Opening Editorial

*Jesse L. Reynolds**

Climate change is among the most important and perhaps *the* most challenging problem that global society presently faces, posing serious risks to humans and the environment. The European Union has made climate change one of its top issues. Commission President Jean-Claude Juncker in his agenda (then as president-elect) named "a forward-looking" and "responsible" climate change policy among his ten priorities.[1] The Commission has adopted very aggressive targets for reducing the greenhouse gas emissions that cause climate change, and intends to allocate 20% of the EU's budget for climate-related activities.[2] Furthermore, Europe was at the forefront in crafting the new Paris climate agreement.

Despite these efforts, it is highly likely that the world will surpass the internationally agreed-upon threshold of 2°C warming.[3] In response to insufficient emissions abatement, some scientists and others are increasingly considering proposals that are more drastic. They assert that society should consider "climate engineering" or "geoengineering", "the deliberate large-scale intervention in the Earth's climate system, in order to moderate global warming".[4] Some proposed climate engineering methods presently appear to have the potential to significantly reduce climate risks. However, they also pose environmental and social risks of their own, and are politically contested. Although some form of regulation is warranted, existing legal instruments are insufficient, leaving regulatory gaps.

Climate engineering proposals are diverse. Those in the first of two primary categories seek to remove carbon dioxide—the most important greenhouse gas—from the atmosphere and sequester it for the long term. These methods are relatively slow, expensive, low risk, further developed, and uncontroversial. For example, plants could be grown at large scales—which pulls carbon dioxide from the air—and burnt for energy. The carbon dioxide emitted during burning could be captured and stored. Those in the second primary category would make the planet slightly more reflective in order to counteract climate change. For the most part, such so-called "solar radiation management" are relatively fast-acting, inexpensive, risky, less developed, and controversial. The leading proposal would involve injecting very fine aerosol particles into the upper atmosphere. These particles would spread globally, cooling the planet in a manner similar to the effects of dust emitted by large volcanic eruptions.

Most attention regarding the application of existing legal instruments, and the potential development of new ones, to regulate climate engineering has focused on the international arena. International law will eventually be important, especially for the potential global implementation of solar radiation management. However, European and national law will be relevant in the shorter term. These legal instruments are, compared with international law, more specific, more detailed, and more readily adapted to changing circumstances. Yet there have been few publications regarding national legal environments, and none for Europe.[5]

This is not due to a lack of interest in climate engineering within Europe. The Commission itself has funded two large international climate engineering assessment projects.[6] The Commissioner for Climate

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1 Jean-Claude Juncker, "A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change. Political Guidelines for the next European Commission," Opening Statement in the European Parliament, Plenary Session, Strasbourg, 15 July 2014.

2 European Commission, "An EU budget for low-carbon growth," Press Release, 19 November 2013.

3 See e.g. Climate Action Tracker, "2.7°C is not enough – we can get lower," 8 December 2015, available on the Internet at <http://climateactiontracker.org/assets/publications/briefing_papers/CAT_Temp_Update_COP21.pdf> (last accessed 29 January 2016).

4 John Shepherd, Ken Caldeira, Peter Cox, et al., *Geoengineering the Climate: Science, Governance and Uncertainty* (London: The Royal Society, 2009), at p. ix.

5 See e.g. Tracy Hester, "Remaking the World to Save it: Applying U.S. Environmental Laws to Climate Engineering Projects", 38 *Ecology Law Quarterly* (2011), pp. 861 *et sqq*.

6 See Hauke Schmidt, Ulrike Niemeier, Claudia Timmreck, et al., "The FP7 Project IMPLICC Implications And Risks Of Engineering Solar Radiation To Limit Climate Change", available on the Internet at < https://implicc.zmaw.de/fileadmin/user_upload/implicc/other_documents/implicc_final_report_20121130_publishable_summary.pdf> (last accessed 29 January 2016); Stefan Schäfer, Mark Lawrence, Harald Stelzer, et al., "The European Transdisciplinary Assessment of Climate Engineering (EuTRACE): Removing Greenhouse Gases from the Atmosphere and Reflecting Sunlight away from Earth", 2015, available on the Internet at <http://www.iass-potsdam.de/sites/default/files/files/rz_150715_eutrace_digital.pdf> (last accessed 29 January 2016).

Action and Energy clearly indicated that carbon dioxide removal is on the table as a potential additional option.[7] Two of its member states—the United Kingdom and Germany—have been quite active, including providing funding, albeit limited, for research programs.[8]

In order to address the gap in understanding the role of Europe in regulating climate engineering and its risks, Tilburg Law School hosted an international workshop on "Climate Engineering Regulation and European Law" at Tilburg University on 22 and 23 September 2014. The thirteen participants' presentations offered a wide of perspectives. Four of these are printed here as a symposium in the *European Journal of Risk Regulation*.

In the first, *Floor Fleurke* lays a foundation by exploring European Union legislation that could be applicable to climate engineering—especially those legal instruments regarding environmental impact assessment; effects on water, air, and biodiversity; and environmental liability—or that could provide a basis for future regulation specific to climate engineering. Concluding that the EU does, indeed, have competence in this domain, she devotes particular attention to the precautionary principle. Its role, she says, is important but unclear, given the risk-risk tradeoff character of climate engineering.

In the next article, *Anne Therese Gullberg* of the Center for International Climate and Environmental Research Oslo and *Jon Hovi* of the University of Oslo consider the political context of climate engineering in Europe, observing that existing EU processes have the capacity to ensure public participation in decision making regarding climate engineering. However, the low level of public awareness of the issue, particularly that of solar climate engineering, may present challenges to public participation. This will likely have implications for the form and substance of future European climate engineering policy.

The University of Bristol's *Janine Sargoni* takes a more theoretical turn in the third piece of this symposium, examining the importance of legitimacy of potential regulation of solar climate engineering research. She asserts that securing and maintaining legitimacy faces challenges given the high levels of uncertainty in climate engineering and in the relationship between politics and science. Drawing from the literatures of EU risk and science regulation, and of transnational private regulation, Sargoni suggests an innovative "incorporated" approach to risk assessment.

Like at the workshop itself, my colleague *Han Somsen* concludes this printed symposium by placing climate engineering in the broader context of environmental enhancement. Noting that humans are already a dominant influence on the "natural" world, as evidenced by the proposal for an Anthropocene geologic epoch,[9] he contextualizes environmental enhancement in European law. In particular, he turns to the mandate for the EU to base its environmental law in "preserving, protecting and *improving* the quality of the environment".[10] Somsen argues that both European law and the environment itself require acknowledging and pursuing more conscious interventions in the "natural" world.

Hopefully, these articles can provide a robust basis from which the dialogue regarding climate engineering and European law can be broadened and deepened.

I thank the authors, the other workshop participants, the editors of *EJRR*, and Tilburg Law School for making the workshop and this symposium possible.[11]

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7 Miguel Arias Cañete said, "About negative emissions, the [UN Intergovernmental Panel on Climate Change] will say when and how." Arthur Neslen, "EU Says 1.5C Global Warming Target Depends on 'Negative Emissions' Technology", 14 December 2015, *The Guardian*.

8 The United Kingdom's Engineering and Physical Sciences, Natural Environment, Economic and Social, and Arts and Humanities Research Councils supported the projects "Integrated Assessment of Geoengineering Proposals", "Stratospheric Particle Injection for Climate Engineering", and "Climate Geoengineering Governance". The German Research Foundation has a Priority Programme "Research to Evaluate Climate Engineering: Risks, Challenges, Opportunities?". Germany's Helmholtz Association of German Research Centres previously supported a field trial of carbon dioxide removal through ocean iron fertilization.

9 See Colin N. Waters, Jan Zalasiewicz, Colin Summerhayes, et al., "The Anthropocene is Functionally and Stratigraphically Distinct from the Holocene,", 351 *Science* (2016), pp. 137 *et sqq*.

10 TFEU, Article 191.1. Emphasis added.

11 The other participants were Sam Adelman of the University of Warwick; Gareth Davies of VU University Amsterdam; Alexander Proelss of the University of Trier; Rosemary Rayfuse of the University of New South Wales and Lund University; and Sjak Smulders and Jonathan Verschuuren, both from Tilburg University.