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Climate Change and the Oceans and International Governance:
Seeking meaningful responses to climate change

Marine geoengineering as a response to climate change: meaningful or misconceived?

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Many thanks to the organisers for the opportunity to address this session on responses to climate change, and apologies from the authors that they are not able to attend and join the panel discussion. They would, of course, be happy to address any outstanding questions subsequently by correspondence.

Greenpeace has worked for many years to raise awareness of climate change and, increasingly, to propose meaningful and sustainable responses to the problem. Those solutions aim at addressing the causes of climate change, not just the symptoms, using established technologies to bring about urgent and deep cuts in greenhouse gas emissions through rapid expansion of renewable energy infrastructure and energy efficiency measures.

As acceptance of the seriousness of climate change, and allied problems such as ocean acidification, have grown, so too has the perception among some that it is already too late to rely on emissions reductions alone. There is increasing talk of the need for a plan B, or even an 'emergency stop' button for the climate. While the desire for technical fixes may be understandable, the practical prospects underlying such ideas are frequently terrifying and all too often based on the scaling up of theoretical concepts which would interfere with planetary systems on a massive scale. As the UK's Royal Society concluded in its recent report on geoengineering, the very nature of such proposals should act as a stark warning of just what might be tried if we continue to fail to bring emissions under control.

Nonetheless, given the apparent enthusiasm from some quarters to embrace or, at least, explore geoengineering options, and the danger that the mere existence of the concept might encourage some governments to reduce their ambitions still further, this is clearly an issue that needs to be tackled head on.

So what is geoengineering?

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There are a variety of definitions but most refer in some way to the:-

"intentional, large-scale manipulation of the environment by humans to bring about environmental change, particularly to counteract the undesired side effects of other human activities"

For this reason, such proposed techniques are also sometimes referred to as Climate Engineering or as Climate Intervention Technologies. Such titles can give the impression that these concepts are proven,

effective and precise engineering tools, a perception which is very far removed from the vast uncertainties and unknowns which characterise them in practice.

Geoengineering proposals fall into two categories, those aiming to reduce carbon dioxide concentrations in the atmosphere and those aiming to reduce the amount of incoming solar radiation absorbed by the earth by increasing its albedo or reflectiveness. Neither addresses the root cause of the problem and neither is guaranteed to bring any net benefit.

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Proposals include large scale manipulation of natural systems on land, at sea and in the atmosphere…and, in fact, beyond the atmosphere…though all have the intention of bringing about major changes in biogeochemical processes at a regional and ultimately global level. It is not, therefore, merely the geographical scale of these proposals which would be unprecedented, but also the intent to cause, rather than minimise or avoid, human-induced changes in those systems.

Geoengineering as a concept is far from new. Some of these ideas have been mooted for well over two decades, though only recently have they gained more widespread attention within scientific and regulatory communities and the press. This interest has been driven in part by desperation at the slow progress in achieving emissions cuts, but also by a fascination in the idea of engineering our way out of a crisis…and, even more worryingly, by the prospect of a quick profit in the process. What is in grave danger of being lost in the rush to apply engineering theory to complex natural systems, even if only in the name of scientific research, is a sense of perspective of the gravity and magnitude of what is being proposed.

This presentation focuses on proposed manipulations of ocean systems, or marine geoengineering, as these may have the most immediate potential for direct impacts on the marine environment. This is not to imply that neither atmospheric nor land-based geoengineering techniques would impact on the oceans, but simply to set some context for consideration of possible governance mechanisms.

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Even the term marine geoeongineering encapsulates a diverse array of technical concepts.

- Ocean fertilization, or attempts to enhance CO_2 absorption through addition of iron, nitrogen or phosphorus to stimulate primary productivity and the biological pump, is probably the best known and most widely researched to date.

- Trials involving the deep sea disposal of crop residues, in the hope that they will be buried in highly sedimentary zones, are also underway.

- Proposals for direct injection of CO_2 at the seafloor or in downwelling systems have now largely been dismissed, not least because of the potential for immediate adverse impacts on marine life.

- In contrast, the idea of managing the alkalinity of seawater to increase its capacity to take up CO_2 remains alive as a theoretical construct at least, though the ecological consequences and material and energy balance of adding lime to seawater or artificially enhancing weathering on land remain very much open to question.

- Other schemes require an even greater leap in concept, such as suggestions to install long pipes suspended beneath floating structures every few kilometres over vast swathes of the oceans in order to enhance the upwelling of nutrient-rich deep water and stimulate productivity.

And while the majority of marine geoengineering schemes floated to date aim at managing the carbon cycle, solar radiation management also makes an appearance. In addition to the idea of fleets of specialised vessels spraying salt into the lower atmosphere to promote reflective cloud formation, the recent "Bright Water" concept aims to increase the reflectiveness of the sea surface itself through widespread injection of microbubbles.

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Despite being a rather loose collection of themes, all these proposals do have some things in common, namely that there is no guarantee that they will yield any measurable and verifiable benefit for the climate, while at the same time raising the very real prospect of unintended, uncontrollable and possibly irreversible side effects.

- Large-scale iron fertilization, for example, may be expected on the basis of evidence from numerous field studies to bring about only marginal and transient increases in carbon flux to deep water, while at the same time causing significant shifts in planktonic community composition, accelerating decay processes and oxygen consumption at depth and even promoting the growth of harmful algal blooms.

- Dumping organic wastes at sea could also enhance deoxygenation at depth, which could in turn stimulate the formation of climate active gases such as nitrous oxide.

- And attempts to manage seawater chemistry by increasing alkalinity would, if conducted at the scales required to make a difference, have massive implications for resource and energy use on land.

Despite the huge uncertainties and potential for adverse impacts, there is, it seems, a growing compulsion on the part of some to begin researching these concepts more systematically and at ever bigger scales. This raises a number of fundamental questions.

- Firstly, given that in order to produce distinguishable and attributable effects it will be necessary to make substantial perturbations to natural systems, how can we draw a line between experimentation and deployment of geoengineering schemes?

- Secondly, given that most proposals envisage use of the high seas and cannot preclude transboundary impacts, how can we attribute responsibilities for unforeseen collateral damage?

- And thirdly, against this background, how can field research into marine geoengineering concepts be brought under effective regulatory control?

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One possible answer to this last question is the approach taken under the London Convention and London Protocol towards the regulation of ocean fertilization. Scientific advisors to these joint instruments (initially developed to protect the marine environment from deliberate waste disposal) responded in 2007 to the intentions of a number of commercial enterprises to conduct large-scale fertilization trials in the open ocean, by issuing a statement of scientific concern on the basis that too little was known about the consequences to

sanction such projects. In November 2007, Parties to the Convention and Protocol announced their intention to regulate, and in October 2008 agreed unanimously that:-

"…given the present state of knowledge, ocean fertilization activities other than legitimate scientific research should not be allowed"

Work is now underway on an assessment framework to enable national authorities to distinguish in a clear and consistent manner between proposals which are likely to make a legitimate and important contribution to scientific knowledge with the minimum of impacts and those which are more damaging, speculative or dubious in nature. While far from perfect, this initiative is a good example of what could be done in order to bring marine geoengineering research more broadly under some semblance of oversight and control.

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As a contribution to the development of effective governance mechanisms, Greenpeace has proposed a set of 7 principles or criteria by which to identify "legitimate scientific research":-

- Justification – the proposal must be capable of yielding significant scientific knowledge and understanding which could not be obtained in any other way
- Consultation & consent – consultation with neighbouring states and other entities with reasonable concerns should be required and completed in advance
- Assessment – clear and consistent processes should be applied in order to evaluate the likely impact of the research and identify options to minimise or avoid impacts
- Precautionary regulation – including the setting of limits and conditions which confer a high level of protection for the marine environment & ensure effective monitoring
- Transparency – full disclosure of hypotheses, methodologies and results as well as of participants, affiliations and sources of funding
- Liability & redress – including effective mechanisms for the assignment of liabilities in the event of adverse impacts, and the discharge of responsibilities for remediation
- Non-commerciality – exclusion from further consideration of any projects driven by commercial interest or which aim to generate carbon credits or offsets

Greenpeace does not view marine geoengineering as a sensible or sustainable response to climate change mitigation, and is concerned that the pursuit of such concepts, even in research terms, will draw attention, ambition and funding from where it is really needed to achieve far deeper emissions cuts than are currently planned. Nonetheless, we recognise that research into geoengineering will inevitably be proposed. Far better, in this case, that global, transparent and effective regulatory and control mechanisms are put in place than to entrust judgments on the legitimacy of geoengineering ventures to individual researchers, institutes or corporations.

Thank you.