

Newsweek

The 'Geo-Engineering' Scenario

Why even a desperate measure is starting to look reasonable.

by [Sharon Begley \(/authors/sharon-begley.html\)](/authors/sharon-begley.html) November 23, 2007

After decades spent studying volcanoes, Alan Robock can list 20 reasons why humans should not try to play God with the world's climate by, well, mimicking Krakatoa. Proponents of "geo-engineering" actually like the idea because the eruptions spread sulfate aerosols and other particles throughout the planet's atmosphere, reflecting incoming sunlight. The resulting cooling might counter the global warming caused by carbon dioxide and other greenhouse gases. But that's not all sulfates do, which is where Robock's list comes in.

The particles also deplete the planet's ozone layer, which is just starting to repair itself now that ozone-shredding chemicals are banned. They cause acid rain, too. And by cooling large land masses like Asia and Africa, the heat-reflecting particles reduce the temperature difference between them and the already-cooler oceans, which could stifle the monsoons that millions of people depend on for agriculture. Because the particles block direct sunlight more than diffuse rays, they also alter the balance of radiation reaching Earth's surface, with unknown consequences for plants that can be kind of finicky about the kind of sunlight they need.

And yet ... In a sign of how dangerous global warming is starting to look and of how pitiful the world's efforts to control greenhouse gases are, even Robock—list and all—hedges his bets. Geo-engineering, allows the Rutgers University meteorologist, "might be held in reserve for an emergency."

The prospect of a climate emergency has put geo-engineering, which experts have been weighing since at least 1992, on the drawing board more than ever before. That reflects two alarming developments. The first is that some projections of climate change, far from being Cassandra-ish, are turning out to be too conservative. According to satellite measurements, sea levels rose 3.3 millimeters per year from 1993 to 2006; the Intergovernmental Panel on Climate Change had projected less than 2 millimeters. Also, the IPCC projected loss of arctic sea ice at 2.5 percent per decade from 1953 to 2006. It's actually been 7.8 percent, or 30 years ahead of projections. Greenland's ice sheets, too, are melting faster than expected. If other consequences of climate change—heat waves, storms and severe droughts like the one now gripping the southeast—also turn out to be worse than projected, the world may become desperate for a way to turn down the thermostat much faster than reducing CO₂ emissions can accomplish. (Especially since emissions are trending the wrong way. In the 1990s, they increased 1 percent a year. In the early 2000s, 3 percent a year.)

The physics of geo-engineering is not in dispute. Studies of volcanoes established what amount of particles produces how much cooling, as well as how the particles spread and how long they remain aloft (a year or two). Knowing this, it should be possible to roll back the global warming projected for 2100 enough to return the planet to its climate of 1900, Damon Matthews and Ken Caldeira of the Carnegie Institution reported in June.

The devil, however, is in the details. Injecting sulfates into the atmosphere—by lofting big,

aerosol-filled balloons or rockets—would reduce global precipitation to below the levels of 1900, their study showed, threatening agriculture. Cooling would be uneven, with some regions benefiting more than others. (What would Russia, which might benefit from global warming, do if India, which would suffer, decided to cool things down through geo-engineering?) And if the world stopped geo-engineering and therefore unmasked the effects of CO_2 that had been accumulating all along, the effect could be calamitous, as temperatures shot up 20 times faster than current warming, notes Matthews. That would be harder to adapt to than an equal rise spread over more time.

Geo-engineering cannot replace emissions reductions. The less CO_2 you have to balance with sulfates, the more effective geo-engineering would be. But reducing CO_2 emissions by, say, substituting solar and nuclear for coal will only delay climate change. *Any* net emissions will eventually tip the atmosphere into dangerous territory. If the world wants a techno-fix for climate change, it must develop ways to capture CO_2 from the air and seas.

Researchers are trying, but they have less financial support than producers of corn-based ethanol (which does next to nothing to help climate change). Still, one company is developing a system in which plastic mesh sheets blowing in the wind capture CO_2 from the air. When saturated with CO_2 , the sheets are doused with sodium carbonate, yielding harmless baking soda, after which they can be reused. Another approach would remove hydrochloric acid from seawater, which would make oceans less acidic and thus able to absorb more CO_2 . About 100 treatment plants could reduce the CO_2 entering the atmosphere by 15 percent, scientists report in the journal *Environmental Science & Technology*; 700 could offset all CO_2 emissions.

Neither method is ready to go. Without more funding, they never will be, though Richard Branson's \$25 million prize for carbon capture is an incentive. If we don't want to resort to the climate solution of last resort, it's time to stop pretending that changing light bulbs and driving hybrids will be enough to prevent dangerous climate change.