White House is pushing ahead research to cool Earth by reflecting back sunlight

Catherine Clifford
@CLIFFORDCATH
Senior Contributor

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KEY POINTS

- The White House Office of Science and Technology Policy is considering a research program that would cool the planet by reflecting the amount of sunlight that reaches the Earth in order to temporarily dampen the effects of global warming.
- There are several kinds of sunlight-reflection technologies being considered, including stratospheric aerosol injection, marine cloud brightening and cirrus cloud thinning.
- Stratospheric aerosol injection involves spraying a substance into the stratosphere to reflect the sun's rays back into space. The surface effects of this strategy, which would take place over years, are uncertain.
- While arguments of moral hazard have been leveled against efforts, the idea is getting more urgent attention in the worsening climate crisis.

Pollution can, Climate change, Hazardous sun, Global warming from the sun and burning.
Tomas Kasparek | Getty Images

The White House is considering a five-year research plan to study sunlight reflection as a means of sunlight that reaches the earth's temper the effects of global warming, a process scientists called solar geoengineering or sunlight reflection.

The research plan will assess climate interventions, including spraying aerosols into the atmosphere to reflect sunlight into space, and should include goals for research, which's necessary to analyze the atmosphere, and what impact these kinds of climate interventions may have on Earth, according to the White House's Office of Science and Technology Policy. The research plan discussed in the ongoing plan for 2025, which President Joe Biden signed in March.

Some of the techniques, such as spraying sulfur dioxide into the atmosphere, are known to have the potential to cool the environment and human health. But scientists and climate leaders who are concerned that research will accelerate climate interventions that research is important to figure out how best to balance these risks against a possible catastrophe on the Earth's temperature.

Getting ready to research a topic is a very preliminary step, but it's a step in the right direction, said Daniel Sarewitz, a professor at Arizona State and co-director of the Consortium for Science, Policy and Outcomes. Robinson's science fiction novel, "The Ministry for the Future," is set next to India's 50-year, 1,000-day plan to cool the atmosphere. India decides to implement its own strategy of limiting the sunlight that gets to Earth.

Chris Sacca, the founder of climate tech investment fund Lowercarbon Capital, said the White House's research plan is the spearheading the research effort.

"Sunlight reflection has the potential to dramatically lowering the temperature of the Earth and the impacts of climate change," that this" is advancing the research so that our future decisions can be rooted in science not geopolitical brinkmanship," Sacca told CNBC. Sacca has invested money to support research in the area, but said he has "seen financial interests beyond philanthropy." He also does not from their investment, which has been invested in the space, he told CNBC.

Harvard professor David Keith, who first worked on the topic in 1989, said it's being taken much more seriously now. He points to formal statements of support for researching sunlight reflection from the Environmental Defense Fund, the Union of Concerned Scientists, and the Natural Resources Defense Council, and the creation of a new group to advocate called the Climate Davidson Commission, an international group of scientists and economists that's estimating climate interventions in preparation for a world that reaches beyond the Paris Climate Accord recommended.

To be clear, anybody is scoping sunlight reflection modification is the solution to climate change. Reducing greenhouse emissions is the priority.

"You cannot judge what the country does on solar radiation modification without looking at what it is doing to emission reductions, because the priority is emission reductions," said Inez Fung, emeritus director of the Carnegie Climate Governance Initiative. "Solar radiation modification will never be a solution to the climate."

Three ways to reduce sunlight

The idea of sunlight reflection first appeared prominently in a 1965 report to President Lyndon B. Johnson, entitled "Restoring the Quality of Our Environment." Keith told CNBC. The report floated the idea of spreading particles over the ocean at a cost of $100 per square mile. A year earlier change in the reflectivity of the Earth would cost $500 million per year, which, the report said, "would be the equivalent of a 2 percent increase in albedo."

The estimated price tag has gone up since then. The current estimate is that it would cost $10 billion per year to cool a program that cools the Earth by 1 degree Celsius, said Edward A. Parson, a professor of environmental law at UCLA. Parson and Keith's research is seen to be remarkably cheap compared to other climate change mitigation initiatives.

A landmark report released in March 2021 from the National Academies of Sciences, Engineering, and Medicine addressed three kinds of solar geoengineering: stratospheric aerosol injection, marine cloud brightening, and cirrus cloud thinning.

Stratospheric aerosol injection would involve flying aircraft into the stratosphere, or between 10 miles and 30 miles above sea level, and spraying a fine mist that would hang in the air, reflecting some of the sun's radiation back into space.

"The stratosphere is calm, and things stay up there for a long time," Parson told CNBC. "The equivalent of a puff of smoke that's injected in the stratosphere is between six months and two years."

Stratospheric aerosol injection "would immediately cool the high end of hot extremes," Parson said. And also it would "pretty much immediately" alter rainfall patterns around the world.

"The top-line stuff about stratospheric aerosol injection, which I wrote in a paper more than 10 years ago — but it's still up — is fast, cheap and imperfect. That is crucial. Nothing else that we do for climate change is fast. Cheap, it is cheap," Parson told CNBC.

"And it's not imperfect because we haven't got it right yet. It's imperfect because the imperfection is embedded in the way it works. The same reason it's fast is the reason that it's imperfect, and there's no way to get around that."

One option for an aerosol is sulfur dioxide, the cooling effects of which are well known from volcanic eruptions. The 1991 eruption of Mount Pinatubo, for instance, spewed thousands of tons of sulfur dioxide into the stratosphere, creating global temperatures to drop temporarily by about 1 degree Fahrenheit, according to the U.S. Geological Survey.

A giant volcanic eruption cloud explodes under Mt Pinatubo high from Mount Pinatubo, since about threshold 20 Click the Bonus Photo to see more. Image credit: Dave Harlow, USGS Cascades Volcano Observatory
Dave Harlow | Corbis Historical | Getty Images

There's also a precedent in factories that burn fossil fuels, especially coal. Coal has some sulfur that oxidizes when burned, creating sulfur dioxide. That sulfur dioxide gets mixed with other chemical reactions and eventually falls to the earth as sulfuric acid in rain. But adjusting the time that the sulfur dioxide gets in the air, is does some as a kind of irradiation from the heat of the sun.

Ironically, as the world reduces coal burning to cool the carbon dioxide emissions that cause global warming, we'll also be eliminating the sulfur dioxide emissions that cool the earth.

"Sulfur pollution that's coming out of smokestacks right now is masking between a third and a half of the heating signal from the greenhouse gases humans have already emitted into the atmosphere," Parson said.

In other words, we're now doing one form of sunlight reflection for decades already, but in an uncontrolled fashion, explained Kelly Wanser, the executive director of SilverLining, an organization promoting research and governance of climate interventions.

"This isn't something really new and Frankenstein-y. We are already doing it, we're doing it in the most dirty, unplanned way you could possibly do it, and we don't understand what we're doing," Wanser told CNBC.

Spraying sulfur in the atmosphere is not the only way of manipulating the amount of sunlight that gets to the Earth, and some say it's not the best option.

"Sulfur dioxide is likely not the best aerosol and is by no means the only technique for this. Cloud brightening is a very promising technique as well, for example," Sacca told CNBC.

Marine cloud brightening is another technique the reflectivity of clouds by spraying tiny particles into them. It's a less-invasive technique than spraying an such crystals into the air. Marine cloud brightening generally gets less attention than stratospheric aerosol injection because it affects a small area of the ocean, but it's also not would potentially only last hours to days, Parson told CNBC.

Cirrus cloud thinning, the third category addressed in the 2021 report from the National Academies, involves thinning cold-level clouds, between 5.7 and 8.5 miles high, to allow heat to escape from the Earth's surface. It is not technically part of the "solar geoengineering" research category because it doesn't involve reflecting sunlight, but instead involves increasing the release of thermal radiation.

Known risks to people and the environment

There are significant and well-known risks to some of these techniques — sulfur dioxide aerosol injection, in particular.

First, spraying sulfur into the atmosphere will "mess with the ozone chemistry in a way that might delay the recovery of the ozone layer," Parson said CNBC.

The Montreal Protocol adopted in 1987 regulates and phases out the use of ozone-depleting substances, such as hydrochlorofluorocarbons (HCFCs) which were commonly used in refrigeration and air conditioners, but that healing process is still going on.

Also, sulfates injected into the atmosphere eventually come down as acid rain, which affects soil, water resources, and ecosystems.

Third, the sulfur in the atmosphere forms very fine particulates that can cause respiratory illness.

The question, then, is whether these known effects are more or less harmful than the warming they would offset.

"Yes, damaging the ozone hole, if that's what happens is bad, respiratory illness is bad, obviously. And spraying sulfur in the stratosphere would contribute to that. But disorders of all those things," Parson said CNBC. "But you also have to ask, how much are relative to what?"

The sulfur already being emitted from the burning of fossil fuels is causing environmental damage and is already killing between 10 million to 20 million people a year due to respiratory illness, said Parson, "So that is the way we're doing it, right now."

Meanwhile, "the world is getting hotter, and there will be catastrophic impacts for many people in the world," he said.

"There's already too much carbon out there. And even if you stop all emissions today, the global temperature will still go up a little and remain high for hundreds of years. So, that's why scientists are saying maybe we need something else, in addition to cut emissions — but maybe in addition to everything else that is being done," he said. "The current action/inaction of climate change is causing — we are committing millions of people to death. That's what we're doing."

For sunlight reflection technology to become a tool in the climate change mitigation toolbox, awareness among the public and lawmakers has to grow slowly and steadily, according to Tyler Felgenhauer, a researcher at Duke University who studies public policy and risk.

"If it is to rise to the agenda, it'll be kind of an evolutionary development where more and more environmental groups are willing to raise publicly that they're for research," Felgenhauer told CNBC. "We're arguing it's not going to be some sort of one big, big decision where a switch is all suddenly adopt or be open to solar geoengineering — there will be more of a gradual process."

A test outdoor for a problem displaying two of the cases with long temperatures in New York on May 27, 2020. India is setting under a plan to reduce sunlight that gets to the country. Image credit: Photo by Eugenio Castro, CIO Geographic Information Systems and the Lighter and Brighter Project
Photo by Eugenio Castro, CIO Geographic Information Systems and the Lighter and Brighter Project

Research it now or be caught off guard later?

Some environmentalists consider sunlight reflection a "Faustian bargain," because it offers a relatively easy and inexpensive alternative to slashing the world's emissions of carbon.

Once experimenta to study stratospheric aerosols by the French company Stratolaunch and Keith's group in 2022, the outcry was so intense, the experiment would "threaten the reputation and credibility of the climate leadership between nonprofits and many groups who rely on to deal effectively with the climate crisis: powerful measures for a climate event that makes it will suddenly adapt or be open to solar geoengineering — there will be more of a gradual process."

But proponents insist that researching sunlight modification technologies should not prevent emissions reduction work.

"Even the people like me who think it's very important to do research on these things and to develop the capabilities of agree that the urgent top priority for managing climate change is cutting emissions," Parson told CNBC.

Keith of Harvard agreed, saying that "we learn more and develop better mechanisms/ideas/processes."

Doing research is also important because many calculators expect that some emissions, facing non-emissions sectors, such as cement, are unfamiliarly to will try some version of sunlight modification anyway — even if it hasn't been carefully studied.

"In my opinion, it's more than 90 percent likely that within the next 20 years, some major nation wants to do this," Parson said.

Sacca put the odds even higher.

"The odds are 100 percent that some country presses sunlight reflection, particularly in the wake of catastrophic events of their citizens die from extreme weather," Sacca told CNBC. "The world will not stand idly by and leaders will feel compelled to take action. Our only hope is that by doing the research now, and in public, the world can collaboratively understand the upsides and how methods for any future project."

Correction: The Climate Davidson Commission has not issued a formal statement of support for sunlight reflection.

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