REA Response to BEIS Green Gas Removal (GGRs) Technology Call for Evidence

1. ***Do you give permission for your evidence to be shared with third party contractors for the purpose of analysis?***

   Yes

2. ***Do you agree that some GGRs will be required to achieve the UK's net-zero target by 2050? What are your views on the suitability and mix of different technologies in supporting the delivery of net-zero?***

   The REA agree that a wide range of both engineering-based and nature-based GGRs will be required to meet the UK's net-zero targets. Energy scenarios set out by the Climate Change Committee, National Grid ESO Future Energy Scenarios and the REA's Bioenergy Strategy (2019) all demonstrate the need for negative emissions for delivering the UK's net-zero emissions target.

   Bioenergy with carbon capture and storage (BECCS) is seen as of critical strategic importance within the CCC sixth carbon budget, identifying the need for it to provide approximately 53 $MtCO_2$ by 2050 across a mix of biomass power, waste-to-energy, industrial heat, biohydrogen, biojet and other biofuel & biomethane facilities. It, therefore, must be recognised that the delivery of BECCS is dependent on the continued growth and development of existing energy sectors. As BEIS will be aware, the biomass power sector is already pioneering demonstration projects in BECCS and will be ready to deploy at scale within the late 2020s. Anaerobic digestion and bioethanol plants are also already capturing carbon dioxide for use in the food and drinks industry, replacing imports. Further bioenergy industries are also considering how the retrofitting of CCS on existing infrastructure may be achieved, following the CCC's sixth carbon budget which suggest this will be needed within the 2030s. As such, policy design for the delivery of BECCS, and other GGRs, must consider existing industries as their starting point, with the continued growth and transition of these sectors being crucial to the delivery of GGR at the scales required.

   Similarly, we strongly support carbon sequestration through environmental land management methods including agriculture, forestry, agroforestry, energy crops and peatland restoration. The CCC identify an estimated 39 $MtCO_2$ of greenhouse gas savings that could come from these measures alone. As such, the delivery of nature-based solutions should be considered of equal importance alongside engineering-based solutions and will likely require separate policy approaches to see them delivered. Also, we stress the link between land use and bioenergy carbon capture and storage that must also be considered, with policies that promote GGR through bioenergy and environmental land management having co-benefits to the broader bioeconomy, supporting the delivery of each sector.

   REA members are currently involved in the following GGR technologies and are therefore the focus of our response.

- Bioenergy Carbon Capture and Storage (BECCS) – including on non-biomass power applications such as anaerobic digestion.
- Biochar
- Afforestation
- Habitat Restoration
- Soil Carbon Sequestration

The REA are also members of the Coalition for Negative Emissions and are supportive of other GGR technologies, as identified within their submission to this call for evidence, where powered by renewable energy sources.

3. ***Concerning the GGRs listed in Figure 1 (except afforestation, habitat restoration and wood in construction), is there new evidence that you can submit in relation to any of the following:***

(i) technology readiness levels
(ii) scale-up potential (in the UK and/or globally)
(iii) costs per tonne of CO2 removed, including any additional information about cost savings per tonne for removals "in bulk" (where possible, please provide evidence for cost breakdowns across the various elements e.g. capture costs, transport and storage costs)
(iv) constraints to deployment
(v) ability to verify removals, taking into account considerations of permanence of removal (i.e. how accurately can you measure the amount of CO2 removed and stored by this method)
(vi) lifecycle emissions for these methods in the UK (please specify any assumptions as part of this calculation, for example the carbon intensity of the electricity being used. If you are assuming a lower carbon intensity than the modern grid, why?)
(vii) wider environmental impacts and risks.

Given the breadth of technologies represented by the REA, it is difficult for us to provide a detailed answer to this question and leave it to individual technology developers to provide estimated costs. However, in general, we highlight that the main costs of engineer based GGRs include:

1. Feedstock conversion into an energy/CO_2 mixture (E.g. Biomass being converted to electricity)
2. The capture of CO_2 - the cost of this can vary significantly depending on the technology. For example, relatively low for bioethanol/ AD.
3. Compression/liquefaction of CO_2 – the cost of which is the same for all technologies.
4. Transport of CO_2 – the cost of which depends on the method of transportation, being injected into a grid vs being tinkered, plus dependent on location and distances involved.
5. Sequestration of CO_2 – cost again depending on method and location.

Any future framework must consider these costs and how any support mechanism helps cover them. Cost 1, is likely covered by an existing support mechanism such as the CfD, RHI or RTFO. However, consideration does need to be given to the development and retrofitting of CCS technology on existing infrastructure, given support mechanisms all focus on delivering brand new projects. Cost 2, is where GGR support needs to focus to provide a revenue stream for negative emission production. Cost 3-4 are associated costs around transport and storage that are relevant to GGRs and therefore should also be considered within the design of any support mechanism.

We would also like to direct BEIS's attention to the REA Report *"Going Negative: Policy Proposals for UK Bioenergy with Carbon Capture and Storage"*. Produced in 2019, this report examines how UK carbon price could be used to support BECCS, in conjunction with existing policies like the CfD. The report can be read here: https://www.r-e-a.net/resources/going-negative-policy-proposals-for-uk-bioenergy-with-carbon-capture-and-storage-beccs/

4. ***Is there any evidence you would like to submit in relation to other nascent GGR methods not outlined in Figure 1? If so, please provide a clear description of the method and the evidence available in respect to the categories listed above, including deployment potential in the UK. If evidence is not available, please outline why and when it might become available. Please ensure that you cite the appropriate sources and publications in relation to evidence submitted, if relevant, as BEIS will seek commercial and engineering support in considering stakeholder responses***

In addition to the GGR methods highlighted in Figure 1 we also highlight the possibilities for GGR using:

Perennial Energy Crops

Perennial Energy Crops such as miscanthus or short Rotation Coppice (SRC) e.g. willow have significant potential to sequester carbon in root systems. This has a net zero cost being a biproduct of the biomass crop. Domestic biomass supply chains using these crops are already responding and increasing in scale due to market pull of an active and growing bioenergy sector. Studies demonstrate that miscanthus can remove up to 2.58 tonnes of CO2e or 0.7 tonnes of carbon from the atmosphere annually, dependent on soil type and crop vigour (See Carbon Study submitted by miscanthus company, Terravesta, for further information).

Biobased, biodegrable plastics and Biobased Carbon Fibres

GHG removals are also possible through agricultural feedstocks converted into long-lived bio-based products, many of which are substitutes for durable goods of petrochemical origin, such as biobased and biodegradable plastics or bio-based carbon fibre insulation or decorative products.

Bioplastics in product forms such as lightweight carrier bags and liners for kitchen caddies and food waste bins, which are designed to be compostable in their end-of-life phase, help to maximise and support the efficient separate collection of biodegradable waste arisings from household and other municipal sources, particularly food waste. This represents a

valuable contribution to the biological cycling of biodegradable materials, as the industrially produced composts and digestates – made from society's food, garden, and other plant wastes - return valuable nutrients, organic matter (including carbon) and beneficial microbes to soils (agricultural soils are the main market in which composts and digestates are used).

Anaerobic Digestion and Bioethanol Plants

There is potential for investment in AD and bioethanol plants that are optimised for net GHG removal and the possibility of Small Scale BECCS/BECCUS. AD and bioethanol plants are already capturing carbon dioxide for use in the food industry. All AD plants have a stream of CO_2 that is easy to capture and compress/liquefy. This represents some low hanging fruit for GGR. In addition, there are a variety of technologies for processing digestates in ways that reduce ammonia emissions; government should support their deployment and any necessary updates to waste management regulations and the Quality Protocol for Anaerobic Digestates.

Sequential or Double Cropping

The government should also consider the merit and potential role of sequential or double cropping in the UK. There may be some parts of the UK where this approach, or one adapted to our climate, can be adopted. This approach has been developed mostly in Southern Europe, pioneered by the Consorzio Italiano Biogas (CIB) to integrate anaerobic digestion with agro-ecology. It is a highly sustainable model that has proven to deliver a significant reduction in GHG emissions from agriculture and carbon sequestration, as well as to restore soil health and organic matter. CIB has called it Biogasdoneright® model (BDR), which describes a set of practices that link biogas production to sustainable agriculture and is being implemented on a large scale in Italy.

Under BDR, food production is not adversely affected by double crops as these are typically grown in seasons when most food cropland is fallow. Therefore, food and feed production are not displaced when producers adopt sequential cropping. The 'energy crops' represent 'additional carbon' – that is carbon removed from the atmosphere by the BDR cropping system above and beyond the carbon fixed by current agricultural practices.

The EBA's position on sequential cropping and the associated benefits can be found here. Evidence collected from the biogas sector shows that proper biogas production based on sequential cropping is a sustainable activity. On top of that, it is a powerful solution leading to decreased greenhouse gas (GHG) emissions, protection of biodiversity and restoration of soil quality through agroecological innovation and organic fertilization.'

Further information can be found here.

More research needs to be carried out in the UK to understand whether double cropping is possible and could be adopted in the UK given the different climate.

Industrial composting with one or more enclosed phases

The UK has approximately 45 facilities of this kind which are approved for treating 'animal by-products', some categories of which are catering (food) wastes from domestic and C&I

sources. The gaseous emissions from the wastes while being composted are captured and treated using a variety of simple through to more complex treatment systems for gaseous emissions. This industry (and the AD industry) is adjusting to implement Best Available Techniques so the suitability of DACCS technologies should be considered for abatement of their gaseous emissions.

Application of compost to land

Compost when applied to land has the potential to sequester carbon in soil. Studies[1] have shown that over a period of 4-12 years, between 11-45% of the organic carbon applied to soils as compost remained as soil organic carbon. Every tonne of soil organic carbon holds the equivalent of 3.67 tonnes of atmospheric CO_2. One tonne of green waste derived compost applied to soil over one-hectare results in a net CO_2 equivalent saving of 143kg per hectare per year due to the increase in soil organic matter alone.

5. What do you consider to be the main barriers to the development and deployment of GGRs?

Primary barriers to deployment are currently commercial and lack of dedicated policy support for the foundational industries from where GGRs are going to be delivered.

The development of a market price for negative emissions is seen as critical for building the commercial case for GGR technologies. Carbon pricing in its current form does not reward negative emission and will need to be reformed if there is to be a tradeable carbon market in which GGRs can participate and realise meaningful revenue streams.

As identified in question 2, in many cases GGR's are a potential additional commercial activity for existing sectors. In such cases, both the primary activity must continue to have a market if they are to build on existing supply chains and knowledge to deliver innovative GGR technologies. The additional investment to deliver GGR technologies in these sectors must therefore be regarded as part of stackable revenue streams. In the case of BECCS, this includes being appropriately rewarded for dispatchable renewable power, contributing to energy security and grid flexibility. In the case of nature-based solutions, largely resulting from land management sectors, the benefits of GGRs need to be suitably rewarded as part of the broader agriculture payments. As such, ensuring GGRs are strategically considered as part of current wider policy proposals is crucial to avoiding barriers to deployment of the foundational technologies from which GGRs are attainted. In terms of current Government workstreams this means GGRs being incorporated into such policy proposals as the reforms to the CfD, the Biomass Strategy, the Heat and Buildings strategy, the Hydrogen Strategy, the England Tree Strategy, reforms to the Renewable Transport Fuel Obligation and the Environmental Land Management Scheme, amongst others.

The deployment rate of GGRs will also depend on the availability of infrastructure. As part of the Government strategic thinking on infrastructure priorities, there must be a focus on areas

[1] https://www.iswa.org/uploads/media/Report_2_Benefits_of_Compost_and_Anaerobic_Digestate_01.pdf

such as addressing capacity constraints on the gas network to allow for increased injection of green gasses or identifying carbon storage regions within the UK.

Regulatory barriers must also avoid being a factor. Early engagement with authorities like the Environment Agency will be crucial to ensure the development of a suitable regulatory environment that enables the deployment of GGR technologies, and appropriate accounting for negative emissions, while also ensuring mitigation of any environmental risks posed if GGRs are done badly.

Finally, in the immediate term, commercialisation is likely to be the biggest barrier to GGR deployment. Different GGR technologies are at different technology readiness levels, with many not yet being commercially viable. Dedicated bespoke support, to different GGR solutions, will be required to see the establishment of these technologies and sectors, building developer and investor confidence. This should also include the development of CCS technologies that can be retrofitted on to existing bioenergy infrastructure, to enable the transition of these sectors. This can be done to move towards more market based, and technology-neutral, delivery solutions in the long run.

6. What principles would you like to see included in a framework for incentivisation of greenhouse gas removals?

The REA suggest the following principles should be considered to ensure confidence in a GGR framework:

- **Verification of removals**: having a transparent and agreed method of accounting for GHG emissions is essential. Much of this work can be based on existing accounting methods in current support schemes. For example. The Renewable Energy Directive (RED) methodology used to assess GHG emissions from transport fuels under the RTFO could be adapted to assess negative emissions. Further accounting methods are also found within the renewable heat incentive or contract for difference. It is recognised that different GGR approaches between engineered or nature-based solutions may require different approaches, but these should be comparable.
- **Sustainability governance**: the UK already has world-leading sustainability governance arrangements for bioenergy. These need to be maintained and considered in light of other GGR solutions.
- **Investor confidence:** new market frameworks must be suitably bankable for investors and consider the likely higher risk profiles that early investors may consider they are taking on. In conjunction, existing investments within existing sectors, such as biomass power or anaerobic digestion, must not be undermined to maintain investor confidence in the existing policy.
- **Fair cost-sharing:** there are expected to be some significant costs involved in the establishment of the GGR sectors and different technologies. Ensuring both costs and benefits of the technologies are shared across the industrial and domestic sectors will be important. This is combined with ensuring value for money, with a market-based mechanism, in the longer term, being used to ensure costs are encouraged to decrease.

- **Permanence and scalability:** frameworks will need to provide long term stable support, likely over the lifetime of the plant. Recognising that different technologies have different characteristics and challenges that will impact their speed of deployment, higher support in the early years will be needed to cover the cost of capital, and ongoing revenue support required to cover the marginal costs of production in the longer term. A combined approach is therefore needed, such as a carbon price that rewards ongoing negative emissions to provide permanence, while a CfD like structure sees new projects deployed and technologies to become scalable. Similarly, separate forms of support maybe needed for retrofitting CCS onto existing bioenergy infrastructure, incentivising the deployment of further CCS technology.
- **Moving towards a market-based approach:** in the immediate term bespoke support for different GGR solutions will likely be required to establish sectors, however, longer-term ambitions should be to see the establishment of a market-based mechanism that suitably rewards negative emissions.

7.What specific policy mechanisms could the government consider to incentivise (a) innovation and (b) initial deployment? Could any of the policy options outlined above be designed in a way that stimulates investment in innovation, including pilots and demonstrators for less mature technologies?

We generally agree with the policy leavers identified in figure two. The nature of different sectors will need to be considered to ensure the appropriate use of these leavers to realise the deployment of different GGR sectors. For example, regulatory methods might well have a strong role to play in nature-based solutions, determining environmental land management practices or the use of bioplastics, while payment and service contracts may also have a strong role to play in engineering-based solutions. In the immediate term, we are supportive of bespoke mechanisms being designed for different GGR technologies, recognising different technology readiness levels or the status of the sectors in which they are being implemented. Less mature technologies, including those that could be adopted by land managers or the agricultural sector, will need longer-term support in the form of commercialisation grants to get beyond initial field studies.

In the case of technologies where demonstration projects are more advanced, such as BECCS, we are supportive of market-based leavers that reward both the energy production, along with a payment for the negative emissions achieved. A CfD based mechanism that includes BECCS would allow new biomass power or energy from waste projects to receive a reliable revenue for the power generated, along with any additional benefit for services provided to the grid. A separate carbon payment is then provided to reward negative emissions. Set at a £/tonne level the payment will need to cover both the operational costs of capturing carbon, along with transporting and storing it. Over time, assuming the UK ETS matures successfully, the carbon payment will likely be able to transition to a straight market-based price that ensures ongoing revenue for negative emission production.

Such a payment also has the advantage of being adaptable to other foundational technologies, operating in conjunction with other support mechanisms that deliver different renewable energy supplies such as the RTFO, RHI or future mechanism aimed at hydrogen production.

Further initial support will need to be considered for the development and deployment of CCS technology that can be retrofitted onto existing infrastructure, given that support mechanisms focus on delivery of new projects. However, a consistent carbon price will also be crucial in securing the business case for investment in retrofit projects as identified as required by the CCC by the mid-2030s.

8. How could government best contribute to establishing optimum market conditions for GGRs to be developed and deployed at a large scale?

As identified in question 7, in the immediate term we are supportive of technology-specific mechanisms being designed for different GGR technologies, recognising different readiness levels or the status of the sectors in which they are being implemented. Bespoke grants will likely be required to drive appropriate levels of research, development, and deployment as appropriate to the specific sector to get to a level of commercialisation that enables more market-based approaches to operate.

Much of the regulatory or infrastructure requirements for carbon transport and storage will also need to be developed in parallel. As part of the Government strategic thinking on GGRs, there must be a focus on areas such as addressing capacity constraints on the gas network to allow for increased injection of green gasses or identifying carbon storage regions within the UK. On the regulatory side, thought should also be given to the development of suitable accounting methodologies for negative emissions of different sectors so that the establishment of a market-based mechanism can be successfully developed. For example, the RED methodology used to assess GHG emissions from transport fuels under the RTFO could be adapted to assess negative emissions.

In addition, the government must recognise the importance of maintaining the foundational industries for different GGR technologies. It is the established sectors, such as the bioenergy sector, that have developed the knowledge, supply chains and skills necessary to see these GGR innovations delivered. This is equally true for building on existing investor confidence, private funders will not be encouraged to invest in new technologies if their existing investments in UK industries are undermined. If Government lets these foundational industries contract, rather than enabling them to transition through dedicated support for retrofitting, then delivering the innovation and commercialisation required will become harder. As such, GGR priorities must start to be built into existing government workstreams, with the potential for technologies deploying today being able to contribute to negative emissions in the future.

9. How might the role of the government change overtime to bring GGR technologies to market and encourage their deployment up to 2050?

The role of the Government will change as GGR technologies become more commercially established. Once achieved it is appropriate that the Government facilitate a move to more market-based solutions, that drives competition between technologies and drives down costs. This is likely to be achieved through the maturing of a cross-sector carbon price,

potentially through the UK ETS, which rewards negative emissions. However, given the range of technologies that will be required and the need to get them all to successful commercialisation, such a technology-neutral policy role should be considered a medium to long-term policy objective.

It is also worth noting, that at some point governments role will also change from facilitating the innovation and commercialisation of GGRs to ensuring their ongoing deployment and retrofitting of the technologies. This change may require the Government to review initial approaches and make appropriate changes, likely within the 2030s.

Aside from any policy changes, the Government must still maintain regulatory clarity and consistent direction of travel to maintain investor confidence and enable long-term planning for projects.

10. Which factors should be considered when assessing the suitability of different policy options for businesses?

Considerations should include:

- ***Bankability*** – the ability for developers to build a viable business case that will enable financiers to invest in the project.
- ***Fair cost-sharing and value for money*** – costs need to be shared appropriately across beneficiaries, including the additional products from GGR activities, for example, BEECS producing both negative emissions and renewable energy, or nature-based solutions providing further environmental benefits.
- ***Ability to enable existing sectors to transition*** – GGR delivery will depend on existing supply chains, knowledge, existing investor confidence. Any new framework should aim to also support these foundational sectors and avoid contraction. This means being able to both deliver innovation and see existing sectors adopt that innovation.
- ***Long term stability*** – as seen with the CfD, investors are favourable to long term predictable contracts. This helps manage and allocate risks appropriately. This needs to be replicated in future GGR policy frameworks.
- ***Frequency of support*** – if using a mechanism based on allocation windows, a clear timetable for future allocations should be set well in advance allowing developers to plan a pipeline of projects. Current arrangements of the CfD happening every two years are both too vague and too infrequent.
- ***Transparency*** – any awarding process for support must be transparent and then increasingly competitive to help drive down costs.
- ***Transition to a market-based approach*** – Government intentions and target dates should be set for the industry to deliver against when the government aim to see a full transition to a market-based mechanism. Such targets should have suitable review periods built into them.

11. Are there any existing business models in other sectors – such as power, industry, transport or land use – that could complement new schemes to incentivise GGRs?

Within the bioenergy sector, there are current support mechanisms that could be adapted to also reward negative emissions. As discussed, we believe a CfD based mechanism for BECCS, to reward renewable power production, combined with a separate carbon payment for negative emissions is a useful combination for delivering biomass power projects with CCS. Such a payment also has the advantage of being adaptable to other foundational technologies, operating in conjunction with other support mechanisms that deliver different renewable energy supplies such as the RTFO, RHI or future mechanism aimed at hydrogen production. Equally, existing infrastructure, such as AD sites which already capture CO_2, could utilise the carbon payments to enable further investment in carbon capture and storage.

Over time, assuming the UK ETS matures successfully, the carbon payment will likely be able to transition to a straight market-based price that ensures ongoing revenue for negative emission production.

In the agriculture and forestry sectors, consideration should be given to how direct payments such as those being developed within the Environmental Land Management Scheme and England Tree Strategy could also be used to deliver nature-based GGRs by rewarding carbon-fixing in soils, tree growth and habitat restoration.

12. Are price instruments or quantity instruments likely to be more effective in encouraging and sustaining the deployment of GGRs? Or will a combination be required?

A combination of both is likely required to ensure a variety of options are commercialised. Quantity based instruments might be important in establishing sectors, while cost-based metrics will help sustain deployment and drive down costs. Support must both address the capital expenditure and ongoing operational costs of realising negative emissions. As such a quantitative approach may see significant early deployment but a price instrument will be needed to sustain the industry in the longer term, as well as provide long term price certainty providing bankable projects for investors.

Lessons can be learned from other sectors. While predominantly a price-based instrument, the early days of the renewable heat incentive were focused on driving the number of renewable heat systems. In many cases, it did so at the cost of quality and did not effectively drive down costs in a sustainable fashion. This has had led to long term legacy issues for the renewable heat sector, now resolved, requiring better standards and better-focused price instruments to be introduced to deliver a sustainable sector today. As such, the focus must be on strong support system design, with quality standards in place from the start.

13. How far should a policy framework aspire to be technology-neutral between different GGR options?

Given the breadth of GGR technologies, operating across a wide range of different sectors, we believe a technology-neutral approach should be a longer-term ambition for policymakers, enabled by the successful establishment of a carbon market for negative emissions in the future. In the immediate term more bespoke mechanisms are going to be required, that take into consideration, both the different technology readiness levels of

technologies and the status of the foundational sectors into which they are being introduced.

14. Could wider support for GGRs have any unintended effects on the development and commercialisation of technologies in other sectors, and how could this be mitigated?

The deployment of GGRs should complement, and not replace, methods for decarbonisation, eliminating carbon emissions in the first place. However, as evidence from the CCC has demonstrated, GGRs are going to be required to achieve net-zero. As such government should focus on delivering decarbonisation strategies across the UK economy that prioritises decarbonisation while also ensuring GGRs can play their role in delivering negative emissions. Having an effective carbon market will play an important role in seeing this realised by firstly incentivising emission reduction and then by, secondly, rewarding negative emission from GGRs.

15. Are there any international examples that have proved effective at incentivising GGRs? Why were they effective, and are there any barriers to taking similar action in the UK? Are there examples of international approaches that have not worked well?

- No Comment

16. Should the government introduce a tax credit, and if so, how should this be designed? Should it be provided only for specific GGR technologies or a broad range of methods? Would multiple, specific rates be effective at incentivising as much investment as possible?

Tax credits could be used to incentivise the uptake of GGRs. The use of enhanced capital allowances and tax rebates have played a role in enhancing revenue streams from renewables projects, which has helped bring in investors and reinforce business models. However, by themselves tax credits will not address the current lack of revenue for negative emissions, so a wider policy mechanism will be required. Any tax credits introduced must also be consistent and avoid regular political review within each government budget.

17. Should participants from specific sectors with historical carbon emissions be eligible to apply for the credit or should the credit be economy-wide?

Given the range of GGR technologies and sectors involved it is likely it will need to be economy-wide to deliver significant levels of GGRs.

18. If the government were to introduce a GGR obligation scheme, which businesses and emitting sectors could this cover? How could such a scheme be designed to minimise competitiveness impacts and regressive passed-through costs (e.g. to consumers and bill-payers)?

Obligations could be applied to the highest emitting sectors including areas like agriculture, transport, waste, and power production. However, this will need to be done carefully to avoid increased costs for consumers. It is noted that obligations have worked effectively in the

power (RO) and transport sectors (RTFO), where lessons can be learned in relation to keeping prices low and avoiding negative impacts.

Obligations could also be considered regarding driving domestic supply chains, for example regarding biomass fuel stocks. Obligating lower fossil fuel use could drive demand for renewable fuel alternatives, helping to further establish these domestic markets.

As identified in question 10, there should be fair cost sharing of obligation across consumers and businesses, with costs appropriately socialised as everyone benefits from emission reductions and mitigating climate impacts.

19. What other regulatory approaches could government explore to incentivise GGR deployment?

Regulatory approaches maybe effective for delivering nature-based solutions. For example, bans on use of domestic-source and imported peat within soil improvers and, where adequate technical performance of alternatives has been proven, in growing media would drive down demand and contribute to peat habitat restoration. To date, composted plant wastes ('green compost') and composted plant and food wastes ('green+food compost') have a successful track record as partial replacement material for peat substrates in growing media and as the sole material in a range of soil improver products. The major growing media manufacturers in the UK and Ireland reported producing 2.79 MT of growing media and soil improver products in 2017, of/in which nearly 227 kt was Green compost (8.1 %). Based on figures reported at the end of 2018, UK production of waste-derived composts that achieve product status (i.e. exit waste regulatory controls) was 954 kt Green compost and 446 kt Green+Food compost, and with tonnages expected to rise as a result of likely requirements in England for separate collections of food and garden wastes from 2023, production of waste-derived composts (and digestates) that achieve product status is expected to rise considerably.

The government should encourage the use of organic recycling processes, because of waste-derived composts' further potential as an alternative to peat (in combination with other alternative bulky substrates) in growing media and their potential for use in greater tonnages use as soil improvers in a range of markets (aiding carbon storage and cycling in agricultural soils for example), and because of the potential for using solid digestates in a range of applications and for further use of liquid digestates in applications where the supply of plant-available nutrients is important. There are current regulatory barriers that would need to change to enable these materials to reach their full potential.

Regulatory measures that ensure quality or drive down poor agricultural practices will help in promoting GGR nature-based solutions. These will need to be carefully designed to avoid any unintended consequences for the broader agricultural sector. We are aware Defra has supported research into Soil Quality Indicators, including measures of soil organic carbon. In responding to Defra's consultation on their Environment and Land Management Scheme we suggested that in the short term it financially rewards land managers for actions that support soil health (e.g. applying compost or digstate in accordance with good agricultural practice),

then move to evidence-based payments after the soil health metrics and monitoring programmes have been sufficiently developed.

In relation to engineered-based solution, regulation is likely to be required, but is not expected to sufficiently incentivise deployment by itself given that development and operational costs will still need to be supported.

20. What are the merits and risks of introducing payment schemes for GGRs, potentially involving up-front grants or payments for each tonne of CO2 stored? Which GGRs would be suitable for a payment scheme

Grants could have a strong role to play in field studies and enabling research and development of GGR technologies, as well as helping commercialisation of the first few projects to build sector confidence. However, grants fail to address operational costs without providing an ongoing revenue stream to produce negative emissions. This in turn will not help deliver a market-based sector. As such grants, while helpful in the short term, should not be considered a long-term solution for establishing a negative emissions market.

21. Could a contract scheme be effective in incentivising GGRs such as DACCS and BECCS? What would be the main challenges and limitations of such a mechanism, and how could it be designed to maximise its effectiveness

We believe a CfD based mechanism for BECCS, to reward renewable power production, combined with a separate carbon payment for negative emissions is a useful combination for delivering biomass power projects with CCS. Such a payment also has the advantage of being adaptable to other foundational technologies, operating in conjunction with other support mechanisms that deliver new renewable energy projects such as the RTFO, RHI or future mechanism aimed at hydrogen production. Equally, existing infrastructure, such as AD sites already capturing CO_2, could utilise the carbon payments to enable further capture and storage.

Further initial consideration will also need to be given to other areas of existing infrastructure, supporting the development and deployment of CCS technology suitable for other bioenergy users, especially given that support mechanisms focus on delivery of new projects. However, a consistent contracted carbon price will then be influential in securing the business case for investment in retrofit projects as identified as required by the CCC by the mid-2030s.

Lessons can be learned from the existing CfD mechanism especially in considering the success of the CfD in driving down costs within the offshore wind sector.

22. What could a cap and trade scheme for negative emissions look like, and which sectors would you propose to be included in such a market?

The development of a cap-and-trade scheme should be a longer-term ambition, with negative emissions being introduced into the development of the UK ETS. However, a market for negative emissions will need to be established first, requiring a dedicated payment to be in place and this to transition into a market-based cap and trade mechanism.

23. The costs of different GGR technologies vary significantly. How could a cap and trade system address these differences? How could a cap and trade system be used to incentivise initial investment in any future emerging GGR technologies over a long-term trajectory?

As mentioned, more bespoke mechanisms that recognise the situation of individual GGRs will be needed in the short to medium term to both establish commercial sectors and a market for negative emissions. Over time this will deliver a more even playing field in terms of costs and enable the establishment of a cap-and-trade scheme that ensures continued deployment of established GGR sectors.

24. What role can government play in encouraging more companies to make voluntary commitments to invest in GGR technologies in the UK? To what extent can this support innovation in, and deployment of, these technologies?

Use of government investment through an infrastructure bank, invested into new GGR technologies, would help encourage private investment into the sector on a more voluntary basis. Lessons can be learned from what was achieved through the public Green Investment Bank and their focus on higher risk renewable energy projects, which saw significant levels of private investment then enter the market.

There could also be a significant role for voluntary carbon markets in enabling investment in GGRs, however, this would need to be carefully considered especially regarding interactions with any mandated traded schemes.

The REA would also be happy to help facilitate discussions with our Finance Forum, with whom the government would be able to explore different framework ideas and understand what would help release private investment in this sector.

25. What are your views on the government's intention to coordinate the deployment of GGR technologies such as DACCS and BECCS in line with our stated CCUS ambitions, and how could we best do this?

The REA supports the government's overall aim to develop industrial clusters with GGR infrastructure for large-scale technologies. These will be important for establishing the GGR sector and delivering commercial scale GGR application. However, this should be done in parallel to exploring smaller scale BECCS applications, along with support for nature-based solutions.

26. What principles would you wish to see in any accreditation scheme for negative emissions? How should the government regulate this? Any evidence relating to the best practice of existing negative emissions MRV is welcomed.

A starting position that BEIS might wish to consider is building on the RED accreditation scheme used within the Renewable Transport Fuel Obligation. Building on existing schemes and regulations, rather than developing new ones, will help build confidence and understanding in the accreditation scheme.

27. What are the most significant barriers to developing robust monitoring, reporting and verification system for GGRs?

A variety of MRV systems may be required for GGR, consistent with existing international guidelines – to include government-led auditing, self-reporting and the use of independent data sources such as remote sensing. Different sectors might require different approaches.

February 2021