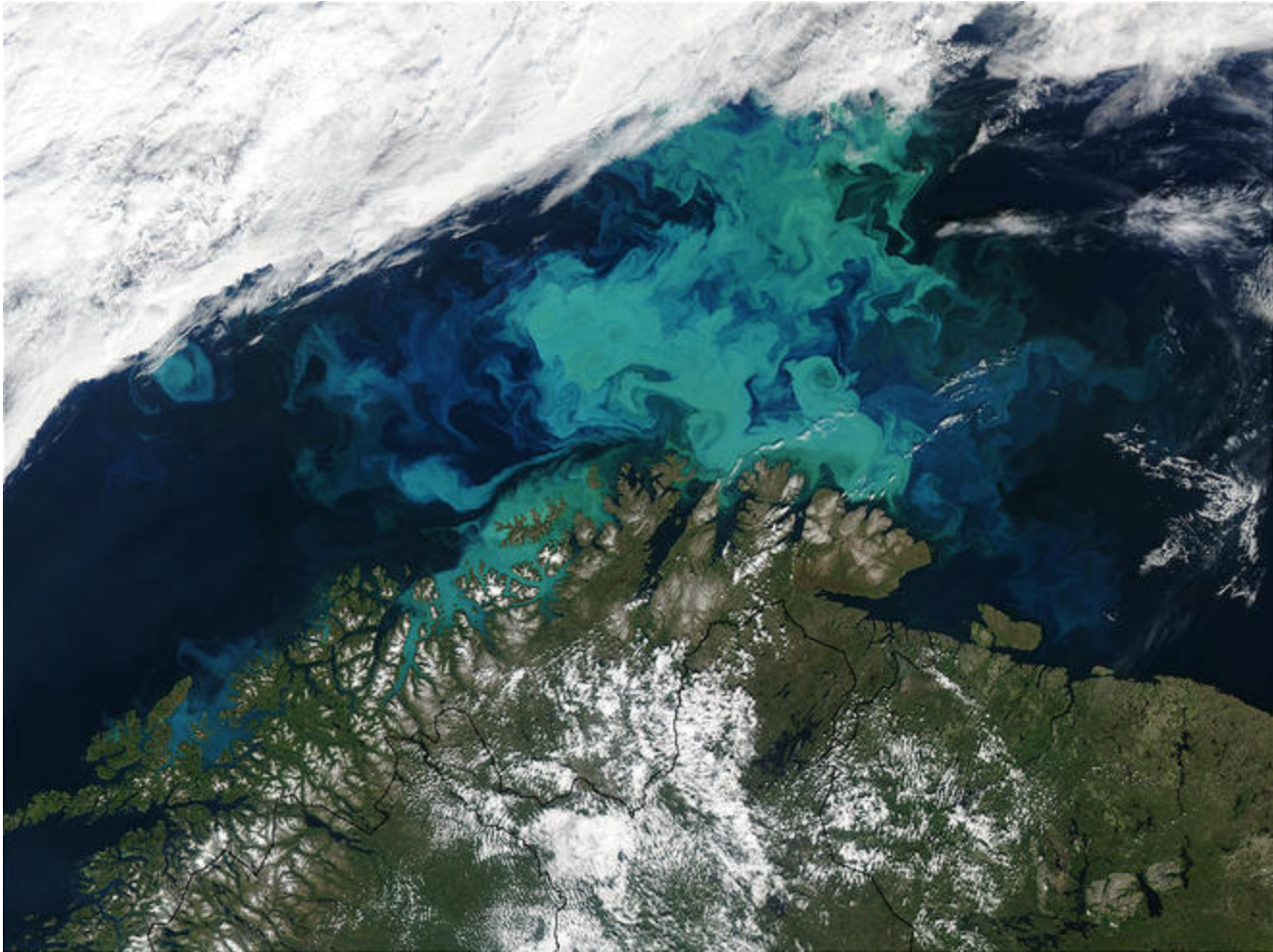


JANUARY 9, 2009 **U.N. Says 'No,' Climate Hackers Say, 'Yes We Can'**

By Alexis Madrigal [✉](#) January 09, 2009 | 10:46:37 AM Categories:

[Climate](#), [Environment](#), [Exploration](#), [Physics](#)



This story has been updated.

A major Indian-German geoengineering expedition set sail this week for the Scotia Sea, flouting a U.N. ban on ocean iron fertilization experiments in hopes of garnering data about whether the process actually does take carbon dioxide out of the atmosphere and sequester it in the deep ocean, a technique that may help reverse global warming.

The [LOHAFEX experiment](#) will spread 20-tons of iron sulphate particles over a 115-square-mile section of open ocean north of Antarctica — that's about 1.7 times the size of Washington, D.C. The initiative has drawn fire from environmental groups who point out that [200 countries agreed to the moratorium](#) until more evidence was available about its efficacy.

But that hasn't stopped the LOHAFEX team, composed of Alfred Wegener Institute and Indian National Institute of Oceanography scientists, who say they need to conduct experiments to get such data.

"If the LOHAFEX iron dump goes ahead, it will be a clear defiance of the U.N. Convention on Biological Diversity," Jim Thomas of ETC Group, said in a press release.

It's becoming clear that when it comes to global warming reversal schemes, [deciding who will control the global thermostat](#) is as complex an issue as how such schemes could actually be accomplished. Ocean iron fertilization is considered one of the more promising options for global-scale geoengineering, which aims to slow or reverse the effects of climate change caused by man's burning of fossil fuels.

While Thomas expressed outrage, [Jamais Cascio](#), a futurist who has written about the [geopolitical repercussions of geoengineering](#) for the journal *Foreign Policy*, took a more measured tone.

"ETC is right that we need international standards and safeguards for these experiments, and hopefully this attempt will spur action in that regard," Cascio said. "I think they're wrong, however, to suggest that any look at geoengineering is inherently problematic."

Importantly, iron fertilization would deal directly with the amount of CO2 in the atmosphere, as opposed to, say, blocking out some of the sun's rays with [a global molecular parasol](#).

By providing plankton with iron in water where iron is lacking, the marine creatures grow in tremendous numbers, incorporating carbon into their bodies. When the plankton die and sink, the carbon goes with down with their skeletons. It is unknown, however, how much of that carbon actually makes it deep into the ocean, where it would be sequestered for decades, not days.

At a panel at meeting of the American Association for the Advancement of Science last year, marine geochemist Ken Buesseler of the Woods Hole Oceanographic Institute said that [somewhere between 2 and 50 percent](#) of the carbon the plankton eat could actually make it to the depths of the ocean, which is basically like saying that we don't know if the process works.

"The efficacy of iron-induced sequestration of atmospheric CO2 to the deep sea, however, remains poorly constrained," [he summarized](#). "We do not yet understand the full range of intended and potential unintended biogeochemical and ecological impacts."

The voluntary U.N. ban included language to allow countries to do tests near their shores. But it's the open seas, particularly in the southern hemisphere, that would allow in-situ testing of the LOHAFEX scientists' hypotheses.

"The fate of carbon from the bloom could not be adequately determined in earlier experiments," the LOHAFEX website reads. "LOHAFEX will now study the entire range of processes determining the partitioning of carbon between atmosphere and deep ocean in the experimental bloom."

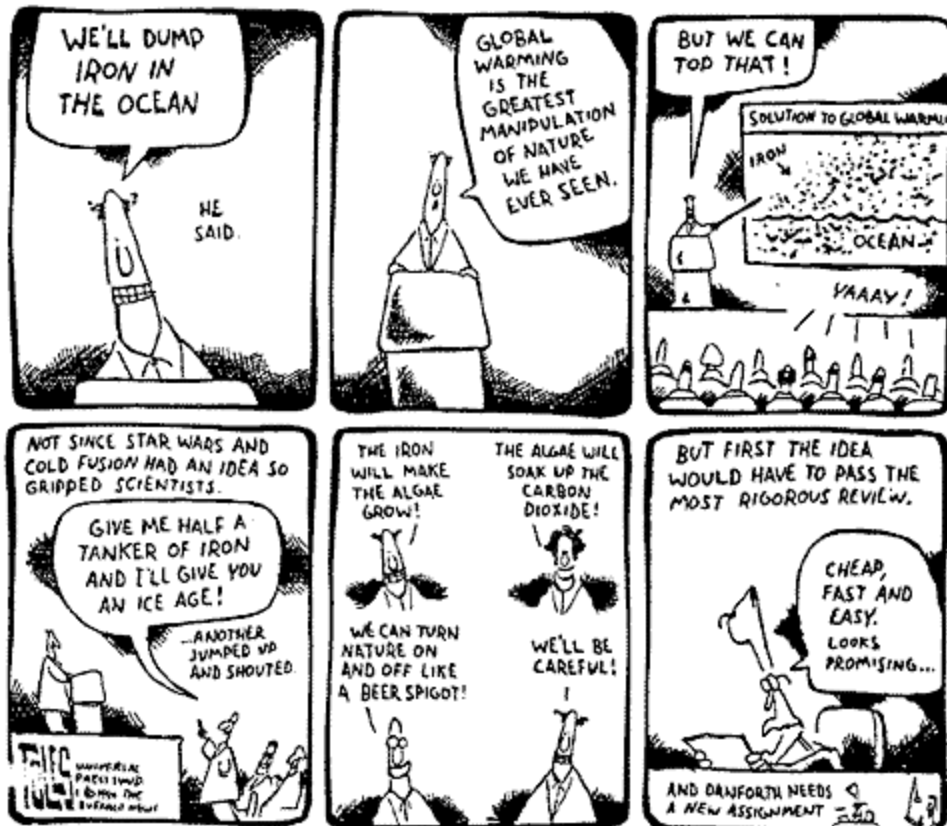
Cascio said that it's likely that further geoengineering experiments or actual efforts will be made.

"This comes as absolutely no surprise to me," he said. "The confluence of desperation as we see climate disruption hit faster than anticipated, inaction on the carbon emission front, and the ease with which geoengineering can be undertaken means that this won't be the last time that a sub-national group tries something like this."

Already, two ocean-iron-fertilization companies, Climos and Planktos, have been founded. They've met different fates, though. Last year, Planktos went belly up, while [Climos pulled in \\$4 million](#) in venture capital.

UPDATE 11:10 am PST: Climos CEO, Dan Whaley, notes in our comments section that there was a clause included in an October resolution of a separate U.N. organization, parties to [the London Convention](#), in which 88 countries voted to allow "legitimate scientific research" on ocean iron fertilization, without restrictions to coastal waters. It was under this ruling that the researchers proceeded. [The full text of that resolution](#) is available at Climos' website. End

CLIMOS http://climos.com/note_detail.php?pid=103 The London Convention October 2008




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Global Climate Engineering: Who Controls the Thermostat? By Brandon Keim



 Mount Pinatubo's 1991 eruption sent 10 million tons of sulfur into the atmosphere, blocking sunlight and temporarily cooling the planet by nearly one degree Fahrenheit. Some Russian scientists suggest pumping massive amounts of sulphur into the atmosphere to attempt a cooling effect.
Image: United Nations Environment Programme

It would take decades to significantly reduce greenhouse-gas pollution even if humans immediately kicked their fossil-fuel addiction. But dumping a few supertanker loads of iron into polar oceans could do the trick in no time.

That, at least, is the highly controversial best-case scenario of [iron seeding](#) -- one of many schemes scientists and entrepreneurs have hatched to keep the planet from cooking. Other plans include using orbital mirrors to reflect the sun, pumping reflective particles into the atmosphere, modifying microbes to eat methane and feeding plankton with nutrients pumped from the bottom of the sea.

All these so-called geo-engineering plans could powerfully influence the world's weather, though there's no guarantee that any of them will work. In fact, they could actually make our problems worse by accelerating global warming or destroying marine life.

But with climate-change threats looming, companies and countries may decide that the risks are worth taking. And there's nothing to stop them, or even to make sure they do it carefully.

"It's the Wild West out there," said [Jeffrey Kiehl](#), a climate scientist at the National Center for Atmospheric Research.

Calls for regulation might sound wimpy in the face of climate-change risks. There's broad scientific agreement on the dangers of a warming planet: drought, famine, social and economic unrest -- catastrophes that could be just decades away. Or, if we hit so-called tipping points, such as unexpectedly fast-melting polar-ice caps, or a thawing Siberian permafrost, they might be a few years away.

But scientists say that without an international regulatory system governing geo-engineering, Earth is vulnerable to some risky propositions, despite their good intentions.

"There are no regulations in place to govern geo-engineering and scientific debate is taking place in the absence of public discussion," said [Hope Shand](#), research director of the ETC Group, an Ottawa-based environment-and-technology watchdog. "There's no intergovernmental body that has the mandate to decide when or if large-scale manipulations of the earth, sea and atmosphere are acceptable as a response to climate change."

Some existing environmental laws might apply, but their governing power is likely weak. Iron seeding, for example, might fall under the Environmental Protection Agency's 1988 [Ocean Dumping Act](#). However, that legislation only applies to boats registered as American. If companies use boats flying under other countries' flags, they'd be exempt.

Internationally, the only law potentially applicable to geo-engineering is the [Environmental Modification Convention](#), signed by the United Nations in 1977. But the connection is tenuous: The regulations address only military weather control.

Two years ago, the head of Moscow's Institute of Global Climate and Ecology suggested to Russian President Vladimir Putin that the country immediately pump enough sulfur into the atmosphere to cool the planet by a couple degrees Celsius. It's never been tested, but scientists say it could wreak havoc on agriculture.

Putin hasn't heeded the suggestion -- yet -- but iron seeding is on the horizon. Two San Francisco-based companies, [Planktos](#) and [Climos](#), plan to sell carbon-offset credits in the form of iron scattered in the Pacific Ocean.

But there's no scientific consensus on whether iron seeding would actually benefit the environment. As *The Boston Globe* recently reported, 11 large-scale experiments conducted in the last 15 years haven't concluded whether the plankton actually emit more greenhouse gases than they absorb, or could cause disruptive nutrient shifts. Still, some scientists believe iron seeding is understood well enough, especially compared to other geo-engineering technologies. (Continued on Page 2)

Global Climate Engineering: Who Controls the Thermostat? Page 2

http://www.wired.com/science/planetearth/news/2007/10/globalwarming_regulation?currentPage=2

By Brandon Keim

Wired Science

"There are people who are advocating doing experiments in the atmosphere right now, without any modeling," said Rutgers University climate scientist [Alan Robock](#). "Their speculations about what the response might be don't take into account the way the earth's systems actually work."

Kiehl, who favors a U.N.-level geo-engineering body, notes another risk: Climate-change projects could work for the planet, but leave specific regions in worse condition than before.

"Not everyone's going to be a winner, in terms of how the climate system responds. How are those inequities going to be addressed?" he said. "And if something goes wrong, how are you going to handle that?"

Other geo-engineering risks include the mutation of modified microbes and catastrophic weather disruption. Regulation could help make sure that geo-engineering is done correctly. If, for example, atmospheric particulates are used to cool the planet but carbon dioxide levels don't change, the temperature could rise radically unless the particulates are [continually refreshed](#). In practical terms, a bankrupt sulfur-spewing company could bring down the planet's climate.

Regulation could guide science and help establish a consensus, as the [Intergovernmental Panel on Climate Change](#) has done with climate change, ensuring that projects be adequately tested and their impacts predicted. Regulations could also help settle international disputes.

"What if Russia wants it warmer, and India cooler?" said Robock. "Whose hand is on the thermostat? Who's going to decide it?"

And, say scientists, it's likely that humanity, whether in the form of a single nation or a global consensus, eventually will reach for the thermostat.

"Most people won't argue that a geo-engineered world is better than the natural world," said Carnegie Institution climatologist [Ken Caldeira](#), "but I think you can make a good argument that it's better than a world with lots of greenhouse gases and no geo-engineering." (END)

See Also:

- [Global Climate Engineering: Who Controls the Thermostat?](#)
- [Weaponizing the Climate: Geoengineering's Military Potential](#)
- [Geoengineering Quick-Fix Would Wreak Ozone Havoc](#)
- [New Geoengineering Scheme Tackles Ocean Acidification, Too](#)
- [Geoengineering for Animals](#)
- [Weaponizing the Climate: Geoengineering's Military Potential](#)
- [Geoengineering: Does Dumping Iron in the Ocean Sequester CO2](#)
- [Geoengineering vs. Gestureengineering](#)
- [Geoengineering Firm Sequesters \\$4 Million](#)
- [Wired Science Goes Canadian With Geoengineering](#)

WiSci 2.0: Alexis Madrigal's [Twitter](#) , [Google Reader](#) feed, and project site, [Inventing Green: the lost history of American clean tech](#); [Wired Science on Facebook](#). End

<http://blog.wired.com/wiredscience/2008/01/weaponizing-the.html#previouspost>

Wired Science

January 30, 2008

Weaponizing the Climate: Geoengineering's Military Potential

By Alexis Madrigal [✉](#) January 30, 2008 | 3:21:45 PM Categories: [Climate](#), [Military](#)



Hacking the climate to save ourselves from global warming's worst consequences is [a real possibility](#) that we've explored several times [here at Wired](#) and [elsewhere](#). But a new article in [Foreign Policy](#) by futurist [Jamais Cascio](#) takes a deep look at the geopolitical dilemmas presented by our prospective ability to intentionally alter the climate. He argues that the the "subtle, long-term aspects of geoengineering could make it appealing" to states looking for "alternative, unexpected ways of boosting their strategic power relative to competitors."

The offensive use of geoengineering could take a variety of forms. Overproductive algae blooms can actually sterilize large stretches of ocean over time, effectively destroying fisheries and local ecosystems. Sulfur dioxide carries health risks when it cycles out of the stratosphere. One proposal would pull cooler water from the deep oceans to the surface in an explicit attempt to shift the trajectories of hurricanes. Some actors might even deploy counter-geoengineering projects to slow or alter the effects of other efforts.

Cascio also notes that it would be hard to detect geoengineering efforts designed to combat global warming or its effects with those intended to harm another country's environment, which is a total bonus for military planners. He recommends that we both try to avoid a climate disaster, but just in case, also "expand the global environmental sensor and satellite networks allowing us to monitor ecosystem changes—and manipulation."

Note that Brandon has touched on some of these issues in an excellent article and blog post: [Global Climate Engineering: Who Controls the Thermostat?](#) and [China Leads Weather Control Race](#). End

<http://blog.wired.com/wiredscience/2007/10/geoengineering-.html>

Wired Science

October 9, 2007

Geoengineering Not a Free Pass to Pollute

By Brandon Keim [✉](#) October 09, 2007 | 11:46:47 AM Categories: [Climate](#), [Engineering](#)



I recently interviewed Carnegie Institution climatologist [Ken Caldeira](#) for an upcoming article about geoengineering -- the direct and intentional modification of our planet's climate.

As is so often the case, Ken was thoughtful, articulate and generous with his time, but none of his quotes made the final draft. Fortunately, we've got Wired Science to fall back on, so I'll be posting remarks from Caldeira and other scientists who are both optimistic and concerned about our power to hack the climate.

As much as you might think geoengineering is a bad thing, it's hard to see how you can claim that a world with lots of greenhouse gases in the atmosphere and no geoengineering is better than a world with lots of greenhouse gases in the atmosphere and geoengineering.

It was interesting, actually, that none of the scientists I spoke with do think geoengineering is a fundamentally bad idea. Instead they're concerned about how it's going to be done. But Ken does worry that it could be perceived as giving humanity a free pass on its current energy habits:

The prime danger of geoengineering is that there'd be a perception that there's a technological fix to large environmental problems, so therefore we don't have to worry about greenhouse gas emissions because we can engineer them away.

Of course, if we could keep pumping out greenhouse gases without making the planet warmer, why would we stop? Find out in the next post. End

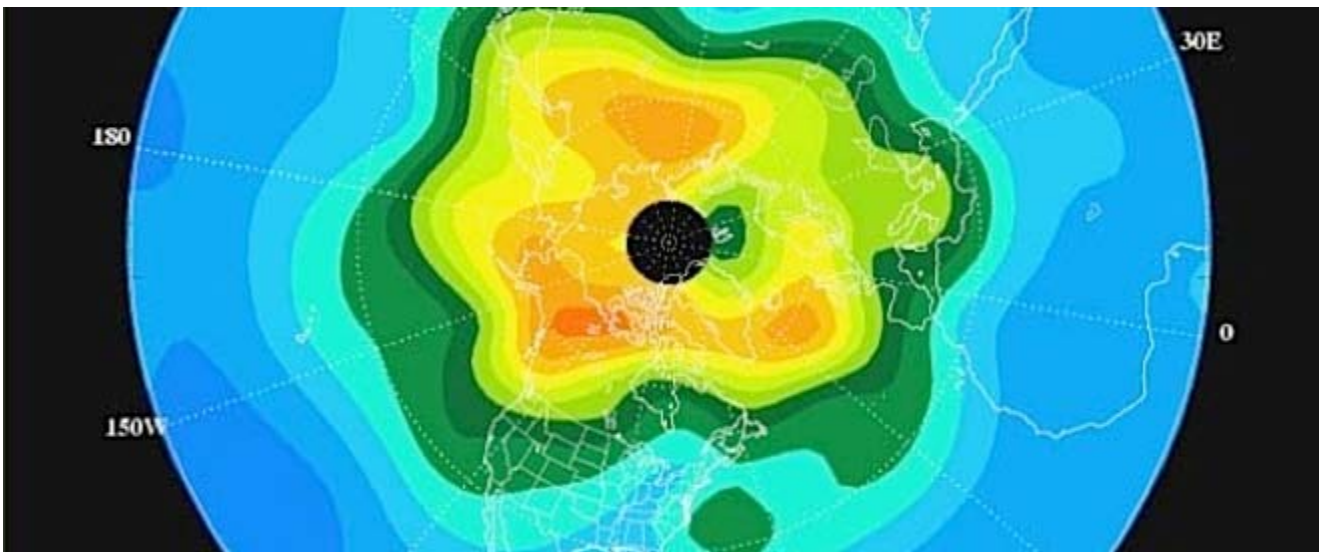
<http://blog.wired.com/wiredscience/2008/04/geoengineering.html#previouspost>

Wired Science

April 24, 2008

Geoengineering Quick-Fix Would Wreak Ozone Havoc

By Brandon Keim [✉](#) April 24, 2008 | 2:40:33 PM Categories: [Climate](#), [Engineering](#), [Environment](#)



A proposed quick fix for climate change will make our problems worse.

In a study published today in *Science*, researchers say that clouding Earth's atmosphere with sulfur particles will deplete global [ozone layers](#). Thinning would be worst at the North and South poles -- but in case turning those regions into irradiated dead zones seems a fair price for a cooled climate, mid-latitude ozone layers would also take a hit.

Some would-be [geoengineers](#) say that a steady, man-made stream of atmospheric aerosol particles could reflect sunlight and cool the planet, just as [Mount Pinatubo's eruption did in 1991](#). But the potential for unintended harm is grave. Weather patterns could shift in unwanted ways. Were the pump suddenly stopped,

backlash would be catastrophic, the effects of still-accumulating carbon dioxide emerging with climatically overnight rapidity.

Today's study, led by [Simone Tilmes](#) at the National Center for Atmospheric Research, adds ozone depletion to this litany of possible problems. The volume of sulfur particles needed to cool the planet, says Tilmes, would destroy much of the Arctic's ozone layer; delay recovery of Antarctica's current ozone hole; and cause ozone thinning in [mid-latitude regions](#) -- which span, to be nationally self-centered for a moment, the United States.

Such depletion is undesirable because the ozone layer blocks ultraviolet radiation. That's why we used to hear so much about the vanishing ozone layer, though it's hardly a concern now. Why is that? Because the global community acted as one to deal with a pressing environmental threat.

Granted, banning [chlorofluorocarbons](#) -- a once-ubiquitous, ozone-gobbling ingredient in aerosol sprays -- was a lesser task than those demanded by climate change. But it's an instructive precedent.

At the moment, humanity is best served by pursuing industrial, economic and lifestyle changes appropriate to a carbon-neutral civilization. Sulfur pumps and other global geoengineering schemes should be held in reserve until catastrophic climate change can't be otherwise avoided.

"Aerosols could cool the Earth, but also change climate circulation," said Alan Robock, a Rutgers University climate scientist, when I talked to him last October for a [story on geoengineering](#). After warning of droughts and famine, he added, "There won't be blue skies anymore. The sky will look cloudy all the time."

[The Sensitivity of Polar Ozone Depletion to Proposed Geoengineering Schemes](#) [Science]

Image: National Oceanic and Atmospheric Administration

See Also:

- [Fighting Climate Change: Engineer First, Ask Questions Later?](#)
- [What Good is Global Cooling if the Oceans Go Acidic?](#)
- [Geoengineering Not a Free Pass to Pollute](#)
- [Wired Science Goes Canadian With Geoengineering](#)
- [Geoengineering Firm Sequesters \\$4 Million](#)
- [Geoengineering: Does Dumping Iron in the Ocean Sequester CO2?](#)
- [Weaponizing the Climate: Geoengineering's Military Potential](#)

WiSci 2.0: Brandon Keim's [Twitter](#) and [Del.icio.us](#) feeds; Wired Science on [Facebook](#). End

End

July 22, 2008

<http://blog.wired.com/wiredscience/2008/07/new-geoengineer.html#previouspost>

New Geoengineering Scheme Tackles Ocean Acidification, Too

By Alexis Madrigal [✉](#) July 22, 2008 | 6:10:36 PM Categories: [Clean Tech](#), [Climate](#), [Engineering](#), [Environment](#)



A scheme to dump quicklime into the oceans to sequester more carbon in their depths is being revived by a British management consultant with backing from Shell.

First proposed back in the '90s by Exxon engineer Haroon Kheshgi ([.pdf](#)), the idea takes advantage of a series of simple chemical reactions. Limestone, at high temperatures, breaks down into carbon dioxide and quicklime, in a process that produces greenhouse gas. But dump that quicklime in seawater, and it absorbs roughly twice as much CO₂ as was released in the first reaction.

The heat required to decompose the limestone will probably come from fossil fuel, generating more CO₂, but even so, the sum of the process could be a reduction of the CO₂ in the atmosphere.

"If we discover we've overshot the amount of CO₂ the environment can cope with, the carbon-negative process I'm describing can reduce the amount of carbon dioxide in the atmosphere," said Tim Kruger, founder

of [Cquestrate.com](#), which has drawn seed funding from Shell and bills itself as developing an open source solution to climate change.

Geoengineering projections have shown that it might be possible to stop the warming of the Earth, but the workable ones have had a big problem: the oceans. While schemes like [shooting sulfur dioxide into the stratosphere](#) to deflect some of the sun's energy could cool the Earth, they don't deal directly with the problem of carbon dioxide in the atmosphere. Regardless of the greenhouse effect, CO2 buildup will lead to ocean acidification, which could [wipe out coral reefs](#) and lead to large-scale oceanic ecosystem collapse.

The quicklime scheme is different. It would go right at the heart of the CO2 buildup problem by removing the gas from the air and sequestering it in the world's oceans. It also makes the oceans more alkaline, directly combating ocean acidification.

Of course, the scale of the project would have to be eye-poppingly large. The early calculations, Kruger told [Wired.com](#), indicate that 56 billion cubic feet of limestone would be required to sequester each gigaton of carbon. Humans put out about 5.5 billion tons of carbon annually by burning fossil fuels, so a limestone offset budget could reach 300 billion cubic feet of limestone per year.

The [U.S. Geological Survey estimates](#) limestone reserves as adequate for every country in the world. This scheme, however, would require a major ramp-up in lime production from the 300 million tons now produced in the world.

The energy requirements would also be enormous. Kruger estimates that 2.7 gigajoules of energy will be required for the conversion of each ton of limestone. Multiplied out, his numbers suggest the equivalent of 10 billion barrels of oil would be necessary to generate the heat for decomposing those billions of cubic feet of limestone -- although oil would not be the fuel of choice.

Where would that energy come from in a world of rising energy prices? Kruger said that the first place would be "stranded energy," like the natural gas that is flared during oil recovery. The World Bank estimates that 3 trillion cubic feet of natural gas are flared each year. That amount of gas translates into about 3.3 billion exajoules of energy, or about one-third of the energy required to decompose enough limestone to offset all of the carbon emissions generated by human fossil-fuel use. Kruger said that [solar thermal](#) and [nuclear power](#) plants could be other heat-generating options.

Still, geoengineering experts are skeptical that securing enough energy for the process to scale up will be possible.

"The basic problem is that there is not all that much stranded energy around, so it is at best a niche opportunity," Ken Caldeira, the Stanford professor and geoengineering expert, wrote on the [Geoengineering Google Group](#).

Environmental advocates, too, worry about unforeseen deleterious effects on the ocean ecosystems near lime deposition points.

EcoGeek blogger Hank Green even [compared the scheme to a lobotomy](#) for the Earth, opining, "Pouring many tons of calcium hydroxide into the oceans in an attempt to decrease the amount of CO2 in the atmosphere is akin to shoving a rod into your brain and hoping you come out the other side a happier person."

Logistically, the idea would have to work at the global scale, but use local supplies of limestone that happen to be located near natural gas fields or solar-plant filled deserts. Kruger said that was necessary to make the process cost-effective while remaining net carbon-negative.

"The important point is to locate the process where the energy is cheap," Kruger said. "That's the only way that this is going to be economically feasible."

Whether or not the scheme works, it's likely to spark more debate about how human beings should be approaching the dual problems of ocean acidification and climate change. You can join the official debate around Kruger's idea at Cquestrate.

"I want to make sure that this succeeds, or that if it doesn't succeed, it fails quickly," he said. "Getting people to contribute information, we'll see if there is some fundamental flaw in the idea."

Image: A limestone quarry in Malta. Thanks, flickr user [DBarefoot!](#)

WiSci 2.0: Alexis Madrigal's [Twitter](#) , [Google Reader](#) feed, and [webpage](#); [Wired Science](#) on [Facebook](#).

End

<http://blog.wired.com/wiredscience/2008/02/geoengineering.html#previouspost>

Wired Science

February 18, 2008

Geoengineering: Does Dumping Iron in the Ocean Sequester CO2?

By Alexis Madrigal [✉](#) February 18, 2008 | 1:46:06 PM Categories: [AAAS 2008](#), [Climate](#), [Environment](#)



BOSTON, Mass - If we made made the globe warm, we can make the globe cool. That's the premise and promise of geoengineering, the name given to intentional attempts to alter the climate. But, the science behind most of [the current schemes](#) is relatively unproven.

Perhaps the most attempted geoengineering strategy is to put small amounts of iron into the ocean, which spawns hordes of plankton that eat CO₂ and carry it into the depths of the abyss. Or so the story goes.

[Ken Buesseler](#) a senior scientist at the Woods Hole Oceanographic Institute spoke on the science of this process, known as ocean iron fertilization at a symposium addressing the feasibility of this type of carbon sequestration at the AAAS annual meeting. His talk came a week after Planktos, one of two iron fertilization startups, indefinitely suspended its operations (as Earth2Tech cleverly put it, "[Planktos Dead in the Water](#)").

You need to know three things from Buesseler's talk, which was based on looking at twelve fertilization experiments. One, putting iron in the ocean does increase plankton numbers. Two, scientists don't really have any idea how much of the carbon the organisms eat actually drops from the surface into the depths, which is the key to sequestration. It could be anywhere from 2-50 percent, which is almost like saying, "It could work or it could not work." Three, the leading scientists in the field don't have enough confidence to say that ocean iron fertilization could have any real impact on stopping or even slow climate change.

For the full story and a ton of detail, check out these [features on ocean iron fertilization](#) straight from Woods Hole.

More generally, geoengineering is going to be harder than people think. You're talking about reversing the effects of the entire world economy's reliance on burning carbon-based substances to generate energy for moving or making. End

Geoengineering vs. Gestureengineering

July 24, 2008

<http://blog.wired.com/wiredscience/2008/07/geoengineerin-1.html#previouspost>

Wired Science

By Alexis Madrigal [✉](#) July 24, 2008 | 2:08:44 PM Categories: [Climate](#), [Engineering](#), [Environment](#), [Web/Tech](#)



We took some heat recently because of a story I wrote about [a geoengineering scheme to lime the oceans](#), which reduces their acidity and increases their ability to sequester carbon.

There was a lot of hemming and hawing in the comments about the proposed scale of the project. For example, Nils wrote (emphasis added):

As a long-time reader I know that Wired is about futuristic gadgets and such but to report on harebrained schemes as this one shows really bad judgement. To *lime the sea or any of these other monstrous ideas*, will not be part of the future.

The argument seems to be that any global-scale scheme is by definition monstrous. We're already manipulating the atmosphere and the oceans at a massive scale; we're just doing it unintentionally by living in the world that cheap energy built. Any project to tackle CO₂ accumulation has to be big! That's the only way we're going to have a meaningful impact on the problem and buy some amount of time to decarbonize an economy completely built on fossil fuels.

In fact, the real problem with the [Cquestrate](#) scheme is that it might not be able to get big enough to truly combat atmospheric CO₂ accumulation. Ken Caldeira, Stanford ecologist and geoengineering expert, got back to me today with this critique of the proposal:

Solving even 10% of the problem with this approach would mean mining 10 billion tons of calcium carbonate (limestone)... The proposed approach is energy intensive and depends on having large

amounts of cheap or free stranded energy. For both of these reasons (high amounts of mass handling, high energy input needed), I think this is likely to remain a niche player at best.

In covering the environment and energy, I see far too many ideologically pure, conceptually perfect, beautifully symbolic, and totally ineffectual ideas floated for "helping the planet." From here on, I've got a name for nice ideas that will have no impact on the world's very real environmental problems: gestureengineering.

Geoengineering might not be the best solution for combating the impacts of burning too much fossil fuel. Liming the oceans, in particular, might end up a partial solution, or out of the mix entirely, but at least it attempts to address the problem on the scale that's necessary.

Image: The [USB powered greenhouse](#). Yeah, you read that right. End

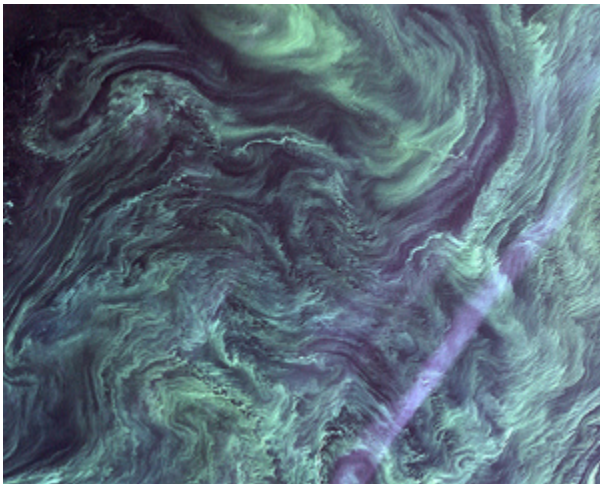
Wired Science

<http://blog.wired.com/wiredscience/2008/02/geoengineerin-1.html#previouspost>

February 22, 2008

Geoengineering Firm Sequesters \$4 Million (CLIMOS)

By Alexis Madrigal [✉](#) February 22, 2008 | 5:22:26 PM Categories: [Environment](#)



Ocean iron fertilization is probably the most well known form of intentional climate change, known as geoengineering. Last year, two companies entered the space, Planktos and Climos. Just last week [Planktos went belly up](#), but Climos is plowing ahead, revealing to CNET that they have received \$4 million in venture funding.

The move represents the latest step in efforts to commercialize the technology by selling carbon offset credits in exchange for the company depositing iron sulfate across 100 km by 100 km patches of ocean. The premise behind the practice is that iron stimulates the growth of phytoplankton, which then consume large quantities of CO₂ and take some of it into the ocean's depths, thereby keeping it out of the atmosphere.

As we reported last week, the [leading iron fertilization scientists](#), are not sure how much of the consumed carbon ends up sequestered and therefore "don't have enough confidence to say that ocean iron fertilization could have any real impact on stopping or even slowing climate change." And [a long-time climate ethicist](#) called geoengineering a "moral hazard" because ""if you promise a solution to the problem of emissions, you encourage people to continue emitting."

Nonetheless, the number of [schemes for reversing climate change](#) is likely to increase as its effects get more severe.

[Link](#) (Nice scoop, Martin!), Via [Earth2Tech](#)

Image: USGS ([Via](#))

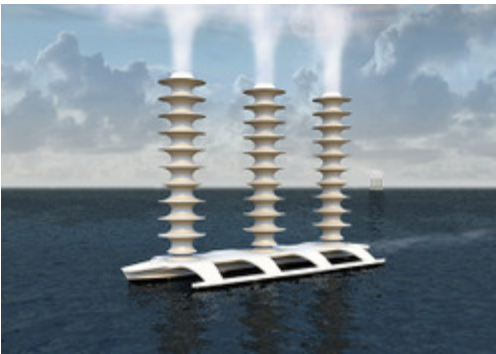
Wired Science

<http://blog.wired.com/wiredscience/2008/01/wired-science-g.html#previouspost>

Goes Canadian With Geoengineering

January 10, 2008

By Brandon Keim [✉](#) January 10, 2008 | 3:10:58 PM Categories: [Climate](#), [Engineering](#), [Environment](#)



"We should think of the planet we have now as one big experiment in hacking the Earth," I told Barbara Budd, host of CBC Radio show [As It Happens](#), during an interview about my 2007-ending [Ten Craziest Ways to Hack the Earth](#) article.

Budd conducted the interview last month, and when it didn't come out right away I figured I'd blown it. But a friend (who, coincidentally enough, is a public servant in the Inuit homeland of [Nunavut](#), and thus has a very personal stake in things like Arctic ice melts) emailed me today to say that, much to his surprise, my voice came out of his radio last night.

The audio for my portion of the show is [here](#). (WMV format; Mac users might need the free [Flip4Mac](#) to listen.) I managed not to trip too badly, and there weren't any repeats of an embarrassing moment during a recent discussion of formaldehyde-choked Hurricane Katrina refugee trailers on the [Santita Jackson Show](#).

"Talk about Paul Stewart," Jackson said, and I thought -- Paul Stewart? Who's Paul Stewart? Thank goodness for Google, which reminded me that I'd written about Stewart -- an ex-cop whose pet cockatiel nearly died from formaldehyde fumes -- in July.

No such problems on *As It Happens*, though, and I even had a chance to say something that didn't quite fit in the original article: implicit in the idea of "crazy" is a germ of inspiration. Geoengineering schemes are unorthodox, but they also reflect the plucky ingenuity that just might get humanity out of its self-made climate mess.

Note: the article also prompted a call from Dan Whaley, founder and CEO of ocean fertilization company [Climos](#). He had some pointed -- and valid -- criticisms of my ocean fertilization coverage; I'll post the interview in the next few days.

Image: John MacNeill's rendering of an [Albedo Yacht](#).

See Also:

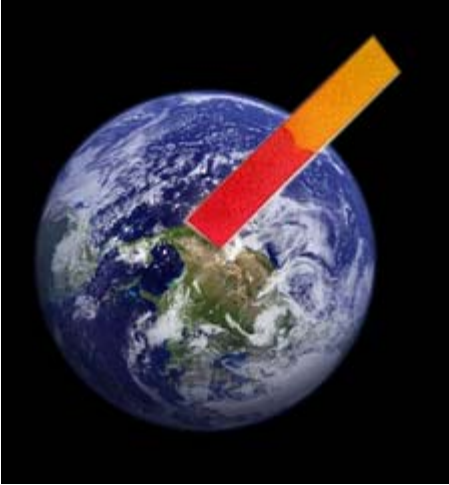
- [What Good is Global Cooling if the Oceans Go Acidic?](#)
 - [These Ships Could Save the Planet ... and Make Great Houseboats, Too](#)
 - [Pumping Particles Into the Atmosphere: A Global Warming Doomsday ...](#)
 - [Vertical Farming: Apple Store Meets Greenhouse Meets Skyscraper](#)
 - [Fighting Climate Change: Engineer First, Ask Questions Later?](#)
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October 9, 2007

<http://blog.wired.com/wiredscience/2007/10/what-good-is-co.html#previouspost>

What Good is Global Cooling if the Oceans Go Acidic?

By Brandon Keim [✉](#) October 09, 2007 | 1:27:33 PM Categories: [Climate](#), [Engineering](#)



If geoengineering allowed us to keep pumping out greenhouse gases without cooking the planet, would we have any reason to stop? Couldn't I finally desire a Hummer H3 without feeling guilty about it?

(That's right, I like the Hummer H3. I like SUV's in general. I'm not ashamed.)

According to Ken Caldeira, the answer, sadly, is no. I couldn't feel any better about the H3, not unless it ran on power generated by the sun or the wind or the goodwill of mankind. And why is this?

Well, there's basically two types of geoengineering projects: those that try to remove greenhouse gases from the atmosphere, such as iron seeding and CO₂ scrubbers, and those that offset the effects of greenhouse gases, such as adding sun-blocking particles to the atmosphere.

Caldeira, who's studied geoengineering -- and particularly iron fertilization -- extensively, thinks that only the latter class of projects would actually work. But while these might cool down the planet, there wouldn't be any less carbon dioxide. When CO₂ dissolves in water, it produces carbonic acid. If the seas turn to acid ... well, maybe you'll get rich selling all the coral you hoarded with such great foresight. But everyone else is going to be in a world of hurt.

Image: Look, the Earth is pregnant! Actually, it's supposed to be a piece of litmus paper ... um ... stuck in the ocean ... somewhere near Mexico.

See Also:

- [An Umbrella Big Enough to Cool the World](#)

- [Fighting Climate Change: Engineer First, Ask Questions Later?](#)
- [Could Huge Underwater Pipes Reverse Global Warming? - wired.com](#)
- [Geoengineering Not a Free Pass to Pollute](#)
- End

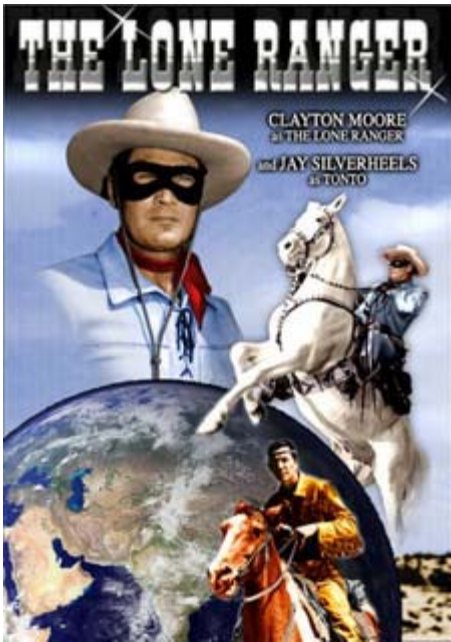
Wired Science

October 3, 2007

<http://blog.wired.com/wiredscience/2007/10/fighting-climat.html#previouspost>

Fighting Climate Change: Engineer First, Ask Questions Later?

By Brandon Keim [✉](#) October 03, 2007 | 10:00:00 AM Categories: [Climate](#), [Environment](#)



Building deep-sea pumps to grow CO₂-gobbling algae, or feeding the algae with iron and nitrogen. Sending clouds of sunlight-deflecting mirrors into orbit. Pumping carbon dioxide into vast underground reservoirs. Genetically engineering plants to absorb more greenhouse gases. Covering the Arctic with dust.

These are just a few of the large-scale engineering projects that scientists have recommended to fight global warming. They also put people who believe that climate change is both happening and reversible -- or at least slow-able -- into a quandary. Change, we believe, is coming; we believe it's likely to be catastrophic; and unless we do something big and do it quick, we're screwed -- but how do we know we're not going to make it worse?

The *Boston Globe* recently covered a conference at the Woods Hole Oceanographic Institution, where scientists gathered to discuss dumping huge amounts of iron into the ocean, thereby feeding plankton that

absorb CO2 and sink to the bottom of the sea again. A lot of scientists are skeptical; tests don't show how much carbon dioxide is actually absorbed, or whether greenhouse gases emitted by decomposing plankton offset the CO2 benefits.

But in a way, the scientific consensus doesn't matter.

While participants clashed over what the environmental impact of iron seeding will be, one clear policy problem emerged: If a company wants to seed the high seas, there is extraordinarily little that scientists - or governments - can do to stop them. Few enforceable treaties exist in international waters and if a company wanted to avoid them, it would be easy to do so.

This holds for a lot of large-scale climate engineering schemes. Regulators -- those folks we just love to hate, but run to whenever someone's about to do something scary -- just don't have much power in international waters. Or, for that matter, on quite a bit of national land. Is this a blessing? Or a curse? Should environmentalists demand strict international controls on cowboy climate fighters who'll burn the town down to save it? Or should we cheer the cowboys on as they ride to battle while regulators and scientists are still sitting on their hands, hemming and hawing until it's too late?

I really don't know. What do you think?

[Seeds of a solution](#) [Boston Globe]

Image: I have Photoshop and too much time. I admit this.

See Also:

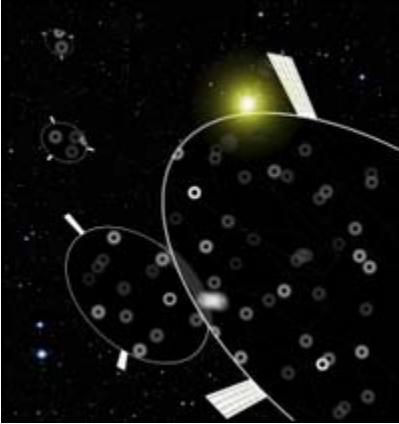
- [Could Huge Underwater Pipes Reverse Global Warming?](#)
 - [Plankton Plantations to Sequester CO2: Plant First, Ask Questions ...](#)
 - [An Umbrella Big Enough to Cool the World](#)
 - End
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April 23, 2007

http://blog.wired.com/wiredscience/2007/04/an_umbrella_big.html#previouspost

An Umbrella Big Enough to Cool the World

By Brandon Keim [✉](#) April 23, 2007 | 10:19:05 AM Categories: [Climate](#), [Engineering](#)



If covering an area the size of Arizona with [300-foot-high CO2-sucking trees](#) seemed like a radical idea, how about an atmospheric sun blocker big enough to cover most of the United States?

That's the fallback plan of Roger Angel, a University of Arizona astronomer and optics expert who proposes to launch into earth's atmosphere 16 trillion reflectors, each two feet wide and shaped like a dish, that could bounce back about two percent of the sun's light.

From an engineering standpoint, it's pretty wild, cool stuff

At every stage, Angel has proposed high-technology solutions to staggering challenges. He would launch the refractors to escape velocity with an electromagnetic coil gun, which propels a missile based on electromagnetic repulsion, then propel them to L1 with ion thrusters using argon as fuel. Once in place, each disk would sense its position using hyper-miniature cameras that detect sun and Earth. Adjustable trim tabs (tiny mirrors) catch solar radiation pressure as needed to maintain the disk's correct orientation and position in space.

If the disks had reflective mirror surfaces, they would quickly be pushed toward Earth by solar radiation pressure, so they will be designed to refract (bend) sunlight, not reflect it. Since they would make only a small deflection, the disks would evade most of the radiation pressure, Angel says. He estimates the disks could remain in orbit for at least 50 years, until their solar cells degraded and they could no longer position themselves.

... but do we really have any idea of how badly this could go wrong? Call me a Luddite, but it seems that some ideas are so conceivably catastrophic that they should be abandoned out of hand.

I mean, can you imagine if the same people responsible for the [ballistic missile shield](#) were given the job of blocking the sun? Goodbye global warming; hello ice age!

[Pies in the Sky: A Solution to Global Warming?](#) [Astrobiology Magazine]

Image: University of Arizona

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<http://blog.wired.com/wiredscience/2007/09/could-huge-unde.html#previouspost>

Wired Science

September 27, 2007

Could Huge Underwater Pipes Reverse Global Warming?

By Alexis Madrigal [✉](#) September 27, 2007 | 7:10:57 PM Categories: [Climate](#), [Sustainability](#)



It may sound like the conceit of a new movie starring Bill Pullman and Bruce Willis, but controversial scientist Dr. James Lovelock and Chris Rapley are serious about their proposal to "stimulate the earth's capacity to cure itself" via ocean tubes pumping deep water towards the surface.

Lovelock, originator of the [Gaia hypothesis](#) that the Earth itself is a type of living organism, and Rapley, director of the [Science Museum](#) in London, published their proposal in a [recent letter](#) in *Nature*. As the authors describe their scheme:

Water pumped up pipes — say, 100 to 200 metres long, 10 metres in diameter and with a one-way flap valve at the lower end for pumping by wave movement — would fertilize algae in the surface waters and encourage them to bloom. This would pump down carbon dioxide and produce dimethyl sulphide, the precursor of nuclei that form sunlight-reflecting clouds.

Sure, it sounds a little nuts. But, have you seen what venture capitalists are investing in these days? And I don't just mean [our cover story](#) on switchgrass. Financing, and lots of it, has been doled out to companies that turn sewage into fuel for your car ([EnerTech Environmental](#)), geothermal here in the US ([Vulcan Power](#): \$35 million), and biofuel producing algae ([Solazyme](#): \$5 million).

The fact is that Americans probably need to reduce our carbon footprints by [something like 90%](#) in the next 30 years. Prominent businesspeople, like Kleiner Perkins' [John Doerr](#), not just traditional environmentalists, don't think we're going to reduce emissions enough to avert disaster. If they're right, we're going to need some wild climate remediation schemes. Maybe these pipes are exactly the kind of "it's so crazy, it just might work" idea that it makes sense to float. I will confess that it does remind my internal BS detector of the cloud seeding talk that bounced around LA when I was a kid during each drought and which [apparently still has a pulse](#) as a form of weather modding.

[Gracias: [GreenTech Pastures](#).]

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