

Submission on potential for integrating GGRs into the UK ETS, by CO₂RE

Correspondence address: co2re@smithschool.ox.ac.uk

1. [CO₂RE](#) is the UK research hub on Greenhouse Gas Removal (GGR), funded by UKRI. CO₂RE's submission focuses on the section of the Call for Evidence (CfE) related to the potential integration of GGR methods into the UK ETS. The key points of our submission are:

- There is a wide range of GGR methods, differing in important characteristics such as cost, durability, ability to monitor and verify, and technical potential. These differences mean methods should not all be treated as the same when thinking about policy mechanisms.
- GGR methods in general require long-term, viable policy support to scale alongside emissions reductions and achieve UK climate targets. In judging whether inclusion in the UK ETS or any other policy is appropriate, we identify a set of criteria for determining successful outcomes. These are:
 - fungibility of removals with emissions reductions;
 - confidence provided for suppliers and investors to deploy;
 - income sustainability;
 - administrative ease;
 - distribution of costs and benefits; and
 - public acceptance.
- Based on these considerations, we assess there are major challenges and risks to including GGR methods which do not involve geological storage in the UK ETS. Some challenges and risks also exist in including geological GGR methods, but these may be manageable through provisions within the ETS and a wider policy package.
- A separate but linked market for GGR may be more effective for near-term upscaling and long-term deployment—including as the ETS cap falls to or beyond zero.
- It is likely that whatever form the market framework ultimately takes, government intervention across demand, supply and business environment domains will be essential to upscale a UK market for geological GGR.

147) Do you believe the UK ETS could be an appropriate long-term market for GGRs?

2. There are issues to be overcome in including any GGRs in the UK ETS, but it could be an appropriate long-term market for some GGRs—particularly those that involve permanent geological CO₂ storage. Appropriateness depends crucially on understanding the range of GGR methods in scope, and on the criteria for judging appropriateness. We set out our suggestions on both these points below.

3. *GGR methods.* The term GGR covers a wide range of methods to remove greenhouse gases from the atmosphere and oceans, and differ in approach, status of development, cost, removals potential, and type of carbon storage, as Table 1 illustrates.

Method	Status (TRL)	Cost per tCO ₂ (\$)	UK Potential (2050)	Storage type
DACCS	6	100-300	53 MtCO ₂ *	Geological
BECCS	5-6	15-400	5 MtCO ₂ *	Geological
Tree planting	8-9	0-240	18 MtCO ₂ * †	Tree biomass
Enhanced weathering	3-4	50-200	Insufficient data	Dissolved bicarbonate & mineral carbonate
Biochar in soils	6-7	10-345	Insufficient data	Soils
Soil carbon in croplands/grasslands	8-9	45-100	Insufficient data	Soils
Peatland and wetland restoration	8-9	Insufficient data	10 MtCO ₂ *	Soils
Blue carbon	2-3	Insufficient data	Insufficient data	Marine biomass
Ocean alkalinity	1-2	40-260	Insufficient data	Dissolved bicarbonate & carbonate
Ocean fertilisation	1-2	50-500	Insufficient data	Marine biomass (possibly sinking to deep ocean)

Table 1: non-exhaustive list of GGR methods and key characteristics (Source: IPCC WG3 AR6 Table 12.6; Climate Change Committee, Sixth Carbon Budget). * = CCC Balanced Net Zero Pathway, UK-specific potential.

† = this figure combines afforestation and tree-based energy crops.

4. Our suggested criteria for assessing appropriateness of inclusion are as follows.

Criterion 1: Fungibility with emissions

5. GGRs differ from greenhouse gas emissions (GHGs) in two ways: permanence and nature as units for trading. For permanence, the temperature-raising effect of fossil CO₂ remains for centuries to millennia after emission; to achieve lasting net zero emissions, any CO₂ removal used to balance fossil emissions needs to endure on these timescales.¹ This points to a greater equivalence for GGR methods involving geological or mineral storage. One potential way to create fungibility between more- and less-durable forms of GGR is an exchange rate, similar to that used to compare emissions of different GHGs;² i.e. a tonne of fossil CO₂ emission may be compensated with multiple tonnes of less permanent GGR. However, this is a poor indicator of global temperature outcomes,³ and may increase the likelihood of negative impacts from large-scale use of land-intensive GGRs.

6. As trading units, while an emissions allowance is an administrative licence that permits the holder to emit one tonne of CO₂-equivalent GHG, a removal unit represents a share of the outcome of investment in a project to remove and store GHGs. The only commonality is the unit of measurement, and governing legislation would likely require amendment to enable the inclusion of GGR units in the ETS.⁴

Criterion 2: Confidence to invest in deployment

¹ Fankhauser, S., Smith, S.M., Allen, M. *et al.* The meaning of net zero and how to get it right. *Nat. Clim. Chang.* **12**, 15–21 (2022).

² For instance, policies usually equate one tonne of methane to 28 tonnes of CO₂, according to the 100-year Global Warming Potential metric.

³ Lynch, J., Cain, M., Pierrehumbert, R., Allen, M. (2020). ["Demonstrating GWP*: a means of reporting warming-equivalent emissions that captures the contrasting impacts of short- and long-lived climate pollutants"](#). *Environ. Res. Lett.* **15** (4)

⁴ Macinante, J. & Ghaleigh, N. S. Regulating Removals: Bundling to Achieve Fungibility in GGR 'Removal Units' (March 23, 2022). *Carbon and Climate Law Review* 16:1, 3-17 (2022).

7. Across the range of GGR methods, UK markets currently exist only for tree planting and peatland restoration (via the Woodland and Peatland Carbon Codes) with units trading at roughly £10-20.⁵ Other GGR methods are at an earlier stage of development and lack a 'market pull' policy mechanism⁶ to support innovation and upscaling.⁷ A small number of private sector initiatives, such as the Frontier Fund⁸ and the Microsoft \$1bn carbon removal fund⁹, are providing initial such market pull to upscale GGRs.

8. Inclusion in the UK ETS or an alternative market mechanism could provide greater confidence in the availability of revenue for GGR than the current situation, particularly for those GGRs with no current market pull mechanism. The ETS is an obvious potential source of funds, with revenues on the order of £3bn per year.¹⁰ Inclusion in the ETS is not however a prerequisite for using ETS revenues to fund GGR; there are different options to link GGR markets to ETS revenue.^{11, 12}

9. Confidence is also about the price and quantity of GGR market demand. In the near-term (next 5 years), geological GGRs will likely require price support until unit costs fall in any market mechanism. The near-term UK ETS price on its own is likely too low and too volatile to make these projects viable at the price per tonne noted above. Whether included in the UK ETS or not, a priority for these approaches will be early-stage support, such as long-term contracts or first-of-a-kind subsidies.¹³

Criterion 3: Income sustainability

10. GGRs will need to be supported at scale into the second half of the century. In the long-term (15+ years), the attractiveness of ETSs as a revenue stream for GGR will decline. Although the carbon price is expected to rise to levels at or above the cost of BECCS and DACCS, there will be fewer emission sources within the ETS to pay. Figure 1.2 in the consultation document indicates that the UK ETS cap could be just a third of its current size within this decade. Indeed, the direction of the ETS cap, and UK emissions as a whole, will be to go to *zero or even net negative*. Long-term policy mechanisms for GGR need to be thought of in a context of declining emissions and sustained GGR need.

Criterion 4: Administrative ease

11. New policies create complexity and expense for government and market participants. Inclusion of GGR in the UK ETS would make the ETS more complex—especially if conducted at a time when the ETS is undergoing significant modification and expansion in other areas—but it may be administratively easier than creating a new, separate policy mechanism for GGR, unless that new mechanism broadly replicated another established instrument such as the renewable energy Contracts for Difference model.

12. Different GGR methods also present different levels of compatibility with the UK ETS. Regulatory provisions exist already for permanent geological storage via CCS; biomass standards and inclusion of energy-from-waste facilities are considered in this consultation. These all point to relative compatibility for

⁵ See <https://woodlandcarboncode.org.uk/buy-carbon/what-are-woodland-carbon-units>

⁶ On a typology for innovation policy, see: Grubb *et al.* Induced innovation in energy technologies and systems: A review of evidence and potential implications for CO₂ mitigation. *Environ. Res. Lett.* **16** (2021) 043007 <https://doi.org/10.1088/1748-9326/abde07>

⁷ Nemet *et al.* Negative emissions—Part 3: Innovation and upscaling. *Environ. Res. Lett.* **13** (2018) 063003 <https://doi.org/10.1088/1748-9326/aabff4>

⁸ See <https://frontierclimate.com/>

⁹ See <https://www.microsoft.com/en-us/corporate-responsibility/sustainability/carbon-removal-program>

¹⁰ Based on an allowance volume of 40 MtCO₂ for 2022 (ICE) and a possible average price of £75/tCO₂.

¹¹ Rickels, W., Proelß, A., Geden, O., Burhenne, J., & Fridahl, M. Integrating Carbon Dioxide Removal Into European Emissions Trading. *Frontiers in Climate*. 3:690023 (2021). <https://doi.org/10.3389/fclim.2021.690023>

¹² Oxera. *Market design for negative emissions in the UK ETS*. 2022 <https://www.oxera.com/wp-content/uploads/2022/03/Market-design-for-negative-emissions-in-the-ETS.pdf>

¹³ Zhou, N., Boot, M., Hickey, C., Fankhauser, F., Sen, A., & Smith, S., Deployment support for geological Greenhouse Gas Removals in the UK. Oxford Smith School for Enterprise and the Environment Policy Brief. 2022. Available at: <https://www.smithschool.ox.ac.uk/sites/default/files/2022-06/Policy-brief-Deployment-support-for-geological-GGR-in-UK.pdf>

DACCS and BECCS (including the biological component of energy-from-waste with CCS), which are also easier to MRV.¹⁴ In contrast, methods for monitoring, reporting and verifying GGR methods such as biochar and enhanced weathering are challenging and yet to be standardised, making them more administratively complex and therefore less compatible with ETS inclusion.

13. If a policy goal is to connect the UK ETS to other ETSs, then different approaches to GGR inclusion (or exclusion) may also cause compatibility issues between systems, increasing administrative complexity.¹⁵

Criterion 5: Distribution of costs and benefits

14. Inclusion in the UK ETS would mean the economic sectors covered by the ETS would be the main funding source for the included GGRs. In addition to being a broadly economic efficient way of correcting this negative externality, this may be popularly perceived as fairer than funding GGR deployment through general taxation,¹⁶ as may other policy mechanisms such as extended producer responsibility,¹⁷ although this is an area that requires more research.

15. Inclusion of tree planting and other land-intensive GGRs introduces distributional risks for land managers. Large-emitting facilities would be incentivised to pay for removal credits that require large tracts of land. There is already anecdotal evidence that carbon credit-driven projects are displacing small-scale land managers in parts of the UK.¹⁸ This is a risk for any scheme allowing trade between large emitters and land credits—not just an ETS—and it is also a risk for inclusion of BECCS. Robust social and environmental standards for land management are therefore required, whatever policies are used to reach net zero. But this risk is heightened for trees and peatlands in the ETS, as prices for these projects are already below the UK ETS price.

Criterion 6: Public acceptance of scheme

16. Research shows that public support for GGR is contingent on clear, corresponding efforts to reduce emissions. Any perception that GGR is being used to justify high-carbon policies elsewhere in the economy is likely to be extremely damaging to public acceptance.^{19, 20} If emissions and removals are combined into one cap, and if this gives the impression of decelerating efforts on emissions, there is a risk that the public acceptance of both GGR and the ETS itself will be damaged.²¹

Summary

17. These criteria point to some benefits to inclusion of GGRs in the UK ETS. It would provide a greater source of revenue for GGR than the current situation. It may be administratively easier than creating wholly new mechanisms for GGR deployment.

18. There are however challenges for inclusion of any and all GGRs with regard to the definition of a removal unit, longer-term revenue, distribution of costs and benefits, and public acceptance. BECCS and DACCS are more ETS-compatible with regard to their fungibility and administrative ease—including MRV—and may

¹⁴ Rickels, W. *et al.* Integrating Carbon Dioxide Removal Into European Emissions Trading.

¹⁵ CO₂RE & NEGEM. Consideration of GGR in Emissions Trading Systems: Principles and Practice. Workshop Report, 25 April 2022. Available at: <https://co2re.org/wp-content/uploads/2022/06/ETS-workshop-report-v3.pdf>

¹⁶ Burke, J. & Gambhir, A. Policy incentives for Greenhouse Gas Removal Techniques: the risks of premature inclusion in carbon markets and the need for a multi-pronged policy framework. *Energy and Climate Change*. 3:100074 (2022). <https://doi.org/10.1016/j.egycc.2022.100074>

¹⁷ See for example: Jenkins S., *et al.* Upstream decarbonization through a carbon takeback obligation: An affordable backstop climate policy, *Joule*, 5 (11) 2021, <https://doi.org/10.1016/j.joule.2021.10.012>

¹⁸ E.g. Cox, H. "Carbon capture pitches smallholders against big business", *Financial Times*, 11 March 2022.

¹⁹ Cox, E., Spence, E. & Pidgeon, N. Public perceptions of carbon dioxide removal in the United States and the United Kingdom. *Nat. Clim. Chang.* 10, 744–749 (2020). <https://doi.org/10.1038/s41558-020-0823-z>

²⁰ Cox E, Pidgeon N, Spence E. But They Told Us It Was Safe! Carbon Dioxide Removal, Fracking, and Ripple Effects in Risk Perceptions. Risk Analysis. (2021) doi: 10.1111/risa.13717

²¹ CO₂RE & NEGEM. Consideration of GGR in Emissions Trading Systems.

be more publicly acceptable as their higher price is less likely to undercut emissions reduction. But they would require additional, early-stage support, especially on price, certification through a credible MRV authority and enabling infrastructure.

19. Non-geological GGRs such as tree planting, peatland restoration and soil restoration are lower-cost and likely more publicly acceptable—albeit not if they result in land purchase and conversion that disadvantages local communities, or if their ETS inclusion undercut emissions reductions. But they are less fungible and harder to measure and verify, and therefore would likely be more administratively challenging. Other early-stage, durable GGR methods need further development before an assessment of ETS compatibility against our suggested criteria can be made.

148) How could the design of the UK ETS be adapted to include GGRs while still maintaining the incentive to decarbonise for ETS participants?

20. In addition to limiting ETS inclusion to geological GGRs, we suggest placing a cap on market participants' potential to use removals units as a substitute for emissions reduction through allowances, if/when included GGRs' removals unit costs fall below the allowance price.

149) To what extent could the UK ETS price signal incentivise development of the full range of GGRs, including engineered and nature-based GGRs, given the expected differences in the project costs?

21. For several GGRs (see Table 1) the price signal alone will not be sufficient to incentivise development of these methods, and a wider policy package that includes demand side, supply side, and enabling regulation and business environment policies will be required to drive innovation and upscaling.^{22, 23} This package should be broadly technology neutral but may usefully account for GGRs' differing levels of readiness, and shouldn't attempt to include non-carbon co-benefits.²⁴

150) What impacts or opportunities could arise for the UK voluntary carbon markets, if GGRs were included in a compliance market like the UK ETS? For example, what impacts, or opportunities could there be for voluntary carbon market schemes such as the Woodland Carbon Code?

22. Apart from tree planting, GGRs barely exist in mainstream voluntary carbon markets at present, meaning there may be little impact. Longer-term, impacts and opportunities would depend on how and what is included in the UK ETS, but could:

- Result in greater scrutiny of voluntary markets, and potentially tighten regulation or standards for GGRs traded in voluntary markets.
- Support growth of ETS-included GGRs in the voluntary markets by increasing overall demand for those methods.
- Be complicated by fragmentation in GGR registries and standards. Both Woodland Code units and Peatland Code units are registered in the UK Land Carbon Registry, but each code has its own separate registry. Similarly in the voluntary carbon market, each standard (e.g., Gold Standard, Verra, etc.) has its own registry and units registered under one standard cannot be registered or traded on another. This could result in GGRs needing registration and certification across multiple

²² Zhou, N. *et al.* Deployment support for geological Greenhouse Gas Removals in the UK.

²³ Burke, J. & Gambhir, A. Policy incentives for Greenhouse Gas Removal Techniques.

²⁴ CO₂RE & NEGEM. Consideration of GGR in Emissions Trading Systems.

compliance and voluntary market registries and standards—but present an opportunity to increase alignment.

152) Are there any impacts, constraints or unintended consequences that need to be managed if incorporating GGRs within an ETS?

23. *Price interactions.* Uncertainty in the future cost of removals and the UK ETS carbon price can lead to two unexpected outcomes about the relative quantities of GGR and emissions reduction:

- 1) If removal units remain sufficiently more expensive than allowances, then the ETS could procure limited to no removals,²⁵ risking allocating insufficient revenue to GGR suppliers to drive the necessary innovation and the upscaling of GGRs.
- 2) If removal units are cheaper than allowances, it could disincentivise emissions reductions, as occurred when CDM-derived CERs were introduced in the New Zealand ETS.²⁶

24. *Divergence in the UK ETS from other ETSs.* Different approaches to GGR inclusion in ETS may limit the potential for connection and therefore the liquidity of the UK ETS,²⁷ especially as ETS market size decreases.

25. *Portfolio diversity.* If GGRs in the ETS or another market mechanism are driven solely or primarily by price, this may result in the selection of a limited range of GGRs. Supporting the development of a portfolio is likely to increase the resilience of removals targets to the potential failure of specific GGR methods,²⁸ and widen the variety of non-carbon co-benefits.

26. *ETS integrity.* Establishing a functioning EU ETS was a major achievement, and its early phases were characterised by prolonged periods of limited functionality that required major re-design. Inclusion of a substantial new component risks compromising this hard-won functionality if not managed carefully.²⁹

27. *Indirect impacts on land prices and ownership.* See answer to Q147.

154) What MRV criteria need considering for GGRs and what steps need to be taken to ensure a framework of criteria is robust, cost-effective, and scalable?

28. We suggest establishing an independent MRV regime that robustly and transparently quantifies the volume, permanence and risks of removals and storage, across the range of GGR methods within scope, in line with the recommendations made in the MRV Task and Finish Group Report.³⁰

29. There are models from other spheres which can provide learning for MRV accreditation. For example, the Kyoto Protocol's Clean Development Mechanism Executive Board, which established and managed the regime under which Designated Operational Entities (DOEs) could deliver Certified Emission Reduction (CER) credits.³¹

²⁵ Rickels, W. *et al.* Integrating Carbon Dioxide Removal Into European Emissions Trading.

²⁶ Burke, J. & Gambhir, A. Policy incentives for Greenhouse Gas Removal Techniques.

²⁷ Burke, J. & Gambhir, A. Policy incentives for Greenhouse Gas Removal Techniques.

²⁸ Grant, N., Hawkes, A., Mittal, S. & Gambhir, A. The policy implications of an uncertain carbon dioxide removal potential. *Joule*. 5(10). 2593-2605. <https://doi.org/10.1016/j.joule.2021.09.004>

²⁹ CO₂RE & NEGEM. Consideration of GGR in Emissions Trading Systems.

³⁰ BEIS. Monitoring, Reporting and Verification of Greenhouse Gas Removals: Task and Finish Group Report. (2021).

³¹ UNFCCC, The role of the CDM EB, <https://cdm.unfccc.int/EB/index.html>

157) Who should own the rights of a possible GGR allowance or credit in a possible future market - the buyer, or the seller?

30. A credit/allowance will likely only come into being after it has been certified by an authority, at which points the GGR supplier will have the right to sell that credit. Once a transaction has taken place, the legal ownership of the credit will necessarily transfer to the credit buyer. The supplier will retain a contractual obligation to fulfil the terms of that transaction—i.e. deliver verified removals—if they have not done so at the point of sale.

159) Should GGRs be incorporated into the UK ETS or would it be preferable to establish a separate, but linked, market for GGRs?

31. Based on our suggested assessment criteria (Q147), we think a separate market for geological GGRs, linked to the ETS via revenue recycling, would be preferable.

- Fungibility. It would reduce the problems of equating emissions and removals, and of comparing removals of differing durability.
- Confidence. It would allow a competitive price for earlier-stage GGRs and provide a clearer signal for suppliers and investors to scale up deployment.
- Revenue sustainability. The market would require a revenue stream. This could be drawn from the UK ETS, and also from other sources, providing flexibility over distribution of costs and enabling a sustained GGR market after the ETS cap has shrunk to zero.
- Administrative ease. This would depend on the specifics of the mechanism, but may avoid the administrative challenge of ETS integration at a time the ETS is expanding and changing in other domains.
- Distribution of costs and benefits. By being funded primarily through ETS revenues, it would at least in part retain the 'polluter pays' approach embedded in the ETS, which has both economic efficiency and social benefits.
- Public acceptance. This would likely enjoy greater public acceptance by reducing the risk of negatively impacting the ETS, clouding the requirement on ETS-participating facilities to reduce their emissions, and damaging public acceptance of GGR and/or the ETS.

32. Nevertheless, the urgency of scaling GGR to meet UK ambition means the perfect should not be the enemy of the good. If a separate market for geological GGR is unattainable, controlled inclusion in the ETS, with wider support and scope for improvements with learning, is preferable to the current situation.

160) Are there other market designs or proposals we should consider for longer-term GGR deployment that would be preferable to inclusion in the UK ETS?

33. Other options include a carbon takeback obligation on fossil fuel producers,³² an obligation on emitters to pay a carbon debt,³³ a separate, linked market for removals (as discussed above), public procurement, subsidies or tax credits.³⁴ Obligation schemes on producers or emitters could be preferable to the UK ETS, although this is an area for further research.

³² Jenkins S., *et al.* Upstream decarbonization through a carbon takeback obligation.

³³ Bednar, J., Obersteiner, M., Baklanov, A. *et al.* Operationalizing the net-negative carbon economy. *Nature* **596**, 377–383 (2021). <https://doi.org/10.1038/s41586-021-03723-9>

³⁴ Zhou, N. *et al.* Deployment support for geological Greenhouse Gas Removals in the UK.

161) How and when could eligible GGRs be phased into a market such as the UK ETS?

34. The timing of potential GGR inclusion into the UK ETS is important; GGRs need to be ready for the market, and the market needs to be ready for eligible GGRs. GGR readiness should include a relatively small differential between durable GGRs' prices and ETS allowance prices, and an established track record of the eligible GGR: i.e. measured and verified safe and durable sequestration and storage. ETS readiness relates primarily to the resilience of regulatory mechanisms, cap setting processes, and market stability mechanisms to absorb substantial volumes of GGR.³⁵

163) Should we trial eligible GGRs in a market or scheme before fully integrating to an existing market like the UK ETS?

35. It is important to create an early 'market pull' mechanism for suitable GGRs, to drive near-term (i.e. pre-2030) delivery of removals outcomes in line with UK targets, and thereby lower the risk of delaying GGR while longer term market arrangements are determined.³⁶ It would also help quickly shape expectations about the future of GGR in the UK, inducing more innovation and directing more investment.³⁷ And it would provide opportunities for all market participants, including government, to learn and inform subsequent phases of larger-scale GGR market mechanisms.

36. We propose a separate GGR market, linked to the UK ETS through revenue recycling, which holds open the option of integration into an existing market at a later date. The detailed terms of a trial GGR market would be subject to further design, and we suggest that the six criteria for assessing appropriateness described in the answer to Question 147 be used to guide the design of the trial GGR market.

END

³⁵ CO₂RE & NEGEM. Consideration of GGR in Emissions Trading Systems.

³⁶ Burke, J. & Gambhir, A. Policy incentives for Greenhouse Gas Removal Techniques.

³⁷ Ekins, P. & Zenghelis, D. The costs and benefits of environmental sustainability. *Sustainability Science*. 16: 949-965 (2021). <https://doi.org/10.1007/s11625-021-00910-5>