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Resetting Earth's Thermostat

By Samuel Thernstrom

In this article, Samuel Thernstrom, codirector of AEI's geoengineering project, notes that policymakers generally discuss two different ways to address global warming: cutting emissions and adaptation—that is, learning to live with a warmer planet. But there is another way to cool the planet, he says, "that could be fast, effective, and affordable." This strategy is geoengineering, and in this article, Thernstrom explains how it would work and why it is being ignored. In the race to respond to climate change, he says, it is time to invest in this alternative solution.

Two facts about climate change have become increasingly clear: new efforts to constrain global greenhouse gas emissions are likely within the next few years—and their effect on the climate will be modest at best. Rapidly rising emissions in the developing world will swamp whatever reductions the United States, Europe, and Japan may make. Atmospheric concentrations of greenhouse gases will continue to rise for decades to come, and warming will continue well into the next century.

What will happen? We may hope that the effects will be modest, but there is real risk that they will be very serious, at least for the most vulnerable nations. Some scientists warn of the possibility of abrupt climate change, with unpredictable but conceivably catastrophic consequences. Most troubling, by the time there are unmistakable signs of disaster, even a crash course of emissions reductions would be too late.

Policymakers have considered only two responses to climate change: cutting emissions and adaptation—that is, learning to live with a warmer planet. There is, however, a third possible strategy, one that could be fast, effective, and affordable—but that is being ignored. This idea is commonly known as geoengineering, although a more accurate term would be "climate engineering."

The earth is warmed by two forces: solar radiation, which enters the atmosphere, and the greenhouse gases that trap it there. There are two ways to cool the planet: reduce greenhouse gases or reduce the amount of solar radiation that reaches the earth's surface. Or both. If we cannot do enough of the first, we must consider whether the second option—geoengineering—is feasible.

In fact, geoengineering could be surprisingly simple. Scientists noted that the 1991 eruption of Mount Pinatubo in the Philippines cooled the planet for two to three years by roughly half a degree Celsius. There are various ways of artificially reproducing this effect using relatively simple technologies. A small amount of ultrafine sulfur particles injected into the upper atmosphere could deflect 1 or 2 percent of incoming sunlight—almost unnoticeable, but enough to cancel out the warming expected to occur this century. Or a fleet of ships spraying seawater into the air might achieve the same general effect by increasing the reflectivity of low-altitude marine clouds. Even painting the roofs of buildings white would be a low-tech way of reflecting a little sunlight.

Geoengineering may seem far-fetched, but a growing number of leading scientists and environmental

Samuel Thernstrom is a resident fellow at AEI, director of the AEI Press, and codirector of AEI's geoengineering project. A version of this article appeared in the *Los Angeles Times* on June 23, 2008.

economists take the idea very seriously. In 2006, Nobel Laureate Paul Crutzen called for more research on geoengineering. The National Academy of Sciences, NASA, and the Department of Energy have all studied geoengineering and concluded that it could be, in the words of the National Academy, "feasible, economical and capable." And in early June, the national academies of sciences of the G8+5 nations called for more study of geoengineering.

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The question for policymakers is not whether to deploy a geoengineering system immediately or to make it the primary focus of climate policy. Rather, it is whether to make a serious investment in the research and development needed to accurately evaluate its risks and rewards. Unfortunately, the Bush administration has declined to pursue such research, although it would cost only a small fraction of the $3 billion the federal government spends annually on developing new technologies to reduce emissions.

Why the reluctance to study this idea? Fear. Fear that geoengineering would not work, and fear that it would.

There are two main concerns about geoengineering. One is the risk of unintended consequences. Scientists note that sulfur particles could cause stratospheric ozone depletion, although the evidence from Pinatubo suggests that this effect would be relatively modest. Others fear possible disruption of regional climates, such as the Asian monsoon. Most scientists studying geoengineering believe that these side effects are not likely to be nearly as dangerous as uncontrolled warming, but much more research is needed. Until scientists determine which geoengineering technique (or mix of techniques) is optimal, we cannot know what side effects we should be most concerned about or what the possible solutions to them might be.

Fear that geoengineering might work, however, is the reason some people reject, or are reluctant to even openly discuss, this idea. Critics worry that geoengineering could be used as an excuse to continue unchecked emissions forever. Within the last two years, three high-level conferences have explored geoengineering; each was held behind closed doors. One premier university was too frightened even to do that. There have been calls for boycotts of the research or, failing that, strict international regulations.

This concern is badly misplaced. Geoengineering is a remarkable idea with tremendous potential, but it is neither a permanent nor a perfect solution to warming. There are risks to and, more important, limitations on what it can do. At least one effect of high-CO_2 concentrations in the atmosphere—the acidification of the oceans—cannot be halted by geoengineering. Even among its most enthusiastic advocates, no one calls for a policy of "geoengineering forever, emissions reductions never." Geoengineering would be a complement to, rather than a substitute for, a long-term program to transition to a zero-emissions economy.

What geoengineering could do is buy us time to make that transition while protecting us from the worst potential effects of warming. It may be possible to find ways to phase out fossil fuels or capture their greenhouse gases—but it will take a very long time. Tom Wigley of the National Center for Atmospheric Research believes that geoengineering, coupled with a long-term effort to reduce emissions, could stabilize the climate, while doing so through emissions reductions alone would be "virtually impossible." When warming begins to have severe effects on, say, India, it is likely that attention will turn to geoengineering. The sooner we begin to study this idea seriously, the more we will know when decisions about deployment have to be made.

The idea of "engineering" the climate may strike people as horrifying or absurd; in fact, we are changing the global climate now—in a massive, unintentional, and uncontrolled experiment. There is no other public policy problem of comparable importance for which the potential harm is so large and the proposed solutions are so clearly inadequate—while a potentially effective, affordable, and practical approach to the issue is being ignored.