

7 December 2018

Submission to Committee on Climate Change zero carbon economy call for evidence

1. The Royal Society and Royal Academy of Engineering welcome the opportunity to submit to this call for evidence. The Royal Society is the National Academy of Science for the UK and the Commonwealth. It is a self-governing Fellowship of many of the world's most distinguished scientists working across a broad range of disciplines in academia and industry. The Society draws on the expertise of its Fellows and Foreign Members to provide independent and authoritative scientific advice to regional, national, UK, European and international decision makers.
2. The Royal Academy of Engineering is the UK's National Academy for engineering. It brings together the most successful and talented engineers from across the engineering sectors for a shared purpose: to advance and promote excellence in engineering for the benefit of society. Through its Fellowship, the Academy has access to highly qualified individuals with a range of expertise including chemical engineering, sustainability, energy, materials and process systems engineering. The Academy harnesses their experience and expertise to provide independent advice to government.
3. The two Academies have recently undertaken a joint project highlighting the status and potential of Greenhouse Gas Removal technologies (GGRs), including their potential role in bringing the UK to net zero emissions in 2050. In this report we outline a feasible pathway to 130 MtCO₂ a year of removals which could, alongside substantial emissions reductions, bring the UK to net-zero emissions in 2050.
4. The Academies have shared this work with the Committee and would be happy to discuss their findings and broader work in this area further. This submission draws on the findings of the Academies joint work on GGRs to answer the following two of the Committee's specific questions:
 - Question 4: Beyond setting and meeting its own targets, how can the UK best support efforts to cut emissions elsewhere in the world through international collaboration (e.g. emissions trading schemes and other initiatives with partner countries, technology transfer, capacity building, climate finance)? What efforts are effective currently?
 - Question 7: (Greenhouse gas removals): Not all sources of emissions can be reduced to zero. How far can greenhouse gas removal from the atmosphere, in the UK or internationally, be used to offset any remaining emissions, both prior to 2050 and beyond?
5. Bringing the UK to net-zero emissions in 2050 would require deploying a wide suite of technologies. The role of rapid emissions reduction in meeting this target is widely understood. But it is increasingly clearer that reducing emissions is not enough – we must also actively remove greenhouse gases from the atmosphere. Our report outlines a feasible pathway to 130 MtCO₂ a year of removals which could, alongside substantial emissions reductions, bring the UK to net-zero emissions in 2050.

6. International collaboration will be important in incentivising the global use of GGRs as deployment of GGRs is likely to be heavily influenced by location, on both national and global scales. For example, methods requiring Carbon Capture and Storage may be more easily deployed around the relevant infrastructure. Methods requiring mineral, energy, biomass, or water might be most sensibly deployed where there is supply of those resources that could be utilised at low or no cost. A number of methods require significant land-use change from other activities. This will be particularly hard in highly populated areas or those with protected environmental status, but there are also ethical considerations when 'available' land is used by more sparsely populated or itinerant peoples
7. In our report, we recommend action to incentivise removal of atmospheric greenhouse gases through carbon pricing or other mechanisms. GGR has financial cost at scale and so will require incentives to drive technological development and deployment of a suite of methods.
8. While it is possible to imagine some nations meeting their own needs for GGR, it is not likely to be the case for every country, nor to be the most globally efficient approach to meet GGR targets and the goals of the Paris Agreement. International trade in raw materials and carbon credits will be necessary in many cases and could help lower overall costs. Countries with natural resources used for GGR will export them and those with a need will import them. The largest such resource is likely to remain biomass, which is already traded internationally. Mineral resources for enhanced weathering or mineral carbonation may also be traded. International agreement about allocation of credits for GGR will be required for such trade. One question that needs resolving is whether the credit is gained by the country producing the resource or the country using it and storing the removed carbon, or whether the credits are shared.
9. Trading of carbon credits from GGR methods could also be used to increase efficiency, lower costs and enhance development of GGR. A country with large scope for GGR due to economic, technological or geographical reasons might choose to 'over-remove' CO₂ to cover other nation's requirements in exchange for payment. Countries with large capacity for CCS (such as the UK) or mineral carbonation (such as Iceland) might be paid to store CO₂; those with land and water to increase forest mass; and those with substantial non-carbon energy potential to pursue DACCS. While our report focused primarily on the scientific and technical aspects of GGR pathways, we also recognised that successful deployment of GGR will depend on establishing international agreements on trade and carbon credits in the context of GGR.
10. In all cases measurement, reporting and verification will be critical to ensure CO₂ fluxes are accurately accounted for and standards set to prevent double-counting. Additionally, the ethical implications and social acceptability of these transactions will need to be taken into account.
11. The full report can be found online at <http://www.royalsociety.org/greenhouse-gas-removal>.

For further information, please contact Becky Purvis on becky.purvis@royalsociety.org