Response by Carbon Gap to a consultation offered by the Department for Business, Energy and Industrial Strategy regarding Business Models for Engineered Greenhouse Gas Removals (GGR)

Carbon Gap is an independent not-for-profit organisation focused on advancing progress on carbon dioxide removal (greenhouse gas removal) across Europe so that it can play a major role in humanity's toolbox to address climate change.

Introduction

Carbon Gap welcomes the opportunity to submit feedback to the Department for Business, Energy and Industrial Strategy's consultation on Business Models for Engineered Greenhouse Gas Removals (GGR).

The Government's GGR Business Model policy is an important step in enabling and supporting the emergence and deployment, at scale, of a diverse portfolio of innovative GGR methods, vital for achieving the UK's net zero target. The UK has a unique opportunity to position itself as a global leader in GGR solutions, capitalising on its world-class science and research infrastructure and its access to large volumes of CO2 storage sites - while at the same time benefiting from its newly-found regulatory nimbleness and the ability to act quickly to seize opportunities.

We believe that the Government has an important role in kick-starting investment in GGR. The Business Model will be successful if it unleashes private project finance capital to efficiently finance GGR projects. And a truly GGR-method-neutral approach will allow for the development of methods and projects of various types – crucial to build a portfolio of well-demonstrated GGR methods and understand their costs and relative advantages and disadvantages, for both the public and private finance providers.

However, to establish a robust market for GGR, there are several other policy instruments that need to be prioritised as well. The establishment of Government-approved MRV and LCA guidelines, and a certification scheme, for credits is among the single most valuable actions the Government could take - and a key one for establishing the UK's attractiveness to innovators, developers and investors. In addition, a clear pathway and a detailed timeline for the transition to a compliance market would provide a guaranteed market for GGR project developers to sell into at market prices. The UK Government should ensure that it leverages GGR development to benefit those rural communities transitioning from dependence on fossil fuel production. Finally, without the completion of infrastructure for carbon management (such as transport and storage infrastructure) and an appropriate permitting regime, the market in the UK will not be able to grow.

These policies can take place both within and outside of the confines of the Business Model. A mechanism such as various contracts-based mechanisms proposed will be helpful, but left alone will be insufficient.

We agree that a contracts-based approach, as opposed to tax credits, competitions, and a Regulated Asset Base model, can indeed provide the necessary revenue certainty and encourage innovation, helping to develop GGR methods. But it presents significant challenges, notably for smaller projects and those that may be at an earlier stage in their development. We would, therefore, urge the Government to consider policy support that provides a suitably high, stable, and flat price for removals. Such a support would not necessarily cover the full cost of the removal, incentivising market development, and would be paid on delivery of stored carbon, subject to certification.

This document sets out our proposed approach and outlines other key considerations we believe the Government should take into account as it prepares its policy on accelerating investment in engineered carbon removals.

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, we support the roll out of a method-agnostic GGR Business Model that focuses on the outcome delivered - in this case highly-durable, permanently stored CO2 removed from the atmosphere or upper ocean - not the nature of the specific method (be it “technological” or not). In practice, this includes methods that mineralise carbon into non-labile forms above or below ground, for example in the built environment or in subsurface reservoirs. We understand and assume that Power BECCS is one method that is excluded from this Business Model, since it is being separately considered in a bespoke business model.

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?

We fully support a portfolio approach to GGR development and a policy that is method-neutral, and appreciate the Government’s commitment to not picking winners nor developing a series of bespoke strategies.

We are concerned that the Government’s proposed policies do not live up to this commitment. The use of language is concerning; GGR can be performed by a wide variety of methods, and both the terms ‘technology-neutral’ and ‘engineered GGRs’ suggest that the Government may overlook parts of the portfolio, especially those that bridge the gap between fully engineered methods like BECCS and nature-based solutions. The separate commitments to BECCS, rather than to broader categories such as Biomass Carbon Removal (which is indeed mentioned in the consultation), suggest the Government is indeed ‘picking winners.’

In our view, method-agnosticism need not preclude a commitment to developing the whole portfolio of GGR methods. As total budget allocation will be finite, **the Government should commit to development a portfolio standard that ensures funding will support development of methods and projects of various types, and, especially, avoid the risk that one or a very small number of methods or developers capture a supermajority of the funding**, which would preclude the growth of a wide market with multiple participants.

3. Do you agree with the Government's principles for policy design?

We generally agree with the principles the Government has laid out, but have several specific comments on a selection of the principles stated. We also invite the Government to consider a number of additional important principles that we set out below.

Our comments on several of the principles are as follow:

Revenue Certainty - This is absolutely critical, but must be achieved in multiple ways. Specifically, we believe the Government should work on clearly defining the regulatory standards qualifying removals, via MRV and LCA, as a way to allow project developers to access both private and public funding.

Deliverability - This will be determined not just by the complexity of the Government's support scheme, but also the priority that it gives to the development of MRV and LCA standards and accreditation, as well as the completion of needed infrastructure for carbon management (such as transport and storage infrastructure). The EU is already proceeding with developing a Carbon Removal Certification Mechanism and leadership here would make it more likely for projects to be developed in the UK.

Market Development - The Government should remain open to having a direct role in the carbon removal marketplace, such as holding stakes in the credits that it purchases or supports and determining appropriate allocation of those credits, without compromising the ultimate responsibility of the private sector to take responsibility for its own emissions and removals.

Reduced support - We agree that Government support in the form of direct subsidy should reduce over time; that said, overall support may well increase, but with the Government in the role of market regulation and provider of accreditation, as well as direct carbon removal purchaser (procurement). In addition, the manner in which direct subsidy support is reduced is very important, and should not erode other principles such as revenue certainty. The focus should be a transition in the role the Government plays, not on reducing budgetary support as quickly as possible.

Compatibility - The Government should be careful not to double-subsidise. There is a particular risk that inaccurate accounting of the benefits of a certain method leads to one or

several methods to dominate over others because eligibility for other support schemes makes the project more attractive.

Reaching GGR targets - The Government should recognise the risk of failure for one or a small number of methods and be sure to support a portfolio of methods accordingly, such that we achieve the desired outcome: a portfolio of well-demonstrated GGR methods, with high transparency on their costs and relative advantages and disadvantages. This will form the basis for decision-making later in the decade.

As well, we would suggest other important principles:

Internationally compatible – GGR providers will need to be able to seek customers for their removals who are domiciled outside of the UK, and have clear guidance on carbon accounting principles for buyers who are multinational companies that do business in the UK as well as in other countries. There may also be a potential to receive support directly from other jurisdictions (such as the US federal government, individual US states like California, or other policy support), provided any climate benefits are shared fairly and without double-claiming. To the extent possible, this policy design should minimise bespoke requirements and maximise compatibility with international policies, including MRV and certification schemes, to reduce regulatory and administrative burden on recipients of UK GGR support. One clear first step would be international cooperation on MRV & certification scheme development, as well as on agreeing principles for corresponding adjustments and associated contracting, to ensure that common principles and best practices methodology design are shared.

Geographically flexible – The Government should not prohibit projects simply because one or more of the steps of GGR takes place outside of the UK's territory. Of the three steps inherent to GGR – 1) the extraction from the atmosphere or ocean, 2) the conversion of the material to the molecular format desired for storage (note this step is sometimes unnecessary or self-contained within step one), and 3) transport and storage – as well as a possible fourth step in which the removal credit is purchased – one or more steps are likely to take place outside of the UK. Following the precedent of the California LCFS and the Swiss fuel obligation scheme, the UK business model should allow for one or more steps to take place outside of the UK. More work will be needed to determine the scope of removals provided.

Transparent - High-durability GGR methods have not yet been deployed at scale; an unprecedented level of transparency will be needed to ensure that the costs that providers are incurring to conduct GGR are made open and available. Because this business model support is an expenditure of public funds, it should provide learnings to the public in the form of cost discovery and disclosure, to the extent possible and so long that it does not significantly interfere with the competitiveness of participating companies. The Swiss DemoUPCama demonstration project, which provides public funds for the capture and transportation of removed carbon to Iceland for storage, may serve as an example.

4. Do you agree with our overall approach to introduce a contract-based business model for GGRs to provide revenue support for negative emissions

Of the options outlined, we agree that a contracts-based approach is superior to tax credits, competitions, and a Regulated Asset Base model. A contracts-based approach can provide revenue certainty, encourage innovation, and aid competition, helping to develop GGR methods and develop a portfolio of options.

However, we believe that the Government has discounted other approaches which would provide significant value and may be better suited to deliver upon the Government's own stated goals.

The Government should reconsider a policy mechanism that provides a suitably high, stable, and flat price for removals (a tiered series of prices based on several high-level categories of GGR), similar to the 45Q policy mechanism in the US (ignoring the idiosyncrasy of that particular policy being delivered through a tax credit). The US support scheme is premised on providing a payment that is deliberately less than or approximately equal to the levelised clearing cost for the targeted activity. This retains a strong incentive to bridge the gap between the flat incentive and the full cost of the activity using other policy support or VCM payments, and it involves much lower administrative burden or the need to engage in bilateral negotiations between developers and government.

This would essentially be a form of ex-post "negative emissions payment", as proposed by the Government, that would:

a) **not cover the full cost of the removal (the shortfall bridged through the voluntary carbon market), therefore incentivising market development, and**
b) **be paid on delivery of stored carbon subject to certification, underlining the importance of developing a robust MRV and LCA schemes.**

Although 45Q does have a potential permitting bottleneck (mainly on Class 6 well approval for CO_2 storage), that administrative friction and the costs of developing that storage infrastructure can be shifted onto larger companies that have the capacity and knowledge to take care of the last leg of the GGR chain. Such a policy creates minimal administrative burden for both the company and the Government since no elaborate cost discovery is required, though the discussion of the importance of MRV and LCA analysis later in this consultation still apply.

At the very least, the Government should consider such a direct payments approach for projects under a size threshold that may not have the institutional capacity to engage in a bilateral cost-discovery negotiation with BEIS, and that may be at an earlier stage in their development.

5. What is your preferred contract scheme of those outlined in the consultation?

As discussed above, we would prefer an approach that does not require what all three of the proposed schemes require: project-level cost discovery through bilateral negotiation with Government. **We fear the necessity of detailed bottom-up cost discovery will preclude smaller providers, invite gaming, and potentially erode public trust**, though these issues could be partially ameliorated with targeted support for smaller projects, radical transparency of cost discovery, and short statutes of limitations for unsealing commercially-confidential data to watchdogs.

On the other hand, we strongly support the desire to incentivise and down-cost a **wide array of high-durability GGR methods,** a goal which could be delivered in the short-term with project-level cost discovery, and which is in direct tension with the nearly universally shared goal of remaining "method agnostic". The market for GGRs today is very unlike the previous markets (e.g. offshore wind, utility-scale solar, etc.) for which the UK Government employed a contract scheme of this nature. Namely, it encompasses a shockingly diverse array of methods with a wide array of costs, uncertainties, and execution risks. A single clearing price for all eligible high-durability GGR methods would succeed in being cost-effective on the basis of *today's* understanding of GGR costs, but would crowd out methods which are expensive today, but which could have the as-yet-undiscovered potential to see wide deployment and lower costs in the future.

It is imperative that this GGR Business Model provide an opportunity for any GGR method that can deliver high-durability, effectively permanent storage to demonstrate viability and test whether it can in fact come down a cost curve. The only way to ensure this outcome is to provide variable reference prices, ideally at the level of large families of GGR methods, for example: DACCS, high-purity flue gas BiCRS, low-purity flue gas BiCRS, enhanced weathering, cementitious building materials, etc. In the very short-term, we therefore concede that bottom-up negotiated cost discovery could, if designed correctly, open up opportunities for the full spectrum of GGR methods that meet the eligibility criteria to participate, at a wide range of initial price points.

One hybrid approach would be to establish a single clearing price for more mature GGR methods to compete, but carve out smaller portions of Government support to go toward specific methods that meet the legitimacy and durability criteria but are more expensive than the common clearing price.

Among the three options we remain partially agnostic, since all three functionally provide the same incentive to GGR providers, and deferential to the key stakeholders involved - CDR providers, project financiers, and civil society representatives - as to which scheme will unlock the widest array of projects and GGR methods.

A **Negative Emissions Payment scheme has merit**, especially if the Government is able to minimise complexity for developers by taking on the responsibility to sell credits back to the market, or to directly retire credits and apply them to the most expensive to abate emissions in the economy. We note that the Government has considered and rejected this final option, and we urge reconsideration. By conducting the balancing of emissions with removals on its national ledger, the UK would be making progress toward net zero in a responsible way and

addressing expensive-to-abate emissions, but doing so without the companies responsible for these emissions themselves being let off the hook and claiming net zero. These companies are therefore still just as incentivised to eliminate emissions or buy high-quality carbon credits as they were before public funds were used. Were they to do so, that reduction in net emissions would roll up into the UK's ledger and allow the Government-administered removal credits to be applied to the next most expensive emissions. By keeping this high-level account of co-mingled emissions, rather than granting the credits to specific industries, mitigation deterrence concerns can be sidestepped.

A **Negative Emissions Guarantee, *if paired with other market development programs***, *some of which we raise in our response to this consultation*, **would have some advantages over other mechanisms.** This would provide price certainty at a relatively low cost, without compromising the incentives for developers to find buyers for their credits. To be effective, the Guarantee (and any mechanism) should be as wide as possible, inclusive of a variety of methods, a variety of storage types, and a variety of project sizes. The focus should be on providing a high, guaranteed price that is accessible to this diversity of project developers, ideally one that does not depend on labour-intensive bilateral negotiations. If the Government proceeds with other market-incentivising instruments, such as MRV, at pace, a Guarantee would result in relatively small outlays of Government funding.

Regardless of the ultimate choice, we strongly advise that the Government tweak final policy design according to the following principles:

1. Retain a strong incentive to sell credits - Either the provider (in the case of a CfD or Guarantee) or the Government (in the case of a NEP) must retain a strong incentive to sell GGR credits for the highest price possible, to maximise the degree to which the costs of removing carbon are borne by polluters, not the public purse.

2. Ensure clarity of title to the GGR credits - In general, under a NEP we support the UK Government taking title to removal credits as they are generated by participating providers. There are reasons to prefer private GGR providers taking charge of marketing and contracting VCM removal credit sales, rather than the Government playing this role as a central administrator. Voluntary buyers respond well to a positive story, an intuitive case for additionality, and the energy and passion of the provider itself. While such bespoke access is not sustainable in the long-run liquid market the Government and GGR industry would both like to see come to fruition, in the 2020s such an approach may be necessary to secure the highest prices from buyers who are paying 10-100x for high-quality carbon removal credits over conventional avoided emission carbon credits. Consider the UNFCCC's "Climate Neutral Now" platform for legacy Clean Development Mechanism carbon credits, which has struggled to clear old inventory and which cannot match the individualised marketing sophistication of the actual individual projects.

3. Rapidly transition to non-project level cost discovery - Establish flat prices for bucketed families of comparable GGR methods based on findings from project-level cost discovery, as well as publicly available research and input on appropriate price levels.

4. Internationally compatible & competitive - The Government's approach also needs to acknowledge and respond to developments in US policy since this consultation was launched. The $180/tonne award for DACCS through the 45Q policy creates the competitive landscape for UK GGR policy, providing eligible projects with a guaranteed, clear, and minimally burdensome incentive. Without a policy that provides an equally accessible support, projects that find the US support sufficient will go to the US; those that don't (i.e., those that are higher cost) will go to the UK to access a costs-based funding mechanism. This will still have value - it may lead to the UK supporting a higher proportion of earlier-stage projects than the US - but it potentially leaves the UK taxpayer in the position of financing objectively less cost-efficient GGRs.

Nobel laureate William Nordhaus has shown that "climate clubs" that agree on a common carbon price across multiple markets can have powerful extraterritorial effects, encouraging suppliers to gear their production toward compliant, lower-carbon practices. While an explicit UK-US climate club is highly unlikely in the near term, the two countries could look toward tacit cooperation via similarly priced incentives for high-durability GGR specifically, and partially aligned MRV/certification pathways, perhaps facilitated through mutual membership in Mission Innovation (which has launched a Carbon Removal Mission). The UK is especially at a competitive disadvantage given the greater challenges to projects in this country from higher energy costs and a lack of pre-existing CO2 transport and storage infrastructure.

5. Geographically flexible - This further highlights the need, discussed in our response to Question 3 on policy design principles, to create a UK GGR business model that is geographically flexible. If one or more of the GGR steps can occur outside of the UK (e.g., biomass grown in the US, combusted and captured in the UK, with CO2 storage flexibly sited in the UK, Iceland, Norway, or the Netherlands depending on availability) and still receive support, this homogenises GGR project siting and eliminates possible policy support competition. In the hypothetical example mentioned (combustion & capture in the UK), the majority of jobs and physical plant investment would still occur within the UK. Additional benefits can be offered to projects that meet certain criteria, such as siting 2-3 of the GGR steps within the UK or siting projects in economically deprived areas, to support levelling-up and growth objectives.

6. Flexibility and transparency on which methods are eligible - The UK can restore a competitive edge by leveraging a nimbler GGR business model than the US's 45Q policy, whose restrictive eligibility requirements limit support to select GGR methods and can only be modified via legislation. The UK Government should rapidly ensure it can support methods beyond BECCS and early DACCS technologies, such as the wide array of non-bioenergy biomass carbon removal pathways, while providing Government-accredited MRV and LCA verification and a clear pathway to a compliance market, which will provide a guaranteed market to sell into at market prices.

The UK Government should be clear-eyed about the problem it is trying to solve. The problem is less a total absence of demand for GGR, especially for the volumes of supply available in the next few years, and more a lack of proper regulation that allows that supply to access

willing buyers. **The Government should focus on adding value to providers by regulating the market and accelerating MRV development and certification, ensuring needed infrastructure is in place, as well as by providing support to bring new methods from the laboratory to deployment, which can take place both within and outside of the confines of the business model.**

6. When might it be feasible to introduce an auction mechanism for GGR contracts, and what criteria should the Government consider when developing its allocation process?

It is highly uncertain when there will be sufficient market density to introduce an auction mechanism. Further research is needed to establish a timeline for the transition to auctions and depends on the criteria for inclusion that the Government is comfortable with.

An auction process has value, but carries several risks: A) if broken into technology pots it risks insufficient competition, while B) if all GGR methods are lumped together in a single auction, it risks excluding earlier-stage (and likely more expensive) but promising methods, which would harm future growth potential in the sector. We would recommend that the process be broken into technology pots, despite the risk of insufficient competition.

Overall, we highly recommend the Government consider an approach that provides a set of appropriately-priced, flat prices within different GGR methods, paid on an ex-post basis once storage is complete, as a low-burden incentive for GGR providers, anchored on the inclusion of a wide range of GGR methods. The Government should aim to have these prices established even in absence of an auction, to avoid the need for bilateral negotiations for every project.

Though they may be the only way for the Government to attain the level of information required, there are multiple challenges facing the use of bilateral negotiations. Such negotiations are time, money, and capacity-intensive for early-stage organisations, like many of those developing GGR methods, and there is a very real risk that innovative providers will not engage with the process, especially given a newly competitive policy landscape in the United States with the passage of the Inflation Reduction Act. Bilateral agreements are additionally subject to the risk of cost-padding and capture by developers, which would erode the value for and trust of taxpayers. They are also potentially opaque and liable to garner mistrust from the public and the press, who may misinterpret the reasons for keeping commercially-sensitive cost data sealed by BEIS for an appropriate number of years.

To avoid these challenges, projects under a certain size should be able to forgo expensive bilateral contract negotiation with the Government and receive a simplified fixed payment, which would likely be lower than it would be following the process.

7. How can the Government most effectively reward innovation and cost reduction in early GGR contracts?

We recommend the Government focuses deeply on ensuring that its support will be available for a portfolio of different methods, ensuring that innovation will be able to

access this funding. As the market grows, mechanisms like a reverse auction will allow for price discovery and competition; they likely need to be held frequently (annually) and offer a variety of contract lengths, potentially with different parameters.

The bilateral negotiation process suggested by the Government is likely to inhibit innovation, as it diverts resources from innovation and market development to this negotiation process. However, it may be a necessary element of the Government's preferred approach, in which case **we encourage the Government to ensure that this negotiation process maximises cost discovery and transparency for the public, including as rapid timelines as possible to unseal confidential costing information, and minimise burden on smaller providers wherever able.**

8. If the Government pursues a Negative Emissions Contract for Difference, what is the most appropriate basis for setting the reference price for initial contracts? Please provide arguments to support your view.

Our understanding is that for any of the three proposed options (CfD, NEP, Guarantee) it will be necessary for the Government to determine, advertise, and commit to a fixed incentive value, approximately equal to the levelised cost of full-chain capture, conversion, transport, and storage in £ / tCO2 terms inclusive of the cost of capital and a reasonable profit margin. This is the strike price for a CfD, the total value of the NEP, and the level of the Guarantee. Notably, locking in a value for the incentive/reference price is not required when that incentive is set at a fixed level for each bucket of GGR methods – e.g., DACCS at ~£200/tCO2, a biomass carbon removal (with geological storage) at £150/tCO2, seawater removal at £300/tCO2 (etc., cost levels are illustrative only and not meant to reflect appropriate levels).

The lack of a clear market-based process for determining a reference price, as exists in the electricity sector, is the reason that a Negative Emission CfD is challenged. The undeveloped voluntary market and lack of widely-embraced, consistent MRV and certification mean that no reliable market-informed reference price is available. The Government should acknowledge that any attempt to fix a price at this stage will be exactly that - fixing a price - and do so directly, potentially through a reverse auction.

Even in a more mature market, there is unlikely ever to be a single, agreed-upon market price, given differences in removals (e.g., differences in the durability and permanence of the storage).

Price vs Cost - Note that in any VCM, and especially in the nascent market for high-durability, high-cost removals, the levelised cost of the removal is independent of the price it commands on the market, sometimes with a substantial gap. Per the policy design principles and the UK's goals in initiating a GGR business model, we are interested in discovering with as much clarity as possible the ***cost*** of conducting GGR, not the aftermarket price it commands after delivery. Establishing a reference price should therefore not be done on the basis of current publicly-disclosed VCM GGR transactions (e.g. Stripe, Carbon Direct,

Shopify) but rather on project-specific, bottom up cost discovery from GGR providers and researchers, then set at appropriate flat rates for each bucket of like GGR methods.

Avoiding administrative burden - Bilateral negotiations for contracting will be an arduous process for many suppliers, as discussed elsewhere in our response. The Government should consider implementing rules such that projects under a certain size can forgo such negotiations and receive a fixed payment upon delivery of removal, established based on other data points.

9. What mechanism could the Government introduce to ensure that project developers achieve the highest possible sales price for negative emissions credits on the market?

For us, these challenges demonstrate the value of:

1) Providing a high, clear, and flat fee, as with the 45Q incentive in the US, such that the incentive to sell at a higher price is not affected and individual contracts are not required.
2) Being open to the Government purchasing whole credits through its support scheme, and crediting them to only the most expensive-to-abate emissions in the market.
3) Creating a world-leading MRV scheme that makes UK removals the most reliable removals available for purchase, increasing the intrinsic value of UK removals.

Other tools could be used to increase the incentive, besides cost-based tools. Note that, like Government payments, VCM sales are likely to be ex-post, i.e., buyers expect to only pay once the GGR has been delivered (storage is complete). One solution would be for the Government to offer accelerated payments equal to the contracted VCM revenue streams that the provider has secured. For example, a provider with a levelised full-chain cost of £180/tCO2 is eligible for a £200/tCO2 flat NEP, and has succeeded in forward contracting the sale of 5 years' worth of carbon credits to private buyers on the VCM (domiciled outside of the UK) at £150/tCO2. In that case, the Government would move its payment forward, to be reclaimed according to the agreement upon delivery of the payment from the buyer.

10. What do you think is the most appropriate option for setting the length of GGR contracts? Please explain your rationale.

The business model will be successful if it unleashes private project finance capital to efficiently finance GGR projects. Contract length must therefore be acceptable to project financiers. Cost of capital is likely to be high, e.g. >10%, and will most likely come to constitute a high percentage of total levelised cost of GGR (currently 20-50% of solar costs are WACC, according to the IEA).

Some other considerations include the predicted timeline before the UK is likely to integrate removals as an approved means of complying with various obligations (e.g. UK-ETS, an economy-side Carbon Takeback Obligation, a carbon border adjustment mechanism, etc.). For reference, the EU is currently signalling a 2030 timeline for such integration. Ideally the

business model would minimise overlap between the start of these compliance regimes and the number of onward years that projects continue to receive direct payments.

Different lengths may be appropriate for different projects and methods, though given the capital intensity of many GGR projects a longer contract length may be needed to incentivise project developers. Frequent auctions, if that mechanism is chosen, would allow for course adjustment. Contract length may also be a tool to ensure that a variety of methods can be supported; for example, if the Government follows a path of engaging in bilateral agreements with developers, a smaller-scale, earlier stage method may warrant a higher price, but in order to preserve technology neutrality, a shorter length contract may be warranted given the expectations of cost declines as production is scaled.

11. Would it be desirable to include a review mechanism in early GGR contracts? If no, please outline your reasons. If yes, please give your views on how a review mechanism might be designed.

A review mechanism introduces complexity and risks increasing project finance investor uncertainty, hindering project development. However, in exceptional and tightly defined circumstances such a mechanism could mutually benefit the Government, the provider, and the climate.

For example, for GGR methods with high ongoing variable OPEX costs (e.g., any method requiring ongoing sourcing of sustainable biomass feedstock, electricity, or other energy or material inputs), if rapid cost increases make project operation nonviable, and such imminent failure can be demonstrated by an independent audit of the contracts involved (project finance, feedstock supply, Government contract, etc.), relief or an increased payment could be negotiated to salvage the project.

12. Should the Government allow project developers to combine negative emissions support under a GGR business model with other support mechanisms for co-products?

The Government should allow project developers to benefit from other support mechanisms for co-products, provided these support mechanisms are in effect for independent co-products. There should be no penalty for stacking.

However, the Government must carefully consider what is actually being supported by each mechanism. For example, though this consultation is intended for methods beyond Power BECCS, that method provides the best example of a risk, whereby a project could attain separate benefits for negative-carbon electricity and for the associated GGR - despite the fact that the support for GGR is, itself, what makes the electricity “negative-carbon”.

Similarly, if the CO2 is stored in concrete as a building material, the developer should be eligible for any support for lower-carbon concrete, or for GGR, but not both in their full independent value unless the two mechanisms are separate (that is, unless concrete’s low carbon status is not as a result of the GGR). Provided it is clear and transparent how much

support the developer receives for the fact that their carbon is low-carbon, and how much support they receive for having removed and stored carbon, and those separate and distinct supports are each fair relative to other low-carbon concrete and GGR methods respectively, it could be permissible for multiple forms of support to be received. Note that the determination of a reference price for a GGR method should already have netted out not only projected proceeds from the sale of co-produced products (e.g. physical products like biochar or long-lived building components), but also incorporated any policy support received. **The GGR payment must always be sized to fill the uncompensated gap between the levelised cost of the GGR, and the total incoming revenue from the activity. Insufficient attention to the accounting would tilt the market towards certain solutions unfairly.**

13. Do you believe that capital support instruments are necessary to complement GGR business models?

We believe that while capital support instruments are valuable, especially for FOAK projects, they should not come at the expense of other kinds of support and the funds can likely be better used as additional support through the core mechanism, except where project finance has become a particular hurdle. **Developing a portfolio of solutions requires that projects of different methods and different opex and capex can all be developed to at least a certain level, but the Government should not compromise its ability to provide revenue certainty by reallocating significant funds to providing capital support. That said, we do recommend that these tools remain within scope of the support that can be provided** following bilateral negotiations - if the Government pursues that approach, which as we have said elsewhere is a challenged mechanism. The Government should ensure that it has consulted a wide variety of stakeholders on this, critically project finance providers, but also GGR developers and those who are employing methods beyond BECCS and DACCS.

A critical failure point for the success of the business model might be if the reference price is set appropriately, GGR providers are comfortable and ready to proceed, but private project finance providers are unwilling to fund, perhaps due to high perceived technology or execution risk, or the perception of political vulnerability of the GGR business model itself. Government must be confident that project financiers are willing to step in, and design contract lengths and other terms for the contracted NEP or CfD accordingly. Some forms of capital support may be relatively inexpensive for the Government to provide, such as slightly concessionary borrowing rates, while others might be slightly more expensive (e.g. partial first-loss guarantees).

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 work, outside of the scope of this consultation, on Transport and Storage infrastructure is absolutely critical. There can be no market without this infrastructure and the appropriate permitting regime. It is critical that this business model flexibly allow for CO2 storage anywhere where such storage can meet the quality and MRV requirements specified. As such, the UK should work to ensure interoperable standards for shipping and pipelines via its

international partnerships, e.g. with North Sea countries like Norway and the Netherlands to incentivise closer cooperation through a "North Sea CO2 T&S Alliance". There will be occasional downtime at one or more of the UK's geological CO2 storage sites – agreements can be architected with non-UK storage sites to take excess capacity in such cases.

All of this international cooperation will require clarity on corresponding adjustments. For example, a GGR project involving wood grown in Finland, converted into energy & CO2 in the UK (and therefore potentially eligible for the GGR Business Model), with CO2 stored in either Norway or the UK, in order to receive UK government funding, would need to show contracts and agreements clearly documenting how the climate benefit produced is shared among the participating countries without exceeding the total climate benefit generated (no multiple-claiming). The UNFCCC negotiations on Article 6 are ongoing and are unlikely to be concluded before this business model is operating – **the UK therefore has a leadership opportunity to pilot clear and effective multilateral models of carbon accounting that give confidence to voluntary buyers who will be making compensation claims on the promise that the correct corresponding adjustments are being made.**

The Government should continue and heighten its commitment to support GGR R&D at the earliest stages, solidifying the UK as a world leader in researching, piloting, and commercialising new and high-potential GGR methods.

Simultaneously, the Government should, either directly or indirectly through bodies like CO2RE, not overlook research on the social implications of deploying GGR. GGR will become a major global industry, with implications for communities in the UK and worldwide, and it will be crucial to begin the work of building social licence now, taking into consideration the valid concerns likely to arise among public stakeholders. This will reduce barriers to deployment later on, while important social issues are resolved.

The Government should retain a focus on cost discovery, rather than price discovery, and should ensure that if any cost information disclosed by GGR projects and developers in the process of securing Government support must be kept confidential, that that information has a clear schedule for ultimate release to the public both to instil trust and to provide a public and global benefit.

The public should have complete transparency of which methods are eligible for support under this business model, and how decisions are made as to which new methodologies are onboarded. The list of eligible GGR methods should be based on a clear set of criteria, and chosen based on a method's ability to deliver a common outcome: highly-durable, long-term storage (given that lower durability methods are separately supported through policies such as the Woodland Guarantee, Peat Lands Action Plan, and others). The Government should retain a focus on high-durability storage, not specifically "engineered/technological GGR"; while there is significant overlap among these terms, high-durability non-engineered approaches such as various BiCRS methods, which might not take the form of a "technology" but which produce comparably durable storage (e.g., pyrolyzed biomass burial), should be within scope, as well as others. Focusing on the common outcome –

high-durability storage of carbon – is the cleanest way of defining which methods are in and out of scope.

Looking forward, the UK has a strong lead and advantage in developing GGR because of its science and research infrastructure, its access to CO2 storage sites, and, so far, a Government that has been an early-mover in the space, especially compared to other countries in Europe. Long-term, however, GGR will be a global industry producing a geography-independent benefit, as it does not matter from a climate perspective where the removal takes place.The UK has more to gain by positioning itself as an innovator and source of licensing for GGR technologies and **should focus on supporting early-stage development of GGR techniques in the UK, rather than UK-based deployment.**

It is our view that with the exception of the sole existing large scale bioenergy plant in the UK, the GGR conversion of which is being considered separately in the distinct Power BECCS GGR business model consultation and is not the focus of this consultation, all substantial deployment of GGR in the UK will, and should, be non-Power BECCS. Note further that we do not necessarily endorse this proposed conversion, and are considering that question separately in the Power BECCS consultation. The UK has long-since denuded its natural landscapes of former levels of biomass, and as a result is the world's 2nd largest timber importer. There is insufficient working forest capacity to supply even a meaningful percentage of the existing bioenergy plant's demand, let alone supply additional plants.

Instead, the UK should look to establish leadership in GGR using methods that employ biomass waste streams (not necessarily for energy production, but instead with the primary purpose of carbon storage), DACCS, mineralisation, seawater capture, biomass burial, and other high-durability GGR methods. We believe it is disingenuous to advertise the UK's current or planned "leadership in BECCS", when it is far more likely, and more advisable, to pursue leadership in numerous other GGR and GGR-adjacent capabilities: non-energy BiCRS, DACCS, financing of global GGR, export of high-quality MRV methodologies, etc.

Finally, the UK government has an opportunity to innovate new ways of policymaking that take seriously the need to engage all affected communities and stakeholders from the start, with particular attention paid to regions and groups with persistently limited livelihoods, including those suffering from fuel poverty. At every stage of GGR growth, the government should explore ways to promote and scale GGR's potential for positive social impact and co-benefits. For example, the government could consider ways of requiring GGR projects that receive Government support to draw from local communities or unionised labour for their workforce.

As the industry grows, efforts should be made to transparently and systemically embed practices that optimise for distributive and procedural justice, ensuring that the benefits of GGR are fairly distributed and that affected communities have access to decision-making power and processes. The government might require developers or investors to integrate community benefit plans into their bids, and for these to be disclosed publicly to help build social acceptability and awareness for GGR. In line with the government's agenda to 'level up'

and in recognition that all approaches should contribute to a just transition overall, the government should consider adding a social impact dimension to MRV criteria.

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.

We believe the primary goals of the business model to be: 1) deploying multiple at-scale high durability GGR projects, partially or fully-sited in the UK, 2) bringing down costs for a wide array of GGR methods (a global benefit, but brought about through UK leadership), 3) ensuring that removals accelerate and complement rather than undermine absolute emission reductions, and 4) regulating net zero claims to ensure they are made on the basis of compensation with high-quality removal. **These goals are in our view collectively more pressing and important than the goal of establishing a market for GGR credits.** For example, a NEP in which the Government retains title to the removal credits that it has effectively purchased from a provider, then retires those credits to compensate for the nation's most difficult and expensive to abate emissions, could satisfy those four goals without directly involving a market framework. We do however recognise the utility of a market-based mechanism, even if we are not convinced that creating one should be an explicit goal of the Government over guaranteeing urgent climate outcomes.

In the short-term, sale of credits on the voluntary market will provide supplementary support beyond the GGR business model itself. All voluntary sales will roll up to the NDCs of the corresponding countries, so it will be critical to include flexibility in the business model for a multi-country GGR project (e.g. biomass from finland, combusted in UK, stored in Norway & the UK, GGR credit sold by UK Government to an Irish buyer). The participating private actors and governments will need to contractually stipulate how the climate benefit will be shared among them, and commit themselves to make any necessary corresponding adjustments.

We are supportive of a medium-term GGR Obligation mechanism that places an obligation on the basis of extracted or imported fossil carbon, placing the obligation as upstream in the fossil fuel supply chain as possible. In this way, the additional cost of complying with the obligation is passed down to the market as efficiently as possible. At low levels of obligation (single-digit percentages of the total carbon content of the fuel), the additional cost of each tCO2-equivalent unit of oil or gas brought on by the need to purchase removals is de minimis as a percentage of the total price of the commodity. If the obligation is to be placed on a specific set of emitters (rather than fuel suppliers as proposed), we would welcome opportunities to conduct analysis to ensure that obliging specific sectors as compared to obliging suppliers results in a more progressive, rather than regressive, effect on UK citizens. For example, domestic heating fuel caps, energy efficiency financing, and fuel support could be used to commensurately reduce the economic impact of increased fossil fuel costs for economically vulnerable groups.

By placing the obligation on all sources of fossil carbon coming into the market, such a policy would effectively become a Low Carbon Fuel Standard (successful examples in California & Switzerland) that also functions as a Carbon Border Adjustment Mechanism (which the EU will launch in 2028), creating a market within which all fuel supplied must meet the obligation.

UK-ETS prices are likely to remain fairly volatile, at least by the standards of would-be project financiers, for some time. This is therefore a suboptimal instrument to rely on for primary support of GGR projects, which need stable revenues. However, as a means of providing supplemental support to GGR, and to provide an economically and environmentally logical way for regulated emitters to compensate for very expensive-to-abate emissions as the cap declines and net zero date approaches, we support the eventual greenlighting of high-durability, proven GGR methods as approved means of generating some portion of emission allowances. However, we believe it would be advisable to cap the total percentage of UK-ETS-governed emissions that can be compensated for with high-durability removals to ensure that there is an ongoing incentive for absolute elimination of expensive-to-abate emissions.

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

We strongly advise the Government to eliminate its requirement that all GGR credits "generated in the UK" be precluded from applying to other country's NDCs. First, there is no clear definition of what "in the UK" means for a given removal method (an issue we are engaging separately on through the Energy Security Bill HL 39 and ensuing discussions on the re-definition of what constitutes a "UK Removal"). As discussed above, removal entails at least three steps (extraction, conversion, transport & storage), of which one or two might reasonably occur outside of the UK, with the remaining activity considered in the UK. Precluding participating actors and countries from potentially dividing the removal benefit among multiple actors (such that total benefit adds up to "1") will eliminate many possible GGR projects from being built. Given likely diverse sources of biomass supply (very limited domestic supply) and storage (North Sea cooperation around an interoperable, open-source storage network will bring cost benefits), the Government should leave open the possibility of bilateral and multilateral projects, perhaps receiving support from multiple governmental organisations (e.g. Stockholm Exergi). This could lead to a more efficient use of UK public funds spread across more projects and GGR methods.

The best way to stimulate corporate demand for negative emission credits is to change the economic logic (through an obligation, incorporation into a CBAM, ETS, or other compliance mechanism) so that their support is no longer wholly voluntary. Before removals are incorporated into compliance mechanisms however, the Government can stimulate voluntary support by:

1) Strengthening the 2023 Net Zero Law by making it mandatory for corporates to disclose which carbon credits they are purchasing, and which compensation claims

they are intending to make on that basis. This will accelerate the transition toward purchase of higher-durability removal credits to compensate for fossil fuel emissions

2) Increase capacity of the advertising regulator (ASA) and rules setter (CAP) to tightly define voluntary corporate-level ("net zero") and product-level (e.g., "net zero petrol", "climate neutral flight", etc.) claims, and clear pathways for complaints to be lodged and acted upon.
3) Accelerate development of a UK Government framework for MRV & certification of high-quality GGR credits to provide confidence to voluntary buyers, and signal the rapid approach of a fully-regulated market in which all transacted credits must adhere to the UK certification framework (eliminating accusations of a "wild west" once and for all).

17. To maximise voluntary private investment in negative emissions credits, would it be preferable for the Government to (i) establish a regulated market for engineered GGRs or (ii) directly endorse voluntary carbon market bodies that meet high integrity and verification standards? Please outline your view of the main benefits and challenges of each approach.

We imagine the end state being a regulated market for engineered GGRs that nevertheless uses methodologies that originated among VCM bodies. **We strongly support option (i), since the Government has a direct obligation to protect its citizens from fraudulent and misleading claims, ensure that transacted carbon credits meet high standards like any other commodity, and provide the usual protections to reduce irresponsible speculation and risks that could damage the market.** Voluntary purchasers will prefer UK Government-certified credits over those certified by voluntary bodies, some of whom are perceived as being conflicted. These VCM bodies still play a supremely important role in developing principles, certification pathways, methodologies, and guidance on claims which can be reviewed, modified as needed, and adopted by the Government. It's possible for the Government to establish the guardrails of a regulated market, while allowing individual licensed private participants to operate the machinery of that market (accreditors, certifiers, transaction platforms, financiers, etc.). Option (ii) carries the risk of the Government being perceived to favour specific initiatives or companies, and it is highly unlikely that any such scheme can be endorsed wholesale without making some compromises to the UK's GGR "legitimacy" pillars or GGR Business Model policy design principles. Instead, the Government can obtain the best of both worlds by being the active, presiding governor of a regulated market that builds on the infrastructure and existing methodologies (subject to review) of the VCM.

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

Yes - the government should prioritise the establishment of a regulated market for "engineered" GGRs. **A regulated market would allow for a GGR obligation scheme, which is**

our preference for the primary policy support mechanism for GGRs over the medium to long-term, with integration with the UK ETS playing a supporting role (see previous response explaining this position).

As discussed in our responses to the following questions, the most important element of delivering an effective regulated market for GGRs would be government support for establishing clear rules for MRV and a certification scheme, and for the development of new MRV methods where none currently exist. The Government should develop in-house expertise in this area, as it will be necessary to review and revise frameworks and methodologies from standards in the VCM, as well as develop new methodologies, all of which require subject-matter and carbon market expertise. It is critical that standards are set independently of existing market participants to ensure integrity and avoid the perception of market capture. Critically, the development of a UK GGR MRV & certification framework should be conducted with as close coordination with parallel efforts (EU, US, Sweden, etc.) as possible. The UK has a clear opportunity to lead and be a first-mover, given that the US will rely more heavily on voluntary guidelines and the EU CRC-M will take several years to build and deploy.

19. Do you agree with the Government's immediate priority for monitoring, reporting and verification (MRV), including a review of standards that could underpin business model support for initial GGR projects?

We applaud the Government's immediate focus on and identification of the importance of MRV, but do not agree entirely with the proposed approach as described. We differentiate among principles (high-level quality principles or guidelines), standards (programs that allow for the certification of GGRs according to pre-approved methodologies), and methodologies (highly specific documents defining an end-to-end GGR method and laying out how an accredited certifier can assess a given GGR project to determine if it merits certification). We do not believe that the UK Government should onboard existing "standards" (e.g. VERRA) wholesale. Although many of the participants in such standards and initiatives are unparalleled experts in their field and earnest supporters of climate action, the governance of these groups is often vulnerable to conflicts of interest, real or perceived.

Rather than allowing, or at least appearing to allow, "students to mark their own homework", it is critical that the UK Government establish its own framework principles and its own standard (a certification scheme for credits that would be labelled "UK GGR"), based on expert scientific input, to build confidence and trust in ultra-high quality GGRs. However, this scheme should allow non-proprietary, third-party methodologies (which are often housed under other standards) to apply for approval under the UK scheme. In other words, many of the individual methodologies created by groups like Puro, C-Capsule, CCS+, and potentially even some legacy methodologies from the CDM may be robust and meet the as-yet-undisclosed quality principles that the UK Government must establish as guardrails for its standard.

Off-the-shelf methodologies that wish to participate in the UK scheme can be submitted for consideration (by the methodology creator, the corresponding standard body, or a GGR

developer), subjected to expert, transparent, and unconflicted review, modified if necessary to align with UK rules, and onboarded as approved methodologies under the UK GGR Standard. **The establishment of Government-approved MRV and LCA guidelines for credits, and of an official "UK GGR" standard, is among the single most valuable actions the Government could take and would immediately put the UK into a league of its own in its ability to attract attention from innovators and developers.** The MRV Task and Finish group accurately identified challenges to the development of MRV for some methods, and the Government should take an active role in addressing those challenges.

Finally, **a critical role of the Government will be to maintain and update a list of outstanding scientific questions and uncertainties, the answers to which will most improve the ability to measure the certainty that a climate benefit has been delivered.** Either directly through its agencies, in partnership with Government-funded research consortia (e.g., CO2RE), and with counsel from GGR developers and other stakeholders, Government can assist in creating standardised MRV and LCA assessments for different CDR methods, and commit targeted funding to address outstanding research gaps needed for high-certainty removals.

20. Beyond ensuring the legitimacy of initial projects, what is the appropriate role for the Government in developing a robust and enduring framework for negative emissions MRV, compared to the role of other bodies such as those outlined in Figure 1?

Our response to this question is partially captured above in Q19. As useful as some of the entities defined in Figure 1 have been and may continue to be in developing actual ground-level methodologies for assessing GGR projects, they are all ill-suited for the ultimate purpose of establishing UK Government approved and endorsed GGR credits, which will eventually be used in obligation and compliance schemes. Government's role is to ensure that public funds are spent efficiently (including through this business model), that a real public good is generated, and that claims made to the public (e.g., "net zero flight") are not misleading, fraudulent, or serving to undermine future climate action – none of these functions can be delegated to initiatives that are predominantly governed by private sector actors with a real or more likely perceived interest in setting beneficial rules.

IPCC Guidelines will not be ready in time for deployment of this business model, and in any case will focus more on corresponding adjustments for multinational GGR projects than on individual methodology development. The Oxford Principles describe the carbon credit transition necessary to enable a net zero claim, but were not intended to provide specific guidance on GGR methodology development. CORSIA is widely acknowledged to be a largely non-accretive, low-ambition agglomeration of existing carbon credit standards, mostly focused on avoided emission carbon credits, and at high risk of eventual public backlash at perceived industrial capture (note that we endorse the principle of "self-administration", for example with industry-guided spending choices for decarbonisation, but are uncertain as to why "self-regulation" has any remaining earnest adherents). The remaining schemes sited in Figure 1 carry varying degrees of perceived legitimacy, levels of interest or activity on high-durability removals, differing approaches to the question of keeping methodologies proprietary or open-source, and different governance setups (some involving private sector actors with substantial vested interests in the high-emission industries or the VCM). Their

experience, and indeed many of the methodologies contained within their standards, may well be of great use to the UK Government in developing its own, robust certification scheme.

There is a critical need to cooperate with other international efforts on GGR MRV & certification to the extent possible, including the EU's forthcoming CRC-M proposal, Sweden's bio-CCS reverse auction standards, Switzerland's BAFU fuel compensation scheme, US DoE efforts to establish CDR MRV guidance, and other such national and international government-led initiatives. Terrestrial and offshore CO2 storage will of course follow the UK Regulatory Regime for CCUS, but should to the extent possible also align with the EU CCS Directive to further increase interoperability and open source storage, particularly in the North Sea where cooperation will yield more efficient T&S buildout and lower costs.

21. Do you agree with our proposed principles for negative emissions legitimacy?

We welcome the recognised importance of defining "GGR legitimacy principles". Note that we advise more specifically defining these principles as pertaining to the "certainty of climate benefit" delivered, as "legitimacy" could reasonably encompass questions of public acceptance, legitimate compensation claims (potentially policed by the advertising regulator), and incorporation of principles of justice and equity. Specific comments on the proposed principles follow:

- **CO2 source** – For the avoidance of doubt we recommend adding "or upper ocean" after the word "atmosphere" to encompass ocean-based CDR extraction pathways.

- **Net negativity** – This principle is self-evident and may be potentially misleading, we recommend renaming it "Defined climate benefit". Gross positive emissions will of course be ineligible for participation, as they will fail certification against any of the approved methodologies. GGRs must be calculated according to strict LCA principles: A) total negative flux of carbon out of the atmosphere or ocean that arrives at the storage site, less B) total gross positive emissions incurred along the full chain of extraction, conversion, transport, and storage including reasonably attributable "scope 3" supply-chain emissions. Any project which can perform the above calculation and end with a positive number (representing a lifecycle-adjusted negative emission) is a GGR, and should be certified as such.

  It is potentially misleading to compare supply chain emissions (which are only a part of total gross positive emissions associated with the removal) against total amount of stored carbon (an amount which is potentially not representative of the amount of carbon removed, as in cases where some of the stored material came from other non-atmospheric sources).

  This principle must also include discussion of indirect carbon leakage. For any GGR methodology, but especially for any that involve biogenic carbon or any substantial land footprint (either inside or outside the UK), a robust framework to measure and account for indirect carbon leakage must be implemented, including consideration of

the Carbon Opportunity Cost[1] of land use decisions. The core insight that must be embedded into indirect carbon leakage measurement frameworks is that the displacement of emissions from land use change (either in or outside of the UK) is not one-for-one, rather the displacement may occur to a location where the carbon efficiency is higher or lower. Consider non-power biomass carbon removal utilising biomass sourced from land that has been converted from rapeseed production to a working forest. The emissions increase (or decrease) due to re-siting that same rapeseed production in a less (or more) efficient location must be included in the LCA.

- **Permanence** – We advise defining this parameter as "highly durable, contractually permanent" storage. Durability refers to reversal risk of stored CO2, the reciprocal of which is the approximate residence time. It may be necessary to define a threshold reversal risk (and/or corresponding residence time) above (below) which the removal is not eligible under this business model.

- **Usage** – We suggest separating this principle from permanence. It is a discrete (and extremely important) point.

We suggest adding several additional principles to ensure "legitimacy".

- **No adverse harm** – GGR methods must demonstrate that they have minimised adverse impacts on landscapes, ecosystems, and human society.

- **Equitable & just** – The manner in which GGR methods are conducted, deployed, and measured should consider the unique impacts on and concerns of communities local to the site of deployment, disempowered groups, and non-human life. GGR methodology development should be consultative of such groups. Economic benefits of GGR should be broadly distributed. Global North-Global South dynamics, and historical responsibility of the UK, should be considered in the design parameters not just of this policy but also in the deployment of GGR projects.

22. Are there specific policy requirements for initial DACCS projects that the Government should take into consideration? Please provide arguments to support your view.

The Government should be careful not to compromise technology-neutrality by providing outsized support for one GGR method over another. Many other GGR methods are at a similar or earlier stage of development to DACCS, and instead of adjusting support for DACCS specifically, policy should follow a general principle of making adjustments to support all GGR methods and their unique barriers while they are still at an early stage.

DACCS does face the specific challenges outlined here. Here, general principles apply: support should be accessible even for very small projects, with minimal administrative

[1] http://www.nature.com/articles/s41586-018-0757-z

burden and money should be provided as early as possible (here competing with the implementation of Direct Pay practices under the US 45-Q amendments made in the Inflation Reduction Act). As well, the Government should define DACCS generally and take care not to exclude any methods because of the details of their technology, which continues to rapidly innovate and evolve. For example, the modelling by Element Energy only considers hybrid liquid and hybrid solid DACCS plants, while there are a variety of other technologies that could be referred to as DACCS that use other approaches, such as the lime cycle, carbonate rock weathering, or electro-swing, among others.

23. Do you have views on the applicability of the GGR business model to BECCS projects that are not eligible for the Industrial Carbon Capture or Power BECCS business models?

We are confused and alarmed by the separate implementation of a bespoke business model programme for Power BECCS. This contradicts the Government's stated intention to pursue a technology neutral policy, especially as the criteria create an extremely small pool of project bidders.

If in fact a distinct Power BECCS business model is ultimately deployed, then this GGR Business Model should of course not apply to Power BECCS.

We strongly advise redefining this bucket of GGR methods away from "BECCS" and toward a more inclusive and accurate term that reflects the many non-energy-generating biogenic carbon capture and storage options whose status and inclusion might be confused by the "bioenergy" label within the BECCS acronym.

In fact, we strongly support focusing on waste biomass streams, such as biogas digesters, wastewater treatment, byproducts of fermentation, the biogenic component of waste incineration, and all other such streams. It has been suggested that in many cases, biomass has higher carbon value than energy value.[2] The decision of whether to use biomass to generate energy, thereby likely necessitating separation and capture from a sub 10% [CO2] flue gas and possibly incurring public resistance, should be taken carefully and in light of competing energy generation options and their levelised cost of energy. Government should explicitly compare carbon value to energy value, and should prioritise and favour waste biomass streams, in determining which GGR methods to support under this Business Model.

This GGR Business Model should apply only to BECCS and non-energy biogenic GGR projects that are not eligible for other business model support. It is critical that support be provided to a portfolio of different GGR methods, and that cannot be achieved if bespoke rules for a certain method lead to preferential selection as part of the program.

The key determinant for the viability of BECCS is the rules surrounding the source of the biomass. We look forward to the upcoming Biomass Strategy, and hope that it honestly accounts for the tradeoffs involved in determining the best use of biomass in the UK; the

[2] Discussed here https://www.icef-forum.org/roadmap/

honestly of this accounting and the rules around what qualities as sustainable biomass for BECCS will determine whether BECCS is scalable in the UK. This work must inform any BECCS projects developed in the UK.

Our most urgent and strong recommendation on this topic is that, before proceeding with any government support for bioenergy conversion to GGR or direct support of projects that involve live biomass harvesting, the UK Government review the results of the upcoming BIomass Strategy, with an independent re-evaluation of both the sustainability of the biomass (sustainable yield, avoidance of impact on ecosystems, etc.) and the precise climate impacts and carbon accounting (lifecycle emissions of harvest, transport, processing, drying etc.; as well as climate impacts of any non-CO2 emissions including aerosols and particulates from combustion, foregone forest growth in light of harvests, etc.).

Long-term public support for and acceptance of a wide array of GGR methods, without which the UK cannot meet long-term climate goals, will be irreparably undermined if the first and most visible GGR projects are in danger of compromising (or generating the perception of compromise of) wider principles of environmental stewardship, sustainability, and justice. Many GGR methods do not necessitate harvesting biomass, which carries with it complex carbon accounting challenges, the need to consider counterfactual scenarios and the Carbon Opportunity Cost, and potentially make explicit land use tradeoffs (at home or abroad) related to livelihoods, conservation, biodiversity, food production, or cultural values and aesthetics. If other, non-controversial GGR methods that do not necessitate such tradeoffs become associated with those GGR methods that do, the long-term damage to the pace of development of effective climate solutions would be dangerously high.

24. Do you have views on the applicability of the GGR business model to novel technologies excluding DACCS and BECCS? Please outline any specific policy requirements or other considerations we should take into account.

The division of GGR methods into DACCS, BECCS, and Novel Methods does not have an immediately identifiable basis, nor does it reflect the Government's stated commitment to technology-neutrality.

The Government should take care to ensure that the business model includes a wide range of GGR methods, including both 'novel methods' besides DACCS and BECCS, such as Biomass Carbon Removal and Storage and various forms of seawater carbon removal or ocean-based removals, and also novel methods *within* DACCS and BECCS that continue to emerge. We acknowledge the Government's note that other methods, such as biochar and enhanced weathering, need an improved empirical base to better understand their benefits and risks, but strongly recommend that the Government support the creation of this improved empirical base and explicitly aim to include such methods at a later stage.

By explicitly ensuring that a wide range of methods will be eligible for inclusion, and by ensuring that the policy design supports methods at various levels of development,

technological readiness, and cost, the Government can help spur additional early stage investment and R&D prior to deployment. As discussed above, it will be necessary to establish clear principles governing which GGR methods are permitted, which will ultimately be based on which specific methodologies the UK Government accepts into the programme.

We strongly advise that the primary inclusion criteria for this Business Model be the character of the stored carbon, namely that it be highly durable with a vanishingly low reversal risk and long-term expected residence time. This definition would include many methods, some known today and some as-yet to be developed, that store carbon in above ground mineral forms, in long-lived building materials, ocean sediments, geological reservoirs, disused gas and oil wells, and many other locations. This policy should abide by the principle of "technology-neutrality" by providing a common incentive for a common outcome: safe and long-term storage of (originally atmospheric) CO2.

By ensuring that a high level of support is available with as little overhead as possible to all projects that can demonstrate successful removal and storage, the Government can provide the largest possible value and incentive for development in the UK.