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CLIMATE TECH

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

Leslie Hook
Climate Editor
Follow @lesliehook

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KEY POINTS

- The White House Office of Science and Technology Policy is coordinating a five-year research plan to study ways of modifying the amount of sunlight that reaches the Earth in order to temporarily hamper the effects of global warming.
- There are several kinds of sunlight-reflection technology being considered, including stratospheric aerosol injection, marine cloud brightening and cirrus cloud thinning.
- Stratospheric aerosol injection involves spraying an aerosol like sulfur dioxide into the stratosphere and research has the potential to reflect the entire globe, after gets the most attention.
- While arguments of mixed bound have handicapped research efforts, the idea is getting more urgent attention in the worsening climate crisis.

Pull Kanon Lam, Climate change, Hurricane Ian, Global warming from the sun and moving

Courtesy Kanon Lam

The White House is coordinating a five-year research plan to study ways of modifying the amount of sunlight that reaches the earth to temper the effects of global warming, a system sometimes called solar geoengineering or sunlight reflection.

The research plan will assess climate interventions, including spraying aerosols into the stratosphere to reflect sunlight back into space, and should include goals for research, what's necessary to analyze the atmosphere, and what impact these kinds of climate interventions may have on Earth, according to White House's Office of Science and Technology Policy. Congress directed the research plan be produced in its spending plan for 2023, which President Joe Biden signed in March.

Some of the techniques, such as spraying sulfur dioxide into the atmosphere, are known to have harmful effects on the environment and human health. But scientists argue research is needed to understand the potential risks and benefits to emission targets so research is important to figure out how best to balance these risks against a potentially catastrophic rise in the Earth's temperature.

Getting ready to research a topic is a very preliminary step, but it's notable the White House is thinking about sunlight which has largely been seen as the stuff of dystopian fantasy. Ken Stanley Robinson's science fiction novel, "The Ministry for the Future," is best seen in black ink. Stratospheric geoengineering, in desperation, India decides to implement its in-spending plan for 2023, which President Joe Biden signed in March.

Chris Sacca, the founder of climate tech investment fund Lowercarbon Capital, said it's problem for the White House to be spearheaded by research effort.

"Sunlight reflection has the potential to safeguard the livelihoods of billions of people, and it's a sign of the White House's leadership that they're advancing the research so that any future decisions can be rooted in science and geopolitical relationships," Sacca told CNBC. Sacca has donated money to support research in the area, but said he has "zero financial interest beyond philanthropy" in the idea and does not think there should be private business models in the space, he said 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 National Resources Defense Council, and the creation of a new group for advisors called the Climate Overshoot Commission, an intergovernmental group of scientists and leaders that's evaluating climate interventions in preparation for a world that warms beyond goals that Paris Climate Accord recommended.

To be clear, nobody is saying sunlight reflection modification is the solution to climate change. Reducing emissions remains the priority.

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

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." Sacca told CNBC that report floated the idea of spreading particles over the oceans and over 8,000 pages stated, "A major source of change in the reflectivity of the Earth would cost $100 million per year, which is a small sum." The report said, "Such a program, if successful, would be economic and humanitarian of a high order."

The estimated price tag has gone up since then. The current estimate is that it would cost $10 billion per year to run a program that cools the Earth 1 degree Celsius, said Edward A. Parson, a professor of environment at UCLA who's been studying the topic for years. It would be a very manageable cheap compared to other climate change mitigation.

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 deposed, and spraying a fine mist that would hang in the air, reflecting some of the sun's radiation back into space.

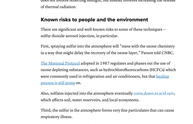
"The stratosphere is calm, and things stay up there for a long time," Parson told CNBC. "The atmosphere is full of stuff that's injected in the stratosphere in between six months and two years."

Stratospheric aerosol injection "would immediately take the high-end of hot outcomes," Parson said. And it doesn't "pretty much immediately" fix the other extreme precipitation events, he said.

"The top five shapes 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. Fast is crucial. Nothing else that we do from climate change is fast. Cheap, it's 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, causing global temperatures to drop temporarily by about 1 degree Fahrenheit, according to the U.S. Geological Survey.



A giant volcanic mushroom cloud explodes some 20 kilometers high from Mount Pinatubo above around dawn(6:30) Clark Air Base, on June 15, 1991 in the Philippines. Mt. Pinatubo's eruption was the most powerful eruption. The eruption of Mount Pinatubo on June 15, 1991 was the second largest volcanic eruption of the twentieth century.

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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 goes through other chemical reactions and eventually falls to the earth as part of what's known as acid rain. Sulfur dioxide can also stay in the air, it does serve as a kind of insulation from the heat of the sun.

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

"Sulfur pollution that's coming out of smokestacks right now is making between a third and a half the difference to climate change so far. Once it's gone, it's gone," Parson told CNBC.

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A man wants his customers dispersing here at his stone artist's shop temperatures in New Delhi on May 27, 2020. India is adding under a temperature, with the Indian Meteorological Department (IMD) forecasting a heat wave in the coming days. Sunlight reflection is a topic of research in the White House's Office of Science and Technology Policy.

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Research it now or be caught off guard later?

Some environmentalists consider sunlight reflection a "moral hazard," because it offers a relatively easy and inexpensive alternative to doing the work of reducing emissions.

One experiment to study stratospheric aerosols by the Scotch Group at Harvard was called off in 2021 due to opposition. The experiment would "threaten the reputation and credibility of the climate leadership therefore and undermine efforts to be able to deal effectively with the climate crisis, where powerful measures for a rapid and sustained reduction in emissions societies, 100% renewable energy and shutdown of the fossil fuel industry," an open letter from opponents said.

But proponents insist that researching sunlight modification technologies should not preclude emission reduction work.

"Even the people like me who think it's very important to do research on these things and to develop the capabilities all 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 for governance."

Doing research is also important because many stakeholders expect that some country, facing an unprecedented climate disaster, will act unilaterally to try to ease tension of sunlight modification anyway — even if it hasn't been carefully studied.

"It's a lot more to do, if 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 pursues sunlight reflection, particularly in the wake of strong millions of their citizens die from extreme weather," Sacca told CNBC. "The world will not stand idly by and watch idly as fed 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 best methods for any future project."

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

A train waits for customers dispersing here at his stone artist's shop temperatures in New Delhi on May 27, 2020. India is adding under a temperature, with the Indian Meteorological Department (IMD) forecasting a heat wave in the coming days. Sunlight reflection is a topic of research in the White House's Office of Science and Technology Policy.

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