Institution: University of Oxford

Unit of Assessment: UOA 24A Anthropology

Title of case study: Guiding the Governance of Climate Geoengineering RD&D, Using the Oxford Principles

1. Summary of the impact

A decade of social science research on emerging technologies carried out and/or directed by Oxford researchers at InSIS (Institute for Science, Innovation and Society) provided the basis for the Oxford Principles for the Governance of Geoengineering Research. These Principles were endorsed by the House of Commons Science and Technology (S&T) Committee in 2010 and were subsequently accepted by the UK Government in its official response to the Committee's report – meaning that appropriate governance arrangements are now a necessary precondition for responsible research, development, and demonstration (RD&D) of geoengineering. The Principles have also been "generally endorsed" by the international geoengineering research community in its efforts to ensure responsible conduct in the controversial emerging area of environmental technology.

2. Underpinning research

Research into climate geoengineering, large-scale intervention in Earth systems to counteract climate change, is highly controversial, creating substantial ethical and political debate. Currently, geoengineering technologies are largely concepts, but there is significant interest in developing them as options to supplement conventional greenhouse gas reduction and adaptation policies.

Significant public policy concerns, identified in a Royal Society Working Group Report *Geoengineering the Climate: Science, Governance and Uncertainty* (2009) (of which Rayner and Redgwell were co-authors), are diverse and include, for example, worries that even conducting research into such technologies might undermine efforts to achieve greenhouse gas mitigation; concerns that deliberate terraformation of the planet is intrinsically unethical and therefore that such research is in itself indefensible; and fear of unintended consequences from eventual field trials, such as disruption of agriculture. Hence there has been a strong interest in social science research to inform whether, and how, RD&D of geoengineering technologies may be conducted safely and responsibly. The report concluded that appropriate governance arrangements would be a necessary precondition for RD&D of geoengineering. In response to the concerns expressed in the report, a group of researchers, largely from Oxford, developed a set of five Oxford Principles **[Section 3: R1]** for the governance of geoengineering, resulting from a meta-analysis, which wove together two longstanding strands of Oxford University research on: (1) the governance of emerging controversial technologies, which unpacked a variety of imperatives to ensure public engagement at an early stage;**[R2]** and (2) alternative policy strategies for dealing with climate change, which stressed the need for new societal investments in research to develop and deploy novel technology for managing climate change.**[R4]**

The Oxford Principles, as they have become known, were designed to apply to a heterogeneous range of technologies from the stage of early research through to implementation. The Principles synthesize social science insights from research into social values evident among the public in relation to novel technologies, such as GM foods, nanomaterials, and human enhancement technologies, into a set of guidelines for the governance of research on climate geoengineering. While the Principles were not the result of a single empirical research project, they represent the distillation of a decade of research on the regulation of frontier research (e.g. **[R2-R6]**) as well as collaboration between researchers both at Oxford and beyond.

The Principles are deliberately 'high level', and require the elaboration of specific research protocols for each geoengineering technique at each stage of development from concept, to design, to prototype through limited and larger-scale field trials, to eventual possible deployment. The recommendation based on the research is that, at each 'stage gate', researchers and developers must demonstrate how they have addressed each of the five Oxford Principles for the next stage of RD&D before they embark on it.

1) "Geoengineering should be regulated as a public good" was based on ESRC-funded research ('Science in Society' Programme), directed by Rayner including c.45 projects around the

UK. **Finding:** Novel technologies involving new risks meet resistance where they are perceived as serving private interests rather than the public good.**[R5]**

2) "Public participation in geoengineering decision-making" also drew on the 'Science in Society' Programme, and was informed by Rayner's research on expert and public engagement in public decision-making **[R3]** and controversial technology development.**[R6] Finding:** Public engagement is an important factor in the social licence to operate, as well as substantively beneficial in refining and improving technical outcomes.

3) "Disclosure of geoengineering research and open publication of results" drew on collaboration between Savulescu and InSIS researchers exploring technology that enhances human cognitive and physical capacities. **Finding:** This research highlighted the propensity of the pharmaceutical sector to avoid publication of negative clinical trials.**[R7]**

4) "Independent assessment of impacts" drew extensively on InSIS research on management of emerging technologies, focusing on competing institutional principles for consent, liability, and trust with regard to risk and new technology.**[R3,R6] Finding:** This research highlighted the apparent lack of institutional learning with the introduction of new technology.

5) "Governance before deployment" was informed by research on establishing appropriate governance for emerging technologies.**[R5] Finding:** This research revealed that public trust in institutional arrangements depends on organizational commitments.

Researchers involved:

The articulation of these Principles was initiated by Professor Steve **Rayner** (Professor of Science and Civilization since 2003 and Director of the Institute for Science, Innovation, and Society (InSIS) at Oxford University) at a research workshop convened under the auspices of the Oxford Geoengineering Programme early in 2010. Additional authors include: Professor Catherine **Redgwell** (then at UCL; Chichele Professor of International Law at Oxford since 2013), Professor Julian **Savulescu** (Professor of Practical Ethics since 2002 and Director of the Uehiro Centre for Practical Ethics, Oxford), Professor Nick **Pidgeon** (Cardiff) and Tim **Kruger** (Oxford Geoengineering Programme), Dr Javier Lezaun (James Martin Lecturer since 2008, and Deputy Director of InSIS since 2012), and Dr Linsey McGoey (Research Fellow, InSIS 2008-2010).

The Oxford-based group continues to explore this topic through a new ESRC-funded project (2012-14) bringing in scholars from Sussex and UCL.

3. References to the research

Note: Researchers based in Oxford are highlighted in bold.

[R1] Rayner, S., **C. Heyward, T. Kruger,** N. Pidgeon, **C. Redgwell,** & **J. Savulescu** 2013 (published online). 'The Oxford Principles for Geoengineering Governance' *Climatic Change.* (http://link.springer.com/article/10.1007/s10584-012-0675-2). IMPACT FACTOR 3.634.

[R2] Rayner, S. 2003. 'Democracy in the Age of Assessment: Reflections on the Roles of Expertise and Democracy in Public-Sector Decision Making' *Science and Public Policy* 30(3):163-170. IMPACT FACTOR 0.983.

[R3] Rayner, S. 2010. 'Trust and the Transformation of Energy Systems' *Energy Policy* 38: 2617-2623. IMPACT FACTOR 2.723.

[R4] Prins, G. & **S. Rayner** 2007. 'Time to Ditch Kyoto' *Nature* 449: 973-975. IMPACT FACTOR 31.673.

[R5] Science in Society Programme 2008. *Science in Governance and the Governance of Science*, ESRC, Swindon

[R6] Lezaun, J. & L. Soneryd 2007. 'Consulting Citizens: Technologies of Elicitation and the Mobility of Publics' *Public Understanding of Science* 16(3): 279-297. IMPACT FACTOR 1.87.

[R7] McGoey, L. 2009. 'Pharmaceutical Controversies and the Performative Value of Uncertainty' *Science as Culture* 18(2): 151-164. IMPACT FACTOR 0.489.

Grants

- ESRC Programme Grant (£1.5 million) 'Science in Society' Research Programme (S. Rayner, PI) to direct research totalling £4.5 million (2002-2008).
- Oxford Martin School Stimulus Grant (£608,000) to Oxford Geoengineering Programme (S. Rayner, J. Savulescu, R. Darton, co-PIs) for interdisciplinary research on climate geoengineering, ethics, and governance (2010-2013).
- ESRC Responsive Mode Grant (£1.2 million) (PI, S. Rayner) for research into issues and solutions for Climate Geoengineering Governance building on the Oxford Principles (2012-2014).

4. Details of the impact

Geoengineering RD&D is at a very early stage, but it is developing fast, and international bodies such as the International Panel on Climate Change (IPCC) and the United Nations Environment Programme (UNEP) have recognized that it is certain to become very significant within the next few years. InSIS research at Oxford has had substantial impact in shaping the UK government's initial approach to the governance of this process and continues to shape discussions in international circles.

In 2008, based on his research on the need for technological innovation to deal with climate change,**[R3,R4]** Rayner was invited to give evidence to the Committee on Innovation Universities and Skills inquiry into the UK's engineering skills base, which argued for UK government funding for geoengineeering research.

Following on the heels of Rayner's involvement in this Committee Inquiry, and publication of the Royal Society Report in 2009, the House of Commons Science and Technology (S&T) Committee launched a joint inquiry into geoengineering with its counterpart committee in the US House of Representatives, and invited submissions.**[Section 5: C6]** In response to this request, the interdisciplinary group of Oxford researchers, with Pidgeon (Cardiff), proposed a set of five principles for the governance of geoengineering research, which have subsequently become known as the Oxford Principles (see section 2).

The S&T Committee's report **[C1]** discussed each of the principles at length **[pp.29-23]**, concluding "We endorse the 5 key principles to guide geoengineering research." **[pp.50-51]** The Committee further recommended that the UK Government and other interested countries formulate proposals for the international regulation of geoengineering RD&D through the UN, stating "The starting point for the formulation has to be the five key principles which we have discussed in this chapter."**[p.40]**

The subsequent official UK Government response to the Committee **[C2]** also accepted the Principles as government policy,**[pp.5-7]** recommending that they, along with four additional principles, should be the basis for international regulatory efforts, "We welcome…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."**[pp.9-10]**

The Principles were also presented to the March 2010 international Conference on Climate Intervention in Asilomar, where, as *The Economist* reported,**[C3,C8]** they were "generally endorsed" by the scientific research and policy community, and were subsequently elaborated upon as the centrepiece of the conference report.**[C4]**

In 2013, the Principles were reiterated in a parliamentary briefing by the Parliamentary Office of Science and Technology: "Given the environmental and social costs of implementing NETs [Negative Emissions Technologies], a group of academics have suggested five principles by which decision-making on NETs might be guided. [The principles are:]

- Regulation as a public good, with private sector involvement
- Public participation in decision-making
- Full public disclosure of research plans and results
- Independent assessment of impacts
- Governance before deployment

These were welcomed by the Science and Technology Committee as a basis to begin the discussion of principles that could be applied to the regulation of NETs."**[C5,p.4]**

In summary, the Oxford Principles have made a direct and significant impact on the initial design of the policy process in a very short time and continue to influence international policy discourse.**[C7]**

In addition to the activities reported above, Rayner has continued to raise public and policymaker awareness of the issues. He was interviewed on the topic on the Today Programme in January 2010. He has been cited on and has written about geoengineering in the *New Scientist* (12 Sep 2009, 11 Oct 2010). In the past three years he has presented more than 20 public lectures and policymaker workshops on geoengineering governance around the world.

5. Sources to corroborate the impact

[C1] House of Commons Science and Technology Committee 2010 *The Regulation of Geoengineering*, HC 221, Fifth Report of Session 2009-10, March 2010. http://www.publications.parliament.uk/pa/cm200910/cmselect/cmsctech/221/221.pdf. See p.29ff.

[C2] Secretary of State for Energy and Climate Change 2010 *Government Response to the House of Commons Science and Technology Committee 5th Report of Session 2009-10: The Regulation of Geoengineering*, presented to Parliament, September 2010. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47928/569-gov-response-commons-science-tech-5th.pdf. See pp. 5-6.

[C3] *The Economist* 2010 'We all want to change the world', March 31 2010. www.economist.com/node/15814427

[C4] Asilomar Scientific Organizing Committee (ASOC), 2010: *The Asilomar Conference Recommendations on Principles for Research into Climate Engineering Techniques*, Climate Institute, Washington DC, 20006 http://www.climate.org/PDF/AsilomarConferenceReport.pdf. See pp. 8-9.

[C5] Parliamentary Office of Science and Technology, 'PostNote 450: Negative Emissions Technologies', July 2013, to appear at: http://www.parliament.uk/mps-lords-and-offices/offices/bicameral/post/publications/postnotes/

[C6] Chair of the Royal Society Working Group can corroborate the impact of this work, especially that of the Royal Society Report (letter on file).

[C7] The Director, Parliamentary Office of Science and Technology, was the Committee Specialist serving the House of Commons Science and Technology Committee, UK Parliament and was responsible for drafting the Committee's report. He has confirmed that he is willing to corroborate the impact of the Oxford Principles (email on file).

[C8] Briefings editor of *The Economist*, who has written extensively on climate geoengineering and reported on the Asilomar Conference (email confirming willingness to corroborate on file).