



**Government Response to the House of Commons
Science and Technology Committee 5th Report of Session 2009-10:
The Regulation of Geoengineering**

Cm 7936

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Presented to Parliament
by the Secretary of State for Energy and Climate Change
by Command of Her Majesty

September 2010

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Government Response to the House of Commons Science and Technology Committee's 5th Report from Session 2009-10:

The Regulation of Geoengineering

Introduction

The Government welcomes the Committee's report as a significant addition to the debate on geoengineering research and deployment, and the relative needs and options for international regulation. This memorandum sets out the Government's response to the conclusions and recommendations of the report, and has been prepared by the Department of Energy and Climate Change with contributions from GO-Science, BIS, Defra, FCO and RCUK.

The Committee's numbered recommendations and conclusions are shown in bold and the paragraph references at the end of each recommendation correspond with those in the Committee's report. The Government's response is given at the end of each section.

The Government's priority is and must be to tackle climate change at source by reducing emissions of greenhouse gases from human activities and to push for strong concerted international action. We recognise, however, that geoengineering might have a possible role to play in aiding our mitigation efforts in the future. However, significant international effort from a wide range of disciplines will be required to improve understanding of the scientific, technological, societal and legal implications of both geoengineering research and deployment.

We consider that there is a need for international regulation to ensure that any geoengineering research and deployment activities are pursued responsibly, in particular for those technologies that have trans-boundary implications. We therefore welcome the Committee's recommendations for more international collaboration and co-ordination towards developing robust international instruments and regulatory frameworks to cover such diverse, complex and potentially 'planet-changing' technologies.

However, the current low level of understanding of the risks and impacts of geoengineering options and the present early development stage of technologies, means that it would be difficult at the present time to formulate effective or appropriate regulatory regimes for geoengineering research and deployment to

cover all possibilities that might receive serious attention. Any future regulatory framework would also need to include flexibility to take account of new findings and developments as they arise.

We recognise that the diversity of geoengineering techniques render it unlikely that a comprehensive, overarching governance framework will be appropriate, and that different techniques may need different governance arrangements. Furthermore, the extent to which geoengineering activities are covered by existing regulations is unclear and a first step must be, therefore, to address this uncertainty and perform a gap analysis.

The Royal Society has launched a Solar Radiation Management Governance Initiative (SRMGI) in partnership with the Academy of Sciences for the Developing World (TWAS) and the U.S. Environmental Defense Fund (EDF) to explore regulatory issues pertaining to SRM techniques. We welcome this initiative which will help us develop a formal position and future strategy.

There are also a number of other activities currently underway which will be important contributions to this process, and which the Government is supporting. The IPCC's next Assessment Report will address geoengineering and will provide further information on the science and environmental consequences of both Carbon Dioxide Removal (CDR) and Solar Radiation Management (SRM) techniques. The Natural Environment Research Council (NERC) has recently completed, with partners, a Public Dialogue Exercise to inform how future geoengineering research is directed, conducted, shaped and communicated.

Finally, the UK is also actively engaged, through Defra, BIS and RCUK, with the London Convention/London Protocol (LC/LP), the Convention on Biological Diversity (CBD) and the Intergovernmental Oceanographic Commission (IOC) in considering an appropriate regulatory regime for ocean fertilization as a potential geoengineering technique, with initial focus on an approval process for relevant research in international waters.

Definition of geoengineering

- 2. We conclude that weather techniques such as cloud seeding should not be included within the definition of geoengineering used for the purposes of activities designed to effect a change in the global climate with the aim of minimising or reversing anthropogenic climate change. (Paragraph 28)**
- 3. In our view, geoengineering as currently defined covers such a range of Carbon Dioxide Removal (CDR) and Solar Radiation Management (SRM) technologies and techniques that any regulatory framework for geoengineering cannot be uniform. (Paragraph 30)**

- 4. We conclude that geoengineering techniques should be graded according to factors such as trans-boundary effect, the dispersal of potentially hazardous materials in the environment and the direct effect on ecosystems. The regulatory regimes for geoengineering should then be tailored accordingly. Those techniques scoring low against the criteria should be subject to no additional regulation to that already in place, while those scoring high would be subject to additional controls. (Paragraph 33)**

The Government agrees that the current definition of geoengineering encompasses a broad range of technologies and techniques, and confirms that methods of weather modification (such as cloud seeding) that achieve local (within national boundary) effects of a transient nature, are not included in our definition of geoengineering.

We also agree that any regulatory frameworks would need to be tailored to different techniques. The degree of regulation should depend on the potential impacts and risks associated with the technique and take into account the extent to which they are covered by existing legislation. The grading of geoengineering technologies on the basis of the scale of their potential adverse consequences would therefore seem sensible from a scientific perspective.

Regulatory framework

- 5. Through its involvement in the existing international regulatory arrangements such as the UN Framework Convention on Climate Change and when these instruments come up for revision we recommend that the Government raise geoengineering, particularly those for Carbon Dioxide Removal (CDR), and seek to develop in conjunction with other governments, the arrangements provided by these international instruments so that they address research on, and deployment of, CDR geoengineering techniques. (Paragraph 38)**
- 6. We conclude that there is a gap in the regulatory framework for geoengineering techniques, especially for SRM techniques. (Paragraph 40)**
- 7. We recommend that the Government review its policy on geoengineering to give it greater priority. (Paragraph 49)**
- 8. The science of geoengineering is not sufficiently advanced to make the technology predictable, but this of itself is not grounds for refusing to develop regulatory frameworks, or for banning it. There are good scientific reasons for allowing investigative research and better reasons for seeking to devise and implement some regulatory frameworks, particularly for those techniques that a single country or small group of countries could test or deploy and impact the whole climate. (Paragraph 54)**

- 9. We conclude that there is a need to develop a regulatory framework for geoengineering. Two areas in particular need to be addressed: (i) the existing international regulatory regimes need to develop a focus on geoengineering and (ii) regulatory systems need to be designed and implemented for those SRM techniques that currently fall outside any international regulatory framework. (Paragraph 55)**

The Government considers it too early to be able to establish appropriate regulatory frameworks for geoengineering research or deployment on a comprehensive basis without a clear view of what needs to be regulated and how. We agree that there seem to be gaps in the existing landscape of international regulation but the first step should be to determine to what extent geoengineering technologies may be covered by existing regulations and what is the nature of any control that is afforded in each case. We suggest that this analysis should be performed at an international level.

In relation to the international regulatory arrangements currently under development for ocean-based CDR, the Government has engaged in discussions on ocean fertilisation under the London Convention and the London Protocol openly and constructively, and will continue to do so. It is important to note that discussions on ocean fertilisation under the London Protocol come from a desire to ensure that parties comply with the Protocol, protecting and preserving the marine environment from all sources of pollution as an overarching objective. Rather than being an attempt at geoengineering regulation *per se*, Contracting Parties are looking at options for the regulation of ocean fertilisation research and the development of an assessment framework to respond to the reality that there are organisations wishing to conduct ocean fertilisation experiments.

With reference to Recommendations 7 and 8, the Government is still developing its policy on geoengineering and, at this stage, considers that any work which is aimed at deploying geoengineering technologies should be deferred pending significant research and that our priority must remain to mitigate climate change. The Government does, however, recognise the need for further research into the feasibility, effectiveness and environmental and societal consequences of geoengineering techniques. We consider that appropriate regulatory frameworks should be developed for managing any future field-based research activities with trans-boundary implications and that in the longer term, any deployment must await appropriate regulatory mechanisms.

Public engagement

- 10. We recommend that the Government give greater priority to public engagement on geoengineering by, for example, showing how it relates to its policy on the reduction of carbon dioxide emissions. We welcome the work of Natural Environment Research Council (NERC) on public engagement on geoengineering and we request that, when the work is completed, the**

Government provide our successor committee with an explanation of how it will inform its policy on geoengineering. (Paragraph 58)

The Government considers that it is important that the public has a clear understanding of science issues and of their impact on their lives. In this context, the work of the Research Councils is valuable. The NERC-led public dialogue aimed to influence the way future research efforts are conducted and communicated. It included consideration of moral and ethical issues at this early stage, to ensure that public research funds are used in ways that reflect the broader concerns and hopes of society around climate change.

The public dialogue involved workshops in Birmingham, Cardiff and Cornwall, where around ninety members of the public heard about potential geoengineering ideas and had a chance to discuss their ethical, social and legal implications. The Government is awaiting the final report, to be published later this year.

The formulation of a regulatory framework

- 11. While accepting that the development of a “top-down” regulatory framework may have risks and limitations, we consider that these are outweighed by the benefits of an international framework: legitimacy; scientific standards; oversight mechanisms; and management of environmental and trans-boundary risks. (Paragraph 65)**
- 12. We welcome the production of the principles by a group of academics which provide a basis to begin the discussion of principles that could be applied to the regulation of geoengineering. (Paragraph 66)**
- 13. We conclude that Principle 1 of the suggested five key principles on how geoengineering research should be guided—“Geoengineering to be regulated as a public good”—needs, first, to be worked up in detail to define public good and public interest. Second, the implied restriction suggested in the explanatory text to the Principle on intellectual property rights must be framed in such a manner that it does not deter investment in geoengineering techniques. Without private investment, some geoengineering techniques will never be developed. (Paragraph 71)**
- 14. We conclude that Principle 2—“Public participation in geoengineering decision-making”—is to be supported but it needs to spell out in the explanatory text what consultation means and whether, and how, those affected can veto or alter proposed geoengineering tests. (Paragraph 74)**
- 15. We endorse Principle 3—“Disclosure of geoengineering research and open publication of results”. The requirement to disclose the results of geoengineering research should be unqualified. We recommend that the**

Government press for an international database of geoengineering research to encourage and facilitate disclosure. (Paragraph 77)

- 16. We also endorse Principle 4—“The independent assessment of impacts”. But it too needs to be worked up in more detail in the explanatory text to: (i) define impacts; (ii) produce agreed mechanisms for assessing impacts, including for assessing the impact of global warming; and (iii) determine whether and how compensation should be assessed and paid. The agreement of these arrangements will need to command the broadest level of support across the globe and we consider that UN-led, multilateral processes are the best way to secure concurrence. (Paragraph 82)**
- 17. We endorse Principle 5—“Governance before deployment of any geoengineering technique”. We recommend that the Government carry out research, and press for research to be carried out through international bodies on the legal, social and ethical implications, and regulation and governance of geoengineering. (Paragraph 84)**
- 18. We conclude that the key principles should not include the precautionary principle as a discrete principle. (Paragraph 86)**
- 19. While some aspects of the suggested five key principles need further development, they provide a sound foundation for developing future regulation. We endorse the five key principles to guide geoengineering research. (Paragraph 87)**

We welcome the contribution of the Committee and academics in framing the outline of a set of principles to guide geoengineering research, but it is clear that the details of these principles require more in-depth discussion.

The Government agrees with the general principle that researchers should be as open as possible in communicating their data, methodology, results and conclusions. This is compatible with the basic scientific approach which allows studies to be replicated for further testing and challenge of results. It is already the policy of many funders of research to require such openness.

That said there are a number of reasons why it is not always possible or appropriate to make the results and/or underlying data associated with research available. These include the need to respect commercial rights to certain data, security considerations and the need to protect personal confidentiality. The Government accepts that such exclusions should be the exception rather than the rule.

The Government agrees that, as with all research areas, it is good practice to share data and research both nationally and internationally and that an international database of geoengineering research would encourage and facilitate disclosure.

We note that the physical scientific basis and impacts of geoengineering techniques will be assessed in several chapters of the Working Group 1 contribution to the Intergovernmental Panel on Climate Change's Fifth Assessment Report. Specifically, it will consider geoengineering involving the carbon cycle, geoengineering involving clouds and aerosols and the possible effects of geoengineering to near-term climate change. We also note that the IPCC will hold an expert meeting in 2011 which will discuss in more detail different geoengineering options, their risks and uncertainties, and the suitability of existing governance mechanisms. The findings will help inform our position on geoengineering research and deployment.

The Government broadly agrees with Principle 5 that there should be governance mechanisms in place before any large-scale field research and deployment, in particular for those which might have trans-boundary effects. We also agree that it is important that research on geoengineering addresses the social, legal and ethical dimensions. To this end, we are working with the Royal Society as they conduct their explorations on regulation of SRM research through their SRM Governance Initiative.

Regulation of research and testing

- 20. Provided those carrying out research follow a code of practice along the lines of that suggested by the Royal Society, incorporating in particular Principle 3 on the disclosure of geoengineering research and open publication of results, we see no reason for an international regulatory regime applying to paper and computer modelling of geoengineering techniques. (Paragraph 90)**
- 21. We consider that a ban, even a short-term ban, on all SRM geoengineering testing would prevent work on geoengineering as "Plan B". It may well also be unenforceable and be counter-productive as those carrying out tests do so in secrecy. (Paragraph 94)**
- 22. We conclude that development and small tests of SRM geoengineering should be allowed provided they:**
 - a. are fully in accordance with an internationally agreed set of principles such as those we have considered in this Report;**
 - b. have negligible or predictable environmental impact; and**
 - c. have no trans-boundary effects. (Paragraph 95)**
- 23. We consider that any testing that impacts on the climate must be subject to an international regulatory framework. (Paragraph 96)**
- 24. We recommend that any UK SRM programmes should involve international scientists, particularly including those from vulnerable developing countries, and that these programmes should give priority to research on SRM schemes**

that may preserve global public welfare. We further recommend that the UK Government press the governments of other countries to adopt a similar approach to SRM research. (Paragraph 98)

The Government agrees that paper studies and computer modelling of geoengineering techniques should not in themselves be subject to an international regulatory regime.

While geoengineering research that takes the form of field-testing is not currently subject to bespoke legislation, various types of geoengineering tests are, by virtue of their character and potential for trans-boundary impact, subject to existing international environmental regulation. For example, the duty not to cause significant trans-boundary harm is recognised in many treaty instruments (CBD, UNFCCC, UN Law of the Sea Convention (UNCLOS), UN Convention to Combat Desertification (UNCCD))¹.

Field-testing of geoengineering techniques (both CDR and SRM) presents risks of negative, trans-boundary impacts on regional climates, ecosystems and human populations. For this reason, the Government is of the view that field-testing of geoengineering techniques that could potentially have non-negligible impacts on the environment should be subject to international regulation. This regulation should fall short of a blanket ban for reasons outlined in the Committee's Report.

We consider a better approach would be to establish internationally-agreed frameworks against which field tests could be considered on a case-by-case basis. The London Convention and London Protocol may, in relation to ocean fertilisation, provide a useful example in terms of developing such frameworks. However, the point at which appropriate frameworks for other geoengineering techniques might ultimately be agreed would appear to be still many years hence, and would require a great deal of preparatory work via international collaboration. Meanwhile, current national and international regulatory frameworks should cover early research and local field trials.

The Government agrees with the principle in Recommendation 24 of the report that international collaboration on scientific research, be it on geoengineering or any other highly policy-relevant concern, is a useful mechanism for helping, ultimately, to develop international consensus on policy. We note that stakeholder partners to the Royal Society's SRMGI will include a wide range of largely non-governmental organisations from natural and social sciences, public policy, civil society and private enterprise, from both developed and developing nations.

The Government is working through its various overseas embassies to gauge the extent and nature of any consideration by other governments of geoengineering.

¹ Royal Society: *Geoengineering the Climate*, September 2009

International regulatory arrangements

- 25. We consider that the way forward for the regulation of geoengineering is through the UN and we recommend that the UK Government and other interested countries develop proposals for the regulation of not only CDR but also SRM techniques and begin to press them through the UN. (Paragraph 100)**
- 26. We recommend that the UK Government is proactive in persuading and working with other governments to press for regulatory arrangements for geoengineering through the UN. They should do this on the basis of the following principles and objectives:**
- a. geoengineering to be regulated as a public good;**
 - b. public participation in geoengineering decision-making;**
 - c. disclosure of geoengineering research and open publication of results;**
 - d. independent assessment of impacts;**
 - e. governance arrangements to be clear before deployment;**
 - f. decisions to be based on the best scientific evidence, including social science;**
 - g. regulatory measures to be able to respond rapidly;**
 - h. regulatory measures imbued with a high level of flexibility to be able, for example, to encompass new technologies as they emerge; and**
 - i. prohibition of the use of geoengineering techniques for military purposes. (Paragraph 103)**
- 27. We recommend that the Government press for a suitable international body to commission a review of existing international and regional mechanisms to: (i) consider the relevant roles of the existing international bodies in the regulation of geoengineering; (ii) identify existing mechanisms that could be used to regulate geoengineering research and deployment activities, if suitably extended as necessary; and (iii) identify where regulatory gaps exist in relation to geoengineering methods proposed to date, and establish a process for the development of mechanism to address these gaps. (Paragraph 106)**
- 28. We recommend that, in parallel with the development of an international regulatory framework, the UK Government press for the establishment of an international consortium, to explore the safest and most effective geoengineering options, while building a community of researchers and developers. (Paragraph 109)**
- 29. We recommend that the UK should take the lead in raising geoengineering within international bodies such as the EU and the Commonwealth. (Paragraph 112)**

The Government considers that international action will be needed by a range of organisations in the near term to develop proposals for regulating research into

both CDR and SRM techniques, once widely-acceptable governance principles have been established for geoengineering research. The Royal Society's SRM Governance Initiative is expected to contribute to this process. However, we consider it premature for inter-governmental action on regulatory arrangements, whether through the UN or some other body, before governance principles have been agreed. We welcome, however, the Committee's suggestions for a set of principles and objectives on which to base future development of regulatory arrangements for both research and deployment.

In the context of research, we agree that a review and gaps analysis of existing international and regional regulatory mechanisms should be undertaken, to determine how a regulatory framework could best be developed for field-scale research with potential cross-boundary implications and whether the UN or some other international agency would be most appropriate route for taking forward a framework. The SRM Governance Initiative will include an assessment of existing mechanisms. This initiative, and the recent Asilomar International Conference on Climate Intervention Technologies² which took place in the US, will enable the establishment of an international consortium of key stakeholders, covering a broad spectrum of interests, that can further explore the suitability of different geoengineering options.

We believe that our principal international priority should be to get agreement on a robust global mitigation framework that is backed up by ambitious national targets and actions, rather than raising the issue of geoengineering. Given the delicate state of the international negotiations, our current focus is on using our international influence to remove the barriers which prevented a binding agreement being reached at Copenhagen.

Collaborative working with the US Congress

- 30. We must put on record that we are enthusiastic supporters of collaborative working between national legislatures on topics with international reach such as geoengineering and we consider that there are a range of measures that could be taken to streamline the process of collaborative working. (Paragraph 117)**
- 31. We conclude that in future collaborative working between legislatures House of Commons committees should request the committee with which collaboration is taking place to provide a "permanent" witness—either an official or member of the committee—to provide oral evidence via video link at all oral evidence sessions. (Paragraph 119)**
- 32. We consider that in future when House of Commons committees participate in collaborative work they should include a statement in the call for submissions**

² www.climateresponsefund.org

that, subject to the appropriate considerations of privilege, memoranda received may be passed to the committee in the other legislature. Reciprocal arrangements should be sought from the other committee. It should also be agreed that the committee receiving the memorandum will arrange and lead on publication. (Paragraph 120)

33. We consider that the House of Commons should consider procedural changes to the effect that, where a select committee resolves to carry out collaborative working with a committee in another national legislature, a member of that committee attend—or communicate via video link—private sessions of the House of Commons committee. (Paragraph 121)

34. Science, technology and engineering are key to solving global challenges. Only through international collaboration will these challenges be met with success. We suggest that the next Science and Technology Committee should re-establish the working relationship with the US House of Representatives Science and Technology Committee. It should also consider making working connections with other international committees. (Paragraph 122)

The Government supports in principle collaborative working by UK Parliamentary Committees with international legislature partners on issues of mutual interest, such as geoengineering regulation. The Foreign and Commonwealth Office frequently provides support at Post for Parliamentary Committee visits overseas.

In this respect, we note that the decision to collaborate with the US House of Representatives on this inquiry arose from the Committee's visit to the US facilitated by the British Embassy in Washington.

Conclusion

35. We are clear that serious consideration for the regulatory arrangements for geoengineering needs to start now, not once highly disruptive climate change is under way. (Paragraph 123)

Whilst it is important to take account of all the possible options available which could help to counteract dangerous climate change, the Government considers many uncertainties remain about the efficacy and potential impacts of geoengineering techniques, particularly those involving SRM. Much further research will be needed into the science and technologies of geoengineering, as well as the wider implications, before they could be considered for deployment. We consider regulatory arrangements, including guiding principles, for geoengineering research do need to be developed as soon as possible to encourage responsible action and transparency.



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