Medium

Engineering Catastrophe: Why We Should Not Geoengineer the Climate

Allie Lowy May 27, 2018 · 9 min read

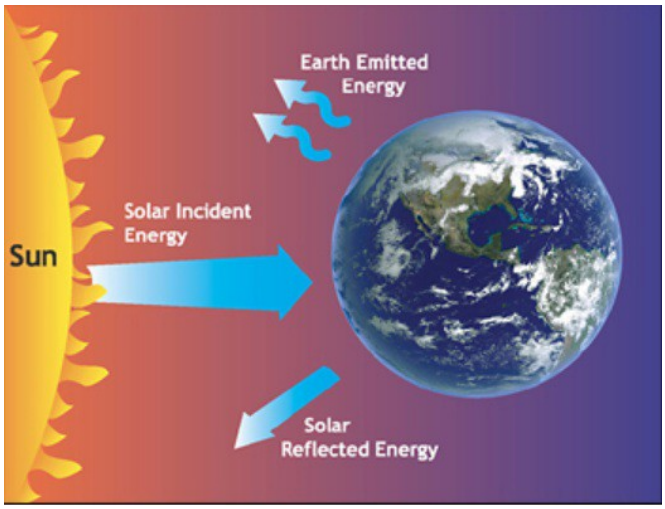
Introduction. *Despite indisputable evidence of anthropogenic climate change, little has been done in the way of mitigation efforts, and, in fact, global CO2 emissions appear to be rising. In the face of the risks posed by climate change — and the developed world's continual hefty carbon emissions, despite these risks — scientists have theorized other ways to reduce the Earth's warming. One method is geoengineering: manipulating Earth's natural systems to counter the effects of climate change. In this essay, I will argue that current humans should not engineer the climate because the conditions necessary to justify geoengineering have not been met.*

Background

Let us begin with a framework through which to consider the geoengineering debate. Geoengineering is the intentional manipulation of planetary systems at a global scale. For an action to be considered geoengineering, environmental change must be the goal (rather than a side effect) and the effect must be large in scale. ***Geoengineering entails applying a technology to counter the unwanted effects of***

climate change, without eliminating their root cause.

To understand the effects of geoengineering, one must begin with a basic understanding of our planetary system. Radiative forcing is the difference between the energy absorbed by the Earth and the energy radiated back to space, and it determines the degree of warming of Earth. Three factors influence Earth's energy balance: **the solar constant** (the amount of incoming solar radiation), **albedo** (the amount of radiation reflected back to space), and **greenhouse gas emissions** (which, trapped by the atmosphere, warm the Earth's surface). Currently, much more energy is absorbed by the Earth than is reflected back to space, predominantly due to the rise in greenhouse gas emissions in the latter half of the twentieth century.



Of the three factors determining Earth's energy balance, **albedo is the focus of geoengineering methods**. The thought is: we can continue business-as-usual fossil fuel emissions if we can reflect more of the sun's energy before it reaches Earth. The two primary methods for achieving this are **sulfate aerosols** and **sunshades.**

Sulfate aerosols work by scattering sulfate particles into the stratosphere — either via military planes or balloons — which act as cloud condensation nuclei, raising the albedo of clouds, thus, increasing the amount of solar radiation reflected back into the atmosphere.

Sunshades are essentially giant shields in space built to scatter sunlight away from the planet. Although geoengineering techniques have not yet been implemented, we can glean insight into their potential effects by examining the effects of volcanic eruptions, coal combustion, and SO2 emissions, all of which release sulfate aerosols into the atmosphere. Even though other geoengineering methods have been proposed, I will limit this essay in scope to the two methods most popular among scientists: sulfate aerosols and sunshades. In this essay, I will frame my argument through what environmental ethicist Stephen Gardiner calls **the Justificatory Question: *under what conditions would geoengineering be justified***? I will ultimately argue that, because the necessary conditions have not been met, current humans should not geoengineer.

Weighing the Pros and Cons

Proponents of geoengineering reference data from volcanic eruptions and anthropogenic sulfate emissions to say that aerosols cool the planet, and, logically, sunshades would have the same cooling effect. Some argue that aerosols would reduce Arctic ice sheet melting and land ice melting, but research shows that it does not cool the poles as much as the tropics, so additional cooling would be necessary to stop ice sheet melting.

Geoengineering advocates also predict a reduction in sea level rise, but that must be weighed against the heightened rates of acid rain, deposition, and ocean acidification that sulfate aerosols would produce. Although fossil fuel combustion leads to more ocean acidification, it all adds up, collectively destroying marine ecosystems.

Ultimately, the notion of mitigating harm from one pollutant — CO2 — by releasing another — SO2 — is nonsensical.

Reducing solar radiation by 1% through geoengineering would cost roughly $100 billion. Although, as geoengineering advocates argue, that's a mere fraction of our global economic output, cost is not the morally relevant issue at hand — in fact, it is cost-benefit analyses like these that leads to regression away from climate progress (like Trump's withdrawal from the Paris Climate Accord for economic reasons).

The moral worry is: considering geoengineering is a way for citizens of developed countries to continue business-as-usual CO2 emissions and avoid the large-scale lifestyle changes necessary to deal with climate change.

Appeals to geoengineering frame it as a moral emergency ("we *must* do anything we can"), but this requires endorsing ethical concerns that one is otherwise unwilling to act on. Gardiner renders this a sort of "moral schizophrenia," providing the following two analogies. In the first, Agent 1 is engaged in activities he ought morally not to be. He has a list of solutions A-Z (from best to worst). He refuses solutions A-X for no morally good reason, without serious grounds for doing so, but takes Y and Z (two pretty bad options). He proceeds to claim that Y and Z are better than nothing, and that not doing Y and Z will surely result in catastrophe. His appeals to emergency are misleading, and this argument lacks internal coherence, because, if he can register the moral reason to do Y and Z, he should too for A-X.

Another less abstract example is what Gardiner calls "Wayne's folly." Wayne, happily married and sexually content with his wife, chooses to continually have unprotected sex with women likely to have HIV. Wayne knows he has probably contracted the virus, but continues to spread it. Rather than practicing safe sex, sleeping with fewer women, or with a different demographic of women, Wayne decides to invest $10 in a new pill designed to offset some of the effects of AIDS (with potential side effects).

As Gardiner argues, the developed world considering geoengineering is largely akin to Wayne investing in the pill. Our behavior violates morally important relationships (like that between Wayne and his wife): our moral stature with other nations, our obligation to future generations, and our relationship to nature. Like Wayne's sexual behavior, our high emissions seem frivolous in the face of the threats they impose onto innocent others (poor, vulnerable communities).

We heat houses, larger and warmer than they need to be, only occupied for part of the day; use inefficient cars often only carrying one person; and manufacture products thoughtlessly consumed and quickly disposed of — the net result of which will cause death, dislocation, and widespread suffering, primarily to the future poor.

Like Wayne, we possess an array of options to mitigate risk: invest in alternative energy, pursue less carbon-intensive infrastructure, or change our way of life to reduce our carbon footprint.

Medium

A large-scale reduction in carbon emissions of developed countries alone would yield a much larger reduction in the Earth's energy imbalance than techniques for albedo enhancement. Choosing to geoengineer, despite this, is what Gardiner calls **"parochial geoengineering" — the current generation securing short-term benefits for itself while passing on more serious long-term risks to future peoples.**

Geoengineering is appealing as a quick, simple technical fix to climate change: a substitute for the large-scale behavioral change necessary to combat it. Thus, the knowledge that geoengineering is possible might induce an absolving of moral responsibility, reducing our incentive to cut emissions. This leads to "moral hazard" — a term taken from the insurance industry — when one takes more risks (i.e. high emissions) because someone else (future generations) bears the costs of those risks.

Geoengineering poses a number of significant risks that scientists have not found a method to mitigate.

Based on findings from volcanic eruptions, sulfate aerosols can adversely affect regional climates, leading to reduced precipitation, soil moisture, and river flow. Aerosols can fuel large-scale changes in atmospheric circulation, like tropical volcanoes causing winter warming in the Northern hemisphere. Sulfate aerosol scattering notoriously depletes ozone, which is how the Antarctic Ozone hole was formed. Stratospheric aerosols would whiten the sky, making it less blue and leading to gasoline-in-water-like sunsets. There would be less rainfall, less sunlight for solar power, and Earth-based optical astronomy would be ruined.

Geoengineering will cause the most harm to those most vulnerable to climate change, with the least capacity to adapt to it, resulting in food insecurity, drought, and famine in populations at the edge of subsistence, particularly in Africa and Asia.

Because burdens might disportionately fall on more vulnerable communities, promoting global distributive justice is crucial. Thus, providing adaptation mechanisms, and reducing harmful effects on vulnerable populations, would need to be components of any geoengineering endeavor.

To promote equity, it would also be important that geoengineering efforts were not controlled by private companies, advancing vested economic interests, or by the governments of only a few countries. Similarly, any geoengineering endeavor would need to ensure procedural justice, which would entail consent from representatives of those affected as part of a just procedure. Because of the ethical implications of action that would place an undue burden on the vulnerable and poor, a consensus among those affected would be necessary before beginning to geoengineer. **Currently, 85 countries — the U.S. included — have signed the U.N. Convention on Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD), which both techniques (stratospheric aerosol insertion and**

sunshades) would violate. Climate policy would have to shift — or 85 countries would have to change their stance — before geoengineering could proceed. Some say we should resort to geoengineering only in the case of emergency, but there are currently no international governance standards that would enable the determination of such an emergency.

Another concern of geoengineering is the problem of lock-in, and, relatedly, path-dependency. The greater investments of time and money in geoengineering research, the harder it is to stop the technology from being implemented. The pressure from vested institutions to implement geoengineering could overwhelm voices of caution about its potential detriments. Enormous investments in infrastructure would make us essentially locked in to a future of geoengineering. Once we begin geoengineering, it would have to continue for decades and be very difficult to stop. After its termination, rapid warming would ensue, which would be much more abrupt and dangerous than the gradual warming we are seeing today. Its effects would be unable to be quickly stopped, placing an even greater burden on societies and ecosystems.

Moreover, we lack a great deal of information about the effects of geoengineering and how our planetary systems would respond. In the face of this uncertainty, until further, more conclusive research is done, it would be unwise to geoengineer. While some object that scientists have a right to geoengineer because of the freedom of scientific inquiry, there is a crucial distinction to be made.

There is a difference between traditional, curiosity-based scientific research and the establishment of huge research programs based on uncertain findings, created on grounds of moral emergency.

The former is encouraged, and, in fact, absolutely necessary before we can proceed with geoengineering schemes. One might object that, since climate models say we are already committed to a certain amount of future warming, we might as well geoengineer to counteract that. However, if we are, indeed, committed to a certain degree of warming, there are a number of other priorities to which we should allocate resources: *protecting the world's vulnerable peoples, implementing adaptation strategies, and paying the costs of damages, losses, and human suffering.*

Thus, through the lens of Gardiner's "Justificatory Question" — under what conditions would geoengineering be justified — we now have a range of criteria, none of which have been met.

We would have to be making significant mitigation efforts prior to — and in conjunction with — geoengineering implementation, so it is not viewed as a panacea technological fix that can replace emissions reductions. We would have to ensure that vulnerable, poor regions are not disproportionately burdened — in order to promote distributive justice. We would have to ensure that potential negative costs — like ozone

depletion, regional drought, and ocean acidification — are minimized. We would have conducted extensive research into its effects on planetary systems. We would need a global consensus among all those affected — in order to promote procedural justice — and would need to ensure that geoengineering efforts are neither privately owned nor in the hands of a few countries, before the implementation of geoengineering could be morally justified. In this essay, I have argued that these conditions have not been met, therefore geoengineering is not morally justified. Thus, current humans should not geoengineer the planet.

References

1. http://climate.envsci.rutgers.edu/pdf/20Reasons.pdf
2. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2009GL039209
3. https://onlinelibrary.wiley.com/doi/abs/10.1002/wcc.198
4. https://muse.jhu.edu/article/694100
5. https://www.jstor.org/stable/23048452
6. https://link.springer.com/article/10.1007/s10584-006-9101-y
7. https://keith.seas.harvard.edu/files/tkg/files/89.keith_.engineeringtheplanet.e.pdf
8. https://philpapers.org/rec/GARGAM-8
9. https://ndpr.nd.edu/news/a-perfect-moral-storm-the-ethical-tragedy-of-climate-change/
10. https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1002/2016EF000521