FEED BACK

Greenhouse Gas Removals - Call for Evidence

Command paper consultation response – Feedback
February 2021

About Feedback

Feedback is a charity (number 1155064) which works to regenerate nature by transforming the food system. To do this, we challenge power, catalyse action, and empower people to achieve positive change.

Introduction

The Paris agreement targets are unlikely to be met by mitigation alone and based on current trajectories, 1.5°C warming is likely to be exceeded between 2030 and 2052.[1] It is therefore clear that the UK will also need to use Greenhouse Gas Removal methods to reach net zero by 2050. However, it is imperative that Greenhouse Gas Removal is **in addition** to maximising the mitigation potential of **all** sectors and therefore we strongly disagree with the green paper statement: “when firm action is taken to decarbonise the economy, reaching net zero is likely to require GGRs to offset residual emissions in the most hard-to-abate sectors that cannot be decarbonised completely”.

Greenhouse Gas removal should be seen as an essential tool in the government’s net zero agenda, but it should be used to remove legacy emissions (i.e., those that have already been released to the atmosphere), not as a means to ‘offset’ ongoing emissions. Framing greenhouse gas removal as an offsetting mechanism is likely to reduce incentives to mitigate emissions because:

- Voluntary offsets mislead the public by allowing companies to make net zero claims without curbing emissions. Instead, emissions accounting should remain separate from carbon sequestration accounting.
- Voluntary offsets mislead investors by sending the wrong signals about which sectors are able to decarbonise and be likely growth sectors
- Voluntary offset markets place no requirements on participating companies to take other carbon cutting actions first
- As additionality is too difficult to prove, compliance offsets undermine the mitigation of emissions that are counted under legally-binding emissions caps, such as the UK’s new ETS

If voluntary offsets are purchased to offset **legacy** emissions these should be by companies with ambitious, credible, verifiable decarbonisation plans so long as that funding is channelled towards people and biodiversity-led Nature-based Solution projects. We simply cannot afford to let any sectors “off the hook” from decarbonisation, particularly aviation and agriculture, which require strong policy to incentivise decarbonisation and address the role of demand in driving or mitigating emissions.

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

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[1] EASAC, 2019. Forest bioenergy, carbon capture and storage, and carbon dioxide removal: An update.

Yes, we give permission for our evidence to be shared with third party contractors for the purpose of analysis.

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?

Due to legacy emissions already released to the atmosphere it will be necessary to deploy large scale Greenhouse Gas removal, via nature-based solutions with dual climate and biodiversity outcomes such as afforestation, habitats and agroforestry. Feedback favours nature-based solutions over BECCS, as emissions associated with biomass feedstocks are likely to remain too high for BECCS to achieve negative emissions.

In any discussion related to offsetting, it is necessary to highlight the shortcomings of a land sparing approach in which land-based carbon dioxide removal requires large areas of dedicated land. Such an approach is usually used to justify 'sustainable intensification' of agriculture, in which inputs are increased at the expense of biodiversity, soil quality and human health, with higher associated greenhouse gas emissions. An alternative to the land-sparing model would be one of land-sharing, in which carbon dioxide removal is integrated into all land use including in every part of the agriculture system: i.e. which crops are grown, with what methods and which inputs.

Achieving land sparing through demand-side measures

Demand-side interventions in the food system to support climate and biodiversity goals have an important role to play in mitigating overall emissions from the food system – indeed the CCC's 'balanced pathway' sees sustainable diets and reduced food waste delivering 60% of overall emissions reductions from the agriculture sector.

As part of a 'decarbonisation first' strategy, the government should prioritise realising the potential of demand-side measures. In this light, we recommend that the UK government set cross-departmental, binding targets to:

1. **Reduce UK meat and dairy consumption by 50% by 2030.** This is line with the approach of the Eating Better Alliance, a coalition of over 60 civil society organisations passionate about health, environment, animal welfare and social justice. A report commissioned by the Committee on Climate Change (CCC) estimates that a 50% reduction in beef, lamb, and dairy consumption by 2050 would alone result in a 37% reduction in the total UK agricultural sector's domestic emissions by 2050, a reduction of 17.49 Mt CO_2e per year.[2] This would free up vast amounts of pastureland for afforestation and ecosystem restoration. The UK currently has ~84,000 km2 of permanent pastureland, and ~58,000 km2 cropland of which 55% is used to grow animal feed, meaning that animal agriculture currently occupies 48% of all UK land in total.[3] Halving meat

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[2] CEH and Rothamsted Research (2019) *Quantifying the impact of future land use scenarios to 2050 and beyond - Final Report*. Committee on Climate Change. P29. Available at: https://www.theccc.org.uk/wp-content/uploads/2018/11/Quantifying-the-impact-of-future-land-use-scenarios-to-2050-and-beyond-Full-Report.pdf (Accessed: 13 May 2019).

[3] Harwatt, H. and Hayek, M. N. (2019) *Eating Away at Climate Change with Negative Emissions: Repurposing UK agricultural land to meet climate goals*. Harvard Law School. P7. Available at: https://growgreenconference.com/sites/default/files/uploads/Eating%20Away%20at%20Climate%20Change%20with%20Negative%20Emissions.pdf (Accessed: 4 July 2019).

consumption by 2030 would result in considerable additional land available for afforestation or growing extra plant-based protein and fruits and vegetables to improve UK food security.

1.1. **Reduce UK food waste from farm to fork by 50% by 2030.** The CCC's report considers 50% reduction of food waste by 2050 as its most ambitious scenario. However, Sustainable Development Goal 12.3, which the UK government endorsed as far back as 2015, sets a global target for 50% reduction of food waste by 2030[4], with WRAP's more recent Food Waste Roadmap encouraging businesses to sign up to and deliver this target. Champions 12.3 recommend that this 50% reduction should be from farm to fork, including food left unharvested in the field.[5] Greater government leadership could speed the uptake of this target. The Committee on Climate Change estimates that reducing avoidable food waste downstream of the farm-gate by 50% by 2050 would result in 1.7 MtCO2e domestic emissions reduction[6]- in addition to emissions reductions achieved overseas. These savings would be greater if the approximately 3.6 million tonnes of food waste and surplus occurring on UK farms[7] was halved also.

To be successful, measures to achieve these goals must be implemented as part of a comprehensive range of measures, not in isolation. The transformation of the food system will require a suite of coordinated policy approaches, from a variety of institutions, incorporating both supply-side and demand-side interventions (Schercher & Verburg, 2017; Willets et al 2019).

To fairly and effectively implement UK land use change, we recommend that the government urgently adopts and implements a detailed **land-use strategy** for England (in addition to existing Scottish and Welsh progress on land use strategies) with targets to deliver a net zero agricultural sector by 2030.

This strategy should take into account optimal use of land and soils in order to produce maximum nutritional value with minimal environmental impact, disincentivise overproduction and shrink the overall size of the agricultural system in order to leave space for nature, conservation and nature-based greenhouse gas removals. Broadly this means maximising agricultural land devoted to horticultural production, in particular in areas with higher likelihood of 'best and most versatile agricultural land' (Natural England 2017), and reducing the area of land given over to animal agriculture, including the production of animal feed, and reducing the area of land used to produce crops which do not contribute to human nutrition, such as biofuel crops and sugar beet.

A land use strategy should respond sensitively to the potential and needs of food production, land, soils, natural ecosystems and human communities. In designing a strategy, we recommend that the government explore the value of a 'landscapes approach', as put forward by the Global Landscapes

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[4] UN. 2016. Goal 12, Sustainable Development Goals Knowledge Platform. Available at: https://sustainabledevelopment.un.org/sdg12.

[5] Hanson, C. (2017) Guidance on Interpreting Sustainable Development Goal Target 12.3. Champions 12.3. Available at: https://champs123blog.files.wordpress.com/2017/10/champions-12-3-guidance-oninterpreting-sdg-target-12-3.pdf.

[6] Committee on Climate Change (2019) Net Zero: Technical report. Committee on Climate Change. p200. Available at: https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-Technical-report-CCC.pdf (Accessed: 13 May 2019).

[7] WRAP (2019) Food waste in primary production in the UK. WRAP. Available at: http://www.wrap.org.uk/content/food-waste-primary-production-uk (Accessed: 23 August 2019).

Forum, which seeks to balance competing land use demands in a way that is best for human well-being and the environment.

Alongside food production goals, a land use strategy should seek to support a shift towards rewilding and reforestation in order to deliver biodiversity and climate goals. Rewilding Britain estimate that "If £1.9 billion of the £3 billion currently spent on CAP payments were allocated to supporting native woodland re-establishment, the restoration and protection of peatbogs and heaths, and species-rich grasslands over a total of 6 million hectare (ha), this could sequester 47 million tonnes of CO2/year" (Rewilding Britain, 2019, p. 4). In some areas, where land is not suitable for either reforestation or crop production, for example some upland areas, sustainably-managed grassland agriculture, or silvopasture, may be the most appropriate and sustainable use of land.

3. In relation to 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:
(vi) lifecycle emissions for these methods in the UK

BECCS
Recent evidence suggests that BECCS may be unlikely to achieve negative emissions over the timescale required. The call for evidence states that DACCS And BECCS could "make the most significant contribution to the negative emissions required to meet net zero", yet recent analyses do not support the large negative emissions capability given to BECCS in climate scenarios.[8] The treatment of imported biomass as zero emissions at the point of combustion, as allowed by the United Nations Framework Convention on Climate Change accounting rules, contributes to incorrect analyses with potentially devastating climate impacts.[9] Similar issues with emissions accounting methods from domestic feedstocks also cause the negative emission potential of BECCS projects to be overestimated.

Behind the argument in favour of BECCS is the assumption that harvesting biomass causes it to regrow and sequester carbon faster than without this type of management or harvest. However, this assumption is incorrect and negative emissions potential of biomass is greater if trees and other feedstocks are left to grow rather than being harvested.[10]

Similarly, the Greenhouse Gas removal potential of BECCS is based on the premise that **additional** biomass is grown for combustion in the bioenergy plant, that is to say that the volume of biomass has increased on any given piece of land, compared to what would have been there without this demand. However, evidence for additionality of forests for bioenergy projects is weak - the forests would have existed anyway (as demand for biomass is high) and should not count towards the negative emissions potential of the bioenergy projects. We would like to bring attention to the following paragraph from the NRDC response to this consultation:

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[8] EASAC, 2019. Forest bioenergy, carbon capture and storage, and carbon dioxide removal: An update.
[9] Norton, M., Baldi, A., Buda, V., Carli, B., Cudlin, P., Jones, M.B., Korhola, A., Michalski, R., Novo, F., Oszlányi, J. and Santos, F.D., 2019. Serious mismatches continue between science and policy in forest bioenergy. *GCB Bioenergy*, *11*(11), pp.1256-1263.
[10] Stephenson, N.L., Das, A.J., Condit, R., Russo, S.E., Baker, P.J., Beckman, N.G., Coomes, D.A., Lines, E.R., Morris, W.K., Rüger, N. and Alvarez, E., 2014. Rate of tree carbon accumulation increases continuously with tree size. *Nature*, *507*(7490), pp.90-93.

> "Existing UK biomass supply chains, at scale, are currently dominated by a) woody biomass, which we define as biomass taken directly from forests; and b) imports from overseas forests. A truly de minimus share of biomass burned for industrial scale electricity production in the UK comes from domestic sources. (According to Drax's 2019 Annual Report to shareholders, domestic sourcing was 0.44% of total wood pellets burned at Drax Power Station over the course of the year).[i] In fact, Drax burns more imported wood a year than the UK produces for all uses."[ii]

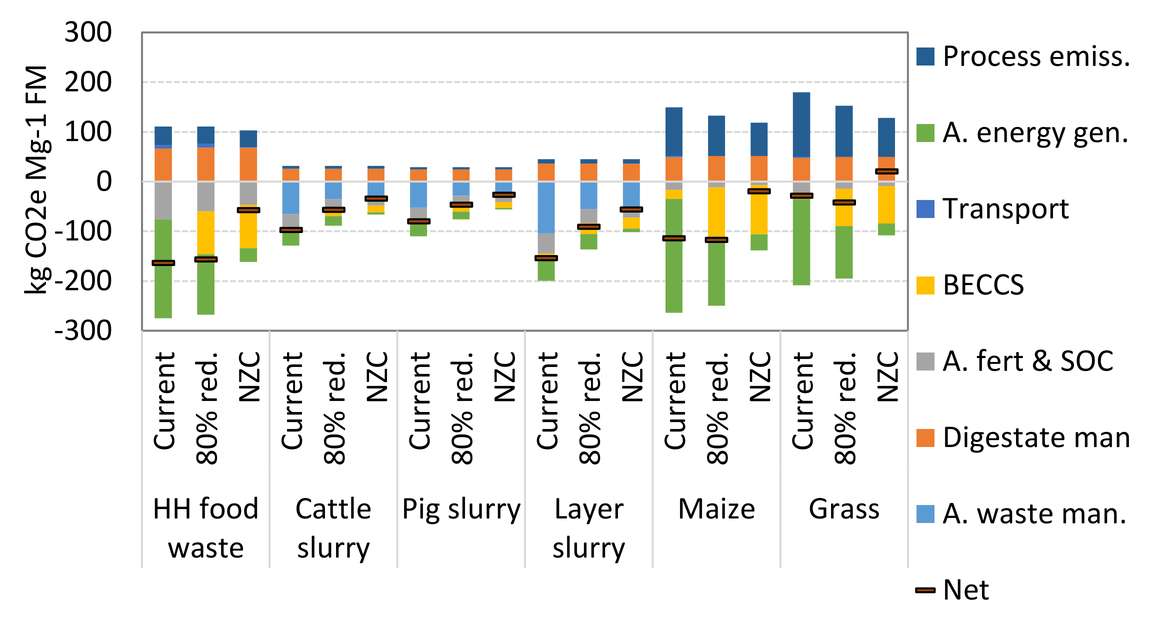
As well as the above evidence on BECCS as applied generally, we would also like to present the new evidence below relating to life cycle emissions of BECCS when applied to Anaerobic Digestion:

Anaerobic Digestion and BECCS

Anaerobic digestion (AD) plants may in the future be fitted with BECCS – using feedstocks such as bioenergy crops, manure and slurries, and food waste. There are significant logistical challenges likely to be associated with this – for instance, a recent report commissioned by BEIS concluded that the small scale and wide distribution of AD plants is likely to make carbon capture and storage (CCS) unviable.[11] Moreover, by the time that BECCS is available as a technology, the UK economy is likely to have decarbonised significantly, by which point the emissions mitigation of AD is likely to have declined significantly. A Life Cycle Assessment commissioned by Feedback and conducted by researchers at Bangor University modelled the environmental impact of sending different feedstocks to AD plants fitted with BECCS in an 80% decarbonisation context (80% Red.) and a net zero context (NZC), alongside a current technology context where BECCS is not fitted.[12] The LCA assumes that BECCS sequesters 90% of the carbon in the 50% of biomethane combusted for electricity generation by the AD plants. The results of this study can be seen below, broken down by each feedstock, with the net balance for each feedstock shown by the thick black horizontal lines.

[11] Alberici, S., Toop, G. and Critchley, S. (2018) *Bioenergy heat pathways to 2050 - rapid evidence assessment: Summary report*. Ecofys for Department for Business, Energy & Industrial Strategy (BEIS), p. 48. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/760328/BE1_D7_Biomass_Heat_REA_FINAL_Summary_Report_for_publication.pdf (Accessed: 20 February 2020).

[12] Styles, D., Yesufu, J., Bowman, M. and Luyckx, K. (2020) *Identifying the Sustainable Niche for Anaerobic Digestion in a Low Carbon Future*. Feedback Global and Bangor University. Available at: https://feedbackglobal.org/wp-content/uploads/2020/08/Styles-et-al-2020-Identifying-the-Sustainable-Niche-for-Anaerobic-Digestion-in-a-Low-Carbon-Future.pdf (Accessed: 10 January 2020).



Even with the assumption of BECCS being fitted to AD plants in the 80% decarbonisation context, the LCA finds that several alternatives to AD would result in significantly higher emissions mitigation. For instance, per tonne of food waste, prevention of food waste results in -1,158kg CO_2e in direct emissions savings compared to -183 kg CO_2e per tonne of food waste sent to AD fitted with BECCS in this context (6 times more). Preventing a tonne of food waste and planting trees on the average grassland spared would result in -5,176 kg CO_2e in emissions savings per year (28 times more). And diversion of food waste to animal feed results in -337 kg CO_2e in emissions savings directly (nearly twice the savings) -– which would rise to -1,103 kg CO_2 eq. Mg^{-1} if spared arable land was afforested. The LCA modelled a Circular scenario where 182,000 hectares of arable land was spared from animal feed production through diverting more food waste to animal feed, and found that this could produce 18% of UK food energy requirement plus 19% of UK food protein requirement.

In the 80% decarbonisation context, sending bioenergy crops to AD fitted with BECCS achieves net mitigation of -42 to -118 kg CO_2 eq. per Mg of grass or maize, respectively. Alternative afforestation of land, instead of growing grass for biofuel production, would achieve 340% more net GHG mitigation per hectare, based on future projected yields for grass. The LCA modelled a Circular scenario where 250,000 hectares of arable land was used for solar PV electricity generation rather than growing bioenergy crops for AD, and found that this could increase net energy output to 464,000 TJ per year in the Circular scenario, over four times the net useful energy generation in the AD-Max scenario. The Soil Association found that 75% of sites with late harvested maize used for AD showed high or severe levels of soil erosion – concluding that maize has a "singularly harmful impact" on soils.[13] Beans, pulses and vining peas would also be excellent candidates to replace maize when grown in rotation – these would have a far better impact on soil quality, contribute to the UK's food security and assist the UK's transition to more plant-based proteins. Feedback have calculated that if peas were grown for human consumption on the land area the ADBA aspires to use for AD crops, this would produce enough food for over 1 million people – 100% of their recommended

[13] Farnworth, G. and Melchett, P. (2015) *Runaway Maize: Subsidised soil destruction*. Bristol: Soil Association. Available at: https://www.soilassociation.org/media/4671/runaway-maize-june-2015.pdf (Accessed: 23 July 2019).

calories per year, including roughly 30% of their recommended protein for a year.[14] Oilseed rape is another alternative.

In the 80% decarbonisation context, the emissions mitigation ranges from -47 to -92 kg CO_2 eq. per tonne of manure or slurries sent to AD plants fitted with BECCS– significantly lower than today, because in the 80% decarbonisation context, a 50% reduction in manure management emissions is assumed due to practices such as covered storage being implemented, which means that sending manures and slurries to AD prevents fewer emissions relative to alternative animal waste management options. It will be a legal requirement for all UK slurry pits and manure heaps to be covered by 2027 to cut ammonia emissions[15], so this scenario will become the default alternative to AD very soon, reducing the emissions mitigation of AD.

In the net zero scenario, prevention of food waste with afforestation on the land spared leads to emissions savings roughly 78 times higher than sending it to AD plants fitted with BECCS (-5,176 compared with -66 kgCO_2e per tonne), and even without afforestation saves over nine times the emissions (-623 kg CO_2e per tonne).

In the net zero context, crop AD becomes completely ineffective as a GHG mitigation option, even after BECCS, achieving net mitigation of just -20 kg CO_2 eq. per Mg of maize and increasing GHG emissions by +20 kg CO_2 eq. per Mg of grass digested. This is because AD results in negligible fossil displacement in a decarbonised energy sector, but still leads to soil emissions, methane leakage and digestate emissions. BECCS does not outweigh these difficult-to-avoid emissions. In contrast, the LCA found that planting trees on equivalent land area rather than growing grass for AD would in contrast result in -183 kg CO_2e in emissions savings in the net zero context.

Sending manures to AD in the net zero context results in relatively small mitigation of -27 to -57 kg CO_2 eq. Mg^{-1}, since the manure management emissions and fertiliser manufacture emissions, which AD avoids, are assumed to be lower in this scenario. In contrast, dietary shifts to less meat and more plant-based proteins are a significantly more effective means of decarbonising the UK agriculture sector, than sending manure and slurries to AD plants fitted with BECCS. For instance, switching from poultry meat to tofu results in reductions of 65% in emissions and 69% in land use.[16] A report commissioned by the Committee on Climate Change (CCC) estimates that a 50% reduction in the UK's beef, lamb and dairy consumption by 2050 could result in a 37% reduction in the total UK agricultural sector's domestic emissions by 2050.[17] It would also free up an estimated 4.2 to 6.9

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[14] Feedback (2020a) *Bad Energy: Defining the Role of Biogas in a Net Zero Future*. London: Feedback. Available at: https://feedbackglobal.org/wp-content/uploads/2020/09/Feedback-2020-Bad-Energy-report.pdf (Accessed: 11 September 2020).

[15] Tasker, J. (2018) *Gove's new farm pollution controls: The details and reaction*, *Farmers Weekly*. Available at: https://www.fwi.co.uk/news/environment/goves-new-farm-pollution-controls-the-details-and-reaction (Accessed: 22 July 2020).

[16] Poore, J. and Nemecek, T. (2018) 'Reducing food's environmental impacts through producers and consumers', *Science*, 360(6392), pp. 987–992. doi: 10.1126/science.aaq0216.

[17] CEH and Rothamsted Research (2019) *Quantifying the impact of future land use scenarios to 2050 and beyond - Final Report*. Committee on Climate Change. Available at: https://www.theccc.org.uk/wp-content/uploads/2018/11/Quantifying-the-impact-of-future-land-use-scenarios-to-2050-and-beyond-Full-Report.pdf (Accessed: 13 May 2019).

million hectares of grassland.[18][19] If trees were planted on 4.2 million hectares, this would result in an estimated 54 million tonnes CO_2eq annual average carbon sequestration by 2032[20], which (assuming UK agriculture's emissions fall by 37%) would be enough to offset remaining UK domestic agricultural emissions nearly twice over. The NFU's plans to only reduce the emissions of the UK agriculture sector by 25% while relying on BECCS and AD plants for the bulk of emissions reductions is not credible – a combination of a just transition to less and better meat and more ambitious food waste reduction can unlock significantly higher emissions reductions at a significantly faster rate. Feedback and Bangor University's LCA study found that in the Circular scenario, halving UK food waste, with afforestation on the roughly 3 million hectares of grassland spared, would save and offset approximately 51 million tonnes CO_2eq – about 11.3% of the UK's current total GHG emissions. In addition, it would save 800,000 hectares of cropland which could produce 6.5 billion kcal per year more than the 'industry-driven AD' scenario – enough to feed 7.9 million people, nearly 10% of the UK population. Feedback have estimated that of the emissions reductions, roughly 18.4 million tonnes CO_2e would be saved domestically, and 32.7 million tonnes CO_2e would be saved overseas, reducing the UK's consumption emissions from food imports.[21] This total is for the current decarbonisation context – this would decline in the 80% decarbonisation and net zero contexts, but still be substantial. Although the emissions reductions of dietary change and food waste overlap – particularly as many of the largest emissions savings from food waste reduction come from wasted meat and dairy – these calculations demonstrate that taken in combination, food waste prevention, dietary change and mass-scale tree planting could make the UK agriculture sector a significant net carbon sink well in advance of 2050 without recourse to BECCS.

The UK is seen as playing a leading role in Biomass technology and incentives, setting standards for other countries to follow. Yet burning biomass, with or without carbon capture is unlikely to reach carbon neutrality, let alone achieve negative emissions. It is vital that the UK leverages its world-leading status on climate action to demonstrate the highest ambition and the most effective solutions to decarbonisation.

3. In relation to 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:
(vi) lifecycle emissions for these methods in the UK

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[18] CEH and Rothamsted Research (2019) *Quantifying the impact of future land use scenarios to 2050 and beyond - Final Report*. Committee on Climate Change. Available at: https://www.theccc.org.uk/wp-content/uploads/2018/11/Quantifying-the-impact-of-future-land-use-scenarios-to-2050-and-beyond-Full-Report.pdf (Accessed: 13 May 2019).

[19] Harwatt, H. and Hayek, M. N. (2019) *Eating Away at Climate Change with Negative Emissions: Repurposing UK agricultural land to meet climate goals*. Harvard Law School. Available at: https://growgreenconference.com/sites/default/files/uploads/Eating%20Away%20at%20Climate%20Change%20with%20Negative%20Emissions.pdf (Accessed: 4 July 2019).

[20] Harwatt, H. and Hayek, M. N. (2019) *Eating Away at Climate Change with Negative Emissions: Repurposing UK agricultural land to meet climate goals*. Harvard Law School. Available at: https://growgreenconference.com/sites/default/files/uploads/Eating%20Away%20at%20Climate%20Change%20with%20Negative%20Emissions.pdf (Accessed: 4 July 2019).

[21] Feedback (2020b) *Where there's no waste, there's a way (to net zero): a call for policy for food waste prevention.* Available at: https://feedbackglobal.org/wp-content/uploads/2020/10/Feedback-2020-When-theres-no-waste-theres-a-way-to-net-zero-low-res.pdf.

Soil
Alongside afforestation and wetlands, increasing soil carbon is currently one of the most cost effective and viable approaches to Greenhouse Gas Removal.[22] Unlike with BECCS, there is a scientific consensus abouts the potential role of soil carbon in carbon dioxide removal.[23] Because the capacity of these sinks is finite it is important that incentivisation of soil carbon storage is accessible to all farm types, including small scale agriculture, and that support is maintained over the long-term.

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?

Framing GGRs as offsets will compromise the ability to achieve the UK's net zero target by 2050. This is because it is not possible to achieve true 'additionality' when using Greenhouse Gas Removal to offset residual emissions in sectors "difficult" to decarbonise, like aviation and agriculture, as offsetting removes the incentive to decarbonise or to use demand-side measures (i.e. sustainable consumption) to reduce emissions. Policies that address demand within the food system have potential to remove some of the current justification for large scale BECCS as they could significantly reduce agricultural emissions, as described in Feedback's Cow in the Room Policy Brief[24]. The food system is the single biggest source of anthropogenic greenhouse gas emissions yet policies that address diets and food waste could together achieve 88% of the emissions reductions required from the food system to limit warming to 1.5 degrees[25]. Meanwhile, agricultural production is often seen as too difficult to decarbonise, yet through soil conservation, no tillage, no external inputs, intercropping and agroforestry substantial emissions reductions can be achieved[26]. We recommend that BEIS work closely with Defra to fund the transformation of UK farming for the purpose of climate change mitigation. It is essential that the climate mitigation of agriculture is fully funded, via the Environmental Land Management Scheme as well as other schemes, as it will not be possible to limit warming to 1.5°C without addressing emissions from the food system.[27]

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[22] EASAC, 2019. Forest bioenergy, carbon capture and storage, and carbon dioxide removal: An update.
[23] Bossio, D.A., Cook-Patton, S.C., Ellis, P.W., Fargione, J., Sanderman, J., Smith, P., Wood, S., Zomer, R.J., Von Unger, M., Emmer, I.M. and Griscom, B.W., 2020. The role of soil carbon in natural climate solutions. *Nature Sustainability*, *3*(5), pp.391-398.
[24] Feedback (2019) *The Cow in the Room.* Available at: https://feedbackglobal.org/wp-content/uploads/2019/08/Feedback-PolicyBrief-CowInRoom-Final-15August2019.pdf
[25] Alongside halving food wastes and eating a healthy level of calories, switching to sustainable diets by 2050 delivers a reduction of 1077 Gt CO2-we compared to cumulative Business as Usual food system emissions of 1356 Gt CO2-we by 2100. See Supplementary materials from Clark, M. A., Domingo, N. G., Colgan, K., Thakrar, S. K., Tilman, D., Lynch, J., ... & Hill, J. D. (2020). Global food system emissions could preclude achieving the 1.5° and 2° C climate change targets. *Science*, *370*(6517), 705-708.
[26] Aubert, J.M., Schwoob, M.H. and Poux, X., 2019. Agroecology and Carbon Neutrality in Europe by 2050: What Are the Issues? Findings from the TYFA Modelling Exercise.
[27] Clark, M. A., Domingo, N. G., Colgan, K., Thakrar, S. K., Tilman, D., Lynch, J., ... & Hill, J. D. (2020). Global food system emissions could preclude achieving the 1.5° and 2° C climate change targets. *Science*, *370*(6517), 705-708.