# SCCS evidence to BEIS on Greenhouse Gas Removals

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Scottish Carbon Capture & Storage (SCCS) is a research partnership between the British Geological Survey (BGS), Heriot-Watt University, the University of Aberdeen, the University of Edinburgh, the University of Glasgow and the University of Strathclyde, with associate member the University of St Andrews. SCCS researchers are engaged in innovative applied research and joint projects with industry and government to support the development and commercialisation of carbon capture and storage as a climate change mitigation technology.

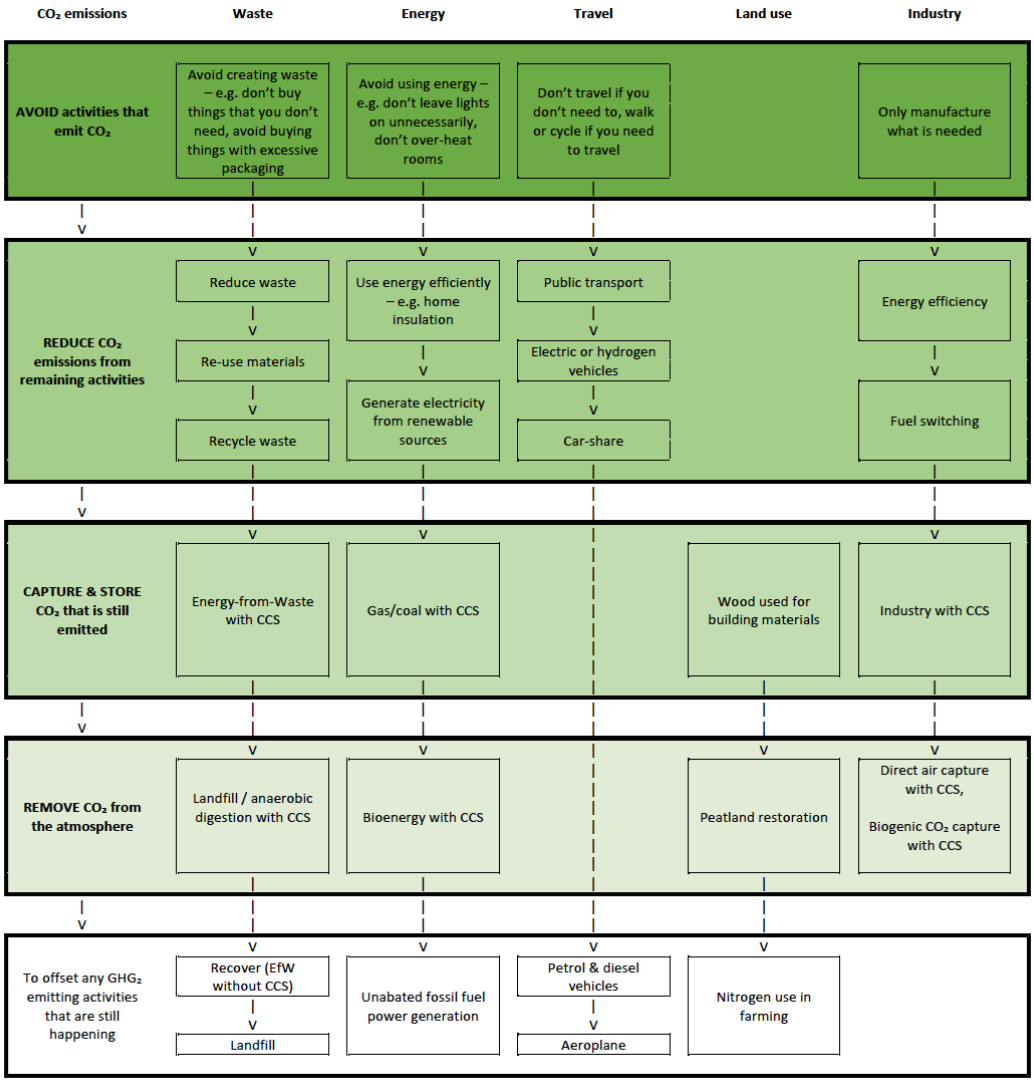
SCCS is pleased to respond to this call for evidence on greenhouse gas removal (GGR) technologies. Carbon capture and storage (CCS) has a crucial role to play in reaching net-zero targets, both by preventing $CO_2$ reaching the atmosphere, and enabling greenhouse gas removals by capturing $CO_2$ either from biogenic sources, or directly from the air.

**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?**

Yes. Many studies have highlighted the critical role that permanent storage of $CO_2$ through DACCS and BECCS will play. Most recently, the Climate Change Committee (CCC)'s Sixth Carbon Budget Advice suggested that by 2050, the UK will require between 45 and 112Mt of $CO_2$ removal per year from engineered solutions (BECCS, DACCS and wood in construction)[1]. Similarly, analysis from National Grid ESO in the 2020 Future of Energy Scenarios predicts 52-64Mt of $CO_2$ removal per year in 2050 from BECCS alone[2].

The role of greenhouse gas removals should be to offset unavoidable greenhouse gas emissions: this means that, where possible, emissions should be avoided and reduced through measures such as reduced consumption and increased energy efficiency, with GGR dealing with the remainder. GGR must be deployed as part of a hierarchy, and should not be a substitute for greenhouse gas emissions reduction. The following diagram attempts to describe this hierarchy with reference to the waste, energy and transport hierarchies and other examples.

[1] Climate Change Committee (2020) The Sixth Carbon Budget: The UK's path to Net Zero. Available at: https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf
[2] National Grid ESO, 2020. Future Energy Scenarios 2020. Available at: https://www.nationalgrideso.com/document/174541/download




In a $CO_2$ emissions hierarchy, GGRs should be the least preferred option; however, this is not to say that they will not be needed, nor that their use should be deferred. Research[3] suggests that early deployment of greenhouse gas removals would be preferable in terms of intergenerational equity and climate and environmental safety, with lower overall impact on land use and food systems.

Analysis by SCCS[4] found that Scotland emits around 3.6 Mt $CO_2$/year from biogenic sources, including large-scale biomass combustion for heat and/or power biogas, landfill gas and biomethane; and fermentation to produce alcohol (which produces an almost pure stream of $CO_2$). Around 60% of this is from just 32 facilities, which represents a significant opportunity for early deployment of GGRs on existing sources of biogenic $CO_2$.

[3] Obersteiner, M *et al* (2018) *How to spend a dwindling greenhouse gas budget*, Nature Climate Change, volume 8. Available at https://doi.org/10.1038/s41558-017-0045-1

[4] Brownsort, P (2018) *Negative Emission Technology in Scotland: carbon capture and storage for biogenic $CO_2$ emissions*. Available at: https://www.sccs.org.uk/images/expertise/reports/working-papers/WP_SCCS_2018_08_Negative_Emission_Technology_in_Scotland.pdf

The UKRI-funded Scotland's Net Zero Roadmap[5] project will build on this work to investigate the potential for $CO_2$ removal from some of Scotland's largest industrial emitters. Working closely with emitters and referencing the most recent publicly available industrial emissions data, the work is expected to cover sites from across the energy, food & drink and waste & wastewater management sectors. Another key strand of this task will be close collaboration with SEPA on the recording and public availability of biogenic $CO_2$ emissions data.

We suggest that similar analysis should be undertaken for the rest of the UK to understand the potential for GGRs from existing activity.

**In relation to the GGRs listed in Figure 1, is there new evidence that you can submit in relation to any of the following: (i) technology readiness levels (ii) scale-up potential; (iii) costs per tonne of CO2 removed (iv) constraints to deployment; (v) ability to verify removals (vi) lifecycle emissions for these methods in the UK; (vii) wider environmental impacts and risks.**

In addition to the research cited above, we would draw your attention to the ERA-NET ACT-funded NEWEST-CCUS[6] project - Negative Emissions in the Waste-to-Energy Sector: Technologies for Carbon Capture, Utilisation & Storage – a summary of which is given below:

*NEWEST-CCUS is an innovative three-year project funded by the ERA-NET Accelerating CCS Technologies (ACT2) initiative to assess the scale of the European market for carbon capture, utilisation and storage (CCUS) technologies in the waste-to-energy (WtE) sector.*

*The project, which began in September 2019, also explores the sector's potential for cumulative net carbon dioxide (CO2) removal from the atmosphere.*

*Our team of academic and industry experts from 21 organisations and six countries will build on work already undertaken to de-risk and accelerate the development and deployment of CO2 capture technologies tailored specifically for WtE applications.*

*By building strong collaborative networks, we will demonstrate technological capability and deliver a robust methodology for negative emissions accounting, which will support the successful implementation of CCUS in the WtE sector and the potential for WtE to be a key contributor to climate change mitigation efforts.*

We were pleased to see the role of CCS in the WtE sector explored in the CCC's Sixth Carbon Budget Advice: the amounts of GGR expected from WtE vary by a factor of 10 depending on the scenarios, with 1 $MtCO_2$/yr of negative emissions at the lower end, and up to 10 in the headwinds scenario. This is a slight underestimate, however, as the CCC assumes a $CO_2$ capture rate of 95%; $CO_2$ capture rates of almost 100% have, in fact, been shown to be possible, with marginal additional cost.[7]

[5] https://www.neccus.co.uk/the-roadmap/scotlands-natural-strengths-for-industrial-decarbonisation/
[6] https://www.newestccus.eu
[7] IEAGHG (2019) *Towards Zero Emissions CCS in Power Plants Using Higher Capture Rates or Biomass.* Available at: https://ieaghg.org/publications/technical-reports/reports-list/9-technical-reports/951-2019-02-towards-zero-emissions

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

This coordination is important: both BECCS and DACCS require the existence of $CO_2$ transport and storage infrastructure, so the government's support for CCUS clusters, and establishment of CCS business models, will be crucial for the deployment of BECCS.

However, any further work needed on GGR should not be allowed to slow down deployment of CCS. Coordination of these workstreams should mean that government activity on GGR (including on business models for GGR) is expedited in line with existing timescales for CCS deployment.

Scottish Carbon Capture & Storage (SCCS) would be happy to answer any questions or provide further information. We have a wealth of research – produced by our partner research institutions and by the SCCS team – that we would be happy to share.[8]

**For more information** contact Rebecca Bell, SCCS Policy & Research Officer

e: rebecca.bell@sccs.org.uk t: 07795 882123

[8] See http://www.sccs.org.uk/expertise/reports , http://www.sccs.org.uk/expertise/reports/working-papers , http://www.sccs.org.uk/expertise/publications