THE CHEAP ENERGY CAMPAIGN

CARBON CAPTURE AND STORAGE

The UK Government's ambitious proclaimed 'net zero' plans for Carbon Capture Usage and Storage (CCUS) are available here https://www.gov.uk/government/news/new-vision-to-create-competitive-carbon-capture-market-follows-unprecedented-20-billion-investment

Four UK carbon capture and storage (CCS) clusters are currently planned to support the government's other costly aims to decarbonise industry and power. These clusters are: HyNet in Northwest England, East Coast Cluster in Teesside and the Humber, Acorn in Scotland, and Viking in the Humber.

While decarbonising industries such as cement may indeed be possible and desirable, applying the same logic to the electricity generating sector with its gas-powered power stations is problematic to say the least, both technically and financially. There is no evidence to show that 100 per cent carbon capture can be achieved, either at an acceptable cost or indeed at all.

There are three main technological routes for CO2 reduction from power plants – pre-combustion (used for coal fired power plants); post-combustion CCS (mainly used for retrofitting to existing natural gas power plants) ; and oxy-fuel combustion (the Allam-Fetvedt process for new build gas power stations). The application of each of these *'may reduce the net efficiency of a plant by up to 14 per cent and increase the cost of electricity by 30%-70%'*
https://www.sciencedirect.com/science/article/pii/S1876610214018189

Evidence in the public domain highlights that the government should be wary of CCS schemes for gas power stations.

1.A report on the economics of CCS published in May by the Lawrence Livermore National Laboratory 2023 https://gs.llnl.gov/sites/gs/files/2023-05/ca-ccs-economic-study-report.pdf concluded that CCS for most natural gas power

stations was the least economically -viable of all applications of CCS.

2. A 2022 report from the Institute for Energy Economics and Financial Analysis (IEEFA) on CCShttps://ieefa.org/resources/carbon-capture-crux-lessons-learned made it clear that failed/underperforming projects considerably outnumbered successful experiences

The report identified only two operating post -combustion projects to draw on. The Petra Nova project, now shut, cost a cool $1bn for a 240MW unit (i.e. £3.25m per MW of capacity) for the prize of only capturing just 28 per cent of emissions. The target capture rate for the Boundary Dam, the only currently operational post -combustion CCS plant, is 65 per cent. The actual capture rate is unreported. Yet the cost has been exceedingly high - $1.3billion for 115 MW of capacity (i.e. £8.8m per MW of capacity).

There is one promising technology that could improve on these rates but it cannot be used in existing gas power stations. This is the Allam-Fetvedt process which aims to capture up to 97.5 per cent of the CO2. Even here a note of caution is needed. Since the thermal efficiency of a plant declines with increasing carbon capture rates, it may not prove economic to have capture rates of above 90 per cent. No current information is available about the capture rates at the 50MW Allam-Fetvedt pilot plant in Texas which was linked to the local grid in 2021.

However, one should be careful about accepting claims of a high capture rates. A recent study https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10407117/ found that theoretical capture rates in the range 95 to 99 per cent are based on steady state operation. However, when gas power stations have frequent Start-Up and Shut Down (SUSD) cycles, rates above 90 per cent will be challenging. As the penetration of intermittent renewables increases, such cycles will inevitably increase. If the CO2 emissions increase considerably during SUSD, this will make the target of 2030 carbon free electricity unachievable. It remains to be seen whether this technology can live up to the general hype surrounding CCS. There have been no recent updates about Keadby 3, a proposed Allam-Fetvedt power station to be built on Humberside and the company has not responded to requests for information.

Of course, as with all the proposed green technologies, there are the costs to the consumer to be considered. According to another recent report electricity from CCS gas power stations is likely to be at least one and a half to two times above current alternatives (https://ieefa.org/resources/ccs-power-yet-stack-against-alternatives). No up to date information is available about the costs of CCS for the Drax wood burning power plants. The Drax CEO was quoted in 2022 as saying that electricity from Drax with CCS would cost £150/MWh. https://www.argusmedia.com/en/news/2326439-uks-drax-puts-a-cost-on-beccs

While wind and solar are carbon free (if the lifecycle of the technologies is discounted) they still need 'back up' for the many hours in a year when these sources fail to meet 20% of demand (over 3,200 hours in every year). The best method of back up will be the next generation of small modular reactors such as those produced by Terrestrial Energy, X-Energy and Arc Cleantech. These SMRs have the ability to ramp up and down to meet demand. Until these are rolled out in large numbers back up will primarily have to come from natural gas power stations as batteries are prohibitively expensive.

It is true that widespread rollout of CCS in all power stations would theoretically enable the UK Government to reduce emissions in the power sector without compromising current output and consistency of energy demand. A 90 percent capture rate of CO2 might be achievable for new build power stations which use the Allam-Fetvedt process. However, there is no evidence that this capture rate will be possible for retrofitted gas power stations and retrofitting CCS to existing gas power stations could add at least 50 per cent to costs.

In conclusion Governments are always keen to talk up technological fixes that will solve seemingly intractable problems and make their job easier. CCS is an unproven technology in terms of a **substantial** reduction of carbon emissions and it is likely to be hugely expensive in the electricity generating sector. Like the many virtue-signalling green policies that have preceded it, the costs and benefits of CCS don't currently add up.

A damning report[1] from the Commons Public Accounts Committee (PAC) published on 7th February 2025 said the technology had never been tested, was likely to prove very expensive and may not work.

[1] https://committees.parliament.uk/publications/46545/documents/237331