Prudent Regulation of Geoengineering

Summary paper prepared for the National Commission on Energy Policy,
Task force on Geoengineering
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Draft, March 4, 2010

If the term geoengineering is restricted to deliberate manipulation of the entire global climate, the most evident possibility derives from a remarkable feature of nature. For whatever deep or arbitrary reason, sulfate molecules injected into the stratosphere can offset the radiative forcing effect of the principal greenhouse gas, carbon dioxide, with spectacular efficiency. A single kilogram of sulfate particles of appropriate size could negate the thermal impulse imparted by at least two hundred thousand and perhaps three hundred thousand kilograms of carbon dioxide. The four order of magnitude difference means that the principal measure of global warming – average surface temperature – could be reduced by half a degree centigrade within a single year at modest cost. Volcano eruptions have demonstrated that effect. Many countries and even private organizations could almost certainly emulate what they do. There may also be alternative methods of accomplishing the same result, but those currently discussed are much more speculative. The sulfate option is the dominant immediate issue.

There is, of course, a major catch with that option. The thermal impulse of carbon dioxide may be offset by stratospheric sulfates, but it would not be removed and is far more enduring. Sulfates precipitate out of the atmosphere in the course of a year or two. Carbon dioxide molecules and their radiative effect persist for more than a century. Stratospheric sulfates would not remove the danger of ocean acidification posed by carbon dioxide, and their supposedly beneficial effect on annual average surface temperature would be accompanied by localized changes to precipitation and other weather patterns that are currently unpredictable and are likely to remain so. Hence any advantage resulting from a reduction of average temperature could be negated by the aggregate consequences of ocean chemistry and local weather changes that cannot be precisely anticipated and may or may not be accurately recorded after the fact.

Until recently the inherent uncertainties entailed in global climate manipulation were considered to be grounds for categorical proscription. “If it were done when it were done,” said the infamous Lady Macbeth about the prospective murder of Duncan, “then it were well it were done quickly.” Messing with the global climate was assumed to be the equivalent of

murdering the king, and the presumption was that ultimate grief would overwhelm fleeting glory, as in the iconic play. As evidence accumulates on the effects of average temperature increases, however, particularly regarding rapid changes in the dynamics of glacial ice, there have been prominent second thoughts. The possibility of some catastrophic effect occurring on a schedule more rapid that any feasible process of mitigation has inspired fears of a climate emergency that would justify immediate intervention. Mainstream scientists have concluded that geoengineering techniques should at least be investigated, and that in turn has posed the problem of prudent regulation.

The situation is essentially unprecedented. The average surface temperature on earth is already at a level that has not occurred for several thousand years, and the increase projected to result over the current century would take it to a level not experienced for tens of millions of years. The rate of increase projected for this century would be substantially more rapid than any period on the geological record. The current state of knowledge is not sufficient to determine the consequences to scientific standards of confidence, but there are some cataclysmic possibilities. Most alarming, perhaps, would be a surging release of frozen gas hydrates from arctic tundra or ocean deposits. The radiative effect of methane is a factor of 21 greater than that of carbon dioxide, and a surging release could generate a positive feedback cycle with truly monumental consequences. That is currently judged to be too unlikely to be a practical concern, but the state of understanding on which that judgment is based cannot provide categorical reassurance.

Implications

At the moment the global warming problem is a prominent concern but a subordinate priority. At the recent international conference on the topic in Copenhagen, the assembled national governments were willing to promise measures that would limit carbon emissions to some extent but they were not prepared to make any binding commitments. And even if the promised measures were to be implemented without exception, they would not hold anthropogenic greenhouse gas concentrations to a prudent standard of protection. Such a standard is itself a matter of disputable judgment, but most of those who have most seriously pondered the question believe it lies below the 500 ppm greenhouse gas concentrations virtually certain to occur by 2050 as a result of established momentum. The fear of violating that standard is not yet sufficiently strong or widespread to motivate the very extensive transformation of energy use patterns required to achieve it.

Fear itself is a major feature of the situation, as it is with all aspects of human organization. Although fear of climate catastrophe is not yet the driving force it would have to be to enable decisive mitigation to occur, there is potential for sudden crystallization of such fear

independent of objective circumstance. Among scientists who are currently at the frontline of the problem, the burden of proof is imposed on anyone positing a cataclysmic danger. For society in general fear has broader scope. If some conception of disaster were to seize public imagination in any major country and trigger standard security attitudes, demands for protective action could readily outrun available science and existing institutional arrangements. Were that to occur, the evident geoengineering option could suddenly become a powerful, even irresistible political impulse.

Available Principles

Not surprisingly there is no directly applicable international law dealing with manipulation of the global climate as a whole. The circumstances that pose the problem are too new to have yet generated an adequately organized response, and as always the mere idea of international legal regulation inspires both ideological opposition and practical skepticism. It is not difficult to anticipate the basic principles that will ultimately be applied, however. They have been developed for roughly comparable problems and will almost certainly be evoked once the need to do so becomes irrefutable.

First, the atmosphere will assuredly be considered a common global asset that cannot be appropriated for exclusive personal or sovereign use. That is the principle applied to the open oceans in the Law of the Sea Convention and to the universe beyond the earth's atmosphere in the Outer Space Treaty. Any action that affects the global composition of the atmosphere will be considered a matter of vital common interest subject to protective rules. Sulfate particles injected into the atmosphere at any location would quickly be globally dispersed as would the array of consequences. Strong global interest means that global consent will be required for any meaningful geoengineering action that is taken no matter how bothersome that might be considered to be.

Second, as with any matter of large consequence, those proposing to undertake a geoengineering initiative will be subjected to independent oversight. No one is allowed to dispose of large sums of money without some form of audit. No individual is ever allowed exclusive control over a nuclear weapon. Independent oversight is a fundamental principle of protection that will assuredly be applied to any geoengineering option that appears to have significant consequence.

And, third, the balance of consequence will be the central criterion of assessment. An oversight process designed to protect vital common interests would impose a heavy burden of proof on any geoengineering initiative, demanding credible assurance that the benefits to be achieved would decisively outweigh destructive side-effects and that the victims of those side-effects

would be fairly compensated. All that would have to be demonstrated to reasonably representative satisfaction.

Practical Thoughts

As a practical matter, the most compelling immediate problem posed by the potential for geoengineering is that of establishing legitimizing rules and appropriate procedures for applying them. Scientific investigation of the sulfate option and of alternative possibilities is desirable but neither a prerequisite nor a substitute for prudent regulation. The research initiatives currently being considered are nonetheless the obvious place to start. Standard procedures for peer review provide an established oversight process that could be extended to assess social impact as well as scientific merit. National academies of science could use existing coordinating procedures to promulgate common oversight standards. They could, for example, set guidelines for evaluating and monitoring geoengineering field trials. Norms of that sort fall short of mandatory regulation, but they provide the foundation for imposing legal obligation and are easier to establish.

Were a significant geoengineering project ever to be actually attempted, however, informal rules would almost certainly not be considered sufficient. There would have to be an authoritative approval process widely accepted as legitimate, and that implies some institutionalized machinery – if not literally the UN Security Council, then some equivalent. It would undoubtedly be difficult to negotiate such an arrangement but at least as difficult to proceed without it. A geoengineering project not accepted as legitimate would be exceedingly vulnerable to preventive attack. It is prudent to assume that if a geoengineering project cannot be legitimized it cannot be done.

Given prevailing uncertainties, the specific circumstances that might command global consent are disputably speculative as are those that might incite unilateral action in defiance of global interest. The scenarios that can be imagined are unlikely to be broadly convincing. The ultimate necessity of global regulation is sufficiently predictable to justify immediate effort to work out appropriate arrangements, but it is admittedly difficult to believe it will actually be done any time soon. It is all too obvious that no single government has yet risen to the occasion, let alone a representative coalition.

No one should harbor any illusion, however, that the evident geoengineering option offers viable unilateral protection against a catastrophic failure of fundamental mitigation. If sulfate seeding of the stratosphere were undertaken as a substitute for enduring limitation on greenhouse gas concentrations, it would be the equivalent of heroin addiction, and that fact would be sufficiently well recognized to make the practice extremely, probably violently

contentious. Temporizing may be inevitable for the moment, political realities being what they are, but it is also dangerous.

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