The Regulation of Geoengineering - Science and Technology Committee Contents

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4 Future regulatory arrangements

59. Having concluded in the previous chapter that there is a need to develop the regulatory regimes for geoengineering, we examine in this chapter what regulatory principles and arrangements should apply and how they might operate.

The formulation of a regulatory regime

60. The first stage in establishing a regulatory regime (or regimes) is to decide on principles and common procedures. The experts who gave us oral evidence favoured a "bottom-up generation of norms"[116] rather than a "top-down" approach from an organisation such as the UN. John Virgoe wished to develop and "socialise" the norms "among the community of nations, the community of scientists and other stakeholders".[117] He considered that the state of international understanding and also the knowledge base was currently so weak that the outcome from a top-down approach could be unsatisfactory. He explained:

> it is very possible to imagine, if this is put on the table in some sort of UN forum, you could end up with a decision [...] to make geoengineering a taboo, to outlaw it, and that would be a mistake, for a couple of reasons. One is that it may be that we actually need to be doing this research and that, some decades down the line, we will be very sorry if we have not started thinking through these techniques. The second is that I think there are a lot of actors out there [...] with the capacity to research and implement these techniques. Some of them may not feel bound by that sort of international decision, some of them may not be as responsible, and it would be very unfortunate if what geoengineering research was happening was going on under the radar screen, if you like. What we need is an open process which builds on some of the principles that are already out there around similar issues; for example, principles developed to deal with long-range air pollution or weather modification: principles around openness, transparency and research, notifying a neighbouring

> country or countries which might be affected. We probably develop these through maybe a slightly messier process than an international negotiation. Individual countries will have a role; communities of scientists will certainly have a role.[118]

61. While accepting that the "bottom-up" approach could work well for developing deployment technologies, laboratory research and computational modelling, Dr Blackstock had reservations whether it would be sufficient when it came to field tests, particularly high leverage SRM technologies and those with trans-boundary impact. He said that as well as the technical risk and the environmental risk there was the political risk in the perception of the test.[119] He cited the recent case of the ocean fertilisation experiment in 2009—Lohafex—an Indo-German collaboration. He said that the test would have had very small impacts in terms of the ecosystems and trans-boundary.[120] But it demonstrated the political sensitivities any geoengineering experiments could evoke. He said that at the core of this controversy was also the "difficulty of defining politically acceptable (national and international) scientific standards and oversight mechanisms for ensuring the environmental and transboundary risks of nominally subscale geoengineering field tests were in fact 'demonstrably negligible'".[121] DECC explained that a moratorium had been placed on large-scale ocean fertilisation research under the Convention for Biological Diversity while a regulatory agreement was being developed under the London Convention/Protocol.[122]

62. Dr Blackstock took the view that "the consideration of the norms is partly necessary but not sufficient to address the sort of political issues that will raise".[123] In his view it was necessary to have a "mechanism of legitimacy", to define subscale (that is, small) experiments "before we start pushing the boundaries of [...] subscale, that is [...] where we really need to have, not just scientific, but political agreement".[124] Where nation states were starting to fund research, particularly if it went to funding subscale experimentation, Dr Blackstock considered that "we need to ask what preventive commitments, what precautionary commitments nation states need [...] up front in order to avoid exacerbating all the mistrust that already exists within the international climate arena".[125]

63. Research Councils UK took a more cautious view than Dr Blackstock. It was concerned that even small-scale actions could generate negative environmental, social and economic consequences if undertaken without appropriate controls in place or a sufficient level of expertise. It cited, as an example, a field trial involving atmospheric SRM manipulations that might temporally—but perhaps coincidentally—be linked to extreme weather events resulting in high economic consequences. Research Councils UK also considered that some highly controversial techniques could be applied at relatively low cost and with relative ease, opening up geoengineering as a feasible unilateral activity to a wide range of actors with different knowledge, skills and motivations. Such actions might be linked to political as well as, or even instead of, environmental concerns. This suggested to Research Councils UK that "regulation might be best monitored at the level of supra-national governance structures such as the UN".[126]

64. Dr van Aalst was anxious that if geoengineering was raised at a high political level too early, it could be sending the "wrong signals".[127] He considered that there were more technically oriented UN bodies that would be more appropriate, such as the Intergovernmental Panel on Climate Change (IPCC). He hoped that, along with some conscious efforts at consultation focussed primarily on looking at risks, it "might actually be then guiding us towards more investments on the mitigation and adaptation sides".[128] He hoped that discussions in "UN bodies would then trigger a much wider debate, involving a larger range of stakeholders, and a more diverse set of stakeholders than have been taking part in this discussion so far".[129]

65. In our view, there is a case for starting to develop the international framework for geoengineering now as opposed to waiting for the state of international understanding and the knowledge base for geoengineering to grow. Characterising the development of an international framework as top-down may be exaggerated as development will not be uniform for geoengineering techniques and the development of geoengineering regulatory arrangements is likely to take years. Nor does it preclude the building of bottom-up practices and approaches to geoengineering. **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.**

PRINCIPLES TO BE APPLIED TO GEOENGINEERING RESEARCH

66. In a submission to our inquiry a group of academics set out five key principles by which they believed geoengineering research should be guided.[130] **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.** We consider that the proposed principles could be useful both to the "top-down" approach and, to a lesser extent, to a "bottom-up" approach. (It could, for example, inform the drafting of the code of practice on research suggested by the Royal Society—see paragraph 89.) We therefore examine the principles in detail. The principles and part of the explanatory text are set out in the box below.

Principle 1: Geoengineering to be regulated as a public good

While the involvement of the private sector in the delivery of a geoengineering technique should not be prohibited, and may indeed be encouraged to ensure that deployment of a suitable technique can be effected in a timely and efficient manner, regulation of such techniques should be undertaken in the public interest by the appropriate bodies at the state and/or international levels.

Principle 2: Public participation in geoengineering decision-making

Wherever possible, those conducting geoengineering research should be required to notify, consult, and ideally obtain the prior informed consent of, those affected by the research activities. The identity of affected parties will be dependent on the specific technique which is being researched—for example, a technique which captures carbon dioxide from the air and geologically sequesters it within the territory of a single state will likely require consultation and agreement only at the national or local level, while a technique which involves changing the albedo of the planet by injecting aerosols into the stratosphere will likely require global agreement.

Principle 3: Disclosure of geoengineering research and open publication of results

There should be complete disclosure of research plans and open publication of results in order to facilitate better understanding of the risks and to reassure the public as to the integrity of the process. It is essential that the results of all research, including negative results, be made publicly available.

Principle 4: Independent assessment of impacts

An assessment of the impacts of geoengineering research should be conducted by a body independent of those undertaking the research; where techniques are likely to have trans-boundary impact, such assessment should be carried out through the appropriate regional and/or international bodies. Assessments should address both the environmental and socio-economic impacts of research, including mitigating the risks of lock-in to particular technologies or vested interests.

Principle 5: Governance before deployment

Any decisions with respect to deployment should only be taken with robust governance structures already in place, using existing rules and institutions wherever possible. [131]

67. In putting forward these principles the academics said that transparency in decision-making, public participation, and open publication of research results were key elements of the framework, designed to ensure maximum public engagement with, and confidence in, the regulation of geoengineering research. Alone or in combination, many of these principles were already applied in the regulation of hazardous substances and activities such as the trans-boundary movement of hazardous wastes and pesticides, radioactive substances and Genetically Modified Organisms (GMOs).[132]

68. Most debate and reservations focused on the regulation of geoengineering for the public good and public participation in geoengineering decision-making.

Principle 1: Geoengineering to be regulated as a public good

69. Commenting on Principle 1—geoengineering to be regulated as a public good—Mr Virgoe asked who was the public—the global public? He pointed out that geoengineering interventions affected the planet as a whole and that there were number of publics. Some publics were suffering very badly, or would be suffering very badly, from the effects of climate change. But some populations might benefit from climate change and, therefore, would not be happy to see climate change being put into "reverse gear", if that could be achieved. He said that the impact of some of the techniques was likely to be heavily differentiated. Some areas might continue to warm, whereas other areas cooled faster and there might be unintentional side effects. He considered that below the surface of the public good "you get into some difficult ethical territory".[133]

70. Sir David King raised the treatment of intellectual property rights (IPR). He pointed out that

> if we are going to go down the route of carbon dioxide capture from oceans or atmosphere, and this is going to be a good thing, we also need to know, where is the investment going to come from, to take the research into demonstration phase and into the marketplace, and there will be a marketplace with a price of carbon dioxide. That is going to be the private sector companies. If we do not allow protection of IPR, are we going to actually inhibit that process of investment? So I think I am a little hesitant to simply back the pure public good argument without IPR protection.[134]

71. **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.**

Principle 2: Public participation in geoengineering decision-making

72. One of the principles international law suggests might be used in developing a regulatory regime for geoengineering is the requirement to inform or consult (Principle 10 of the Rio Declaration).[135] In the context of geoengineering, however, Mr Virgoe questioned what the principle meant at the global level, specifically, how public participation was achieved at the global level and how to ensure that certain parts of the public, or the public in certain countries, did not have privileged access compared with other countries, publics or other parts of the global public.[136]

73. Dr Blackstock said that some countries already had populations marginalised in terms of climate change or were on the edge of suffering from climate change impacts, because those marginalised populations were likely to be the ones most sensitive to geoengineering experiments and a high level of solar radiation management experiments and particularly implementation. He saw a risk that without directive public engagement, an attempt to reach out and provide the information proactively, "we end up with them inevitably being surprised later on by rapid climate change impacts [and] that requires international public consultation, not just domestic".[137] Dr van Aalst voiced a similar concern that the more vulnerable felt "threatened by the possibility that the winners will protect their wins, and the losers, which clearly are mostly them, will not get anything".[138] He wished to see an international debate fostered and to "include attention for [the] human dimension, and to try and involve that side of the debate early on".[139]

74. **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.**

Principle 3: Disclosure of geoengineering research and open publication of results

75. On Principle 3—disclosure of geoengineering research and open publication of results—we would add that as well as publishing plans and results the agency carrying out the test should also publish any modelling relevant to the test.

76. The one concern that was expressed to us which has a bearing on this principle was the effect of classifying or restricting access to SRM research on grounds of national security. Dr Blackstock commented that it "would dangerously provoke [...] international perceptions [...] that national or corporate interests might try (or just be perceived as trying) to control or profiteer from nascent SRM technologies".[140] He added that non-public SRM research would

> exacerbate international mistrust about unilateral control, provoking such disputes and potentially sparking a proliferation of similarly closed programs. This could even encourage the development and unilateral testing of SRM schemes targeted to benefit specific regional climates, regardless of other impacts. And any such developments could prejudice many countries against cooperation on broader climate issues—including mitigation."[141]

77. **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.**

Principle 4: Independent assessment of impacts

78. On Principle 4—independent assessment of impacts—we regard independent review of the results of geoengineering research not only to be good scientific practice but also good politics. In the final resort decisions weighing the benefits and risks of a geoengineering intervention will be made by those most affected by climate change and those affected by the geoengineering. Those affected and those taking the decisions on their behalf will need to be confident that the scientific assessment is the best that can be provided in the circumstances.

79. It is also important to link any decision to develop, and eventually to deploy, geoengineering to global warming. Sir David King reminded us that research into impacts, both in terms of the physical and economic impacts, would also need to take into account the impacts from rising temperature. In other words, geoengineering interventions would be deployed against a temperature rise of, say, 3.5 degrees centigrade.[142]

80. Consideration of impact raised the question of compensation for those affected by geoengineering interventions. Research Councils UK said that "approval-based mechanisms should [...] include protocols for the assessment of fair compensation; should adverse impacts occur, who would meet the costs of such impacts" but acknowledged that in some cases it would be difficult to attribute climatic impacts to particular acts of geoengineering and "research on how this should be done is essential".[143] Dr van Aalst cautioned against purely economic impact assessments as they tended "to lose out on the perspective of the most vulnerable groups, which do not count much on the economic analysis side".[144]

81. Distributional issues—between countries, and between groups—is likely, in our view, to raise questions of compensation, as well as political and legal issues of liability, which, as Mr Virgoe pointed out, will need to be addressed by a governance regime or through litigation. These issues would be particularly problematic in the case of a geoengineering intervention by one country, or a group of countries. We agree with him that this strengthens the case for seeking the explicit agreement of all countries through a UN-led, multilateral process.[145]

82. **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.**

Principle 5: Governance before deployment

83. The sponsors of the principles were clear that it was imperative that governance structures were in place to "guide research in the short term and to ensure that any decisions taken ultimately with respect to deployment occur within an appropriate governance framework".[146] Others took the same view[147] and we consider that this is a sensible approach. It does not mean that research, including tests, the regulation of which we consider below, has to be halted until regulatory frameworks are in place. It does mean that research must be carried out in parallel with discussions on the legal, social and ethical implications of geoengineering, and its regulation and governance.[148]

84. **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.**

The precautionary principle

85. One principle of international law not included in the suggested list is the precautionary principle (Principle 15 of the Rio Declaration).[149] In his recent article Mr Virgoe pointed out that the

> precautionary principle would be likely to influence debate, particularly as the side-effects of geoengineering techniques are not yet well understood. But it is unlikely that it could act as a legal, as opposed to rhetorical or moral, constraint on geoengineering: as noted by Weiss (2006), "no non-European international court has thus far accepted the Precautionary Principle as a binding principle of international law."[150]

He said that it would be necessary to be cautious in the way international debate on geoengineering was initiated. Geoengineering was so far from the current mitigation-adaptation paradigm, and raised so many concerns, "that a premature discussion might well see geoengineering banned in line with the precautionary principle".[151] Already, in June 2008, the Conference of the Parties to the Convention on Biological Diversity cited the precautionary principle in calling for a moratorium on ocean fertilisation activities. While he had sympathy for that decision on the specific issue of ocean fertilisation, Mr Virgoe said that it was "important that genuine research into geoengineering techniques are subjected to an appropriate, cautious regulatory regime rather than a blanket ban".[152]

86. The precautionary principle is an issue that our predecessor committee considered in 2006. In its Report on *Scientific Advice, Risk and Evidence Based Policy Making*, the Committee noted that, while the precautionary principle was "valuable in dealing with uncertainty",[153] it believed that it was

> best to use the term precautionary approach, but with a consistent explanation of the degree and nature of the risks, benefits and uncertainty and an explanation of the concept of proportionality. It should never be considered a substitute for thorough risk analysis which is always required when the science is uncertain and the risks are serious.[154]

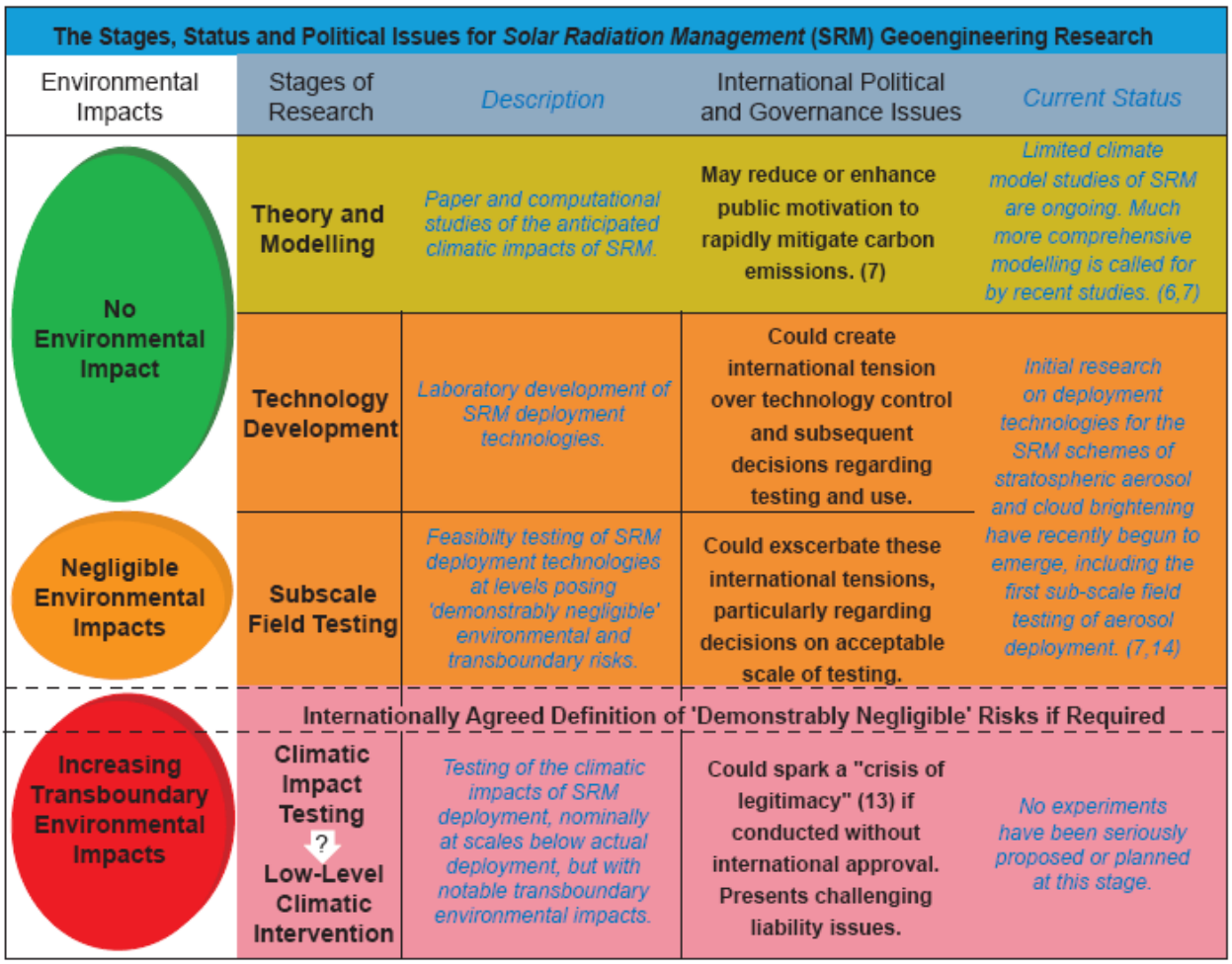
This approach holds good for geoengineering. To go further and make the precautionary principle predominant risks not only halting geoengineering research and small tests being carried out by those states playing by the rules to develop a Plan B but it could also force from international and public scrutiny any research carried out by other bodies or states not playing by the rules. In our view the five Principles as drafted contain a precautionary approach and that to go further is unnecessary. **We conclude that the key principles should not include the precautionary principle as a discrete principle.**

Conclusion on principles

87. In our view the principles as drafted provide a good starting point for either a bottom-up or a top-down approach to building a regulatory arrangements for geoengineering research. **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.**

Research

88. In our earlier Report on engineering we supported research into geoengineering. The research that is most controversial is that into SRM technologies. Dr Blackstock supplied the table below which summarises the stages of SRM research that could be undertaken, along with the environmental risks and political issues each raises.[155] In this Report we have examined three stages of research: modelling; development and subscale (that is, small) field testing; and climate impact testing.



Depiction of the level of environmental impacts and the type international political issues associated with each progressive stage of SRM research

Research: modelling

89. The Minister did not seek to put any constraint on modelling work and pointed out that the Royal Society had suggested there should be a code of conduct for research[156] at a certain level. In her view "a code of conduct is probably entirely appropriate, and we would very much support that".[157] Professor Keith considered that the "crucial thing" was to start from the

> bottom up through the management of a research programme in an international and transparent way. From the bottom up does not mean just that the scientists decide—that is certainly not the right answer—but it means, I think, that it would be premature to start a full UN scale EU Court treaty process, because it is simply not clear yet what the capacities are and states, individuals, have not had long enough to consider seriously what the trade-offs are.[158]

Mr Virgoe said that countries commencing geoengineering research prior to an internationally agreed framework being in place needed to make voluntary commitments to full international collaboration and transparency. Otherwise national geoengineering research that failed to make or meet such commitments "could spark international mistrust over future intentions, and disrupt the already inadequate progress toward essential mitigation".[159]

90. We agree with DECC and Professor Keith and see no reason to develop the panoply of international regulation to cover modelling of geoengineering interventions. **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.**

Research: development and field testing

91. The ETC Group in a graphic phrase wanted to draw a "'line in the sand' at the lab door". It did not believe that it was "warranted to move

geoengineering out of the laboratory and the most urgent questions of governance concern keeping that 'lab door' closed against the pressures from industrial players to move to open air geoengineering research and deployment".[160]

92. Sir David King took that view that there should be a temporary ban on solar radiation management as "the unintended consequences of that are extremely difficult to foresee".[161] He was

> not happy about smaller experiments being conducted at this stage in time before the unintended consequences have been fully evaluated. We are dealing with an extraordinarily complex issue here, and we all know scientifically that complex phenomena, as complexity increases, we get emergent properties that are not always easy to predict. So I do think we need to watch the stratosphere very carefully, but at the same time, in terms of regulation of the others, get ahead of the game, precisely because firstly, you want to keep the public on side, if we lose the public, then we lose the game; and secondly, we want to see that the regulation encourages the right behaviour.[162]

93. While cautious also, Dr Blackstock did not go quite as far as Sir David. To encourage international climate cooperation, he considered that countries beginning SRM research needed to take early steps to encourage the collective international exploration of SRM as a possible means for insuring global public welfare in the face of highly uncertain climate change. This, he suggested, meant making several preventive commitments. First, to foreswear climatic impacts testing—and very conservatively limit field testing—until approved by a broad and legitimate international process. Second, to keep all SRM research, including generated knowledge and technologies, in the public domain. Third, to integrate all SRM research into any subsequent international research framework.[163]

94. While we understand Sir David's concerns, we consider that a temporary ban on SRM may not be the way forward. First, it would have to be negotiated through an international agreement which will take time and may not be achieved. Second, as we noted in the previous chapter, small scale testing may already be underway. Third a ban on all testing could inhibit laboratory development of geoengineering techniques. Instead, we consider that the approach suggested by Dr Blackstock may be the way forward. Much of the focus in the previous chapter on the need for regulation was on testing. For the reasons we set out in that chapter, we are of the view that there are good scientific reasons for allowing investigative research and for seeking to devise and implement some regulatory frameworks, particularly for those techniques with the potential to allow a single country or small group of countries to test or deploy, in order to affect the global climate. **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.**

95. As we have indicated we favour international regulation of SRM technologies. But we recognise that it is going to take time to devise, agree and implement regulatory frameworks for the testing of SRM technologies. In the meantime, in order to encourage research into geoengineering techniques and to foster public understanding of geoengineering, **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.**

RESEARCH: CLIMATE IMPACT TESTING

96. As tests increase in scale and impact they need to be regulated. **We consider that any testing that impacts on the climate must be subject to an international regulatory framework.**

RESEARCH: INTERNATIONAL CONFIDENCE AND COOPERATION

97. Mr Virgoe pointed out that given the pre-existing mistrust on global climate issues, further steps should also be taken to foster international confidence and cooperation. He considered that national SRM programmes should involve international scientists, particularly including those from vulnerable developing countries and "more importantly, these programmes should give priority to research on SRM schemes that may preserve global public welfare, rather than focusing on narrowly defined national interests".[164]

98. We agree with both points and consider that the UK Government should lead by example. **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 a adopt similar approach to SRM research.**

Formulating international regulatory arrangements for geoengineering

99. As we noted at paragraph 39, regulatory regimes for most SMR techniques have yet to be developed. As Mr Virgoe noted in his recent article, [165] there are important arguments in favour of a UN process. It would give the implementation of geoengineering legitimacy, in the form of a multilateral mandate. Most multilateral environmental regimes tend to operate by consensus, at least where major decisions are concerned, whatever their formal decision-making rules. We would add that it would give a voice to those likely to be most likely to be affected by the direct environmental consequences of the use of geoengineering technology. The problem he noted was that the UN process complicated and slowed down the decision-making process and any serious geoengineering proposal would certainly lead to vigorous international debate. He considered that the chances of achieving a multilateral agreement to deploy geoengineering were "not good". He identified the following difficulties.

- The UNFCCC/Kyoto process was committed to the mitigation/adaptation paradigm. Institutional inertia, and

> the commitments already made by states, would make it hard to argue for a complete change in approach under this process—and equally difficult to establish a separate multilateral process.
> - The introduction of a whole new approach would raise developing country suspicions that it would divert attention and funds from adaptation; other countries and communities would be concerned that it would reduce pressure to mitigate climate change.
> - In the absence of a substantial political community in its favour, international discussion of geoengineering would be likely to result in its prohibition in line with the precautionary principle.[166]

100. But he identified a way forward. The dynamics might be different if a powerful country, or a group of countries, "were to act as a policy entrepreneur, pressing for serious consideration of, or research into, geoengineering" and that "growing global concern over global warming might also create more fertile soil for such a proposal, particularly among developing countries which are likely to be hit earlier, and harder, by the negative impacts of climate change".[167] None of the alternative approaches—waiting for events, individual action or regional or interested groups—would have the legitimacy that action through the UN would provide. **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.**

101. The starting point for the formulation has to be the five key principles which we have discussed in this chapter. In addition, as Mr Virgoe pointed out, it will be important to ensure evidence based decision-making.[168] It will also be crucial that regulatory measures are able to respond rapidly, if necessary, following the application of geoengineering techniques. A key criterion for geoengineering to be taken forward will be the facility to withdraw applications quickly in case of negative consequences.[169] The Royal Society considered it was essential that mechanisms for the regulation of geoengineering were imbued with a high level of flexibility because:

> First, regulatory controls will need to adapt to the evolution of environmental, scientific, technological, geo-political, economic and social risks. Major uncertainties remain about geoengineering and it is impossible to foresee how technologies will develop, their public confidence, and the measures that will be needed to shape and respond to such developments. In addition, environmental, geo-political, economic and social factors that will influence the development of geoengineering are also in a constant state of flux and must therefore be accounted for through flexible regulatory arrangement.[170]

102. As we have noted at paragraph 27, the ENMOD treaty requires members "not to engage in military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury to any other State Party". We consider that it is crucial to the development of geoengineering that this principle is applied comprehensively to all geoengineering technologies.

103. **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.**

Suitability of existing bodies to provide regulation of geoengineering

104. We received evidence on the suitability of existing international bodies to provide a model for the regulation of geoengineering, particularly SRM.[171] In the time available we have not been able to examine the operation of the bodies sufficiently to reach a view on whether:

a) any organisation would provide a model for a regulatory regime for SRM; or

b) existing bodies could be adapted to encompass SRM.

105. We were therefore attracted to the proposal of the Royal Society that a suitable international body, not exclusively a UN body, should

commission a review of existing international and regional mechanisms to:

- consider the relevant roles of the following bodies such as UNCLOS,[172] LC/LP,[173] CBD,[174] CLRTAP,[175] Montreal Protocol,[176] Outer Space Treaty,[177] Moon Treaty,[178] UNFCCC/KP,[179] ENMOD[180] the regulation of geoengineering;
- identify existing mechanisms that could be used to regulate geoengineering research and deployment activities, if suitably extended as necessary; and
- (for geoengineering in general) identify where regulatory gaps exist in relation to geoengineering methods proposed to date, and establish a process for the development of mechanisms to address these gaps.[181]

106. **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 mechanisms to address these gaps.**

107. The next stage, which DECC suggested, was that a suitable organisation needed to be identified, whose mandate would enable it to take the lead in facilitating the collaborative development of international regulations.[182] The Royal Society has suggested that an international consortium is formed to explore the safest and most effective geoengineering options while building a community of researchers and developers,[183] and we, like DECC,[184] consider that this is worth pursuing.

108. As the cost, effectiveness, timeliness and risk of putative geoengineering approaches vary substantially, Research Councils UK considered that it was therefore important that international collaboration was sought at an early stage. It explained that:

> An international geoengineering advisory group may well be an appropriate body to help address these challenges. With representation from the scientific, policy, commercial, regulatory and non-governmental communities, such a group would provide independent oversight of evolving regulatory issues concerning geoengineering. It would be tasked with the coordination of existing research, and the identification of a new research agenda, as well as the development of an effective and objective assessment framework to inform the regulation of geoengineering. This would involve making informed judgements about the weight of different environmental, social and economic costs and benefits and striking an appropriate balance between short-term and long-term effects.[185]

109. **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.**

Role of the UK

110. Dr van Aalst pointed out that there was probably a difference between the sort of debate taking place on geoengineering in the UK and the debate in other countries, including in several different states which may already be at the stage of small scale testing of some geoengineering techniques. He considered that the UK was "in a way also operating as an international arena, and in a way setting moral standards and setting an example for how globally we should be approaching this, which is a very important side effect for your own considerations, I think, at this stage".[186]

111. We were disappointed to be told by the Minister that she could not recall any ministerial involvement in discussions on geoengineering and that it was "unlikely that we have had any ministerial discussions on regulation, but we are aware, our officials are alive to the issue, and it is something that we know needs to be done".[187] She continued:

> Of course, the IPCC is going to be reporting itself, and we have taken a lot of our leads from reports from the IPCC. It is clear that if there is to be regulation, it is going to have to be in some international body, whether a scientific body, or whether the UN itself, but clearly, this is something that will have to be developed over time.[188]

112. **We recommend that the UK should take the lead in raising geoengineering within international bodies such as the EU and the Commonwealth.**

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116 Q 23 [Professor Keith] Back

117 Q 22; see also Q 23 Back

118 Q 22; see also Q 28 Back

119 Qq 23 [Dr Blackstock] and 24 Back

120 Q 23 Back

121 Ev 3, para 16 Back

122 Ev 21, para 9 Back

123 Q 24 Back

124 Q 27 Back

125 *As above* *Back*

126 Ev 23, para 12 Back

127 Q 46 Back

128 *As above* *Back*

129 Q 46 Back

130 Ev 42: Professor Steve Rayner (University of Oxford), Professor Catherine Redgwell (University College London), Professor Julian Savulescu (University of Oxford), Professor Nick Pidgeon (Cardiff University) and Mr Tim Kruger (Oxford Geoengineering Institute) Back

131 Ev 44, para 17 Back

132 Ev 43, para 6 Back

133 Q 26 Back

134 Q 43 Back

135 Ev 6 [Mr Virgoe], para 12 Back

136 Q 26 Back

137 Q 30 Back

138 Q 44; see also J Virgoe, "International governance of a possible geoengineering intervention to combat climate change", *Climatic Change*, 2009, 95:103-119, para 2.3. Back

139 Q 44 Back

140 Ev 3, para 14 Back

141 Ev 4, para 19 Back

142 Q 48 Back

143 Ev 23, para 11 Back

144 Q 48 Back

145 J Virgoe, "International governance of a possible geoengineering intervention to combat climate change", *Climatic Change*, 2009, 95:103-119, para 2.3 Back

146 Ev 43, para 6 Back

147 Ev 53 [The Royal Society], para 15, and Ev 21 [DECC] Back

148 Ev 21 [DECC], para 14 Back

149 The Precautionary Principle has been endorsed internationally on many occasions. At the Earth Summit meeting at Rio in 1992, World leaders agreed Agenda 21, which advocated the widespread application of the Precautionary Principle in the following terms: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." (Principle 15) Back

150 J Virgoe, "International governance of a possible geoengineering intervention to combat climate change", *Climatic Change*, 2009, 95:103-119, para 3 Back

151 Ev 6, para 16 Back

152 *As above* *Back*

153 Science and Technology Committee, Seventh Report of Session 2005-06, *Scientific Advice, Risk and Evidence Based Policy Making*, HC 900-I, para 165 Back

154 Science and Technology Committee, Seventh Report of Session 2005-06, *Scientific Advice, Risk and Evidence Based Policy Making*, HC 900-I, para 166 Back

155 Ev 2, para 13 Back

156 The Royal Society, *Geoengineering the climate Science, governance and uncertainty*, September 2009, rec 7 Back

157 Q 62 Back

158 Q 12 Back

159 Ev 1, para 4 Back

160 Ev 50, para 10 Back

161 Q 39 Back

162 Q 40 Back

163 Ev 4, para 21 Back

164 Ev 4, para 22 Back

165 J Virgoe, "International governance of a possible geoengineering intervention to combat climate change", *Climatic Change*, 2009, 95:103-119, para 4.1 Back

166 *As above* *Back*

167 *As above* *Back*

168 J Virgoe, "International governance of a possible geoengineering intervention to combat climate change", *Climatic Change*, 2009, 95:103-119, para 4.1 Back

169 Ev 24, para 19 Back

170 Ev 24, para 17; see also J Virgoe, "International governance of a possible geoengineering intervention to combat climate change", *Climatic Change*, 2009, 95:103-119, para 2.4 Back

171 For example, Ev 53 [Royal Society], para 21 Back

172 1994 United Nations Convention on the Law of the Sea Back

173 1972 London Convention with the 1996 Protocol of the London Convention Back

174 1992 Convention on Biological Diversity Back

175 1979 Convention on Long-Range Transboundary Air Pollution Back

176 1987 Montreal Protocol on Substances That Deplete the Ozone Layer Back

177 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies Back

178 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies Back

179 1997 United Nations Framework Convention on Climate Change/ Kyoto Protocol Back

180 1977 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques Back

181 Ev 53, para 21 Back

182 Ev 21, para 12 Back

183 The Royal Society, *Geoengineering the climate Science, governance and uncertainty*, September 2009, rec 4.2 Back

184 Ev 21, para 13 Back

185 Ev 25, para 24 Back

186 Q 40 Back

187 Q 64 Back

188 *As above* Back

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