Greenhouse gas removals: call for evidence for independent review

Biofuelwatch submission 18 June 2025

Biofuelwatch is a NGO based in the UK and USA providing information and undertaking advocacy and campaigning in relation to the climate, biodiversity, land and human rights, and public health impacts of large-scale industrial bioenergy.

We welcome the opportunity to contribute to this much-needed review of the UK's expectations and plans for Greenhouse Gas Removals, and would appreciate your consideration of the following comments.

SUMMARY

To date, proposals for Greenhouse Gas Removals have over-promised and under-delivered. The sector suffers from undue optimism bias. Unproven technology is projected to scale quickly and to operate reliably at optimum levels.

This optimism bias encompasses system performance (the amount of carbon stored), resilience and safety, deliverability, cost projections and the extent of disruption to nature and current land use. It also relies heavily on off-shoring emissions.

The likely negative impacts of engineered GGRs and the uncertainties in achieving 'best-practice' performance levels are downplayed. The design of the engineered greenhouse gas removal systems currently proposed for the UK lack resilience: there are critical single points of failure and infrastructure is located in areas known to be at risk of flooding and coastal erosion.

There are valid questions about the permanence of geologic storage. Sub-surface geology is not fully understood, meaning projections about injection rates, permeability and consequential impacts like brine displacement and seismic disturbances come with a high degree of uncertainty. The resources and costs involved in long term monitoring of storage are not well understood.

BECCS and other GGR techniques (e.g. Biochar and wood-vaulting) that rely on carbon sequestration by woody biomass are based on a fundamentally flawed concept. They only transfer already-stored terrestrial carbon, not atmospheric carbon, to underground storage. The woody biomass BECCS lifecycle simply moves carbon from one form of storage to another. It does not provide instantaneous removal of carbon from the atmosphere.

Policy treatment of the carbon fluxes resulting from woody biomass power and BECCS wrongly omits consideration of the sequestration opportunity lost when trees are harvested. It ignores the temporal effect of the carbon debt created when trees are burnt that otherwise would be able to continue sequestration.

It is unclear how the need to run high levels of Power BECCS at high load factors fits into the strategic plans for development of an electricity grid using minimal baseload.

Conclusion - over-inflating expectations of what GGRs can deliver we will unavoidably delay and underfund crucial efforts to reduce current emissions and to implement lower cost solutions like energy conservation/efficiency and proven clean energy generation.

DACCS IS A TOTAL WASTE OF TIME AND MONEY IN THE UK

Globally, Direct Air Capture has so far removed fewer than 20,000 tonnes of carbon, just 0.00005% of annual global emissions of 40Gtonnes.

In 2024, Climeworks' direct air capture (DAC) Mammoth plant in Iceland captured just 105 tonnes of carbon dioxide. Its future is uncertain - in mid 2025, the company began laying off a minimum of 10% of its staff of approximately 500.

New, better DAC technologies are repeatedly promised but they can only offer small incremental improvements in efficiency. Capturing CO2 from the atmosphere means moving vast volumes of air across chemically active surfaces, then applying heat, vacuum, or electric fields to regenerate the sorbents. The most mature systems, like Climeworks' solid sorbent modules or Carbon Engineering's hydroxide-calcination loop, require between 2,000 and 3,000 kilowatt-hours of energy per tonne of CO_2. Newer techniques involving electrochemical capture still require 700 to 1,000 kWh per tonne, but a study suggests another 100kWh is needed per tonne, to compress, transport, and inject the CO2 underground.

Then there are the very significant resources, energy and costs required to build and maintain the DAC infrastructure.

Renewable energy resources in the UK would be better used to directly reduce gas power emissions or as a source of green hydrogen for industrial use or for grid storage.

If it is deployed anywhere, DACCS should be located where there is an abundant source of low cost renewable heat, such as Concentrating Solar Power in desert regions. That would achieve the highest level of efficiency, but even so, the case is weak.

POLICY ON BECCS IS BASED ON A MISTAKEN VIEW OF CARBON FLUXES

Numerous published papers dispute the official position on the carbon neutrality of wood biomass. Great reliance is put on the notion that carbon emissions from biomass combustion can be treated as zero (in the Energy sector). This arises from a simplistic reading of book-keeping guidance issued by UNFCCC/IPCC. The carbon neutrality of woody biomass relies on future sequestration over decades by existing and newly planted trees - something which cannot be guaranteed and crucially is not the responsibility of biomass generators in the UK, nor the responsibility of any government. It is left instead to 'the market', with a simplistic view that biomass harvesting is 'sustainable' if landscape-level forest carbon storage is stable or increasing over time.

See for example 'Burning Up the Carbon Sink: How the EU's Forest Biomass Policy Undermines Climate Mitigation', April 2025:

"Policies promoting BECCS could significantly increase emissions and pressure on forests. EU and UK BECCS policies contain two major flaws. First, the idea that BECCS can deliver instantaneous "negative" emissions relies on counting net carbon emissions from burning

"biomass as actually being zero, an unjustified assumption as explained above. Where forest biomass is domestically sourced, land sector impacts may eventually be recognized under national-level GHG reporting, but for imported fuel, they tend to be ignored. Of course, since CO_2 is a global pollutant, unabated biomass will not deliver instantaneously carbon neutral energy, and BECCS will not deliver "carbon negative" energy, no matter where the forest biomass is sourced.

Second and relatedly, policymakers promoting BECCS tend to confound belowground storage of CO_2 with removal of CO_2 from the atmosphere. Since the majority of the carbon in a tree was removed from the atmosphere in previous decades or centuries, transferring that forest carbon to belowground storage does not represent a contemporary removal of carbon from the atmosphere, but simply relocates carbon that was already stored. The situation is analogous to that of harvested wood products (HWP), which, as the 2019 refinement to the IPCC Guidelines explains, do not provide removals:

> *In the context of HWP, when referring to CO_2 removals, it may be noted that HWP do not directly sequester carbon from the atmosphere. …carbon retained in HWP constitutes a pool of carbon that was sequestered originally by the above ground biomass carbon pool of forests and other wood producing land categories (Rüter et al. 2019)."*

[9]

Sterman et al (2022) showed that the impact of harvesting biomass fuel in 2025 is to increase forest emissions until around 2040 because "*the carbon sequestered by regrowth is initially less than the carbon the forest would have stored had it not been harvested"*

[10]

KEY ISSUES WITH CARBON CAPTURE AND GEOLOGICAL STORAGE

1. There is extremely limited experience in building these systems and maintaining them.

Engineered GGR systems based on CCS with geological storage form the main thrust of UK's immediate term carbon drawdown plans. It is held that the long history of CCS deployment for abating emissions from fossil fuel extraction and combustion provides confidence that this technology will allow BECCS and DACCS to be delivered quickly and will operate efficiently.

But there are only 41 operational commercial-scale CCS schemes worldwide, despite the technology being first mooted a hundred years ago. 29 of these schemes exist to improve fossil fuel extraction (EOR). Nine of the 11 new CCS developments this decade are EOR. The world's carbon capture capacity is currently just 51 million tonnes annually, compared to total global emissions of 37.4 billion tonnes in 2024. Most installed carbon capture is being used to extend oil and gas production in depleted fields or is used to reduce emissions from the process of 'sweetening' fossil gas.

There are no large-scale operational BECCS systems anywhere of the type proposed at Drax power plant, the UK's biggest single carbon emitter. Pilot trials of BECCS power have been tiny, short-lived and did not prove that sustained high-levels of carbon capture are

achievable. Yorkshire Post reported on 1 March 2025 that Drax's partner developing CCS had laid off most of its staff and that *"C-Capture had been running a pilot plant at Drax Power Station to capture one tonne per day of carbon and the next stage had been due to be a commercial demonstration plant capable of capturing between 100 and 200 tonnes per day. The ultimate aim would have been a full-scale plant able to capture 10,000 tonnes per day."*

[8]

Equally, there are no large-scale DACCS systems anywhere.

Because most of the installed CCS schemes are for enhanced oil recovery, in contrast with CCS for GGR, there is relatively little practical experience in preventing and minimising CO2 leakages during transport and injection and in assuring the permanence of geological storage. Consequently, the fossil fuel industry CCS experience is not directly applicable to GGR CCS.

According to a 2024 Royal Geological Society research article, 'Long-term risk assessment of subsurface carbon storage: analogues, workflows and quantification'

"*a paradigm shift is required from the focus on geological and subsurface success that is common practice in hydrocarbon exploration and appraisal programmes, to a broader assessment of the chance of failure throughout the life of a project. Operators will be required to develop plans for all stages of an* SCS *project, and that will include monitoring and mitigating events that could lead to project shutdown*." [3]

IEEFA has reported on the unexpected behaviour of geological storage faced by the Norwegian CCS Sleipner-and-Snohvit projects, concluding,

"Sleipner and Snøhvit cast doubt on whether the world has the technical prowess, strength of regulatory oversight, and unwavering multi-decade commitment of capital and resources needed to keep carbon dioxide sequestered below the sea – as the Earth needs – permanently." [5]

2. Engineered GGR systems are expensive and unlikely to see significant cost reductions.

CCS, BECCS and DACCS are expensive. It is suggested that new, simpler and lower cost alternatives to current carbon capture technology are possible. However, the Oxford Smith School of Enterprise and the Environment | Working Paper No. 23-08 December 2023 [1] concluded:

"Assessing data from the past 40 years, no evidence is found for technological learning or associated cost reductions to date in any part of the CCS process – capture, transport or storage."

They go onto to say: "Literature indicates that IAMs may routinely underestimate the cost of CCS and overestimate the likelihood of technological progress. Smith et al. (2021) note that Integrated Assessment Methods routinely use a cost of US$10/tCO2 for transport and storage costs, but that in the real world, costs can span US$5-45/tCO2.

They and others argue that transport and storage costs are unlikely to decline going forward, as they are based on established and basic processes such as pipelines, gas pumps and shipping. In principle, transport and storage costs can be reduced when facilities equipped with CCS form a geographical cluster; in practice, this has yet to be demonstrated.

True storage costs will only become evident after significant real-world experience. For example, what will average costs be for monitoring a CO2 reservoir for integrity, including for multiple decades after it is full? At what rate will reservoirs develop issues that require storage to be stopped, as occurred, for example, with the Salah project in Algeria and the Snøhvit facility in Norway?

And what will be the costs, in such eventualities, of repairing any breaches or addressing unexpected irregularities that might occur, locating a suitable replacement reservoir, or closing down the facility and building another one?

For renewable energy, and for other clean energy devices such as storage batteries and electric vehicles, real-world cost data is by contrast available in prodigious amounts."

3. Carbon capture rates for BECCS will be lower than proponents argue.

UK Government has proposed that BECCS at Drax based on woody biomass will capture and store up to 8m tonnes of CO2 per annum by the early 2030s. This projection is based on the highly implausible claim (put forward by Drax in their DCO application for BECCS and accepted without question) that the capture process will achieve an overall rate of 95%. Firstly, this figure is a gross figure for the Drax plant itself and makes no allowance for downstream leakages and scheduled venting of the carbon transport system, or for venting the power plant when the transport system is under maintenance. Secondly, it makes no allowance for upstream carbon leakage.

It is a clear example of wishful thinking to plan for a 95% carbon capture rate. The DESNZ Task and Finish Group report on BECCS of August 2023 [2] found that "in practice, representative [end to end] carbon removal efficiencies for BECCS are anticipated to be between 65 – 85%, as a function of CO2 capture rate, supply chain, and supply chain logistics."

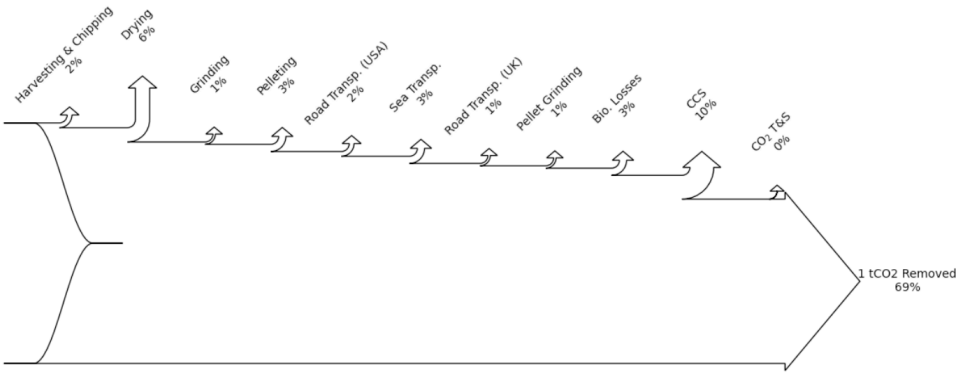

Figure 2: Illustrative carbon removal efficiency diagram for a UK BECCS project using biomass imported from the USA. This example assumes 90% CO2 capture at the BECCS facility. This calculation was performed using the MONET framework[5].

But there is no real world evidence that a plant level carbon capture rate of even 90% is achievable in operation. The Oxford Smith School of Enterprise and the Environment found that *"it is far from proven that rates this high would be routinely applicable." They also reported "Boundary Dam coal-fired power station in Canada. Intended to capture 90% of CO2 emissions, its actual capture rate over seven years of operation averaged 50%. The owners, Saskpower, disputed the figure, but their own estimate of 68% is also well short of the target."*[1]

The DESNZ Task and Finish Group analysis appears to have excluded downstream carbon leakage. That omission combined with their use of an unrealistically high plant capture rate of 90% suggests that the net performance of a BECCS system such as Drax based on imported woody biomass is likely to be considerably less than their estimate of 65 to 85%.

At best BECCS at Drax might achieve 6m tonnes capture per year, but this would require near baseload operation at 1GW (potentially causing grid problems, see below) and consume considerably more wood fuel per MWh than under the proposed 2027-2031 unabated "dispatchable" period of operation.

The government's Net Zero Strategy of 2021 proposed 23 $MtCO_2$/year by 2035 for engineered (essentially geological) GGR, and then 75-81$MtCO_2$/year by 2050.

On the basis that none of this will be provided by DACCS, the expectation would be that BECCS would be delivering as much as 80$MtCO_2$/year by 2050.

Assuming the net carbon capture rate of BECCS is 70% - taking account of upstream supply chain carbon emissions, downstream leakages and maintenance venting and a realistic plant carbon capture performance - then the 'residual' un-captured emissions from BECCS would be at least 34$MtCO_2$/year. (Calculated as 8Mt / 70%).

As the bulk of these un-captured emissions would be from wood combustion and therefore 'biogenic', current UNFCCC/IPCC guidelines would treat them as zero in the UK's greenhouse

gas inventory. However they are emissions that add to climate change during the time period before tree regrowth can (in theory) re-sequester them, and are therefore problematic.

4. Proposals for CCS-based GGR systems lack resilience.

Given the stated critical need for GGRs, the engineering design of the BECCS project at Drax lacks resilience. It has multiple single points of failure, it is subject to flood risk in future years as recognised here by Humber 2100+ : A New Strategy [6], the Humber area will experience increasingly large tidal surges this century, risking the River Ouse close to Drax power station and the shore connection for the proposed offshore pipeline.

The contractual arrangements need multiple private sector businesses, operating emitters (like Drax) and transport and storage infrastructure to work together to ensure reliable and effective near-continuous operation.

5. BECCS and DACCS at Gigatonne scale proposed for drawdown by 2050 are huge engineering challenges.

What is proposed by the IPCC requires building an entire global petroleum-scale infrastructure just to bury waste and to do it in 25 years.

The focus must be on technologies that are scalable now and capable of driving emissions down rapidly. Not delaying emissions reductions in the expectation that GGRs will be effective at the required scale in the necessary timeframe.

BECCS IMPACTS ON THE UK GRID ARE SIGNIFICANT AND INCOMPATIBLE WITH NESO-PROPOSED STRATEGY.

The government's Net Zero Strategy of 2021 proposed 23 $MtCO_2$/year by 2035 for engineered GGR, and then 75-81$MtCO_2$/year by 2050.

As shown earlier, without DACCS the expectation is therefore that BECCS will be delivering as much as 80$MtCO_2$/year by 2050.

The existing Drax BECCS proposal is to have approximately 1GW of generating capacity running as baseload, in order to produce 8 $MtCO_2$/year of negative emissions. Running as baseload is partly in order to maximise carbon capture to make greatest use of the capital investment, but it is also to maximise efficiency of the carbon capture technology which is best left running continuously.

Even if this carbon capture rate (8 $MtCO_2$/year) were achieved in practice, which is highly unlikely, to scale from the current proposal to the target of 80 $MtCO_2$/year would require over 10GW of generating capacity running as baseload.

This is confirmed by Mathilde Fajardyab and Niall Mac Dowell in 'The energy return on investment of BECCS: is BECCS a threat to energy security? [7] "*Meeting the UK's 2050 target will require between 8–14 GW of installed capacity, which represents 14 to 25% of the UK annual electricity generation by 2050.*[37] "

Such a high level of biomass power is not consistent with the recent Clean Power plan for 2030 which proposed a “firm” or baseload capacity of only 3-4 GW, all from nuclear. The likely consequence if 10GW of BECCS power was introduced would be greater constraint of intermittent renewables and less need for nuclear.

The table below is from CarbonBrief analysis at https://www.carbonbrief.org/analysis-how-the-uk-plans-to-reach-clean-power-by-2030/

	Technology	Current installed capacity	NESO 'Further Flex and Renewables' Scenario	NESO 'New Dispatch' Scenario	DESNZ 'Clean Power Capacity Range'
Variable	Offshore wind	15	51	43	43-50
Variable	Onshore wind	14	27	27	27-29
Variable	Solar	17	47	47	45-47
Firm	Nuclear	6	4	4	3-4
Dispatchable	Low Carbon Dispatchable power	4	4	7	2-7
Dispatchable	Unabated gas	36	35	35	35
Flexible	LDES	3	8	5	4-6
Flexible	Batteries	5	27	23	23-27
Flexible	Interconnectors	10	12	12	12-14
Flexible	Consumer-led flexibility	3	12	10	10-12

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In the nearer term, to provide 23 $MtCO_2$/year by 2035 would require biomass baseload of approximately 2.5GW, which again is not consistent with the CP2030 plan, which intends to use biomass only as ‘dispatchable low carbon’ power.

BECCS REQUIREMENTS FOR LAND ARE SIGNIFICANT AND LIKELY UNACCEPTABLE.

In terms of fuel requirements and therefore land use: to service a BECCS carbon capture rate of 8 $MtCO_2$/year (Drax operating on two units at 1GW baseload and generating approx. 8.5TWh net) would require approximately 5m tonnes of fuel per year. Imported wood pellets currently meet this level of demand, and the initial proposal for Drax BECCS would be to continue this model. The land-use implications of this fuel supply are therefore ‘off-shored’ to other countries, but should not be ignored.

If the UK dropped the use of imported woody biomass, fulfilling the 2050 target of total GGR of 80 $MtCO_2$/year with BECCS based on home-grown energy crops would for example require 47 Mt of wheat straw per year, or about 36 Mt of wheat grain, which is more than double the UK annual wheat production in 2014. Other energy crops like short rotation willow and Miscanthus could be used but all have enormous demands for land and water. Adding to the current demand for water is not prudent when we know that changing weather patterns and resultant water shortages are damaging the UK’s ability to grow food crops.

EMERGING INTERNATIONAL CARBON ACCOUNTING RULES MAY AFFECT UK BECCS USING IMPORTED BIOMASS.

UNFCCC/IPCC guidance on the reporting of (positive) carbon emissions means that emissions in the UK from burning imported biomass are zero-rated in our energy sector, and are accounted for in the land use sector of countries supplying the biomass. This is a long-established position from which the UK benefits as its officially recognised emissions exclude in the order of 13 million tonnes per year from burning imported biomass at Drax and Lynemouth.

In contrast, the position on negative emissions from biomass is not settled. Guidance does not specifically address the situation covering internationally traded woody biomass. As well as there being no specific reference to this situation in the extant guidance and in the supporting Q&A, the fact that the IPCC is convening a study group to report by 2027 on accounting for "captured" emissions from biomass shows that the question of where BECCS captured 'negative' emissions are to be reported is not settled.

Were the IPCC to decide that negative emissions from biomass should be allocated to the land use sector in the producing country, the UK's GHG inventory would not benefit from BECCS using imported biomass.

See Appendix for elaboration of this point.

APPENDIX

1. Smith School working paper December 2023. Assessing the relative costs of high-CCS and low-CCS pathways to 1.5 degrees

https://www.inet.ox.ac.uk/publications/assessing-the-relative-costs-of-high-ccs-and-low-ccs-pathways-to-1-5-degrees

EXTRACT:

"CAPTURE RATES AND THEIR IMPLICATIONS

One further confounding factor for the costs of all applications of CCS is the capture rate – the proportion of CO2 that the equipment captures. Typically, IAM scenarios assume a capture rate of 85-95%. But it is far from proven that rates this high would be routinely applicable.

Leeson et al. (2017) cite capture rates from 13 previous studies of performance in the iron and steel sector that range from 8% to 65%. They give no details on targeted capture rates, so some of the low numbers could have occurred by design.

Eighteen studies of petroleum refinery CCS give capture rates of 8-50%, with many data points missing; and two studies of CCS in the pulp and paper sector yield capture rates of 62% and 75%

Robertson and Mousavian (2022) surveyed 13 more current facilities (ten in operation, one recently mothballed, two recently failed) whose combined theoretical capture volumes would have accounted for more than half of the global total in 2022. Only two facilities performed at or close to 90%, while more than half of the 13 captured significantly less than their target rates. These included:

• Boundary Dam coal-fired power station in Canada. Intended to capture 90% of CO2 emissions, its actual capture rate over seven years of operation averaged 50%. The owners, Saskpower, disputed the figure, but their own estimate of 68% is also well short of the target.

• Gorgon gas processing facility in Australia. Captured about 40% of the promised volume over its first five years of operation.

• Illinois Industrial bio-ethanol plant in the United States. Intended to capture 22% of the facility's CO2 emissions, but has averaged only 12%.

Robertson and Mousavian also note that many CCS projects do not openly disclose capture rates. They indicate that, because of a lack of uniformity in how the theoretical or intended capture rate is reported, it is not clear whether this shortfall is all down to underperforming capture equipment. If it were, and if the average intended capture rate were 90%, this would equate to a real-world capture rate of 72.5%.

Underperformance on capture rates has major implications for decarbonisation scenarios. Budinis et al (2018) conclude it is a more important issue than cost in determining whether power sector CCS has a significant role in the second half of the century. But it is also critical for assessing the real cost of abatement with CCS. If CCS equipment removes less CO2 than a

scenario assumes, this creates a greater need for negative emissions to remove the additional CO2 emitted. Indeed Chevron, the operator of the Gorgon plant, had to purchase 5.23 Mt CO2 of carbon credits to make up the shortfall due to its poor capture record.

Additional negative emissions capacity would, at least in models, often take the form of BECCS, which is widely assumed to be cheaper than other carbon removal methods. If the additional BECCS also underperformed, this would result in a need for yet more negative emissions capacity. As an example, a scenario may contain 1 GtCO2 of industrial CCS and assume a 90% capture rate. The 10% emissions remaining could be removed with BECCS, whose capacity for this purpose – assuming a 90% capture rate for these facilities too, and leaving aside emissions generated upstream and downstream – would need to be 0.11 GtCO2, giving a total CCS capacity of 1.11 GtCO2. However, if the real-world capture rate for the industrial units turns out to be 60%, this would imply a need for 0.44 GtCO2 of BECCS operating at 90%. If the BECCS plants also capture only at 60%, the need is for 0.67 GtCO2, resulting in a total CCS capacity of 1.67 GtCO2. The cost of abatement for these industrial facilities would therefore rise 50% above that cited in the scenario, with an increased need for energy crops and therefore land as well. The real world evidence thus far indicates that this degree of capture rate overestimation in models is far from impossible.

Taken together, these factors indicate that the AR6 scenarios are likely to significantly overestimate the mitigation provided by CCS, and thus likely also to significantly underestimate the scale of CCS and/or negative emissions needed (and therefore the cost) to deliver mitigation outcomes."

EXTRACT ENDS

In addition Zhang et al. (2022) found that, across 20 CCS facilities with a claimed capture capacity of 36 MtCO2/yr, only 29 Mt was stored in 2019.

2. Creties Jenkins, Pieter Pestman, Peter Carragher, Rosalie Constable**; Long-term risk assessment of subsurface carbon storage: analogues, workflows and quantification.** *Geoenergy* 2024; 2 (1): geoenergy2024–014. doi: https://doi.org/10.1144/geoenergy2024-014

"EXTRACT

The objective of SCS (Subsurface CO2 Storage) projects is permanent storage of CO2. This requires a framework to assess both uncertainties and risks over hundreds to thousands of years. The assessments will cover site identification and appraisal of the storage complex, injection of CO2, pressure monitoring, and post-injection monitoring to ensure long-term retainment. This very long-term risk assessment requires additional skills and methodologies that are not generally required for oil and gas projects.

Therefore, we propose that a paradigm shift is required from the focus on geological and subsurface success that is common practice in hydrocarbon exploration and appraisal programmes, to a broader assessment of the chance of failure throughout the life of a project. Operators will be required to develop plans for all stages of an SCS project, and that will include monitoring and mitigating events that could lead to project shutdown.
A paradigm shift is also required when considering failures. Exploration and production (E&P) companies are able to plug and abandon dry holes and walk away. If a CO2 injector is

abandoned because the injectant ended up in the wrong formation, there could be a legal liability. If the CO2 plume or pressure front moves beyond the licence area it could impact nearby subsurface operations. The CO2 could also leak upwards into a shallow aquifer or to surface, resulting in contamination or injury.

Unplanned events affecting one CCS project have the potential to impact not only the operator and the project but also the perception of the global emerging industry of CCS. For example, Marshall (2022) recently provided a critical academic analysis of the Gorgon CCS project in Western Australia. Among Marshall's conclusions (Marshall 2022, p. 17) is the following statement:

> *"There is no indication that the Gorgon project, even if it is fully successful, will reduce the emissions from the fossil fuels it excavates and sells, and given the problems it faced, it seems unlikely that storing a significant amount of emissions produced by burning would be possible."*

Opinions such as these highlight the challenge facing the emerging CCS industry in gaining and maintaining the social licence to operate (SLO) throughout a project. A rigorous risk assessment is a key component of managing long-running and complex projects, and demonstrating rigorous due diligence."

EXTRACT ENDS

3. Where do BECCS negative emissions created from internationally traded biomass get reported?

From https://www.ipcc-nggip.iges.or.jp/faq/faq.html

The last paragraph suggests that "captured" biogenic CO2 should be "reported" in the Energy sector, but it doesn't spell out if by "reporting" they mean both accounting and memo-reporting. **However crucially, this Answer doesn't touch on traded woodfuel.**

"Q2-11 How to report CCS of biogenic CO2?

A: In the context of national GHG inventories, carbon dioxide capture and storage (CCS) means geological carbon sequestration. Per the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines), geologic sequestration can be incorporated into GHG inventories using a Tier 3, site-specific methodology. This includes geologic sequestration of biogenic CO2. The 2006 IPCC Guidelines note that "Once captured, there is no differentiated treatment between biogenic carbon and fossil carbon: emissions and storage of both will be estimated and reported." (Volume 2, Chapter 5, Table 5.4), and that "Negative emissions may arise from the capture and compression system if CO2 generated by biomass combustion is captured. This is a correct procedure and negative emissions should be reported as such." (Volume 2, Chapter 5, Section 5.3). Information on Tier 3 methodologies for geologic sequestration can be found in the 2006 IPCC Guidelines, Volume 2, Chapter 5, Section 5.7, Methodological Issues.

In the case of biogenic CO2, the negative emissions are to be reported in the IPCC sector in which capture takes place, at the most disaggregated level possible. For example, in the case of capture of fugitive emissions of biogenic CO2 at ethanol plants that produce ethanol for fuel use, the negative emissions could be reported as capture under 1.B.3.

Relevant text
2006 IPCC Guidelines, Volume 2, Chapter 5, Table 5.1 (UNCHANGED in the 2019 Refinement

to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2019 Refinement))
"Carbon dioxide (CO2) capture and storage (CCS) involves the capture of CO2, its transport to a storage location and its long-term isolation from the atmosphere. Emissions associated with CO2 transport, injection and storage are covered under category 1C. Emissions (and reductions) associated with CO2 capture should be reported under the IPCC sector in which capture takes place (e.g. Stationary Combustion or Industrial Activities)."

2006 IPCC Guidelines, Volume 2, Chapter 5, Table 5.4 (UNCHANGED in 2019 Refinement)
"Once captured, there is no differentiated treatment between biogenic carbon and fossil carbon: emissions and storage of both will be estimated and reported."

2006 IPCC Guidelines, Volume 2, Chapter 5, Section 5.3 (UNCHANGED in 2019 Refinement)
Negative emissions may arise from the capture and compression system if CO2 generated by biomass combustion is captured. This is a correct procedure and negative emissions should be reported as such.

2019 Refinement, Volume 1, Chapter 8, Section 8.2.1
"CO2 emissions from biomass combustion for energy are reported in the energy sector as memo item and estimated and reported in the AFOLU Sector as part of net changes in carbon stocks. (NEW text) The capture of biogenic CO2 emissions from biomass combustion, or other processes, should be treated consistently with CO2 capture from fossil fuel combustion and reported in the Energy and/or IPPU Sectors. Once captured, and added to the carbon capture and storage process there is no differentiated treatment between biogenic carbon and fossil carbon. Both captured biogenic and fossil CO2 should not be added to the total emissions, i.e. net emissions should be reported (also see section 5.3 of Chapter 5 in Volume 2 of the 2006 IPCC Guidelines). Non-CO2 emissions from biomass combustion are reported in the Energy Sector. Non-CO2 fugitive emissions from production of fuels (e.g. charcoal or biochar) are reported in the Energy Sector (see Table 4.3.1 in Chapter 4, Volume 2 for the correct allocation of non-CO2 fugitive emissions from fuel transformation)."

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