Group of Experts on Cleaner Electricity Systems

15th session

Geneva, 5-6 November 2019, Palais des Nations, Salle XI

6 November - 10.00-11.00 Part I Financing fossil fuel infrastructure - what works, what does not, why

UK Experience on Financing CCS and U

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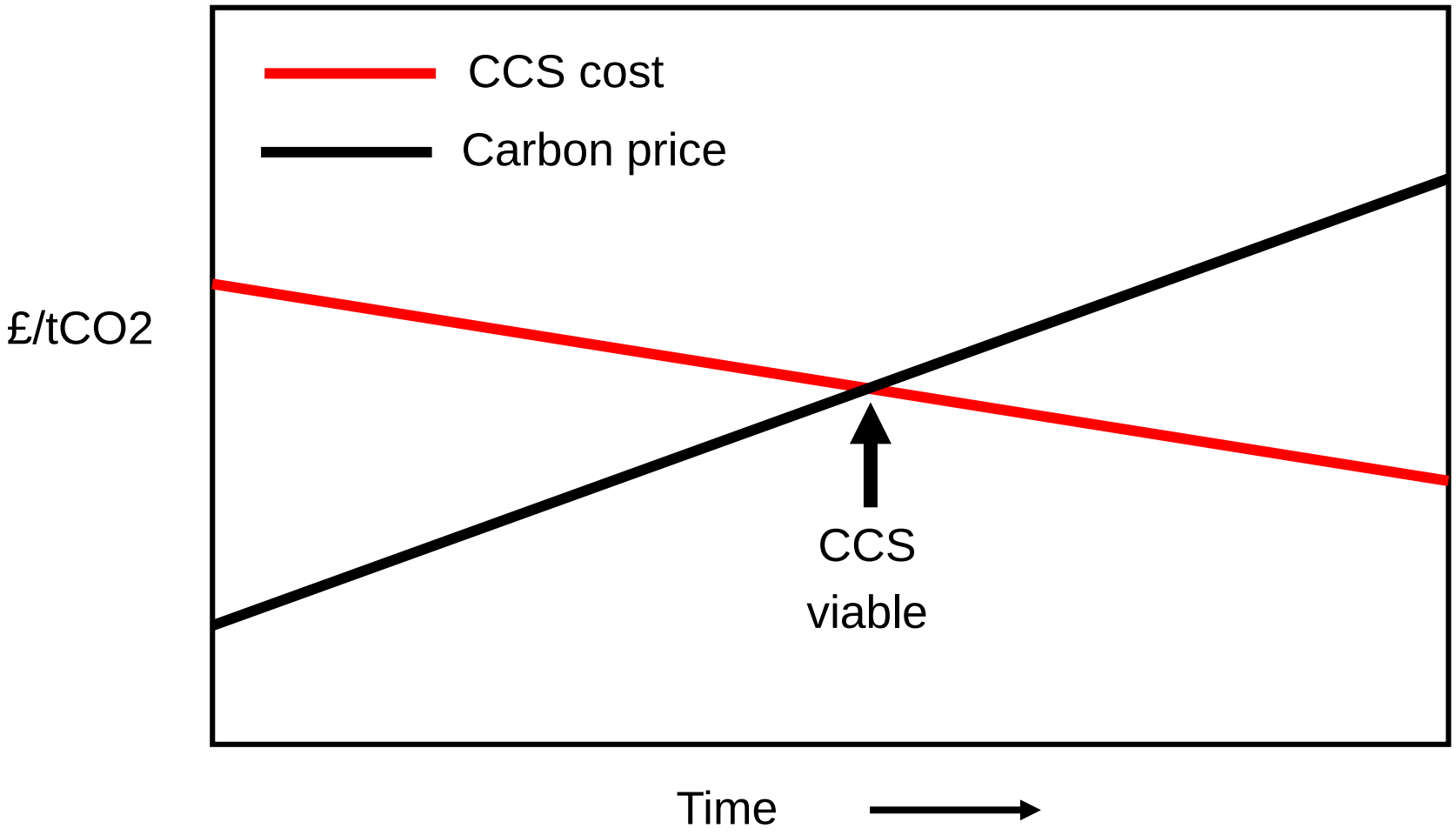
CCS/Carbon price cartoon
Classic view: CCS only happens when rising carbon price exceeds falling CCS cost

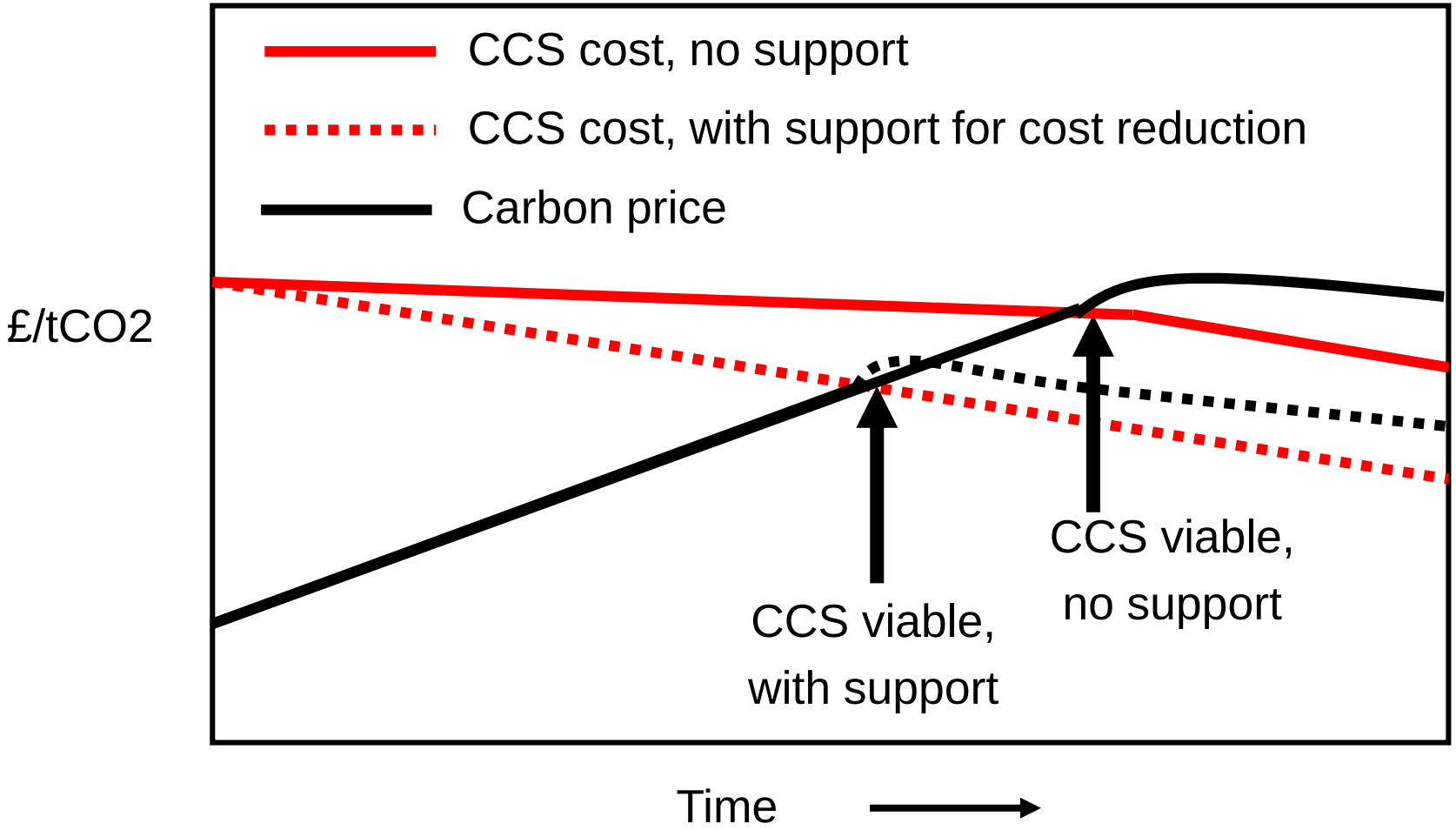


Cap and trade funding for CCS?

But without support CCS doesn't happen and cost doesn't fall - later and higher cap on carbon price

Classic cap and trade market failure for early CCS since first movers get all the costs but everyone benefits

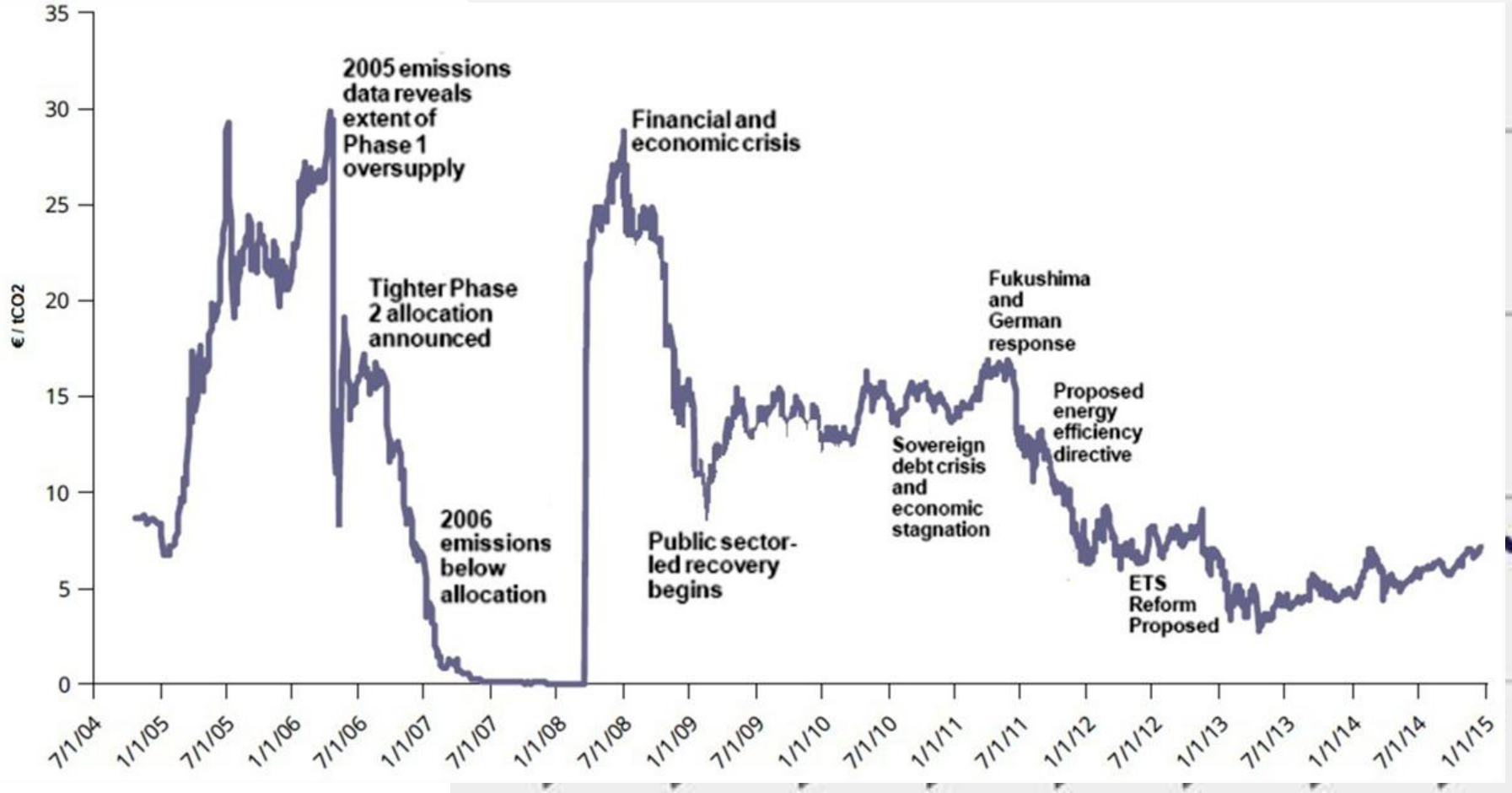
– widely recognised for renewables but not for CCS



For long periods the EU ETS price has not been high enough even to cover just the extra running costs of CCS power plants

Simone Borghesi and Massimiliano Montini, The Best (and Worst) of GHG Emission Trading Systems: Comparing the EU ETS with Its Followers
https://www.frontiersin.org/articles/10.3389/fenrg.2016.00027/full

EU carbon emissions price took-off in 2018 and will now remain elevated
https://www.crugroup.com/knowledge-and-insights/spotlights/2019/european-producers-must-adapt-to-high-ets-prices-as-a-new-normal/

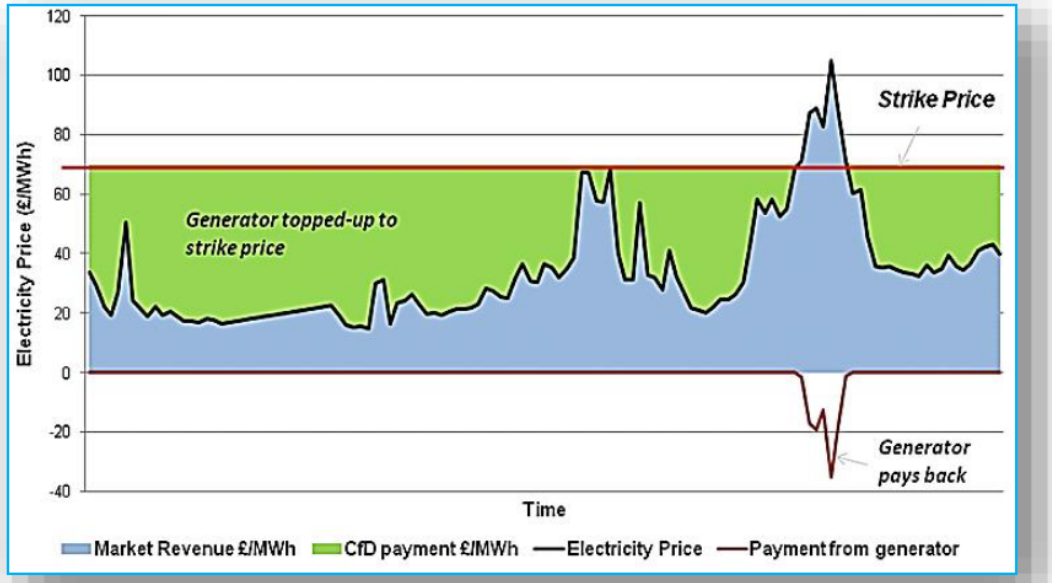


DECC (BEIS) Electricity Market Reform mechanism for all low-carbon electricity

The Feed in Tariff with a CfD is proposed to have some adjustments for CCS, including fuel price index and lower price if plant is asked not to run.

The Contract for Difference - CfD

- Provides long-term revenue stability for all forms of low carbon electricity
- Generators sell their electricity at a fixed price - the 'strike price'
- A single government owned counterparty body (the Low Carbon Contracts Company) will administer the CfD



- When market price < 'strike price'
  - The generator receives a top-up
- When market price > 'strike price'
  - The generator pays back the difference

BUSINESS MODELS FOR CARBON CAPTURE, USAGE AND STORAGE

A consultation seeking views on potential business models for carbon capture, usage and storage

https://www.gov.uk/government/consultations/carbon-capture-usage-and-storage-ccus-business-models

Overarching parameters to guide the development of CCUS business models:

- The models should be market based and incentivise CCUS to **provide value to the economy.** They should drive decarbonisation and be compatible with market operation and existing market frameworks.
- The design of the models **should instil confidence among investors** and should attract innovation and new entrants to the market.
- The models should be **cost efficient** – providing value for money for taxpayers and bill payers, driving cost reductions and attracting new investment.
- There should be **appropriate and fair cost sharing** between the Government and CCUS developers, being mindful of impacts on taxpayers and bill payers.
- There should be an **appropriate allocation of risk** between the Government and CCUS developers, that evolves as the CCUS industry matures.
- The models should have the **potential to become subsidy free**.

The CCUS Advisory Group has considered three viable options for CO_2 T&S:

- a private sector financed CO_2 T&S under a RAB model;
- a private sector financed CO_2 T&S under a RAB model but with an upfront capital grant from Government; and
- a Government-owned T&S model regulated by a RAB framework.

http://www.ccsassociation.org/ccus-advisory-group.

Figure 2: Formula for T&S fees proposed by the Cost Challenge Taskforce

T&S fees = (RAB x WACC) + Opex + Depreciation + FCA + Tax + Decommissioning + Additional T&S Fees + Adjustments

This formula would include:

- **RAB**: the regulated asset base, being the forecast capital cost of the project incurred by the T&S licensee in creating the assets during the construction period;
- **WACC**: the weighted average cost of capital for the T&S licensee, made up of the weighted average cost of the debt and the equity, to the extent possible determined by competition (to ensure attraction of providers with operational expertise) or, in the operational periods, as determined by the regulator;
- **Opex**: the costs incurred by the T&S licensee for the operation of the T&S assets, including operating, maintenance and management costs, costs of regulatory compliance, insurance costs and other similar costs associated with the operation of T&S in the operational phase such as monitoring;
- **Depreciation**: a sum to account for the depreciation of the closing value of the RAB following construction over the useful economic life of the assets, which creates a revenue stream for the amortisation of any financing of the capital cost;
- **FCA**: a financing cost adjustment to protect against movements in the market cost of debt during the construction period; during the operation period embedded debt would be taken into account by the Regulator;
- **Tax**: an allowance for the tax liabilities of the T&S provider, including business rates;
- **Decommissioning**: an allowance for the costs of decommissioning the assets after the closure of the store;
- **Additional T&S Fees**: additional capex to be logged onto the RAB for expansions of the system (for example the drilling of additional wells for injection, additional capacity, pipeline spurs to new Feeder projects, or shipping for development of overseas services); and
- **Adjustments**: including a reconciliation adjustment to update the RAB for actual expenditure such that T&S Licensee's revenues are corrected from the amount earned on the forecast RAB to the amount which should have been earned on the actual RAB and to implement any of the incentivisation mechanism (if any).

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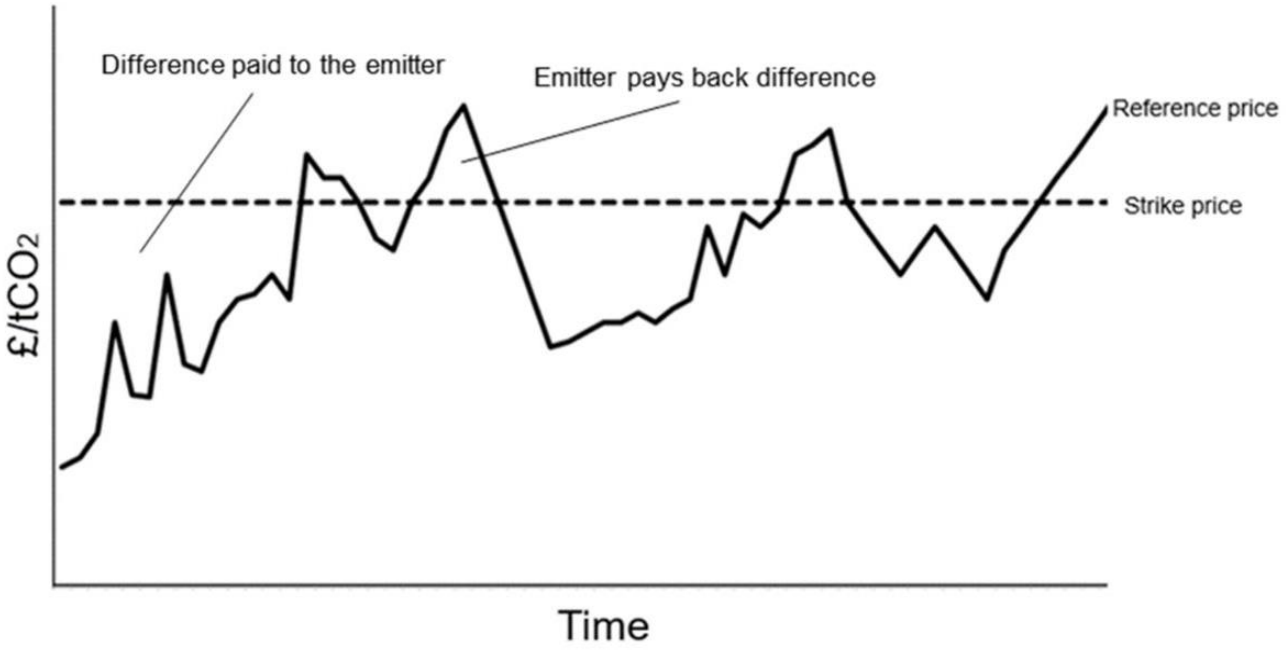
Contract for Difference (CO_2 reference price)

The CfD strike price will vary between industrial carbon capture sectors, and potentially within sectors, if needed. It is anticipated that the mechanism will evolve over time, e.g. contracts may be awarded bilaterally initially, and could be awarded via competitive auctions over time



Tradeable CCS certificates plus obligation

CCS certificates are awarded per tonne of CO_2 abated, relative to an industry benchmark. An obligation is created and would require the specified parties to ensure a certain amount of CO_2 is captured and stored, with the obligations increasing over time to result in a long-term decarbonisation trajectory and provide certainty to investors.

Cost plus open book

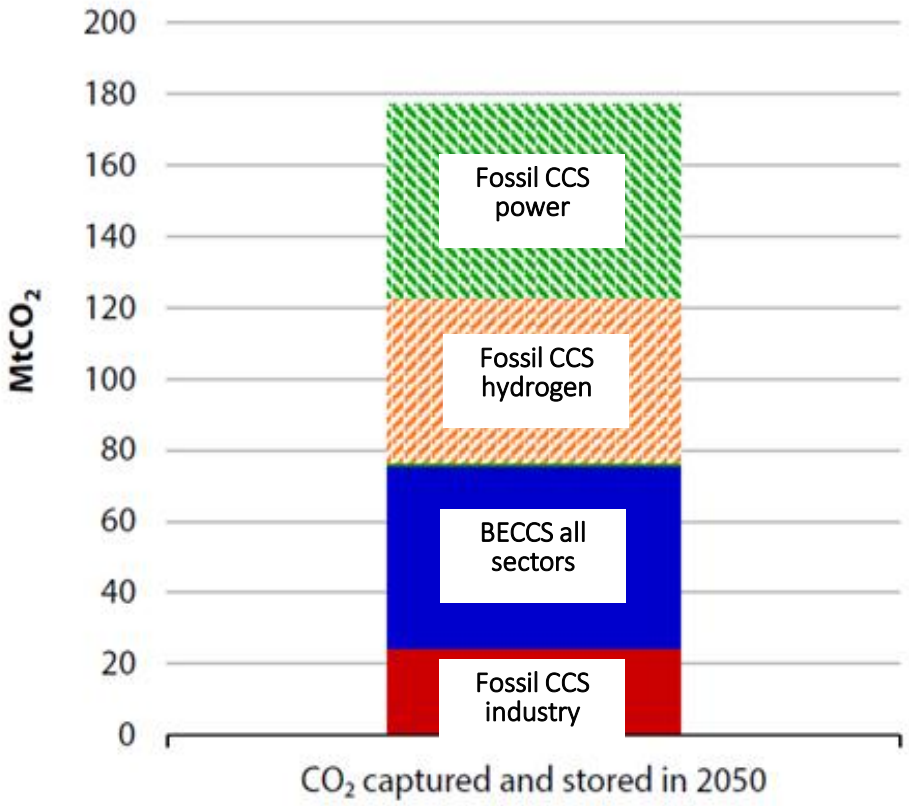
Under cost plus open book, the emitter is directly compensated by the Government for all properly incurred operational costs and the emitter's capital investment is paid back with agreed returns.

CCS in Net-Negative Electricity Systems for Net-Zero GHG Emission Societies

https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/

- UK Committee on Climate Change has scenarios for achieving net-zero GHG emissions nationally in 2050
- "CCS in not an option, it's a necessity"
- Negative emissions are a key requirement to get to net-zero and BECCS is limited only by biomass availability
- Most BECCS expected via combustion for electricity, may be in old or new power plants
- Also significant CCS on power from natural gas , with a limited amount of this via hydrogen

Emission source	$MtCO_2$ in 2017/2018	2050 CCC Further Ambition Scenario for CO_2 captured and stored vs 2018
Natural gas for power	50.2	~50 $MtCO_2$; ~100% of current
Hydrogen, for natural gas substitution and 'new' applications		~45$MtCO_2$; equivalent to~45% of current total direct natural gas use, or >100% of current industry and commercial natural gas use
Direct Air Capture		Yet to be determined
Biomass and wastes into power only (but CO_2 not reported)	30-40	~50 $MtCO_2$; ~ 150% of current, but current is a mix of large and dispersed sources with domestic and imported biomass
Industry, fossil and process above	~35	~25 $MtCO_2$; ~70% of current, some extra reductions could be via H_2



Delivering the Industrial Decarbonisation Challenge

ISCF Industrial Decarbonisation Challenge

£170M grant funding available for FEED study support etc., but business models needed for projects.