



The UK Government's View on Greenhouse Gas Removal Technologies and Solar Radiation Management

What are they?

Greenhouse Gas Removal (GGR) and Solar Radiation Management (SRM) are terms describing a range of technologies that aim to counteract human-caused climate change by deliberate large-scale intervention in the Earth's natural systems. They are sometimes referred to as "geo-engineering" or "climate engineering".

GGR technologies actively remove greenhouse gases from the atmosphere. Examples include afforestation, bioenergy with carbon capture and storage (BECCS), direct air capture and storage (DACCS), and marine fertilisation. Those that specifically remove carbon dioxide (CO₂) from the atmosphere are also known as Carbon Dioxide Removal (CDR) technologies.

SRM technologies reflect some of the Sun's energy that reaches Earth back into space. Examples include the brightening of marine clouds and injection of aerosols into the stratosphere. While these would be likely to reduce the Earth's temperature, they would not reverse ocean acidification (unlike GGRs).

Our priority is to tackle the root cause of climate change by reducing emissions of greenhouse gases from human activities, and adapting to those impacts that are unavoidable. Mitigation of climate change by reducing emissions and protecting natural carbon sinks remains the main focus of our efforts to increase our chances of avoiding dangerous climate change.

Why are they needed?

In order to deliver on the commitment the UK made by signing the Paris Agreement, the UK has legislated for a net zero emissions target by 2050.¹ Our independent advisors, the Committee on Climate Change (CCC), have made it clear that GGRs will be essential to realising this target, to offset remaining emissions in the sectors where it is most difficult to cut them.²

¹ <https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law>

² <https://www.theccc.org.uk/publication/uk-action-following-paris/>

Research, Development and Deployment

We are already encouraging tree planting with a variety of schemes.

Any further deployment must be informed by thorough understanding of the costs, feasibility and environmental and societal impacts. Such understanding is currently limited so we are taking active steps to strengthen our understanding of GGRs and, where appropriate, move forward with deployment. For example:

- We have been working with the Research Councils, who launched an £8.6 million GGR research programme in April 2017.³
- We have launched a new £31.5 million programme funded by the UKRI's Strategic Priorities Fund to support GGR Demonstrators over 4.5 years.⁴
- In September 2018, the Royal Society and Royal Academy of Engineering published a report reviewing the potential for deploying a broad range of GGRs.⁵
- We commissioned a study on policy incentives for GGR deployment in the UK and in other countries, which was published in September 2019.⁶
- In November 2018, we published an action plan setting out how Government and industry can work in partnership to achieve the Government's ambition for carbon capture, usage and storage (CCUS)⁷.
- The Energy Innovation Programme has committed £100m to help decarbonise industry and open routes to CCUS. Funding has been awarded to several projects including a collaboration between C-Capture and Drax to build Europe's first BECCS pilot.

We are building a wider, strategic approach to GGRs, building on this developing evidence base.

The Government is not deploying SRM, and has no plans to do so.

The UK Government has commissioned research into the effects of SRM on climate, and monitors research in this area. The World Climate Research Programme's (WCRP's) Geoengineering Model Intercomparison Project (GeoMIP), is investigating, using computer modelling, the effects which SRM would have on the climate.⁸

³ <http://www.nerc.ac.uk/press/releases/2017/09-greenhousegas/>

⁴ <https://bbsrc.ukri.org/funding/filter/2019-greenhouse-gas-removal-demonstrators/>

⁵ <https://royalsociety.org/topics-policy/projects/greenhouse-gas-removal/>

⁶ <https://www.gov.uk/government/publications/greenhouse-gas-removal-policy-options>

⁷ <https://www.gov.uk/government/publications/the-uk-carbon-capture-usage-and-storage-ccus-deployment-pathway-an-action-plan>

⁸ <http://climate.envsci.rutgers.edu/GeoMIP/>

Regulation

We would expect any deployment of GGRs to comply with local, national and international regulation and guidance. Some forms of GGR are already regulated. For instance, in England, large-scale afforestation is covered by Environmental Impact Assessment Regulations. In addition, work has been undertaken to examine how existing international instruments could apply:

- The Government has supported the Convention on Biological Diversity (CBD) in its review of existing regulatory instruments. Following consideration of this review, the 13th Conference of the Parties (COP) to the CBD adopted a decision in 2016 noting that more research is needed. The COP also recalled a previous decision in 2010 which invites Parties to take a precautionary approach on any geo-engineering activities that may affect biodiversity until there is an adequate scientific basis to justify such activities, with the exception of small-scale, controlled scientific research studies.
- The Government has contributed to work under the London Protocol on the prevention of marine pollution by dumping of wastes and other matter, to adapt the instrument to meet this new challenge. This has resulted in adoption by Parties to the London Protocol, in October 2013, of an amendment to regulate ocean fertilisation activities and, potentially, other forms of marine geo-engineering. The UK was the first country to ratify the amendment, in 2016.
- At the Montreal Protocol meeting in November 2019, the UK supported a decision asking the Protocol's Scientific Assessment Panel to assess research related to SRM, and its potential effect on the stratospheric ozone layer. This assessment will be included in the next Montreal Protocol Quadrennial Assessment Report (due to be published in 2022).

Further reading:

[Vivid Economics for BEIS: "Greenhouse Gas Removal Policy Options \(2019\)](#)

[The Royal Society, Royal Academy of Engineering \(2018\): Greenhouse gas removal](#)

[NAS Programme "Developing a Research Agenda for Carbon Dioxide Removal and Reliable Sequestration" \(2018\)](#)

[Update on climate geoengineering in relation to the Convention on Biological Diversity: Potential impacts and regulatory framework \(2016\)](#)

[Climate Intervention Reflecting Sunlight to Cool Earth \(2015\)](#)