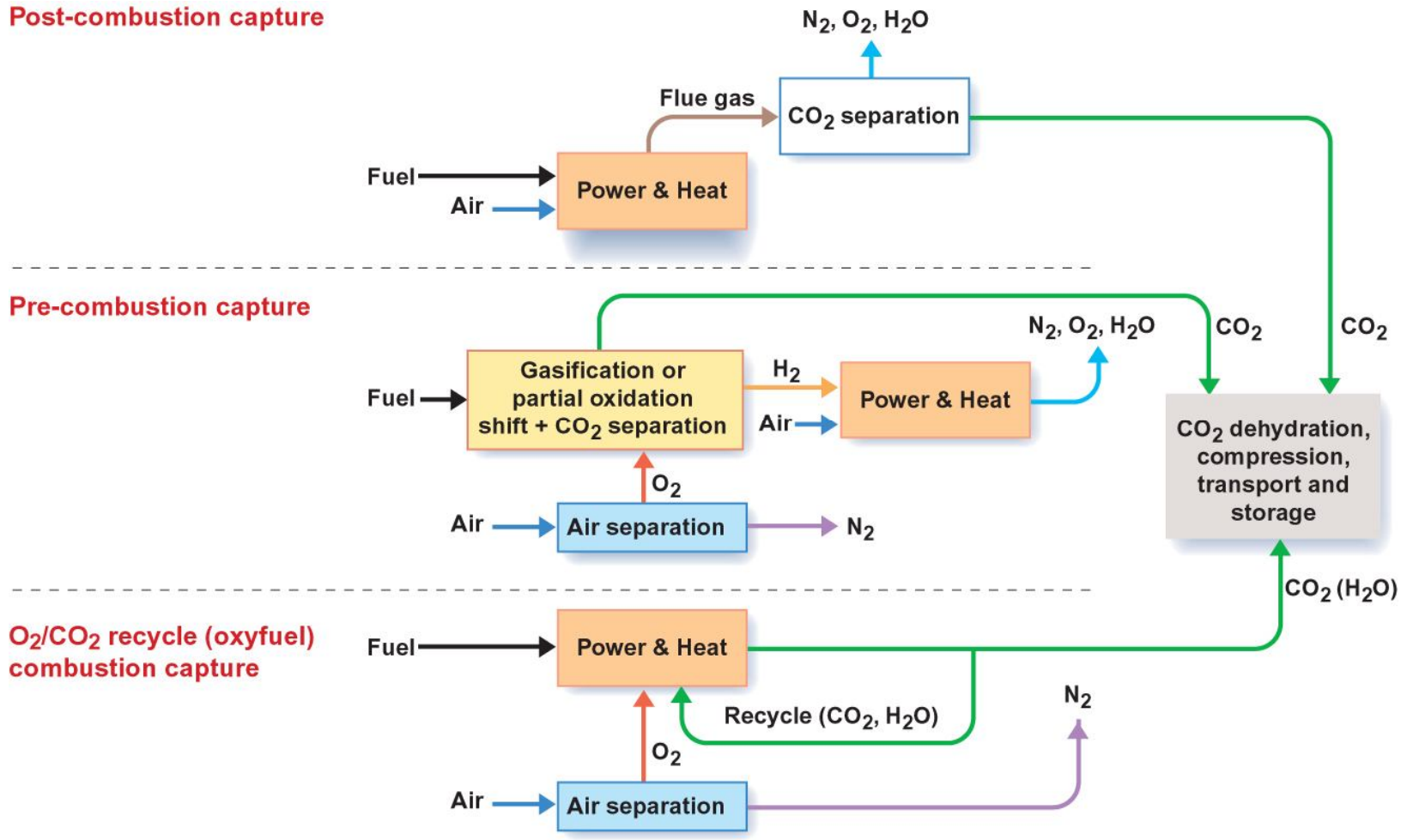
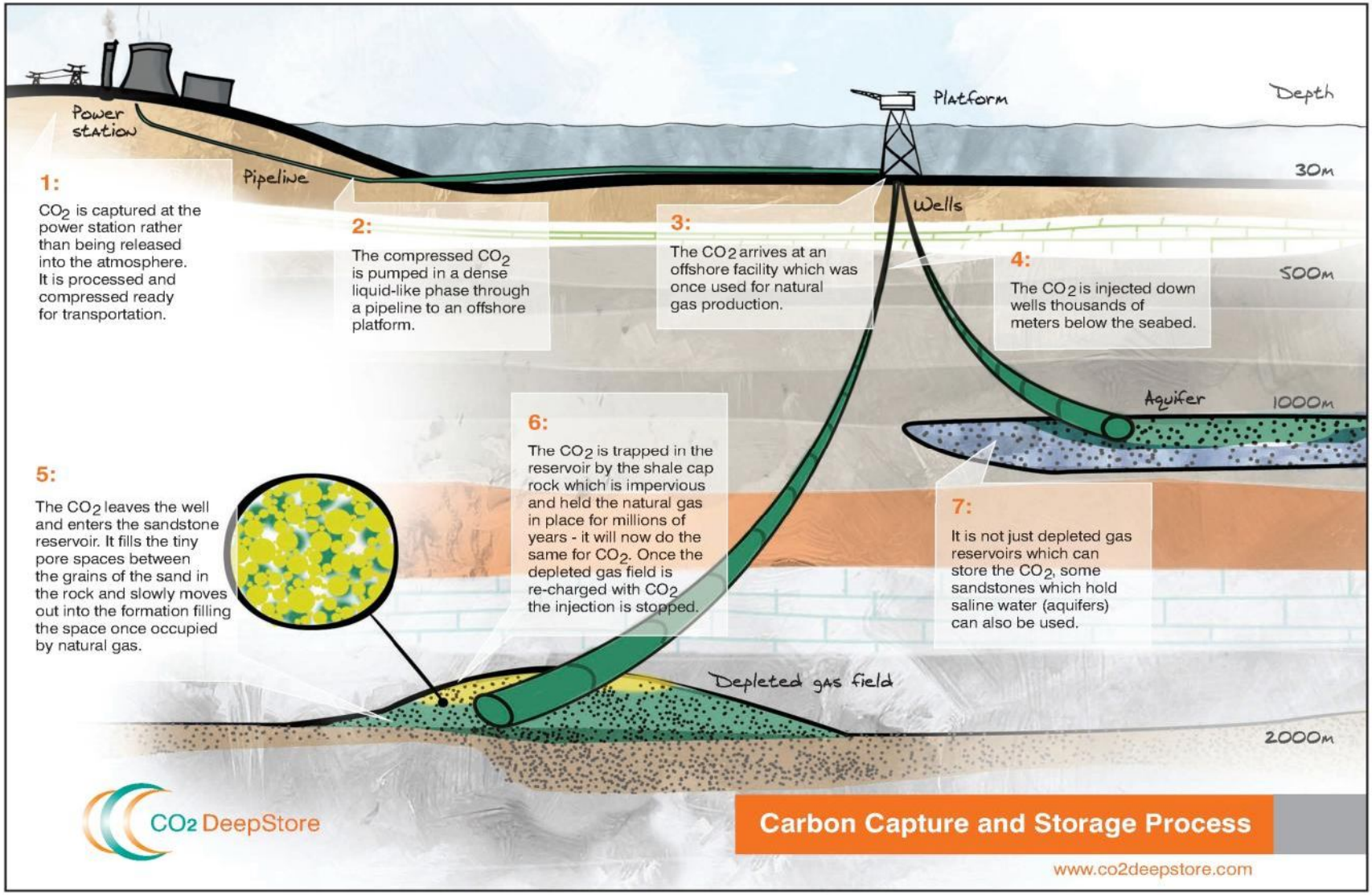
Capture Technologies



The CCS Process



UK Storage Potential

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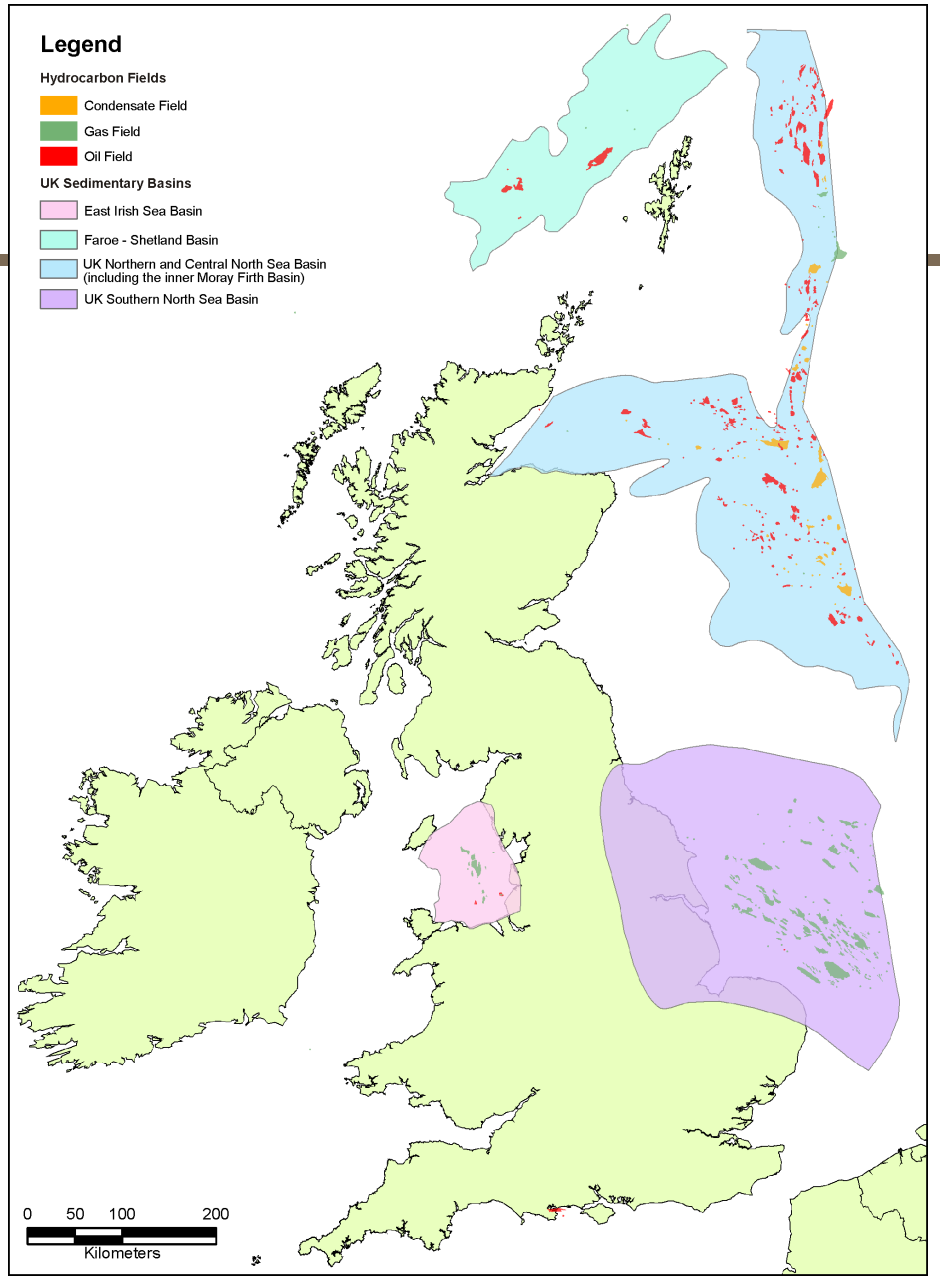
- **Offshore: sufficient storage capacity for more than 100 years of emissions.**
- Oil & gas: 7-10Gt
- Saline aquifers: 20-200Gt



Source: British Geological Survey

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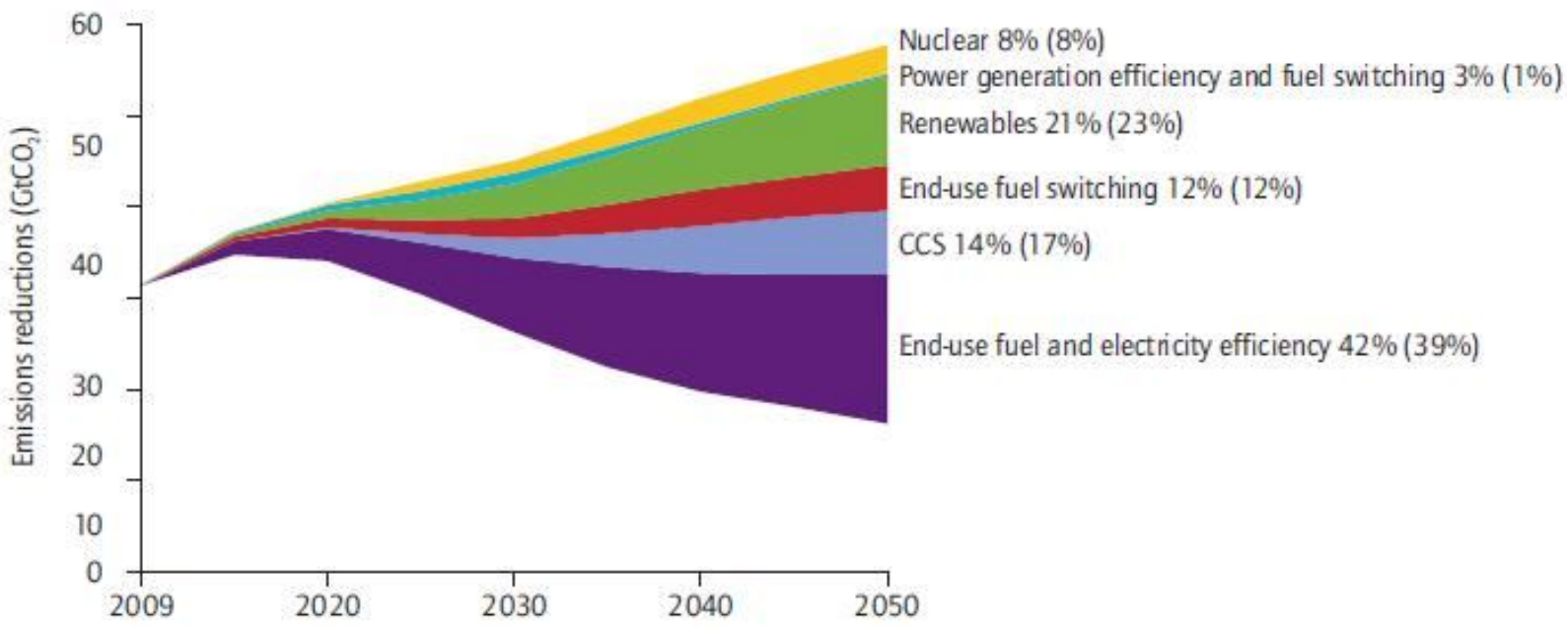
Global need for CCS

Figure 6: CCS contributes 14% of total emission reductions through 2050 in 2DS compared to 6DS



Note: numbers in brackets are shares in 2050. For example, 14% is the share of CCS in cumulative emission reductions through 2050, and 17% is the share of CCS in emission reductions in 2050, compared with the 6DS.

Source: IEA, 2012c.

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Global need for CCS

- Mix of low carbon technologies
- Energy security
- Flexibility
- Industrial emissions
- Lower cost
- Fossil fuel market support
- Protection of living standards
- Unburnable Carbon

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Global need for CCS

- IPCC AR5 – to stand a chance (>66% prob) of limiting to 2ºC total emissions must not exceed 800GtC
- Emissions by 2011 were 531GtC
- The remaining budget of 269GtC will be used up by 2034 at current rate of decarbonisation – PWC
- To achieve 2DS by 2100 decarbonisation must increase to 6% pa - >twice best so far - PWC
- IEA reckons that known resources are three times what will break that budget – 780 GtC
- Not just energy emissions also industrial/agricultural
- RE and nuclear very welcome only defer the day
- Only CCS can arrest climate change

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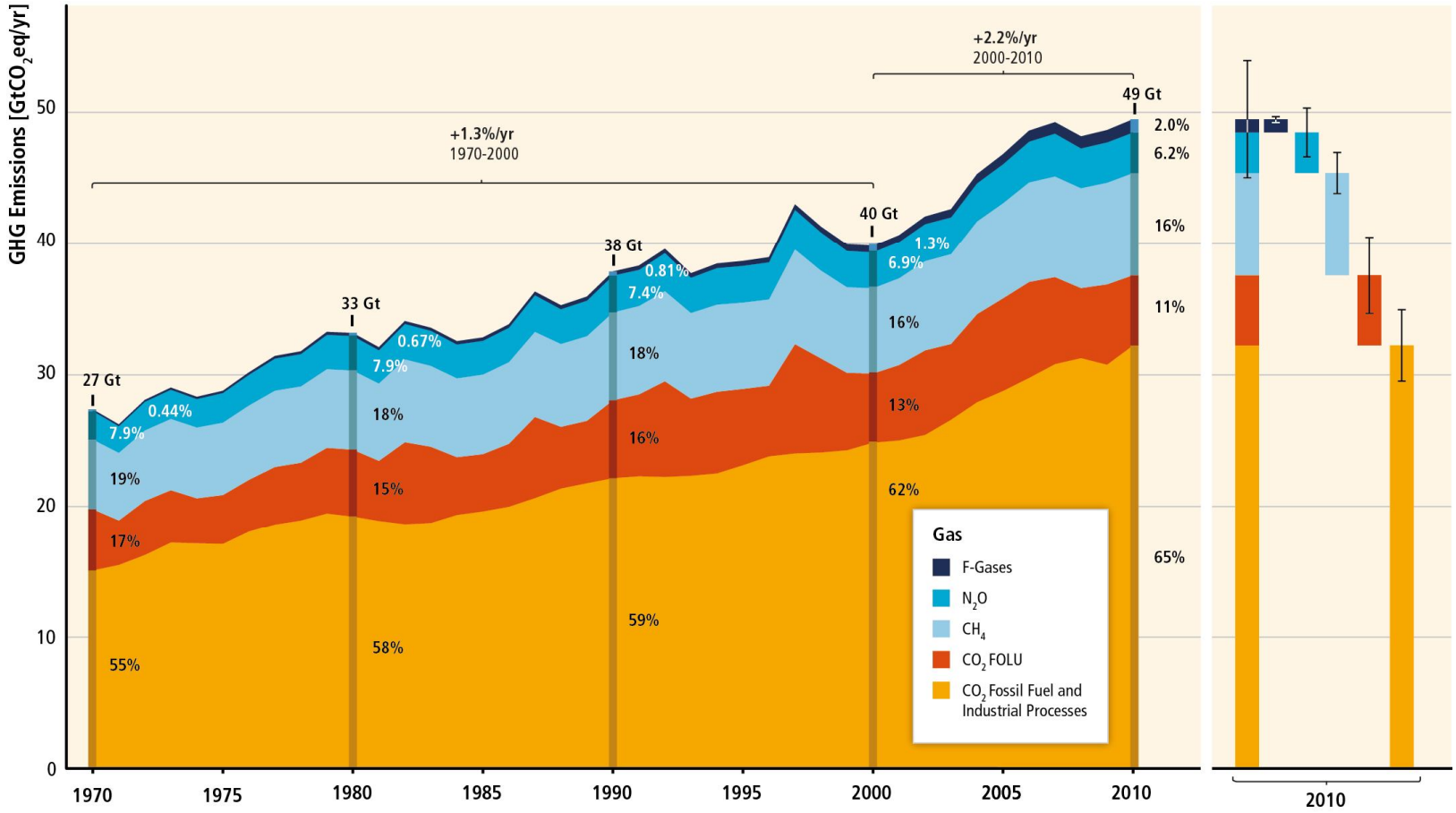
Total Annual Anthropogenic GHG Emissions by Groups of Gases 1970-2010



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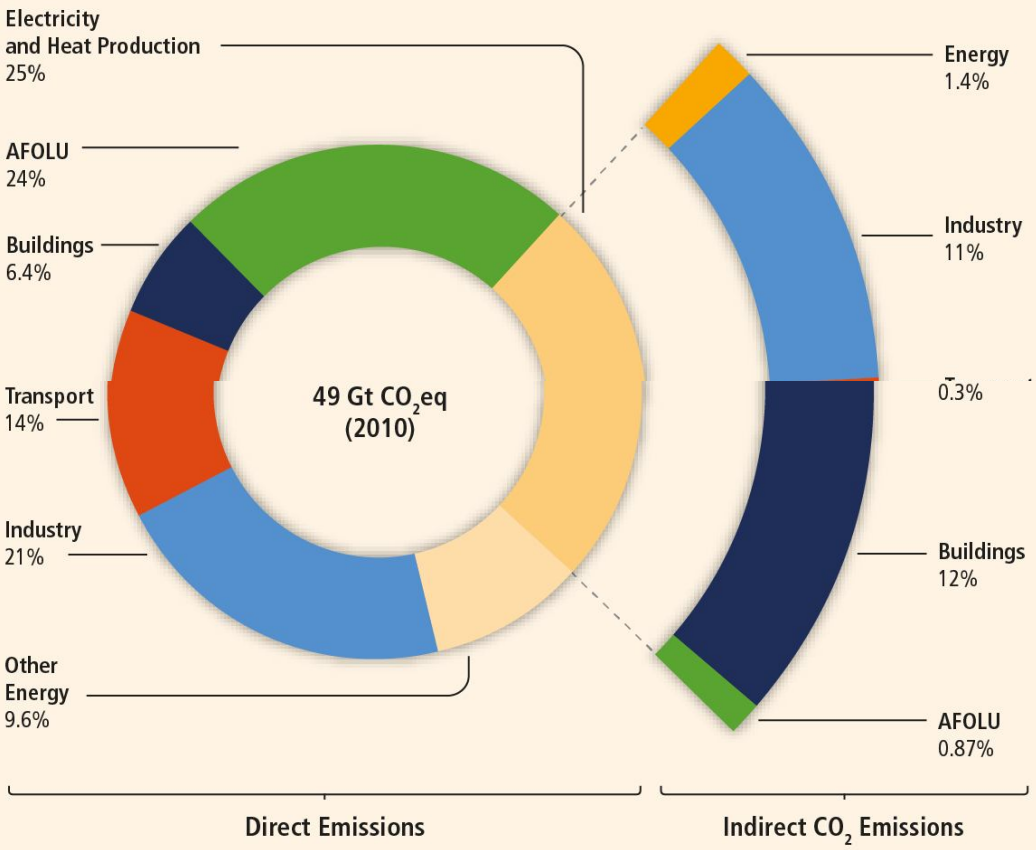
Greenhouse Gas Emissions by Economic Sectors



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UK need for CCS

- Cost-effective decarbonisation (£82 per h.hold 2030)
- Reduction in overall capital requirements
- Flexibilty – complements renewable and nuclear
- Industrial emissions
- Develop domestic fossil fuel resources
- Economic growth opportunity
- Export opportunity

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Where is the UK on CCS?

Ahead:

- Political & NGO support
- Abundant offshore storage space
- Developed regulation
- Electricity Market Reform
- Abundant skills
- Industry coalition – CCSA
- Two projects under design

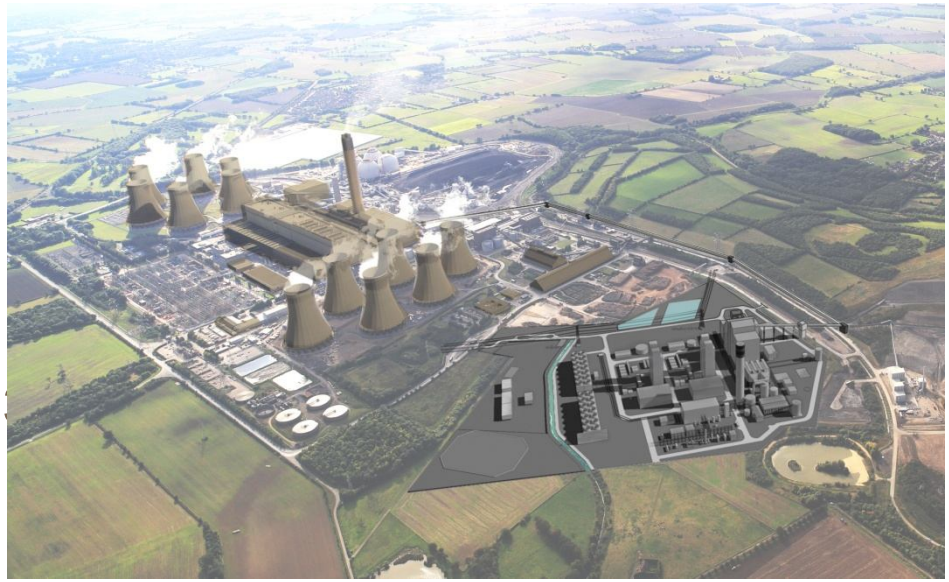
Not further ahead:

- Underestimated scale of challenge
- Mistakes in Government procurement
- Economic downturn
- Competition weariness
- Legal commitment to renewables
- Competition for limited funds
- Cost of first projects

CCS Commercialisation Competition

White Rose

- Drax, North Yorkshire, England
- 304MW oxy-fuel project
- Alstom, Drax, BOC, National Grid
- FEED contract signed 20 Dec 201 and commenced 13 Jan 2014
- FID in 2015/2016
- Design work on a larger capacity 24” CO2 pipeline enabling shared infrastructure and facilitation of further CCS projects



http://www.whiteroseccs.co.uk/

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CCS Commercialisation Competition

Peterhead

- Peterhead, Scotland
- 340MW Post-combustion capture plant retrofitted to existing CCGT
- Shell and SSE
- Storage offshore in depleted gas field – Goldeneye
- FEED signed 20 Mar 2014
- 10 mt CO_2 stored over 10 years

http://www.shell.co.uk/gbr/environment-society/environment-tpkg/peterhead-ccs-project.html

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Why costs of first projects is high

- Not full size – lack economy of scale
- High infrastructure costs
- New design concepts
- New commercial arrangements – challenging business models
- Lack of market/ competition

BUT…

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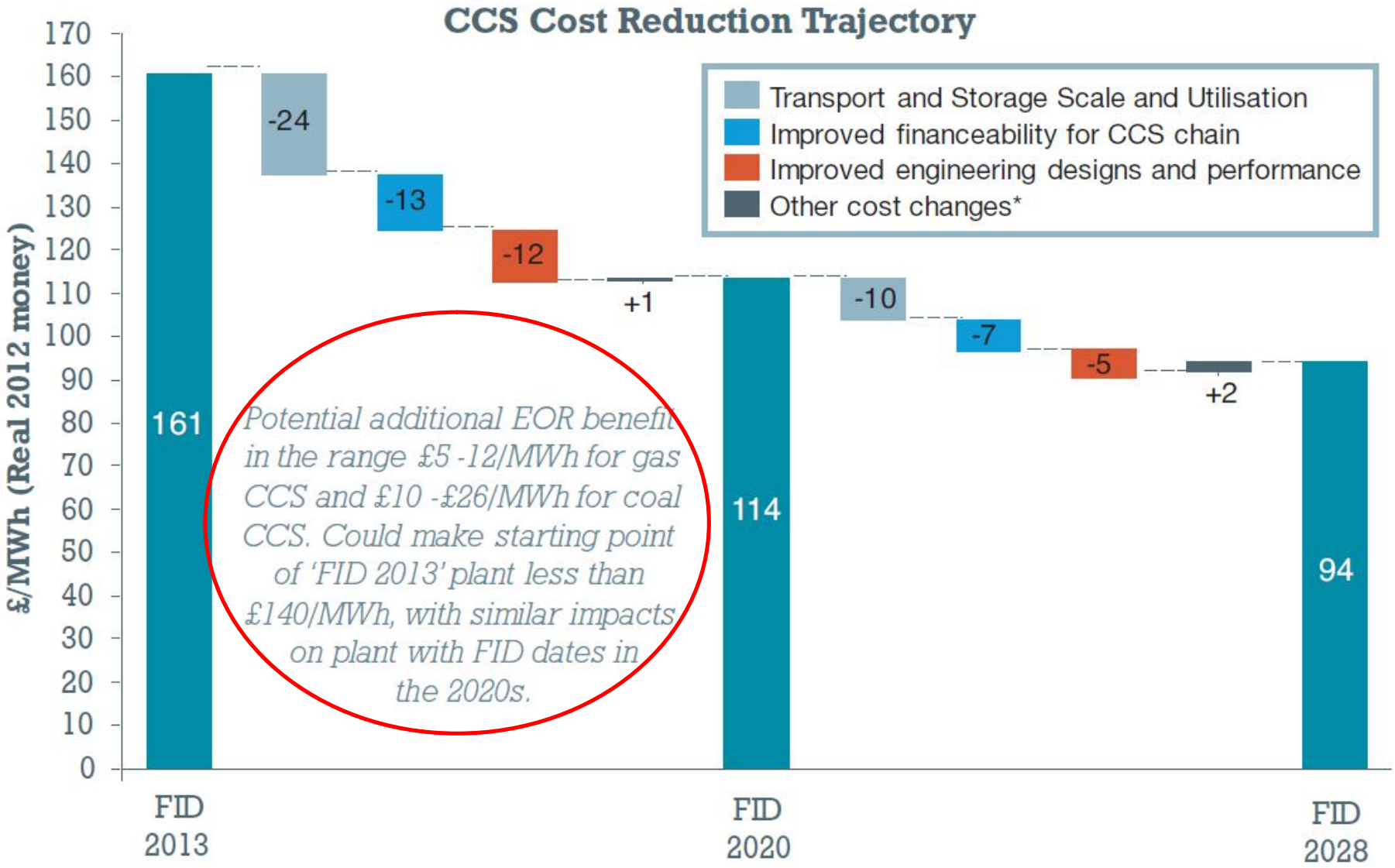

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What's Needed to get the CCS show on the road

- First two projects started
- More to follow
- A development plan
- Strategic infrastructure
- Enhanced oil recovery
- Equality of opportunity with other LC technologies

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Equal treatment - power?

- Same payment per MWh?
- Enhanced payment for flexibility?
- Availability payment?
- Availability of budget (LCF in UK)?
- Contribution to infrastructure?

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Policy anomalies

- In EU renewable targets
- In UK nuclear sites selected for development
- No clear indication of market potential for CCS
- Third Party Access
- Long term liabilities

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Planning Signals

- Wide range of scenario planning for CCS
- Lack of vision on geographical location of capture
- Indeed consenting CCGTs in locations to preclude CCS retro-fit
- Lack of CCS infrastructure plans

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