# PILOT WORKSHOP ON GOVERNING GEOENGINEERING IN THE 21ST CENTURY: ASIAN PERSPECTIVES

18–19 July 2011

Organised by the RSIS Centre for Non-Traditional Security (NTS) Studies

Centre For Non-Traditional Security Studies

PONDER THE IMPROBABLE

# PILOT WORKSHOP ON GOVERNING GEOENGINEERING IN THE 21ST CENTURY: ASIAN PERSPECTIVES

REPORT

CO-ORGANISED BY
THE RSIS CENTRE FOR NON-TRADITIONAL SECURITY (NTS) STUDIES

THE OXFORD GEOENGINEERING PROGRAMME OF THE OXFORD MARTIN SCHOOL, UNIVERSITY OF OXFORD

THE SOLAR RADIATION MANAGEMENT GOVERNANCE INITIATIVE (SRMGI), CO-CONVENED BY THE ROYAL SOCIETY, ENVIRONMENTAL DEFENSE FUND (EDF) AND THE ACADEMY OF SCIENCES FOR THE DEVELOPING WORLD (TWAS)

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S. RAJARATNAM SCHOOL OF INTERNATIONAL STUDIES (RSIS)
NANYANG TECHNOLOGICAL UNIVERSITY (NTU)
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# Executive Summary

Geoengineering, defined by the Royal Society of the United Kingdom as 'the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change' is receiving growing attention from scientists, policymakers and the public concerned with the slow progress of international negotiations to reduce emissions of greenhouse gases. However, the emergence of geoengineering technologies, as a new potential response for ameliorating the human and ecological risks of climate change, appears to have given rise to at least as many challenges as it might have answered. Geoengineering is still a novel notion and the effects of relevant technologies are yet to be fully known. Moreover, research and discussion on geoengineering have mostly been driven by European and North American countries while other regions that are significantly affected by climate change, such as Asia and the Pacific, are yet to make their perspectives heard.

Against this backdrop, the Pilot Workshop on Governing Geoengineering in the 21st Century was the first meeting in the Asia-Pacific region to elicit Asian perspectives in the discourse on geoengineering. The event explored how geoengineering was perceived and framed in Asia-Pacific countries in relation to climate change mitigation and adaptation. It examined the threats ahead of and opportunities in store for geoengineering as a new set of emerging technologies with which to address climate change and the pressing demands for a low-carbon economy.

During the workshop, discussions revolved, in particular, around three main issues:

- The appropriate framing of geoengineering.
- The importance of public engagement.
- The challenges of effective governance.

The following five points were highlighted in these discussions:

- Climate change mitigation is still the top priority. Emission reductions will remain essential in tackling climate change – while geoengineering technologies may complement this endeavour, they are not an alternative to it.

- Since there are currently no regulatory frameworks available that are aimed specifically at controlling research into and the potential development of geoengineering technologies, it is important that the international community moves forward quickly to establish an integrated framework for the governance of some, if not all, geoengineering technologies.

- There is a substantial demand for more thorough investigations of public attitudes, concerns and uncertainties over geoengineering, within and across regions, in parallel with technological R&D to enable better-informed public debate and policymaking.

- If geoengineering techniques are to be deployed, they must be applied within the context of sustainable development.

- Debate on geoengineering must involve all stakeholders, be it the public, civil society, scientists, politicians or the private sector.

# Opening Session

**Welcome Remarks I**

***Ambassador Barry Desker***
*Dean,*
*S. Rajaratnam School of International Studies (RSIS),*
*Nanyang Technological University (NTU),*
*Singapore*

Ambassador Desker began by calling attention to the fact that the Pilot Workshop on Governing Geoengineering in the 21st Century: Asian Perspectives was designed to broaden the discourse on geoengineering in the Asia-Pacific region, as existing explorations into the possibilities and implications of geoengineering had largely been confined to Europe and North America. The purpose of the meeting was to explore the manner in which climate geoengineering is framed in Asia and the governance issues associated with any such research, potential development and deployment.

The joint organisation of this event, opined Amb. Desker, by the Centre for Non-Traditional Security (NTS) Studies, S. Rajaratnam School of International Studies (RSIS); the Oxford Geoengineering Programme of the Oxford Martin School, University of Oxford; and the Solar Radiation Management Governance Initiative (SRMGI), co-convened by the Royal Society in the UK, Environmental Defense Fund (EDF) in the US, and the Academy of Sciences for the Developing World (TWAS), was a testament to the type of international cooperation and dialogue that will be essential for exploring and potentially managing issues relating to geoengineering. Such discussion, he remarked, could scarcely have been more apt or timely.

Amb. Desker observed that the Intergovernmental Panel on Climate Change (IPCC) was currently, for the first time, assessing the scientific basis as well as the potential impacts and side effects of geoengineering proposals in their Fifth Assessment Report, which is scheduled to be finalised in 2014. The IPCC had also recently held a joint working group expert meeting on geoengineering in Lima, Peru (20–22 June 2011). While he acknowledged the advocates of geoengineering who argue that it might provide a useful defence for the planet that could be deployed if surprisingly abrupt or formidable climatic shifts put vital ecosystems and billions of people at risk, Amb. Desker also took notice of the arguments being put forth by detractors regarding the risks involved in introducing geoengineering as the new ‘Plan B’ for tackling climate emissions, which could create even greater problems since the full effects of various geoengineering techniques are not yet well understood. As with many new technologies, he noted, there is no general consensus that geoengineering is safe, appropriate or effective.

Indicating that geoengineering could be perceived in some quarters as a potential moral hazard due to the possibility that it could decrease the political and social impetus to reduce carbon emissions, Amb. Desker pointed out that, as such, it was important that scientific momentum builds up in support of projects that will carefully assess the range of risks and opportunities that are intrinsic to geoengineering technologies.

He noted that legislators in Europe and the US were looking for guidance on how research into geoengineering options should be conducted and how decisions about deploying potential geoengineering technologies should be made. For example, the UK House of Commons Science and Technology Committee has initiated an inquiry on how geoengineering should be governed. Similarly, the US Congress House Committee on Science, Space and Technology has issued a report on the topic, calling for further scientific research and risk assessment. Responding to such calls, the UK Royal Society has even launched a project to explore research governance guidelines for solar radiation management, which is to be conducted in collaboration with the US National Academy of Sciences, TWAS and EDF.

Nevertheless, Amb. Desker was mindful that such initiatives need to be a global rather than a trans-Atlantic endeavour. Any potential new global governance framework will likely require broad legitimacy and support by a critical mass of stakeholders across the globe. The Pilot Workshop, he stated, aimed to contribute to this objective by facilitating a dialogue about geoengineering in the Asia-Pacific region, with the involvement of multiple and differentiated stakeholders helping to ensure that the debate reaches many more communities that may be affected by the subject.

He noted, more specifically, that the maturation of the geoengineering discourse required that a series of difficult questions be addressed. These include foundational inquiries about whether we need geoengineering. Is it a legitimate response to climate change? What are the existing legal and institutional mechanisms to govern geoengineering research, development and potential deployment? How would we manage the uncontrolled use of geoengineering? How would we deal with intended or unintended negative effects? How would we define 'climate emergency' for the purpose of triggering the deployment of geoengineering technology? And finally, what would the criteria that define the success and failure of geoengineering deployment be?

Amb. Desker concluded his remarks by highlighting that it was precisely with such major issues in mind – issues that may divide communities, and generate different answers from the multiple constituencies at the domestic, regional and global levels – that the Workshop was bringing together participants for two days of discussion and deliberation.

**Welcome Remarks II**

***Dr Jochen Prantl***
*Visiting Senior Fellow and Coordinator of the Energy Security Programme*
*Centre for Non-Traditional Security (NTS) Studies*
*S. Rajaratnam School of International Studies (RSIS)*
*Nanyang Technological University (NTU), Singapore;*
*Senior Research Fellow,*
*Department of Politics and International Relations,*
*University of Oxford, UK*

Dr Prantl observed that debates about geoengineering governance are underpinned by two major sets of questions. The first of these sets asks whether we want, and even need, geoengineering? This, he said, is a very complex area, as it involves a whole range of ethical, social and legal issues that cannot be considered by scientific inquiry alone, but must rather be addressed by a much wider audience from across regions.

Dr Prantl noted that debates, such as those currently associated with geoengineering as well as the human genome project and nanotechnology, are indicative of the challenges inherent to the development of new technologies. Key concerns, as for many similar debates, are: how will such technologies be used? Who owns and controls the technology, along with the rights to its potential use or non-use? What are the larger societal issues related to the introduction of a new technology? How will research into and tests of any new technology be evaluated and regulated for accuracy, reliability and utility? How could we contribute to the public's ability to make informed choices? And, importantly, should public debate arrive at the conclusion that we may need geoengineering, how would we ensure that its myriad dangers are addressed?

Introducing geoengineering as the new 'Plan B', Dr Prantl pointed out, may indeed decrease the political and social impetus to reduce carbon emissions. He underscored the need for a clear understanding of how any such new technology would relate to existing climate change mitigation and adaptation efforts, as otherwise, resorting to geoengineering could be construed as the present generation's declaration of surrender in its effort to address one of humankind's most pressing problems. Until these issues are thoroughly addressed and adequately reconciled, the geoengineering discourse, he remarked, risks relative stagnation.

The second major set of questions in the debate on geoengineering governance relates to the issue of how to minimise the possibility of situations where the implementation of geoengineering could result in winners and losers associated with the process. Dr Prantl noted that full-fledged geoengineering technologies do not exist yet, though some of the components are already available or are being developed. At present, there are no regulatory frameworks governing the broad application of geoengineering technology, which opens up the possibility of the technology being applied unilaterally by single countries, businesses or even individuals, without concern for its side effects or transboundary implications.

Noting that further research into and potential development of geoengineering technologies may require a set of governance mechanisms to be established in accordance with the potential risks and benefits to societies across different regions, Dr Prantl summed up that the Workshop would facilitate the beginning of a much-needed dialogue that has thus far been largely driven by the US and Europe. The Asia-Pacific region needs to be part of this debate, and the forum provides a valuable starting point.

# Session 1: What Is Geoengineering? Do We Need It?

*Chair:*

***Dr Ralf Emmers***
*Associate Professor and Acting Head,*
*Centre for Non-Traditional Security (NTS) Studies,*
*S. Rajaratnam School of International Studies (RSIS),*
*Nanyang Technological University (NTU),*
*Singapore*

*Presenter:*

***Mr Tim Kruger***
*James Martin Fellow,*
*Oxford Geoengineering Programme,*
*University of Oxford,*
*UK*

The starting point for geoengineering discussions has to be the acknowledgement that mankind has a problem on hand. Human activities have placed substantial amounts of heat-trapping greenhouse gases (GHGs) into the atmosphere, and our actions continue to emit these gases at an increasing rate. As a result, mankind has achieved the often dubious capacity to alter the atmosphere and, by extension, global weather and climate patterns in significant ways. These unintentional anthropogenic alterations to the atmosphere create a series of challenges for contemporary societies around the world that, importantly, are and will continue to be both geographically and socially differentiated. With some luck, these would be relatively small and surmountable; without luck, the problems could outstrip our ability to address them. The geoengineering discourse must exist within this inescapable context.

Geoengineering is, of course, only part of the climate response conversation. There is growing consensus on the need to reduce emissions – even if the pathways towards achieving this goal remain elusive – and efforts to use less energy, use less carbon-intensive energy and/or capture emissions are all potential parts of an effective climate mitigation strategy. These approaches should be judiciously and aggressively pursued regardless of any decisions that might be taken on geoengineering.

Nonetheless, there are aspects of the climate change challenge that make geoengineering relevant and important even with respect to these other mitigation techniques. Namely, past and ongoing activities have placed enough GHGs into the atmosphere to lead to steady warming for decades to come, regardless of any mitigation efforts that may be taken in the near term. Moreover, growing demands for energy that accompany economic development and demographic momentum may continue to make large-scale mitigation efforts difficult. Such difficulties can result from a deficit of political will or diplomatic success, a lack of technical ability to meet climatic challenges, or simply as a result of the fact that natural environmental systems would prove more sensitive to climatic changes than originally thought. Such scenarios lend relevance and importance to efforts to explore geoengineering possibilities.

Geoengineering can be defined as a large-scale intervention into natural systems to affect changes to the climate. Geoengineering might thus be usefully compared to an automobile airbag, in that it offers some modicum of safety in undesirable scenarios. There are a range of geoengineering techniques and approaches currently under development, and these can be broken down generally into the categories of solar radiation management (SRM) and carbon dioxide removal (CDR). No options are panaceas, however, as SRM remains relatively cheap and easily deployable, but incomplete – not least of which is because it does not address the negative effects that GHG emissions are having on the world's oceans. SRM approaches are also often riskier and have a range of potential unknown corollary effects. CDR, conversely, is more complete and safer, but is slow, expensive and also begs questions about potential effectiveness.

Despite the evidence that there is a need to pursue exploratory geoengineering research, there are three key areas of risk involved in following such a trajectory. The first set of risks deals with the potentially unknown and unsavoury impacts of geoengineering practices on natural environments. Geoengineering could prove to be a fatally flawed strategic approach if these risks are not accounted for or understood. Secondly, there are social risks and moral hazards that might arise from citizens and governments looking upon geoengineering as a 'quick fix' that can preclude them from the difficult charge of reducing emissions. In this sense, it must be made clear that emissions reductions are essential even in the context of geoengineering and that geoengineering techniques should be viewed as emergency response possibilities rather than saving grace technologies. Thirdly, there are the lesser-explored risks of not conducting geoengineering research and then being faced with a climate crisis in which mitigation and adaptation efforts prove inadequate. In such a scenario, there should be legitimate concern that geoengineering technologies might be deployed without proper understanding as to how such technologies will operate and what their social and environmental ramifications might be.

As such, it is important to conduct research on geoengineering that is multidisciplinary, collaborative and respectful of the serious implications that the research begets. This research should be transparent and accompanied by honest consultations with the public. Finally, and most importantly, geoengineering research should be extended in ways that bring into light the range of social and environmental factors that are associated with it.

**Discussion**

The discussion began with questions regarding whether geoengineering should be appropriately framed as simply a 'Plan B' approach to climate change that is only to be pursued in case of climate emergencies or failed mitigation attempts; or, whether it might be conversely viewed as another tool for addressing climate change that could be pursued concomitantly with mitigation. This issue is not easily reconcilable and throws up competing views about the place of geoengineering in the climate change discourse, both conceptually and practically.

There were also concerns about governing geoengineering research that might problematise the future of the sector. For example, it was argued that some geoengineering research, not to mention its potential deployment, is viewed as dangerous and there are legitimate fears that those seeking to conduct such research could target developing states with poor governance records for their experimentation. In such scenarios, it would be the local populations in these developing countries that bear the brunt of any unwanted environmental or social effects of the geoengineering research. Governing research was thus pointed out to be of paramount importance in the contemporary setting.

Further temporal issues surrounding geoengineering that relate to addressing the causes of climate change versus its symptoms were also discussed. It was noted that some regarded geoengineering as only addressing the symptoms of climate change and thus that only other more entrenched mitigation strategies, such as emissions cuts and afforestation, would have lasting effects. Geoengineering, according to this line of logic, is merely a search for short-term solutions to a problem that requires long-term thinking. Discussions concluded on this point as the session speaker suggested that, while long-term solutions are an essential part of effective climate responses, traditional mitigation might prove too slow in addressing the climate challenge. And, because of this unwelcome reality, geoengineering research should continue.

# Session 2: The Challenges of Geoengineering Governance

*Presenter:*

***Professor Steve Rayner***
*James Martin Professor of Science and Civilization,*
*University of Oxford,*
*UK*

Session 2 was delineated along three main themes in the history of governing technology, along with a concluding discussion of a framework for pursuing geoengineering research. These themes centred upon the heterogeneity of technology, the importance of time frames and temporal elements, and the importance of scale in both the geographical and deployment-level senses. The modestly proposed framework for geoengineering research, meanwhile, stems from the existing work of the Royal Society of the United Kingdom's fundamental principles for governing geoengineering research.

Firstly, the heterogeneity of technological development makes governance difficult. A variety of techniques and sectors typically underlie the development of a given technological product. These might include highly varied biological, chemical and technological approaches that each make a contribution or contributions to a given breakthrough or scientific advancement. While these differentiated processes might be bound together by a unified goal, their unique characteristics make the governance of an overarching technology problematic; a point that must be recognised and addressed, if geoengineering governance is to be successful.

Secondly, there are temporal elements that must be addressed in the governing of geoengineering research. There are no established geoengineering techniques currently; they are all in conceptual or experimental phases. Social, scientific and governance approaches attempt to evaluate these techniques while they remain in fledgling phases and develop governance mechanisms for the entire lifespan of the techniques from initial research through to deployment. This, though perhaps ideal, is impossible, as technologies often develop in organic and unpredictable ways. As such, geoengineering research would do well to go forward flexibly, without hubristic searches for quick fixes or monoculture technologies, and governance must follow suit by responding to the prevailing realities and trends of the time in which they operate.

The third issue requiring geoengineering attention is that of scale, and here solar radiation management (SRM) and carbon dioxide removal (CDR) make up important distinctions – SRM would likely require a universal treaty to implement because of its potentially global implications while CDR could perhaps be governed on smaller scales. The climate change deliberations to date have demonstrated the difficulties inherent in finding global consensus. When transferred to geoengineering, this trend suggests that SRM may not be deployable in the foreseeable future. CDR, meanwhile, is potentially less controversial and in need of regulation on only sub-global scales. All the same, the development of CDR technologies is less mature and thus it too is likely to be undeployable in the near term. This reality constitutes a geoengineering paradox. Finally, spatial elements relate to the scale issue as well, in that differing governance issues could arise as a result of differing scales along which research is being undertaken, and the restrictions and regulations that may be appropriate for geoengineering research could vary depending upon whether social or physical approaches to spatiality are employed.

In response to these challenges, the UK Royal Society has proposed basic principles on the governance of geoengineering. These principles are meant to pre-empt and thus inform future policy construction at government and international levels, and have already been adopted by the UK government. The principles state that:

- Geoengineering should be pursued as a public good and treated as non-rivalrous and non-excludable.

- Consultation should go forward in a proportional manner and include at least all those physically affected by the technology and, at times, the broader international community.

- All research should be transparent and made available in the public domain.

- Independent risk assessments should be conducted before research that has the potential to affect environmental or social systems goes forward.

- Agreed government mechanisms should be arrived at before any geoengineering deployment.

These principles are designed to ensure that democratic concerns are recognised while societies have the opportunity to investigate whether given geoengineering technologies are 'fit for purpose'; that is, are they affordable, effective and free from overarching negative corollary impacts?

Questions do arise as to how one can determine what is 'fit for purpose'. This is an unavoidable and intransigent difficulty for which the best response is effective consultation between experts and the general public. As past experiences have shown, such a consultative process can prove to be difficult. Further questions exist regarding the intellectual property issues surrounding geoengineering and the public-private partnerships that it might entail. Since firms will want to retain intellectual property rights over their contributions, a fundamental challenge would be how geoengineering technologies might be governed, regulated and shared in a transparent manner. Defence technologies provide a valuable example in answer to this question. Just as defence industry actors can have patents over parts of a military technology but not the entire product, geoengineering contributors could have rights to specific elements of a technological product without monopolising its control.

Issues of temporal regulation also represent key challenges for geoengineering governance. Efforts to regulate can only create mechanisms and statutes; they cannot predict the specific direction that the technologies will take. As such, governance approaches must recognise limitations and focus on ensuring flexibility. A key responding element of the UK Royal Society principles, which responds to this issue, is that they allow for the research and deployment process to be stopped at multiple stages.

Finally, the issue of the scale and level at which governance should be pursued is foundationally important. The UN provides a wide-ranging forum for such discussions, but also presents the risk of impasse through inclusiveness. National governments could assign logical regulators for several plausible scenarios, but it is likely that different situations might call for different levels of regional and intrastate consultation. The likely outcome to questions on the level of governance regulation would then be that varying technologies and scenarios would require specific and targeted approaches. The key is to try to build consensus around the principles that might guide decision-making in such situations.

# Session 3: The Importance of Global Public Engagement

*Presenter:*

***Ms Jayne Windeatt***
*PhD candidate,*
*Faculty of Engineering Doctoral Training Centre in Low Carbon Technologies,*
*University of Leeds,*
*UK*

This session focused on the importance of stakeholder and public engagement in evaluating the effectiveness and side effects of various geoengineering proposals. Of particular concern were the precise methods with which public opinion on geoengineering could be elicited and assessed, with the intention of democratising decision-making and improving accountability to the public.

**Integrated Assessment of Geoengineering Proposals (IAGP), UK**

The presentation introduced an ongoing project – Integrated Assessment of Geoengineering Proposals (IAGP) – dedicated to developing criteria for assessing a variety of geoengineering proposals, with an emphasis on eliciting stakeholder and public values and including them in the evaluation process. Three aspects were touched on: (1) flaws with previous assessment procedures; (2) how IAGP is to be conducted across a four-year timeline; and (3) the challenges in informing the public without leading their opinion.

Previous reports have tended to illuminate the technical dimensions of the technologies being discussed at the expense of social and ethical considerations. Although criteria such as affordability, effectiveness, safety and timeliness are often factored into the evaluation process, the exclusion of public opinion risks silencing the concerns of those who would be most directly affected by the use of geoengineering technologies. IAGP recognises the need for an assessment procedure that is publicly acceptable, rather than one that arbitrarily privileges the values of governments and scientific communities.

Secondly, the talk dealt with the methodological issues surrounding IAGP's research, specifically the ways in which public engagement could be usefully harnessed to inform criteria development for both the research process as well as its deployment. The choice of criteria is to be governed by two overarching considerations: (1) the criteria must be applicable to all geoengineering technologies – that is, to maximise IAGP's flexibility as a benchmark for effective assessment; and (2) the criteria should be sufficiently operationalisable in order to achieve consistent assessment standards across different technologies.

Also of concern were challenges in eliciting public views on what social, economic and ethical effects are to be considered most salient, and how governance can be designed to mitigate these effects. The way in which geoengineering is framed may lead rather than inform public opinion, thereby undermining the honesty of public consultation processes. For instance, framing geoengineering as a response to climate 'emergencies' would presuppose agreement on: (1) what constitutes an emergency; (2) who has the proper authority to define an event as an emergency; and (3) where the authority to trigger the deployment of geoengineering technologies lies. Such a move prematurely precludes participation of those who do not subscribe to such understandings, diluting the quality of democratic governance.

**Discussion**

Questions revolved around two issues: (1) challenges in getting the public interested in starting a genuine debate on geoengineering; and (2) whether there are sufficient domestic channels through which the public can debate about, and scrutinise, such issues without governmental opinion dominating the discourse.

Geoengineering may be perceived by the public as a complex issue requiring professional expertise as a prerequisite for understanding its scientific-technical dimensions. As such, the public may refrain from engaging academics and policymakers simply because of the high opportunity costs involved in informing themselves. Projects like the IAGP may have to absorb the costs of public education on this issue to overcome the initial barrier to engagement with the broader community.

The discussion highlighted two criteria for genuine engagement: (1) participants should be well-informed on the subject and its attendant complexities; and (2) the sample of participants should be as representative as possible to avoid precluding concerns about the effects of geoengineering on specific groups (categorised by class, age, race and geographical residence, to name a few). To fulfil the first criterion, Ms Windeatt suggested that two-day workshops be designed such that the public is guided through a learning process on the first day before they are expected to discuss the different facets of geoengineering. In educating the public, organisers need to pay particular attention to the risks of manipulating information to garner agreement with a particular position. This is especially important in light of the shortened time frame within which public participants are expected to familiarise themselves with the subject.

The danger of presuming that publics in all countries can debate openly about issues related to geoengineering was also highlighted towards the end of this session. The IAGP's objective of public and stakeholder engagement has been deemed provisionally feasible because of the UK's institutional make-up and political culture, which safeguard the freedom of public members to engage in open and transparent dialogue. By conflating public opinion with governmental opinion, there is a risk of further marginalising publics which lack the opportunity to engage in genuine dialogue about geoengineering.

In assessing the state of public engagement in a country, care should be taken to avoid focusing myopically on formal institutions at the expense of informal channels. Citing Singapore as an example, delegates highlighted the role of think tanks, such as the Singapore Institute of International Affairs (SIIA) and the S. Rajaratnam School of International Studies (RSIS), in initiating and sustaining dialogue on climate change through conferences, workshops and public events. Local media were also identified for proactively assuming responsibility for educating the public on topics with governance dimensions. Lastly, social entrepreneurs can, and do, organise public forums that contribute to the democratisation of participatory channels.

Delegates also suggested that the IAGP could provide opportunities to learn about the effectiveness and credibility of different methods of public engagement. These lessons could be extended worldwide, although concerns were raised with respect to the need for awareness of cultural differences in the geographical areas involved. For instance, certain governments may regard some methods of public engagement as foreign interference; or, local communities may favour indigenous norms of eliciting public opinion. To preserve the integrity of the process, caution should be exercised in presupposing the generalisability of the conclusions reached by the IAGP.

The discussion summed up by concluding that for stakeholder engagement to be effective, initiatives such as the IAGP need to be sensitive to contextual differences that affect the actual degree of participation by publics in their respective domestic debates.

# Session 4: The Solar Radiation Management Governance Initiative (SRMGI) – A Very Brief Introduction

*Presenter:*

***Mr Alex Hanafi***
*Attorney,*
*Environmental Defense Fund (EDF),*
*US*

This presentation outlined the key objectives of the Solar Radiation Management Governance Initiative (SRMGI), a project aimed at increasing stakeholder engagement in devising guidelines to govern research on solar radiation management (SRM). Key themes included the need for diversity in stakeholder engagement, the strengthening of specific norms in research communities and the evaluation of governance options for SRM research.

The SRMGI is a joint initiative of three organisations: the Royal Society of the UK, the Academy of Sciences for the Developing World (TWAS) and the Environmental Defense Fund (EDF). It was developed and launched in March 2010 in response to the 2009 Royal Society report, *Geoengineering the Climate*, and in particular to its conclusions on the need to establish guidelines governing geoengineering research. The SRMGI aims to develop these guidelines such that research is conducted in a transparent, responsible and environmentally sound manner. In meeting the demand for procedural justice, the initiative recognises that geoengineering research will be deemed publicly acceptable insofar as the guidelines governing it respect social, legal and political considerations, and not merely those considered important by the scientific-technical community.

Consistent with the previous session's theme, diversity in stakeholder engagement featured as a main concern in this presentation as well. The SRMGI seeks to establish a common foundation upon which future dialogue and cooperation over the conceptualisation and implementation of SRM governance can be conducted. This initiative aims to accrue legitimacy mainly by engaging a diverse mix of stakeholders, including natural and social scientists, humanitarian and environmental non-governmental organisations, and governance organisations.

Importantly, many of these organisations are based in the developing world, which addresses the need for procedural justice on a global scale in securing widespread stakeholdership of the process. Upcoming workshops will be conducted in China, India and Pakistan in September 2011. By locating these events in the developing world, the initiative would contribute to widening the geoengineering discourse, which has thus far been predominantly driven by American and European academics.

In constructing a common discursive space, the SRMGI can contribute to the strengthening of specific norms in research communities across the world. For instance, the initiative aims to encourage honesty by emphasising the importance of transparency regarding research methodologies and experimental results. To respect particular concerns of stakeholders, researchers need to be upfront about their methods and results so that potential social, economic and environmental costs can be evaluated.

The SRMGI is also more process- than results-oriented, having de-emphasised the importance of achieving consensus at an international conference held in March 2011, where issues surrounding SRM research governance were discussed. This reflects the belief that stakeholders would be more satisfied if they are given time to discuss their views openly. Without being pressured by time to come to an agreement, they would be less likely to paper over deeper differences for the sake of perfunctory consensus.

The SRMGI also seeks to explore and evaluate a spectrum of potential options for governance of SRM research. On one end, existing regulation standards may be applied to SRM research, without the need to make exceptions; on the other, SRM research may be completely prohibited. In between these poles lies a range of different configurations of legal and institutional mechanisms. The SRMGI promises to critically assess alternative regulatory frameworks to determine which would best balance the demand for SRM deployment with the multi-varied concerns of stakeholders. Then again, the initiative promises not to preclude certain options simply because of their current unpopularity among stakeholders.

Phase I of the SRMGI, conducted in March 2011, aimed to kickstart the conversation on policy options. Phase II, to be marked by additional conferences and global outreach programmes, will focus on expanding this conversation. The high degree of inclusiveness envisaged renders possible a more genuine global engagement process, which may sensitise stakeholders to challenges and opportunities in envisioning governance options that transcend national and even regional borders.

# Session 5: Showcasing Proposed Geoengineering Techniques

*Moderator:*

***Mr Tim Kruger***
*James Martin Fellow,*
*Oxford Geoengineering Programme,*
*University of Oxford,*
*UK*

This session introduced delegates to several proposed geoengineering techniques by employing posters as well as a series of six 5-minute videos from experts in each of the techniques. Three prominent issues were touched upon: (1) the capabilities and constraints of current techniques; (2) the underdeveloped state of geoengineering research with respect to potential risks; and (3) thinking about geoengineering using a 'risk/risk' rather than a 'cost/benefit' calculus.

In general, geoengineering techniques belong to one of two groups. The first is solar radiation management (SRM), which involves reflecting a small fraction of the Sun's heat back into space. The second is carbon dioxide removal (CDR), which seeks to reduce the amount of greenhouse gases in the atmosphere. During the session, five types of geoengineering techniques – stratospheric aerosols, cloud whitening, carbon capture and storage (CCS), emission reduction, and carbon-negative techniques – were evaluated with respect to their capabilities and constraints. The first two approaches fall under SRM, while the rest can be treated as CDR techniques.

Given the current state of geoengineering research, certain advantages offered by some techniques are readily identifiable. For instance, one type of SRM involves launching stratospheric sulphate aerosols into the atmosphere, which reflect solar radiation back into space and thereby cool the Earth's surface. Three advantages can be identified: (1) in contrast with CDR techniques, this SRM method works more quickly; (2) the logistical scale-up involved is minimal, given that existing technologies can be utilised to launch the aerosols; and (3) the projected costs are significantly lesser than those related to CDR techniques.

Yet, the capabilities of current techniques are significantly limited in that the scale at which they can be employed will not drastically change the status quo. For instance, a CCS proposal by Biorecro, a Swedish clean technology company, aims to remove 300 million tonnes of carbon dioxide (CO2) – a greenhouse gas – from the atmosphere. This quantity only constitutes 1 per cent of global emissions. Similarly, existing carbon-negative techniques, which draw CO2 out of the atmosphere, can only remove 0.1–1 per cent of current global emissions (the percentages are hotly contested). Even if geoengineering were to be framed as a 'quick' fix to buy time before significant emission reductions are achieved, we should be under no illusions about the time needed for visible improvements to take place.

The other major constraint of CDR techniques lies in the cost of extracting CO2 from the atmosphere and storing it. Firstly, CO2 only makes up 0.04 per cent of air, and a purity level of 90 per cent needs to be reached before CO2 can be compressed into liquid form, which can then be safely sequestered underground. Secondly, the logistical scale-up required involves substantial costs. Thus, CDR techniques make it significantly harder to imagine mitigating the effects of climate change without severely compromising economic growth. At the same time, while SRM techniques may seem relatively cheaper and more attractive, it should be noted that challenges in designing safe, extensive and reliable delivery systems for this approach remain unresolved.

A common theme that resonated throughout the session was the urgent need for more research to be conducted in order to develop comprehensive accounts of potential risks arising from the deployment of certain techniques. Delegates agreed that there is currently little confidence in analysing either the actual or potential costs of deployment for certain techniques. For instance, there are serious concerns regarding the reversibility of techniques like the aforementioned stratospheric aerosols. Two possible side effects were mentioned: (1) if the aerosol deployment were stopped, the temperature of the Earth would rebound rapidly; and (2) the concentration of aerosols may affect rainfall patterns, which may in turn alter agricultural yields.

Non-intrusive research currently includes the studying of natural phenomena to estimate the likely environmental effects of such deployment. For example, scientists have studied the 1991 eruption of Mount Pinatubo in the Philippines to ascertain the extent to which high sulphate concentrations in the air affect precipitation, the thickness of the ozone layer and temperature. However, existing research has not sufficiently considered the long-term environmental impact of the eruption – a conclusion that should encourage more extensive research in the future.

Mr Kruger also suggested using a risk/risk rather than a cost/benefit calculus to evaluate the feasibility of geoengineering techniques, particularly as the current state of research was unable to clarify the exact nature and scope of costs and benefits. Given that geoengineering techniques may be required on short notice, we may not be able to afford to wait until these costs are conclusively determined. Instead, discussions about the risks we would be willing to handle need to be conducted, thus emphasising the importance of democratic consultation of publics and stakeholders. Therefore, apart from effectiveness, affordability and safety (criteria that were recommended by the 2009 Royal Society report, *Geoengineering the Climate*), public acceptance should also be factored into debates on geoengineering.


NANYANG
TECHNOLOGICAL
UNIVERSITY


NANYANG


PROMOTE
REGULATE


Steve Rayner


Antonio


Neth Dano


Akimasa Sumi


***Workshop participants***
*From left to right: Dr Masahiro Sugiyama, Ms Neth Dano, Mr Rafael Senga, Mr Sandeep Chamling Rai, Prof. Akimasa Sumi, Mr Alex Hanafi, Mr Tang Tuck Weng, Prof. Steve Rayner, Mr Yang Razali Kassim, Dr Arunabha Ghosh, Amb. Barry Desker, Dr John Jackson Ewing, Dr Ralf Emmers, Mr Tan Yong Soon, Mr Tim Kruger, Prof. Antonio Marquina, Mr John Low, Dr Jochen Prantl, Mr Cheah Sin Liang, Ms Michelle Lee, Dr Hooman Peimani, Ms Jayne Windeatt, Mr Jonathan How.*

# Session 6: Country Perspectives on Geoengineering Governance

**Governing Geoengineering**

*Presenter:*

***Dr Arunabha Ghosh***
*Chief Executive Officer,*
*Council on Energy, Environment and Water,*
*New Delhi,*
*India*

Geoengineering is a relatively new policy area. As such, there are no regulatory frameworks in place aimed specifically at controlling geoengineering activities. Creating an international governance structure for geoengineering, first and foremost, requires a set of guidelines and principles. Currently, there are two sets of principles, namely the Oxford Principles and the Asilomar conference guidelines.

The Oxford Principles set out the following guidelines for geoengineering governance:

- Geoengineering to be regulated as a public good.
- Public engagement in geoengineering decision-making.
- Disclosure of geoengineering research and open publication of results.
- Independent assessment of impacts.
- Governance before deployment.

The Asilomar geoengineering conference, on the other hand, issued the following principles:

- Climate engineering research should be aimed at promoting the collective benefit of humankind and the environment.
- Governments must clarify responsibilities and, when necessary, create new mechanisms for the governance and oversight of large-scale climate engineering research activities.
- Climate engineering research should be conducted openly and cooperatively, preferably within a framework that has broad international support.
- Iterative, independent technical assessments of research progress will be required to inform the public and policymakers.
- Public engagement and consultation in research planning and oversight, assessments, and development of decision-making mechanisms and processes must be provided.

As to the nature of governance structure, there are currently four options, namely governance at the national level, adapting existing treaties, ad hoc principles and codes of conduct, and creating new treaties and/or organisations. It was emphasised that whatever be the form of governance structures that is adopted, it should be inclusive and should facilitate international cooperation. This is because some geoengineering research simply cannot be conducted nationally due to its very complicated nature and, as such, a lack of coordination could undermine responses to climate change. Then, there is the issue of funding. No country is capable of undertaking research on geoengineering unilaterally, as it is an expensive enterprise that requires sustained funding. Lessons can be learnt from existing internationally coordinated researches, such as World Climate Research Programme, European Organization for Nuclear Research, International Thermonuclear Experimental Reactor, etc.

While there are no regulatory frameworks aimed specifically at controlling geoengineering activities, there are a number of frameworks that could apply to certain aspects of it. These frameworks include international agreements with potential relevance for geoengineering areas, such as Convention on Long-Range Transboundary Air Pollution (CLRTAP), Convention on Biological Diversity (CBD), United Nations Environment Programme (UNEP), International Maritime Organization (IMO), Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD), United Nations Framework Convention on Climate Change (UNFCCC), and Montreal Protocol on Substances that Deplete the Ozone Layer. These frameworks are instructive and should help guide any future framework for geoengineering governance. However, it is imperative to ensure that whatever the type of governance structure created, it should be a multilateral body that facilitates international cooperation.

**Public Perception of Climate Geoengineering in Japan, as Revealed in an Online Survey: Initial Results**

*Presenter:*

***Dr Masahiro Sugiyama***
*Professor,*
*Central Research Institute of Electric Power Industry (CRIEPI),*
*Japan*

Geoengineering research that may impact the environment, or any moves towards potential deployment, should not proceed in the absence of a wider dialogue between scientists, policymakers, the public and civil society groups. As a new and emerging set of technologies that is potentially capable of addressing climate change, geoengineering also comes with both risk and uncertainty. Appropriate mechanisms for government oversight should therefore be established before governments take steps to promote geoengineering technologies and before new geoengineering projects commence. Public attitudes and their engagement during the formation, development and execution of proposed governance frameworks therefore could have a critical bearing on the issue.

An online survey, which was conducted by researchers at Central Research Institute of Electric Power Industry (CRIEPI) in Japan to determine public perceptions of climate change and geoengineering in the country, is instructive on how the public in Japan views geoengineering. The objective of the online survey was to analyse the level of awareness among the Japanese public regarding geoengineering and to find out whether or not they were agreeable to the use of such techniques for combating climate change. The survey began with a summary of key issues related to global warming, such as the current status of climate change and the ongoing scientific efforts to artificially cool the Earth to combat global warming. It also included information on the possible side effects of such initiatives. On the whole, the survey result indicated that few people in Japan had heard of 'geoengineering' and they supported research in the area albeit cautiously. Despite this lack of awareness, the public evidenced an interest in undertaking voluntary actions to combat climate change. These actions included the use of environmentally friendly appliances, such as photovoltaic cells to generate energy, travelling more frequently in public transport to reduce carbon emissions, donating to or helping environmental organisations, and talking about global warming with friends and families to raise awareness. Other proposed actions included the imposition of energy tax to reduce the use of fossil fuels at the household level. Regarding perceptions on the reliability of sources of information on geoengineering, the survey revealed that members of the public trusted university researchers, international organisations, friends and family, and environmental organisations more than they did governments, the media and religious leaders. One important insight offered by the survey was that public perceptions were not fixed and changed over time. This is especially true after the disasters, such as the tsunami, earthquake and nuclear accidents, that have struck Japan in 2011. In the aftermath of these disasters, it was observed that in the eyes of the Japanese public, governments and scientists had lost their credibility and 'big technologies' were less favoured.

On the whole, public opinion on geoengineering is difficult to gauge at this early stage, as it is likely to both evolve, as more information becomes available, and vary depending on the particular technology being discussed. The results of the survey discussed above, however, highlight the need for more thorough investigations of public attitudes, concerns and uncertainties over geoengineering, in parallel with technological R&D to enable better-informed debate and policymaking.

## Personal View about Geoengineering

*Presenter:*

***Professor Akimasa Sumi***
*Executive Director,*
*Integrated Research System for Sustainability Science,*
*University of Tokyo,*
*Japan*

Sustainable development has been defined in many ways, but its most frequently quoted definition is from *Our Common Future*, also known as the Brundtland Report, which defines it as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. One way to address the issue of sustainable development is through the framework of 'sustainability science'. Sustainability science is an emerging field of problem-driven interdisciplinary scholarship that seeks to facilitate interventions that foster shared prosperity and reduced poverty while protecting the environment. The field is defined by the problems it addresses rather than the disciplines it employs. It draws from multiple disciplines of the natural, social, medical and engineering sciences, from the professions, and from practical field experience in business, government and civil society. Specifically, sustainability science is concerned with the following:

- *Global systems* comprising resources, energy and ecosystems that support human life.
- *Social systems* comprising national economies, governments, industries and technological structures.
- *Human systems* comprising individual lifestyles, health, security and safety, and human values.

Given that today's global problems arise from the close interaction between these three systems, it is imperative that sustainability science focuses on the linkage among these systems. Sustainability science seeks to understand the linkages among the global, social and human systems, and the mechanisms that negatively impact them. It also proposes visions and methods for repairing these systems and linkages. Sustainable development has increasingly become a necessity for Asia. However, there has not been a serious attempt in the region to incorporate sustainable development in national development strategies. Current development strategies are single-minded, in that their primary objective is to achieve high economic growth at all costs. Such strategies may in the short term allow the economy to progress rapidly. However, if kept unchecked, they could also negatively impact resources and the environment, as they can facilitate both faster depletion of natural resources and rapid environmental pollution. It is therefore imperative that countries in Asia adopt a development strategy that puts the economic, social and ecological sustainability of economic activity at the forefront. Japan's aims to integrate sustainable development in its development strategy are based on the following:

- *Sustainable society:* coexist in harmony with the Earth's ecosystems and realise an economic society that enjoys sustainable growth and development.
- *Low-carbon society:* reduce greenhouse gas emissions drastically.
- *Sound material-cycle society:* recycle resources through 3Rs (reduce, reuse, recycle).
- *Society in harmony with nature.*

To realise the aforementioned goals, Japan has created the Integrated Research System for Sustainability Science (IR3S) in 2005. IR3S is a research network of five leading Japanese universities supported by six cooperating institutions. These are University of Tokyo, Kyoto University, Osaka University, Hokkaido University, Ibaraki University, Toyo University, the National Institute for Environmental Studies, Tohoku University, Chiba University, Waseda University and Ritsumeikan University. The aim of IR3S is to serve as a global research and educational platform for sustainability science. Its flagship research projects are Sustainable Countermeasures for Global Warming, Development of an Asian Recycling-Oriented Society, and the Concept and Development of Global Sustainability – Reform of the Socioeconomic System and the Role of Science and Technology. IR3S is well-placed to take the lead in geoengineering research in Japan.

It is also noteworthy that Japan could be looking to join the Geoengineering Model Intercomparison Project (GeoMIP). GeoMIP serves to organise geoengineering simulations by prescribing experiments that all participating climate models will perform. Its goals are:

- To provide a better idea of the 'robust' climate impacts of geoengineering.
- To highlight areas for model improvement.
- To provide output to other more specialised studies (e.g., crop models).
- To provide a framework for future geoengineering experiments.

# Session 7: Civil Society Perspectives on Geoengineering Governance

*Presenter:*

***Ms Neth Dano***
*Programme Manager,*
*Action Group on Erosion, Technology and Concentration,*
*The Philippines*

Oceans play a key role in regulating the world's climate. Phytoplankton (microorganisms that dwell on the ocean surface), despite their minute size, collectively account for half of the carbon dioxide ($CO_2$) absorbed annually from the Earth's atmosphere by plants. Through the process of photosynthesis, plankton capture carbon and sunlight for growth and release oxygen into the atmosphere. It is estimated that about one-third of all $CO_2$ generated by human beings over the last 200 years has already been absorbed by the oceans' plankton. In order to further increase plankton's ability to absorb $CO_2$, it is argued that ocean fertilisation, that is the process of dumping nutrients such as iron, nitrogen or phosphorous in waters where there are low concentrations of phytoplankton due to a lack of such nutrients, is essential, as it will spur the growth of phytoplankton which will then absorb more $CO_2$ for photosynthesis.

Phytoplankton is the foundation of the marine food chain and the introduction of iron may well stimulate the growth of algae blooms. However, its potential to capture and eliminate any significant amount of carbon is unproven. Then again, the list of potential side effects of such endeavours includes changes in marine food webs, lowering of oxygen levels, toxic blooms, production of harmful gases, increasing ocean acidification, adverse impacts on coral reefs, etc.

A case in point is that of an Australian firm, Ocean Nourishment Corporation (ONC), which planned to dump urea (nitrogen) into the Sulu Sea in 2007, but was eventually stopped by the Filipino government after over 500 civil society organisations campaigned against the plan. The project, a joint collaboration between ONC and the University of the Philippines in the Visayas (UPV) involved the manufacture of urea from natural gas and its introduction to the upper layers of the ocean. The project elicited strong reactions from various quarters in the Philippines. The Marine Science Institute (MSI) of the University of Philippines, for example, observed that the site chosen for the experiment was inappropriate given that the dynamics of the Sulu Sea were yet to be fully understood. Moreover, the Sulu Sea is home to many critical and sensitive habitats and is the main source of livelihood for a number of coastal communities. It therefore called on all concerned government agencies to initiate the formulation of guidelines to regulate such endeavours. Further, MSI urged ONC to conduct large-scale experiments on ocean fertilisation in Australian waters, such as the Gulf of Carpentaria in their Northern Territories, which is a tropical sea.

Civil society groups, as evidenced above, believed that geoengineering is not merely a cheap technofix for climate change but also a political smokescreen that could be deployed by wealthy nations to avoid undertaking any real domestic emission reductions or commitments to help the global South fend off impending catastrophe. Moreover, they believed that the rush to deploy geoengineering without public consultation or intergovernmental oversight could imperil the marine environment, which is the main source of survival and livelihood for poor fisherfolk in the Philippines. The groups demanded the participation of all stakeholders in geoengineering discussions and transparency on key decision-making. They also called for a moratorium on large-scale and commercial geoengineering projects until public debate, intergovernmental oversight and a thorough assessment of the social, economic and environmental impacts of such projects were undertaken. To date, the most promising multilateral avenue for the governance of geoengineering has been the Convention on Biological Diversity, which adopted a moratorium on ocean fertilisation in 2008.

# Session 8: Workshop on the Solar Radiation Management Governance Initiative (SRMGI)

*Moderator:*

***Mr Alex Hanafi***
*Attorney,*
*Environmental Defense Fund (EDF),*
*US*

For this session, participants were organised into four teams with each team representing a country. The teams were then asked to outline governance systems for solar radiation management (SRM) research that best suited the interests and priorities of the national governments that they represented based on the following criteria:

- *Participation:* which are the governments participating in SRM governance and what are the criteria for inclusion?
- *Legal form and institutionalisation:* how do they act (i.e., informal consultation among appointed government officials and/or international experts, negotiating a treaty or international institution or some combination)?
- *Responsibilities and authority:* what do they do (i.e., fund joint research, design regulations, establish liability and compensation regimes, standardise risk assessment procedures, or something else)?
- *Public consultation and deliberations:* what mechanisms are used for public input and consultation?
- *Linkage to climate change policy:* how, if at all, is the system linked to other aspects of climate change policy?

Team 1 proposed an international conference to flesh out issues related to SRM. The team proposed that research on SRM should be conducted at the subregional level through, for example, the South Asian Association for Regional Cooperation (SAARC) and the ASEAN+3, as these regional organisations are well-placed to take the lead in SRM research. Participating countries would be equally represented. However, since no research would be possible without adequate funds, team 1 proposed that participating countries would contribute financial resources, the amount of which would be determined by the size of their respective GDPs. Other proposals included creating a risk assessment body, encouraging scientific capacity building in developing countries, and collaborating with the United Nations Framework Convention on Climate Change (UNFCCC).

Team 2 was in favour of creating an inclusive governance mechanism, which would be open to any country that might be interested. To be able to establish such mechanisms, it encouraged the exploration of existing frameworks, such as the Montreal Protocol, to draw lessons from them. The team supported joint research and coordination of all efforts among its members and called for a ban on the deployment of SRM technologies that could have negative transboundary effects. The team believed in improving the scientific capacity of developing countries and, to this end, called for collaboration with the UNFCCC.

Team 3 considered research on SRM to be a matter of national interest, and especially so because its ‘rivals’ had also expressed interest on the subject. The team believed that organisations, such as the UN, may not be the right framework for SRM governance because of the bureaucratic nature of the organisation, which they feared would hamper rather than facilitate actions. As such, the team expressed interest in creating a ‘coalition of the willing’ among interested parties. It was argued that the creation of an exclusive group of countries with shared interests is a better option, as cooperation under such governance frameworks would be more productive. They also proposed to raise the issue at G8 meetings, which according to the team is more suitable than the UN to regulate SRM because of its limited membership. Collaboration with the private sector was considered necessary because of the complicated nature of SRM research. Collaboration with the media was also considered a necessity in order to be able to convince the public of the importance of such research. The team’s main thrust was to try to become a role model and place others in a defensive position.

Team 4 believed that climate change would affect the country negatively and was in favour of implementing SRM gradually. One of the major concerns was the possibility of rogue states acquiring SRM technologies. As such, preventing rogue states from acquiring such technologies constituted a high priority. Team 4 believed in forums that would give SRM legitimacy without placing constraint on it, and identified the G20 as an ideal forum to push for SRM research. Once the support of the G20 is secured, the next step would be to push the agenda at bigger forums, such as the UN. The ideal forum, according to this group, would be transparent and informal. A strict code of conduct was also considered necessary, as such a code would allow for penalisation of non-compliance to transparency principles. It would also prove helpful in securing intellectual property rights on key technologies.

## Session 9: Video Conferencing with Panel Members from the Royal Society

*Participants:*

***Professor John Shepherd***
*Professorial Fellow in Earth System Science,*
*University of Southampton;*
*Chair,*
*Royal Society Working Group on Geoengineering,*
*UK*

***Professor Georgina Mace***
*Imperial College, London;*
*Member,*
*Royal Society Working Group on Geoengineering*
*(expert on biodiversity),*
*UK*

***Dr Chris Vivian***
*Chairman,*
*Scientific Groups of the London Convention and Protocol,*
*UK*

***Mr Andy Parker***
*Senior Policy Officer,*
*Royal Society,*
*UK*

***Mr Mike Childs***
*Head of Climate Policy,*
*Friends of the Earth,*
*England, Wales and Northern Ireland*

Video conferencing with panel members of the Royal Society of the UK involved discussion on a number of key issues. The major conclusions of these discussions were the following:

- *Involvement of more stakeholders*: The need to involve more stakeholders was one of the key issues raised in the discussion. Scientists and politicians were identified as among the most important stakeholders upon whom the success or failure of initiatives aimed at reversing climate change depends. Scientists should take the initiative to educate politicians on the need to reduce carbon dioxide (CO2). Besides these actors, civil society organisations were also identified as having an important role, as they could sensitise the public on aspects of climate change and the measures needed to combat it.

- *Expansion of the scope of research:* It was pointed out that initiatives on geoengineering originated mainly from Europe and North America, and most notably from the UK and the US. There is an urgent need for countries in the developing world to also take initiative on the issue. One way to involve developing countries is through collaboration with local partners. Involving local partners will help to increase awareness of climate change and geoengineering among the public.

- *Mitigation is still a top priority:* Discussions about society's response to climate change have revolved primarily around the subject of mitigation. Increasingly, however, the problem of adaptation to an already changed climate is entering the picture as well, and the relationship between these two modes of action is becoming a topic of concern and debate. Climate mitigation is any action taken to permanently eliminate or reduce the long-term risk and hazards of climate change to societies whereas climate adaptation refers to the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damage, to take advantage of opportunities, or to cope with the consequences. It was observed that people tend to think of mitigation as an alternative to adaptation and therefore a solution to climate change, and thus fail to take appropriate measures. There is a fear that people might see geoengineering as an alternative to greenhouse gas emission reductions. What is essential is to educate people and to explain to the public that mitigation and adaptation efforts are not mutually exclusive but instead complement each other.

- *Participation of the private sector:* Geoengineering is still too contested a field for most big corporate investors and, for many, an open association with geoengineering would be a public relations liability. However, the past decades have seen increasing involvement of both commercial and scientific ventures, for example, in ocean fertilisation. The goal of commercial enterprises engaged in ocean fertilisation is to profit from selling carbon credits or offsets for the sequestered CO2 through voluntary or regulated carbon markets. All the same, it is important that private enterprises do not use their power to determine favourable outcomes or to promote schemes that serve their interests. Despite this concern, it was noted that the role of the private sector could not be ignored, as they possess the required skills and funds necessary for such undertakings. In order to improve their contribution, one participant suggested the adoption of a military-like approach to funding and research. Increasingly, weapons R&D and its production are being split up and tasked to many contractors and subcontractors who provide products or services to the military department of a government. Despite their involvement, the role of contractors and subcontractors is limited to R&D and weapons manufacture, and they cannot override the authority of defence ministries. Likewise, governments should take ownership of geoengineering research while involving the private sector in areas such as funding and research.

# Programme

**Day 1**
**18 July 2011 (Monday)**

13:30 – 14:00 **Opening Session**

**Welcome Remarks I**
**Ambassador Berry Desker**
Dean, S. Rajaratnam School of International Studies (RSIS),
Nanyang Technological University (NTU),
Singapore

**Welcome Remarks II**
**Dr Jochen Prantl**
Visiting Senior Fellow and Coordinator of the Energy Security Programme
Centre for Non-Traditional Security (NTS) Studies,
S. Rajaratnam School of International Studies (RSIS),
Nanyang Technological University (NTU), Singapore;
Senior Research Fellow,
Department of Politics and International Relations,
University of Oxford,
UK

14:00 – 15:15 **Session 1: What Is Geoengineering? Do We Need It?**

*Chair:*

**Dr Ralf Emmers**
Associate Professor & Acting Head,
Centre for Non-Traditional Security (NTS) Studies,
S. Rajaratnam School of International Studies (RSIS),
Nanyang Technological University (NTU),
Singapore

*Presenter:*

**Mr Tim Kruger**
James Martin Fellow,
Oxford Geoengineering Programme,
University of Oxford,
UK

**Discussion**

15:15 – 15:45 **Photo-taking and coffee break**

15:45 – 16:15 **Session 2: The Challenges of Geoengineering Governance**

*Presenter:*

**Professor Steve Rayner**
James Martin Professor of Science and Civilization,
University of Oxford,
UK

16:15 – 16:45 **Session 3: The Importance of Global Public Engagement**

*Presenter:*

**Ms Jayne Windeatt**
PhD candidate,
Faculty of Engineering Doctoral Training Centre in Low Carbon Technologies,
University of Leeds,
UK

**Discussion**

16:45 – 17:00 **Session 4: The Solar Radiation Management Governance Initiative (SRMGI) – A Very Brief Introduction**

*Presenter:*

**Mr Alex Hanafi**
Attorney,
Environmental Defense Fund (EDF),
US

17:00 – 18:00 **Session 5: Showcasing Proposed Geoengineering Techniques**

*Moderator:*

**Mr Tim Kruger**
James Martin Fellow,
Oxford Geoengineering Programme,
University of Oxford,
UK

- Delegates view posters on the proposed techniques
- Series of six 5-minute videos from experts in each of the techniques
- Question and answer session

**Day 2**
**19 July 2011 (Tuesday)**

9:30 – 10:00 **Introduction**
**Dr Jochen Prantl**
Visiting Senior Fellow and Coordinator of the Energy Security Programme
Centre for Non-Traditional Security (NTS) Studies,
S. Rajaratnam School of International Studies (RSIS),
Nanyang Technological University (NTU), Singapore;
Senior Research Fellow,
Department of Politics and International Relations,
University of Oxford,
UK

10:00 – 11:30 **Session 6: Country Perspectives on Geoengineering Governance**

*Presenters:*

**Dr Arunabha Ghosh**
Chief Executive Officer,
Council on Energy, Environment and Water,
New Delhi,
India

**Dr Masahiro Sugiyama**
Professor,
Central Research Institute of Electric Power Industry,
Japan

**Professor Akimasa Sumi**
Executive Director,
Integrated Research System for Sustainability Science,
University of Tokyo,
Japan

11:30 – 12:00 **Coffee break**

12:00 – 13:00 **Session 7: Civil Society Perspectives on Geoengineering Governance**

*Presenter:*

**Ms Neth Dano**
Programme Manager,
Action Group on Erosion, Technology and Concentration,
The Philippines

13:00 – 14:00 **Lunch**

14:00 – 15:00 **Session 8: Workshop on the Solar Radiation Management Governance Initiative (SRMGI)**

Moderator:

**Mr Alex Hanafi**
Attorney,
Environmental Defense Fund (EDF),
US

15:00 – 16:00 **Plenary discussion**

16:00 – 16:30 **Coffee break**

16:30 – 17:30 **Session 9: Video Conferencing with Panel Members from the Royal Society**

Participants:

**Professor John Shepherd**
Professorial Fellow in Earth System Science,
University of Southampton;
Chair,
Royal Society Working Group on Geoengineering,
UK

**Professor Georgina Mace**
Imperial College, London;
Member,
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**Dr Chris Vivian**
Chairman,
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UK

**Mr Andy Parker**
Senior Policy Officer,
Royal Society,
UK

**Mr Mike Childs**
Head of Climate Policy,
Friends of the Earth,
England, Wales and Northern Ireland

17:30 – 18:30 **Discussion and next steps**

**- End of Workshop -**

# List of Participants

**in alphabetical order according to last names*

**Speakers**

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4. Professor John Shepherd
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## About the Oxford Geoengineering Programme (OGP)

The Oxford Geoengineering Programme (OGP) is a recent initiative of the Oxford Martin School, addressing questions related to geoengineering – the deliberate, large-scale intervention in the Earth's natural systems in order to limit climate change – which has become an increasing focal point for public debate. This emerging field raises a wide range of questions across many disciplines, including engineering, physical and biological sciences, ethics, politics, economics, law and governance. The OGP aims to conduct research to assess which, if any, of the proposed techniques could be employed without creating countervailing social or environmental side effects.

More information about OGP can be found here:
http://www.oxfordmartin.ox.ac.uk/institutes geoengineering/

## About the Solar Radiation Management Research Governance Initiative (SRMGI)

The Solar Radiation Management Research Governance Initiative (SRMGI) was launched in March 2010 in response to the 2009 Royal Society report, *Geoengineering the Climate*. The convening partners of the SRMGI are the Royal Society of the United Kingdom, the Academy of Sciences for the Developing World (TWAS) and the Environmental Defense Fund (EDF). The SRMGI aims to ensure that geoengineering research is conducted in a manner that is responsible, transparent and environmentally sound.

The initiative focuses on solar radiation management (SRM), a geoengineering technique that would counteract global warming by reflecting a small percentage of the Sun's light and heat back into space. SRM may offer valuable opportunities to reduce global warming, but it could also have harmful side effects on ecosystems and human society.

The SRMGI will involve a wide variety of stakeholders to ensure its recommendations are well-informed and widely accepted. Participants will be invited from the natural and social sciences, non-governmental organisations, private enterprises and the governments of developed and developing countries.

More information about the SRMGI can be found here:
http://www.srmgi.org/

# About the RSIS Centre for Non-Traditional Security (NTS) Studies

The RSIS Centre for Non-Traditional Security (NTS) Studies conducts research and produces policy-relevant analyses aimed at furthering awareness and building capacity to address NTS issues and challenges in the Asia-Pacific region and beyond.

To fulfil this mission, the Centre aims to:

- Advance the understanding of NTS issues and challenges in the Asia-Pacific by highlighting gaps in knowledge and policy, and identifying best practices among state and non-state actors in responding to these challenges.
- Provide a platform for scholars and policymakers within and outside Asia to discuss and analyse NTS issues in the region.
- Network with institutions and organisations worldwide to exchange information, insights and experiences in the area of NTS.
- Engage policymakers on the importance of NTS in guiding political responses to NTS emergencies and develop strategies to mitigate the risks to state and human security.
- Contribute to building the institutional capacity of governments, and regional and international organisations to respond to NTS challenges.

## Our Research

The key programmes at the **RSIS Centre for NTS Studies** include:

1) Internal and Cross-Border Conflict Programme
   - Dynamics of Internal Conflicts
   - Multi-level and Multilateral Approaches to Internal Conflict
   - Responsibility to Protect (RtoP) in Asia
   - Peacebuilding

2) Climate Change, Environmental Security and Natural Disasters Programme
   - Mitigation and Adaptation Policy Studies
   - The Politics and Diplomacy of Climate Change

3) Energy and Human Security Programme
   - Security and Safety of Energy Infrastructure
   - Stability of Energy Markets
   - Energy Sustainability
   - Nuclear Energy and Security

4) Food Security Programme
   - Regional Cooperation
   - Food Security Indicators
   - Food Production and Human Security

5) Health and Human Security Programme
   - Health and Human Security
   - Global Health Governance
   - Pandemic Preparedness and Global Response Networks

*Research in the RSIS Centre for NTS Studies received a boost when the Centre was selected as one of three core institutions to lead the MacArthur Asia Security Initiative in 2009.*

## Our Output

***Policy Relevant Publications***

The **RSIS Centre for NTS Studies** produces a range of output such as research reports, books, monographs, policy briefs and conference proceedings.

***Training***

Based in RSIS, which has an excellent record of post-graduate teaching, an international faculty, and an extensive network of policy institutes worldwide, the Centre is well-placed to develop robust research capabilities, conduct training courses and facilitate advanced education on NTS. These are aimed at, but not limited to, academics, analysts, policymakers and non-governmental organisations (NGOs).

***Networking and Outreach***

The Centre serves as a networking hub for researchers, policy analysts, policymakers, NGOs and media from across Asia and farther afield interested in NTS issues and challenges.

The **RSIS Centre for NTS Studies** is also the Secretariat of the Consortium of Non-Traditional Security Studies in Asia (NTS-Asia), which brings together 20 research institutes and think tanks from across Asia, and strives to develop the process of networking, consolidate existing research on NTS-related issues, and mainstream NTS studies in Asia.

More information on our Centre is available at www.rsis.edu.sg/nts

*The Asia Security Initiative was launched by the John D. and Catherine T. MacArthur Foundation in January 2009, through which approximately US$68 million in grants will be made to policy research institutions over seven years to help raise the effectiveness of international cooperation in preventing conflict and promoting peace and security in Asia.*

Centre For Non-Traditional Security Studies

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