If Geoengineering Is The First Best Step Towards Global Climate Change Control, How Could It Best Be Implemented?

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Disclaimer

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If Geoengineering Is the Best First Step Towards Global Climate Change Control, How Could It Best Be Implemented?

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Abstract

If, as argued elsewhere, geoengineering represents the most efficient and effective first step towards a solution of the global climate change problem, it is important to analyze how such a geoengineering effort might best be organized. A number of possible organizations are discussed and criteria are proposed for judging between them. The paper concludes that since different phases of the program can be carried on by different organizations, involving one or a possibly only a few countries would appear to offer advantages for the early and less politically sensitive research and plan development while international organizations would appear to offer important advantages for the later implementation and maintenance phases. An important question is whether the international organization should be very broadly representative of all nations, such as the United Nations, or have a narrower membership, say of developed countries willing to contribute resources towards actually implementing a plan once it has been agreed to.

Keywords: Global warming control, global climate change control, implementation, organizational analysis

Subject areas: Climate change, environmental policy, institutional issues: general

Introduction

There has been increasing interest[1] in 2006 in the possibility of using geoengineering to solve, or at least to help solve, global climate change problems. Geoengineering has been defined by Keith[2] as "intentional large-scale manipulation of the environment." The particular proposals that have received the most interest involve adding small particles to the stratosphere to scatter a little of the incoming sunlight so that it does not reach the Earth. The result would be a reduction in global temperatures that would offset the higher temperatures which many scientists believe result from increasing levels of greenhouse gases (such as carbon dioxide) in the atmosphere. This approach is very different from the currently popular proposals to attempt to reduce man-made emissions of these gases in that average global temperatures would be directly determined by explicit human decisions rather than indirectly affected by human decisions to increase or decrease greenhouse gas emissions.

I have previously argued[3] that such intentional reductions in solar radiation reaching the Earth, which I have referred to as engineered climate selection, represent the most effective and efficient first step towards solution of most of the problems associated with climate change. The practical question arises, however, as to how engineered climate selection (or other geoengineering approaches) might actually be implemented in organizational terms. Even the best program may turn out badly if it is badly implemented. It is particularly important that such a program be well and carefully implemented because of the risk of unintended consequences.[4] This paper will explore some of the possibilities.

Proposed Implementation Goals

Presumably the goals of any such implementation might usefully include the following:

(1) Global political legitimization of the activity. People and governments are likely to want some assurance that their interests are being heard and taken into account by any organization that would be charged with carrying out geoengineering projects.

(2) Rapidly reaching physical climate change control goals. Since one of the reasons for selecting engineered climate selection and some other geoengineering approaches is the rapidity with which they could be implemented from a technical viewpoint, this should also be an important criterion in selecting an organization to do the implementation.

(3) Capability for intermediate course corrections in case of important new information. Although it is well established that at least some technical approaches to engineered climate selection would be effective in controlling global temperatures, there are a

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[1] William J. Broad, *How to Cool a Planet (Maybe)*," N.Y. TIMES, June 27, 2006; P.J. Crutzen, *Albedo Enhancement by Stratospheric Sulfur Injections: A Contribution to Resolve a Policy Dilemma?,* CLIMATIC CHANGE, Aug. 2006; T.M.L.Wigley, *A Combined Mitigation/Geoengineering Approach to Climate Stabilization*, SCI., October 20, 2006; *Scientists: Pollution Could Combat Global Warming,* Associated Press, November 16, 2006, available at http://www.cnn.com/2006/TECH/science/11/16/smog.warming.ap/index.html

[2] David Keith, *Geoengineerig the Climate: History and Prospect*, 25 ANNUAL REVIEW ENERGY ENVIRON 245 (2000), available at http://www.ucalgary.ca/~keith/papers/26.Keith.2000.GeoengineeringHistoryandProspect.e.pdf

[3] Alan Carlin, *Global Climate Change Control: Is There a Better Strategy than Reducing Greenhouse Gas Emissions?* 155 PENN LAW REV, No. 6 (June, 2007), forthcoming.

[4] *Op. cit.,* Section 6

number of unanswered questions that need research and development.[5] Such research may result in the need for mid-course corrections in any implementation program, and therefore the need to provide for an organizational capability to bring this about.

(4) Careful implementation and testing. Given the risk of unintended consequences, careful testing, subscale experiments, and quality control of all aspects of the program would be essential.

(5) Minimizing or at least efficiently handling any resulting legal liability for alleged adverse consequences. It appears likely that any attempt to implement engineered climate selection will result in lawsuits claiming damages for adverse weather conditions allegedly resulting from the project.[6] Unless these are prohibited in some way or greatly minimized, this could greatly impede the program.

(6) Minimizing implementation costs. Since one of the reasons for selecting engineered climate selection is its very low cost in terms of resources, this should also be an important criterion in selecting an organization to implement it.

(7) Organization has positive view towards program and capability to manage high technology projects. Those strongly opposed to engineered climate selection are unlikely to be willing to give it a serious try.

Implementation Phases

There would appear to be a number of phases that any engineered climate selection or other geoengineering program might ideally follow:

(a) The first phase might be research to better understand any critical uncertainties of such a program and try to find ways to reduce any that may be found.

(b) The second might be to carefully test the proposed engineered climate selection or other geoengineering techniques--first with modeling, followed by subscale real world experiments, and finally to develop a detailed plan for final implementation.

(c) The third might be to gain acceptance of the plan by some legitimizing organization(s), possibly with modifications that they may want.

(d) The fourth might be to implement the plan and possibly revise it on the basis of new information gained after plan approval.

(e) The last might be to maintain the resulting system after initial implementation.

Not all these phases need be carried out done by the same organization.

Some Alternative Implementation Organizations

The quickest and probably simplest approach (A) would be for one nation with the needed technical and financial resources to carry out all phases of the project, perhaps with the assistance of contracts to the best qualified aerospace or possibly other companies to carry out each phase. To my knowledge there is currently nothing to prevent such a nation from doing exactly this. The cost would be quite small compared to major military weapon systems and the administrative procedures for such systems development are fairly well established in most countries with large military development programs. And the initial implementation could

[5] Lowell Wood, *Earth Albedo Engineering*, presentation to Energy and Engineering Study Group, Lawrence Livermore National Laboratory, Livermore, CA, April 7, 2005.

[6] See *supra* note 3, Section 6.

probably be accomplished in a few years time if there were no delays caused by non-technical issues.

One obvious possibility at the opposite extreme would be (C) the United Nations. They are already deeply involved in climate change issues and have an established organization to deal with them. An intermediate possibility (B) might be an organization of the countries listed in Annex I of the Kyoto Protocol that are interested and willing to make a financial contribution to the effort. One existing such organization might be the OECD. Another possibility might be NATO; although it does not include several of the Annex I nations, it does have experience with large aerospace procurements.

Since the less developed countries have been adamant in their view that the climate change problem has been caused by the developed countries and that it is the latter's responsibility to solve it, the choice of an organization representing developed countries would seem appropriate. Presumably only those countries willing to make a financial contribution would be involved so as to minimize the number of players and improve the speed with which decisions can be arrived at. It would also seem reasonable for the organization to retain control over all policy issues but to contract out the actual implementation, presumably on the basis of competitive bidding.

Comparison of Organizations using Criteria

So how do these organizational alternative fare in general in terms of the criteria listed at the beginning of this paper?

(1) Global Political Legitimization

Of the three options listed above, the greatest political legitimization would presumably result from using (C) the United Nations. Restricting the countries involved, as in (B) and particularly (A), presumably makes any actions taken less legitimate. In brief, the more countries involved, the better.

(2) Rapidly reaching physical climate change control goals

This criterion yields the opposite conclusions from those found for (1): The fewer the countries involved, the better since fewer voices are likely to result in greater speed in implementing a solution. Thus (A) would be the best, followed by (B) and then (C) under this criterion.

(3) Capability for intermediate course corrections in case of important new information

This criterion relates to the structure of the endeavor—in this case whether there are provisions for such mid-course corrections. Presumably this capability could be equally well included in all three—although there may be differences between them in how long they might take to actually implement the plan.

(4) Careful implementation and testing

This once again relates to the structure of the endeavor and could presumably be included in all three organizational approaches.

(5) Minimizing or Handling Any Resulting Legal Liability for Alleged Adverse Consequences

As discussed elsewhere,[7] this is likely to be a significant problem with regard to any of the three approaches. Presumably there are ways to set up a geoengineering climate change control program that either minimizes such liability or at least provides for an orderly way to settle such

[7] *Op. cit.*

disputes. This is obviously an important area for future legal research on this topic. To what extent would the exemption provisions of the Federal Tort Claims Act apply if the geoengineering were carried out solely by the United States Government? What if the alleged damages occurred elsewhere or other governments or organizations were involved? A simple-minded answer would seem to be that the fewer countries involved, the fewer the complications, but this may be overly simplistic. So the application of this criterion will be summarized as unknown but possibly favoring fewer countries being involved.

(6) Minimizing costs

Presumably the more countries there are involved, the higher the cost of deciding what to do. And the greater likelihood that some country or countries will have to be "bought off" by added expenditures desired by that country. So using this criterion, the best approach would appear to be (A), (B), and (C), in that order. However, since the costs should be modest, this may not be a major consideration.

(7) Organization has positive view towards program and capability to manage high technology projects

The United Nations has been so closely identified with an emissions reduction approach to global climate change control that one can question whether they would be likely to give geoengineering a fair trial. It also may not have much experience running high technology aerospace projects. So count this criterion as favoring (A) or (B).

Conclusions with Regard to Implications for Choice of Organization in General

Legitimization (1) appears to favor (C), the United Nations, while criteria (2) and (6) favor (A), a single country approach. Criterion (5) has an unknown impact and needs further research, but may possibly favor (A). Criterion (7) argues against (C). The other criteria appear to be neutral between the various approaches.

Discussion

Option A, a single country approach, has many things going for it, but I would argue that it is precisely the wrong thing to do, at least for phases (c), (d), and (e). The result would be likely to be international anger at the country involved, many lawsuits by groups claiming damages, and lack of public support worldwide and maybe even in the country involved. A political consensus would appear to be fundamental to a successful effort. If so, that leaves (B) and (C). Option (C) looks somewhat unwieldy and cumbersome, but offers some advantages in terms of increased political legitimization. The experience to date, primarily the experience in drafting the Kyoto Protocol, is not particularly encouraging since in order to gain LDC support, the developed nations felt that they had to agree to shoulder the entire bill, which in turn contributed to lack of support for the Protocol in the United States and Australia.

One possibility would be for one country to carry out (a) the research, since no implementation decisions would be made during this phase. In the case of the United States, one possibility might be the use of an organization modeled on the US Defense Department's Advance Research Projects Agency (or ARPA-E for short) such as Lane has proposed.[8] A draft version of (b) the implementation plan might also be done by a single country, but interaction with other countries

[8] Lee Lane, *Strategic Options for Bush Administration Climate Policy*, AEI Press, Washington, DC, 2006, at 90-95.

and political legitimization would be more important as the plan development progressed in order for it (c) to be accepted by other countries. Phase (c) would clearly be better done by an international organization. Finally, the (d) actual implementation and (e) maintenance would also be better handled by a politically very legitimate international organization.

Conclusions

It would appear that there would be some advantages for (a) research and (b) initial testing and implementation plan development to be done by a single country (as under approach A), or at least a small group of countries (as under approach B), while (c) plan acceptance, (d) initial implementation, and (e) maintenance is carried out by an international organization such as under approaches (B) or (C). In that way it might be possible to capture the advantages of using approaches (A) or (B) under criteria (2) and (6) for the initial phases while emphasizing legitimization (1) in the later phases by using (B) or (C).