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Submission to the BEIS consultation on business models for greenhouse gas removals

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About this report

In July 2022, the UK Government's Department for Business, Energy and Industrial Strategy (BEIS) opened a consultation inviting initial proposals on business models to support the deployment of engineered greenhouse gas removal (GGR) projects. Read more about the consultation here: **https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1087918/greenhouse-gas-removals-business-models-consultation.pdf**

This report consists of a written submission to this consultation and was first published in November 2022 by the Grantham Research Institute on Climate Change and the Environment and the Centre for Climate Change Economics and Policy.

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Headline points

- **If the UK is to build a diverse and large-scale portfolio of greenhouse gas removal (GGR) technologies, direct government support will be required in the short- to medium-term** (as is offered in the proposed GGR and BECCS Power business models). This would drive currently expensive, yet highly scalable, technological GGR down the cost curve.
- **A technology-neutral approach to GGR policy could lead to poor substitutability between GGR and conventional climate mitigation measures**. This is because standardisation between nature-based and engineered GGR techniques could mask important differences in the duration of carbon storage and co-benefits.
- Depending on the sectors selected to recover the costs of GGR policy, **there is a risk of socially regressive impacts, whereby the cost as a proportion of income is greater for low-income groups than for higher-income groups**. Funding the GGR business model through energy bills would entrench existing inequalities as low-income households spend a disproportionately large share of their income on electricity.
- **However, funding for GGR policy can be designed in a way that mitigates unequal distributional impacts across the population**. For example, income tax is shown to be a progressive policy funding option. Funding GGR technologies through air travel can also have minimal impacts on social welfare as high-income households have larger aviation carbon footprints than lower-income households.
- **Policymakers can help to drive voluntary demand from corporates and other non-state actors for high-quality GGR projects by improving voluntary market governance and architecture**. This would involve supporting the development of information infrastructure, such as carbon credit ratings, and setting out a clear pathway towards regulation that enforces high standards around emissions performance claims.
- **The future integration of GGR within the UK Emission Trading Scheme (ETS) poses risks for two key reasons**. First, treating emissions removals and emissions reductions as entirely fungible allows for undesirable substitution. Second, carbon markets may provide insufficient demand to make currently more-costly GGR techniques affordable for deployment at commercial scales.

Section 1: Rationale for developing business models for GGRs

Question 1: Do you agree that the Government should develop a GGR business model to enable a diverse portfolio of GGR technologies to deploy at scale in the next decade?

Yes, there is a strong case for the Government to develop a greenhouse gas removal (GGR) business model to enable the deployment of a diverse portfolio of GGR technologies at scale in the next decade. As already recognised in the consultation, given the absence of a stable market price for negative emissions at present, market-based policies alone are unlikely to be sufficient in the early stages of the sector to crowd in private sector investment at the pace and scale required to deploy GGR in line with Government ambitions.

Along with being insufficient, using a market-based approach (in particular, integration into the UK ETS) as the principal short- to medium-term policy framework for GGRs brings a number of risks which could hamper not just GGR deployment but the net zero mitigation effort overall (Sato et al., 2022). These risks include a potential undesirable substitution of emissions *reductions* for emissions *removals*, potentially insufficient demand pull for currently more costly GGR techniques, and a possible downward pressure on the overall market-based price of carbon (Burke and Gambhir, 2022). *See Question 18 for a more detailed discussion of these risks.*

Recognising the absence of a competitive market for GGRs today, the National Infrastructure Commission (2021) recommended direct government support for GGRs in the short term (by 2030) through a combination of staged competitions, direct investment and contracts with government for revenue. Burke and Gambhir (2022) find that a multi-pronged and inter-temporal policy framework is needed to support GGR deployment which should include technology-specific mechanisms to make currently expensive, yet highly scalable, technological GGR more affordable. As such, the Government's current proposals for GGR business models, which account for the unique characteristics of different GGR technologies to ensure support is allocated cost-effectively (as demonstrated by the separate handling of the Power BECCS business model) is in line with the literature to date on ways to address prevailing market barriers and unlock investment in GGR technologies over this decade. Backing the proposed business models with a funding framework spanning a sufficiently long timeframe (similar to the Levy Framework which provided both funding visibility and consumer protection for renewables a decade ago [AFRY, 2021]) will be key to provide confidence for the private sector to invest in GGR infrastructure and supply chains.

Question 2: To support a portfolio approach to GGR deployment, do you agree that Government policy for incentivising negative emissions should be technology neutral as far as possible?

In theory this is a useful philosophy, especially for engineered GGR techniques such as Bioenergy with Carbon Capture and Storage (BECCS) and Direct Air Carbon Capture and Storage (DACCS). However, this may not be appropriate when thinking about policy mechanisms that include nature-based greenhouse gas removal solutions and components.

In the context of GGR, the standardisation of nature-based and engineered GGR techniques could mask differences in environmental durability and additionality. Consequently, poor substitutability between GGR and conventional mitigation could be obscured under a policy framework that promotes carbon markets or broader technology neutrality, and thus increase the likelihood that less mitigation would take place.

Technology neutrality may fail to recognise the distinctive contexts in which these very different solutions operate and the risks embedded within them, especially as it can be difficult to scientifically define the equivalence between one negative emissions unit generated through GGR and one positive emissions unit abated. If technology neutrality is to be considered, long-term

durability and overall net additionality of emissions reductions needs to be ensured in both the capture and the storage of greenhouse gases to ensure genuine and permanent emissions reductions. For example, nature-based solutions are far more prone to reversal than engineered solutions, particularly in jurisdictions with a chequered history of land use governance, due to the imperative to protect stocks of vegetation over substantial periods of time. Moreover, technology neutrality may further ignore the implications of competing priorities for land use which could be exacerbated if biomass-based removals become difficult to reconcile with planetary boundaries. BECCS also has the ability to stack revenues (from both public and private sources) in ways other removal technologies cannot. This should be factored in when designing policy frameworks for engineered removals to ensure a level playing field.

The differences between sequestered, captured and avoided emissions exist due to the different timescales involved, particularly the temporal characteristics of fossil versus biotic carbon (such as vegetation or forests with storage durations of decades compared to millennia for carbon stored in fossils), which pose a challenge to measuring and achieving equivalence and neutrality. In this way, when comparing the viability of nature-based and engineered solutions, and indeed BECCS and DACCS, policymakers must recognise the distinctive contexts in which the very different solutions operate, and the risks embedded within them.

Section 2: A contract-based business model for negative emissions

Question 5: What is your preferred contract scheme of those outlined in the consultation? Please provide arguments to support your view.

The negative emissions Contract for Difference (CfD) is the preferred contract scheme. As alluded to in the consultation document, this option would limit the financial burden on the Government as the market price rises. The policy is well understood, having been in operation for a number of years, and it does not require the Government to sell credits which requires extensive regulatory architecture to be built. The negative emissions CfD itself is the preferred contract scheme but the funding envelope (i.e. a levy on consumer bills) must be different to its predecessor to ensure that the policy costs do not disproportionately impact low-income households.

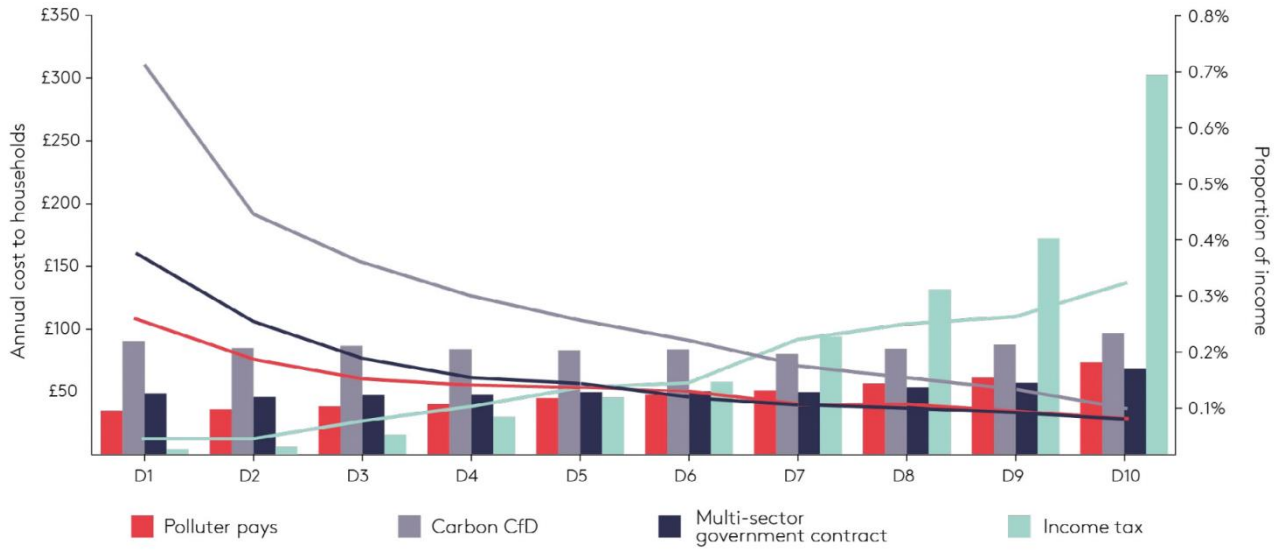
Question 14: What other issues should the Government consider when progressing work on the design of a GGR business model? Please focus your response on issues that are not directly considered through this consultation.

The Government should thoroughly consider how the policy costs of the proposed business model for GGRs can be fairly distributed across society. BECCS and DACCS are currently seen by the public as controversial and incompatible with prevailing visions of decarbonisation (Cox et al., 2020). One study found that the public opposed guarantees of higher prices for producers selling energy derived from BECCS due to the resulting high costs imposed on taxpayers by such a mechanism (Bellamy and Healey, 2018). These findings are evidence that choosing an equitable funding model will be vital to ensure public legitimacy of GGR technologies and, in turn, the immediate political feasibility as well as the durability of the policy to support their development. Depending on the sectors or consumption categories through which the costs of GGRs are recovered, there is a risk of socially regressive impacts, whereby the cost as a proportion of income is greater for low-income groups than for higher-income groups. This risk applies not only to the GGR business model proposed under the current consultation but also for the Power BECCS business model which is being consulted on separately.

Research by Owen, Burke and Serin (2022) has considered four policy funding options to examine the potential impacts on UK households across different income levels if costs for deploying GGR technologies – specifically, BECCS and DACCS – are placed on different sectors of the economy. Figure 1 below shows how the costs of funding GGRs fall to the public across income deciles, both

in absolute terms and as a proportion of annual income. This helps to determine whether a policy funding option is regressive (line with negative gradient) or progressive (line with positive gradient). Three of the options considered, all of which are designed to pass GGR costs onto consumers through one or a combination of household consumption sectors, were found to be regressive. The most severely regressive option is a levy on consumer bills. This mechanism has already been shown to be regressive given low-income households spend a disproportionately large share of their income on electricity (Owen and Barrett, 2020). Funding the GGR business model through energy bills would further entrench inequality and therefore is not a recommended funding envelope.

Figure 1: Distributional impacts of GGR policy funding options on UK households, income deciles 1-10



Source: Owen, Burke and Serin (2022)

Notes: Based on a 2-person household under the CCC's Balanced Net Zero Pathway in 2035. Bars show annual costs (in 2018 prices) and lines show proportion of annual income. Decile 1 (D1) is the lowest income group and decile 10 (D10) is the highest.

Option 1 (polluter pays) has the smallest and flattest spread of costs as some of the main sectors that bear the costs in this policy represent a smaller proportion of spend for low-income households than for higher-income households. This becomes especially apparent in 2050, where the majority of costs under this option are apportioned to the aviation sector, alongside agriculture. However, this is only the 'least worst' option among the regressive policy options. Even though the polluter pays principle – which rests on a key principle of environmental law – is framed as an equitable policy choice, this option still creates a socially regressive outcome and is not inherently fair. Notably, this option draws attention to aviation as an important point for intervention to reduce unfair distributional impacts. High-income households have larger aviation carbon footprints than low-income households, so passing on costs through air travel could help fund GGR technologies while having minimal impacts on social welfare.

Income tax is the only progressive approach to recovering GGR policy costs among the four options considered in this research. This highlights that the only funding option with a truly progressive outcome is the one requiring a greater role for the state (as opposed to, for example, polluter pays which is a predominantly market-based approach to recovering costs). Although funding GGR technologies through income tax avoids excessive costs for low-income households, socialising costs in this way may have the unintended consequence of blunting the price signal polluters face. Passing costs to carbon emitters themselves may be desirable as an increase in the cost of production helps create an incentive to switch to cleaner inputs, adopt low-carbon technologies, or mobilise large-scale investments to achieve net zero in hard-to-abate sectors. It

is also important to remember that the different funding options are not mutually exclusive and the proposed contract-based business model for GGR can be designed to recover costs from a combination of areas that are known to mitigate regressive distributional impacts, including but not limited to, income tax.

Section 3: Building a market for negative emissions

Question 15: What do you believe is the most appropriate market framework for supporting initial GGR projects over the next decade, and how might this framework evolve over time? In your answer, please consider the market options outlined in Section 3, indicating which option or combination of options would be preferable to achieve our objectives.

A more complex set of mechanisms than solely an emissions trading system-determined carbon price are needed to deliver innovation cost reductions, as is demonstrated in the literature and through real-world experience. Therefore, we suggest that well before any integration of GGRs into carbon markets takes place, there should be a range of innovation- and technology-specific mechanisms to drive currently expensive, yet highly scalable, technological GGR down the cost curve. This involves a multi-pronged inter-temporal policy framework.

Short-term actions include focusing on ensuring the cost-effective, scalable and reliable development of these novel techniques through support for piloting and demonstration. In the medium term, policymakers can draw on the successful experience of promoting renewable energy sources in the electricity sector, particularly the role of Contracts for Difference (CfDs) in deploying significant quantities of offshore wind in the UK. A similar but modified approach could be used to encourage nascent GGR techniques as outlined in the consultation. A competitively awarded public procurement contract (such as Carbon Contracts for Difference, which is benchmarked against a reference price) is preferable to a general subsidy for negative emissions (such as Feed-in-Tariffs in the electricity sector where the Government rewards all producers with a fixed level of support). This is because an auction is more responsive to technological progress, which can reduce the overall cost of the policy as well as control the levels of deployment which tend not to be fixed under a Feed-in-Tariff policy.

Although it is not a simple process, if robust monitoring, reporting and verification (MRV) standards are established in the longer-term – and enforced through an independent MRV regulator, as proposed by the UK Government – a separate negative emissions carbon market could be established, for eventual linking to existing markets.

Question 16: What steps should the Government take to stimulate voluntary corporate demand for negative emissions credits?

Several recent developments have created conditions for a sharp increase in the volume of finance available for carbon removals though corporate voluntary commitments. Among these are policy processes to define high-integrity benchmarks for supply and demand in the carbon market. The Integrity Council for the Voluntary Carbon Market's (IC-VCM's) Core Carbon Principles (CCPs) will set a minimum threshold for integrity, consisting of criteria that all carbon credit-issuing projects and certification standards must apply to be deemed CCP-compliant. These criteria are likely to trigger a significant increase in transparency around project activities (including whether credits remove or reduce carbon emissions) and their impact, including requirements for quantifying emissions removals and attributes of quality, like the permanence of storage. These measures are expected to lead to greater harmonisation of certification methodologies, which are currently highly varied and opaque (Arcusa and Sprenkle-Hyppolite, 2022). Increasing project credibility and market transparency should lead to higher corporate demand for removals. However, there is nothing inherent to the CCPs that would incentivise a

preference for removals over 'avoidance' credits where emissions are merely reduced against a baseline.

The Voluntary Carbon Market Integrity Initiative (VCMI) is developing a Code of Practice consisting of guidance for corporates and other non-state actors making claims about their emissions performance ('net zero', or similar). Under VCMI's draft Code, a precondition of making any such claim is that a company has set a science-based target (as verified under the Science-Based Targets initiative's [SBTi's] methodology) and that it is on track with reductions of at least scope 1 and scope 2 emissions in its own value chain. Once this is achieved, companies can purchase removals. The Code does not differentiate between how removals and avoidance credits contribute towards a company's total offset emissions, but it does require transparent reporting on the use of credits towards any claims, including the methodology and project type for each credit retired (VCMI, 2022).

Even when these bodies conclude their work, significant gaps will remain. Because of the nascence of many removal technologies, the price for engineered credits remains extremely high compared to nature-based alternatives (Christie-Miller and Harvey, 2022). Two helpful steps that the Government could take are (i) supporting information infrastructure and (ii) establishing a clear pathway to legal enforcement of corporate climate performance claims, potentially with an escalating requirement for removals.

Firstly, beyond the minimum benchmark provided by IC-VCM, informational tools like carbon credit ratings can provide additional clarity on the quality of carbon credits. These tools require a large volume of data to operate and add value to decision-making. Therefore, the Government could create a requirement for GGR projects to collect and openly share appropriate data. It could also collaborate with those bodies to develop more accurate research, based on learnings from early-stage funding and contracts. Importantly, projects that are eligible for and would otherwise receive policy support would **not** be viable to issue carbon credits, since the impact of that carbon finance would not be 'additional'. Nevertheless, as the market grows beyond the scale of initial policy support, a reliable bank of comparable data will be necessary to inform ratings assessments for later, similar projects. The Government could also fund the development of digital tools that can automate and increase the accuracy of emissions quantification – not only for removals themselves, but also for corporates to measure emissions across their own supply chains and better understand their need to purchase credits.

Secondly, VCMI has been explicit that its Code of Practice is intended to be 'one piece of a larger puzzle': corporate climate accountability initiatives, business, governments and other stakeholders must create a coherent governance framework that effectively holds corporates to account for their claims. Climate-related greenwashing is gaining pace globally (Setzer and Higham 2022) as legal cases are filed against corporate entities or governments for misleading communications, including relating to commitments and disclosure of investments, risks and harm. To prevent spiralling mistrust that could even undermine incentives for voluntary action by climate leaders, the Government should consider regulation that adopts or builds on the claims Code to give it force. This could be achieved through several possible avenues including climate disclosure requirements, marketing claim regulations, or possibly even requirements (currently under development) for all companies to publish transition plans. Depending on the content of the final Code, regulation could go further to boost demand for removals, for example by requiring that removals account for at least a minimum share of retired credits, potentially kicking in from a certain date (e.g., 2030) and rising over time. Clearly signalling the intention to move towards regulation, such as through an open consultation, would in itself shift expectations in favour of high-integrity use of credits.

Question 18: Would it be desirable for the Government to establish a regulated market for engineered GGRs to allow for future integration with the UK ETS and/or provide the foundation for a GGR obligation scheme? If so, how could this be achieved?

Research by Cox and Edwards (2019) and Mclaren (2012) previously examined the risks of carbon markets as the predominant policy lever for GGRs, concluding that inclusion of GGRs in carbon markets risks exacerbating moral hazard and that a range of policies are needed to recognise and reward the additional co-benefits that nature-based GGRs offer.

Burke and Gambhir (2022) build on this research, finding there is a risk that moral hazard around GGRs could be operationalised in the design of carbon markets through future borrowing provisions. For example, this may lead some firms to over-emit in the current trading period, deterring mitigation and potentially locking themselves into carbon-intensive activities with the hope that future abatement through GGRs would atone for this. If GGRs fail to scale up and future abatement fails to materialise, this could be ruinously costly for those firms, or incentivise them to lobby for a relaxation in policy stringency – a risk that was identified early in the development of ETS.

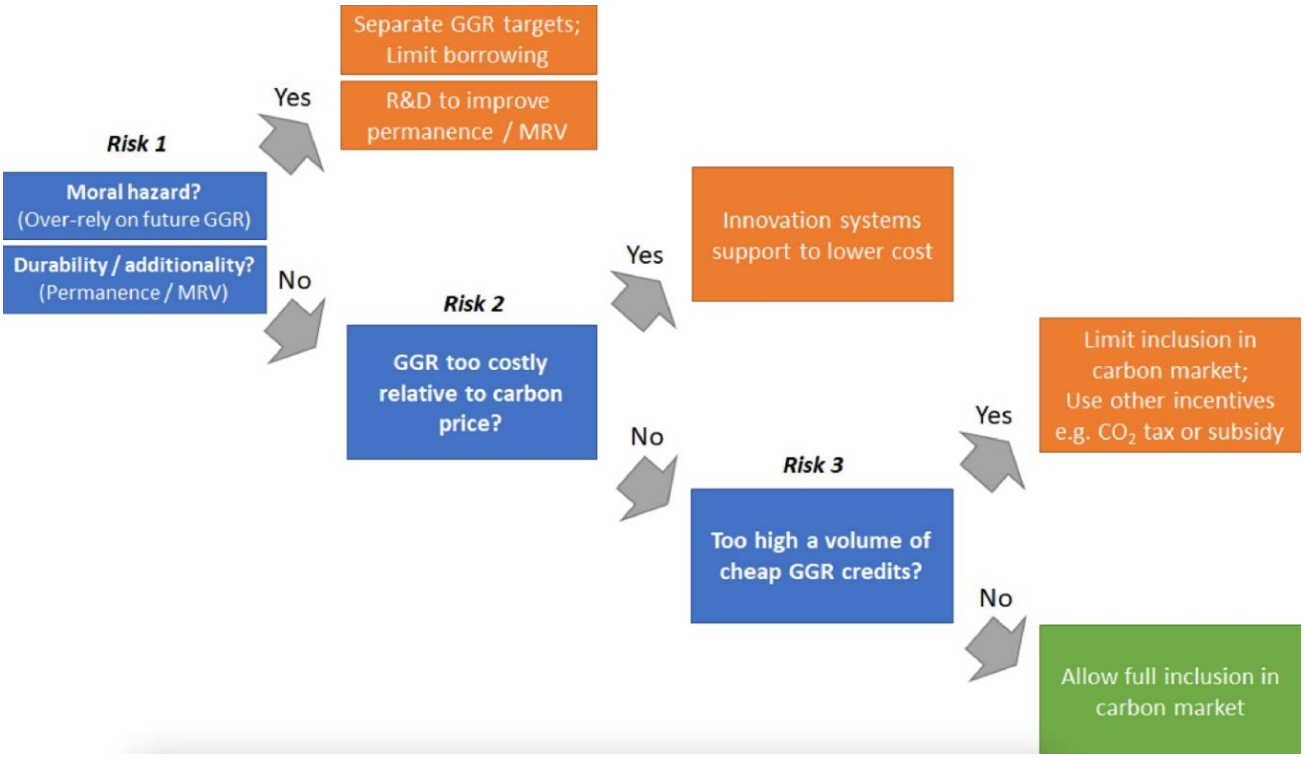
At the same time, there is uncertainty around the ability of different GGR techniques to deliver genuine and permanent abatement at scale. It is therefore fair to raise doubts about whether early GGR permits should be granted perfect fungibility with conventional carbon permits.

Furthermore, Burke and Gambhir find several reasons to be sceptical about the ability of a carbon price delivered by an emissions trading system to drive the requisite innovation and cost reductions in GGR techniques – at least in the short term. Even though a strong future carbon price could provide a much-needed boost to the economic prospects of GGR techniques, such a price has failed to materialise in most jurisdictions to date, given the projected costs of engineered, technological GGRs.

Figure 2 below summarises these risks, with guidance on how to mitigate each one and at the same time incentivise the development of GGRs towards their eventual inclusion in carbon markets. GGRs may be included in carbon markets if they are able to provide proven, high-integrity removal and sequestration of CO_2 and/or other greenhouse gases, benefit from the carbon price in Emissions Trading Systems in a way that allows them to be deployed and reduce in cost, and if they can be incorporated without risking downward price pressure on the market. If not, there are a range of measures that should be undertaken to maintain the integrity and strength of carbon markets on one hand while incentivising the development and cost reduction of GGRs on the other.

With regards to carbon markets, in all cases, a technology-specific approach must be taken as different GGR solutions will entail different risks, depending on their stage of development, the durability of emissions removals and sequestration that they provide, and their cost.

Figure 2: Summary of carbon markets risk taxonomy GGR incentives framework



Source: *Burke and Gambhir (2022)*

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