

# Geoengineering: 'Plan B' for the planet

April 29 2021, by Marlowe Hood

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The sun sets in a sky dusted with ash over Mårdalsjškull, 20 km east from Iceland's Eyjafjoell volcano, on May 5, 2010

Dismissed a decade ago as far-fetched and dangerous, schemes to tame the effects of global warming by engineering the climate have migrated from the margins of policy debates towards centre stage.

"Plan A" remains tackling the problem at its source. But the UN's top climate science body has made it clear that slashing carbon pollution won't be enough to keep Earth from overheating.

That has opened the door to a host of geoengineering schemes, from building underwater walls to shore up an Antarctic glacier the size of Britain to injecting a giant sunscreen into the stratosphere.

Here is a menu of "Plan B" geoengineering solutions, along with their potential drawbacks:

### **Direct CO<sub>2</sub> capture**

Experiments have shown it is possible to suck planet-warming carbon dioxide directly from the air, converting it into fuel pellets or storing it underground.

A company backed by Microsoft co-founder Bill Gates launched a pilot facility in Canada in 2015, and another company operates one in Iceland.

**DRAWBACK:** The technology is currently prohibitively expensive and might take decades to operate at scale.

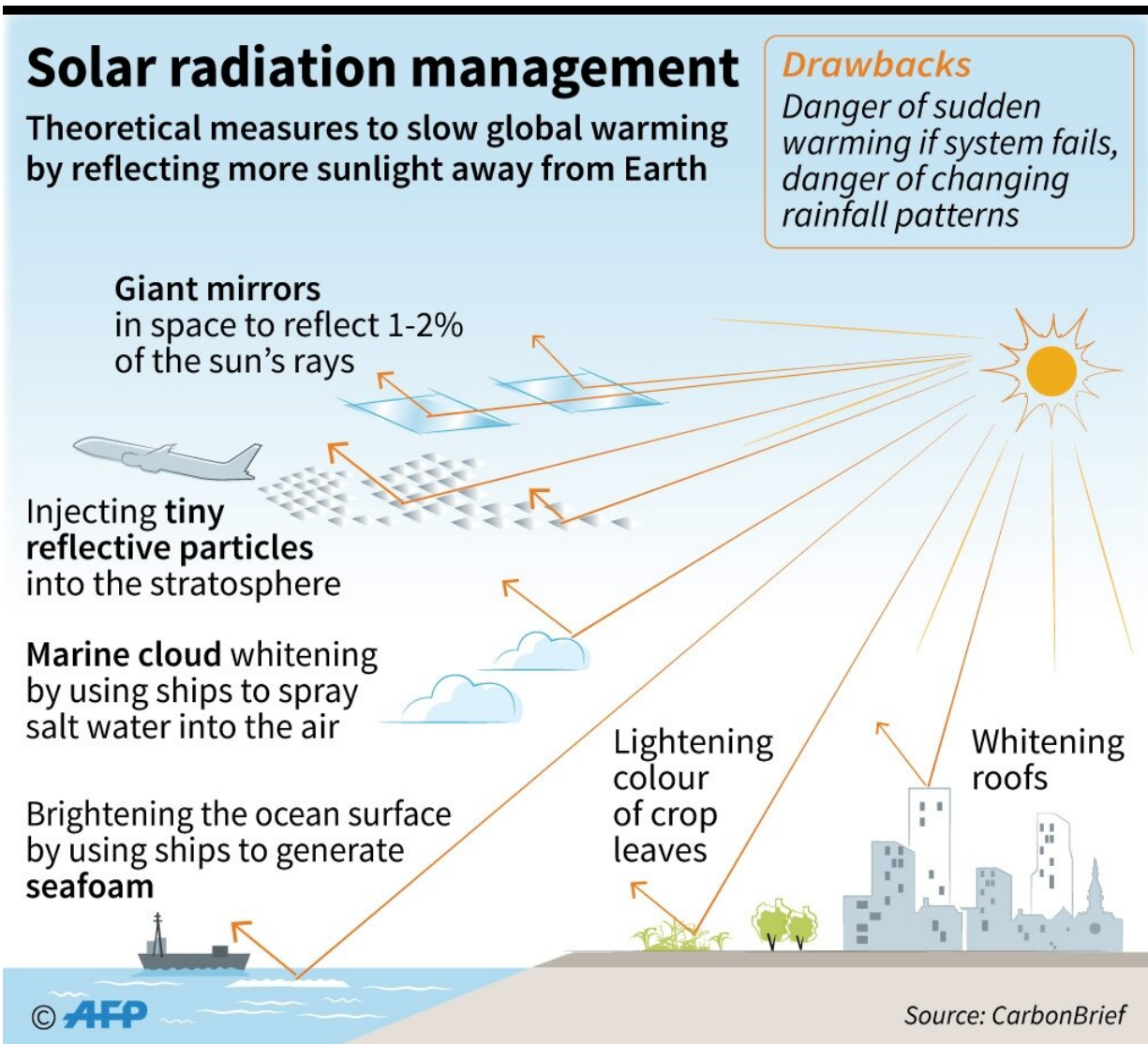
### **Solar radiation management**

Unlike other strategies, solar radiation management does not target CO<sub>2</sub>. The goal is simple: prevent some of the sun's rays from hitting the planet's surface, forcing them back up into space.

One idea is to inject or spray tiny reflective particles into the stratosphere—possibly with balloons, aircraft or through giant tubes.

Nature sometimes does the same: Debris from the 1991 eruption of

Mount Pinatubo in the Philippines lowered the planet's average surface temperature for a year or two afterwards.



Solar radiation management would slow global warming by reflecting more sunlight away from Earth

Sixty-six million years ago, a ten-kilometre wide asteroid strike threw up

so much debris that it wiped out land-based dinosaurs built for steamy tropical climes.

In April, a balloon test flight in Sweden for the Harvard-led project SCoPEX, short for "Stratospheric Controlled Perturbation Experiment", was postponed amid concerns over the implications for the environment and people in the country.

In Australia, trials of a controversial technique to spray microscopic salt crystals into the air above the threatened Great Barrier Reef to make the clouds brighter began last year.

Australian scientists say if successful and combined with other climate and protection measures this could help slow the decline of the reef.

**DRAWBACKS:** Even if it works as intended, solar radiation management would do nothing to reduce atmospheric CO<sub>2</sub>, which is making oceans too acidic. There is also the danger of knock-on consequences, including changes in rainfall patterns, and what scientists call "termination shock"—a sudden warming if the system were to fail.

## **Afforestation**

Extensive planting of trees could significantly slow the concentration of CO<sub>2</sub> in the atmosphere, which currently stands at more than 510 parts per million, 50 percent more than 150 years ago.

**DRAWBACK:** Even if deforestation could be reversed—more than 100,000 square kilometres of tropical forests have disappeared each year since 2013—the huge number of trees needed to put a dent in CO<sub>2</sub> emissions would clash with food and biofuel crops.

## BECCS

Bioenergy with carbon capture and storage (BECCS) marries a [natural process](#) with a high-tech one.

The first step is to plant rapeseed, sugarcane, corn or "2nd-generation" biofuel crops such as switchgrass, which pull CO<sub>2</sub> from the air while growing. The second step is while burning the harvested plants for energy to sequester the CO<sub>2</sub> produced.

In theory, the result is less CO<sub>2</sub> in the atmosphere than when the process started. Virtually all climate change models projecting a future consistent with the Paris Agreement's temperature targets assume a key role for BECCS.

**DRAWBACK:** Studies calculate that up to twice the area of India would need to be given over to biofuels, putting BECCS in conflict with food crops. Such schemes would also require vast amounts of fresh water.





Tree planting projects - like this one to reforest the Sahel - are among ideas put forward to reduce CO<sub>2</sub>

## **Ocean fertilisation**

Microscopic ocean plants called phytoplankton gobble up CO<sub>2</sub> and drag it to the bottom of the ocean when they die. Their colony size is limited by a lack of natural iron, but experiments have shown that sowing the ocean with iron sulphate powder creates large blooms.

**DRAWBACKS:** Scientists worry about unintended impacts. Die-offs of plankton, for example, use up oxygen, which could create massive "dead zones" in the oceans, something already on the rise.

## Enhanced weathering

Natural weathering of rocks removes about one billion tonnes of CO<sub>2</sub> from the atmosphere every year—about two percent of total man-made CO<sub>2</sub> emissions.

Spreading a powdered form of a greenish iron silicate called olivine across certain landscapes can mimic that process, experiments have shown.

**DRAWBACKS:** It would be expensive to mine and mill enough olivine to make a difference.

## Biochar

Biochar is charcoal made by heating plant waste—rice straw, peanut shells, wood scraps—over long periods in low-oxygen conditions. It can store CO<sub>2</sub> for long periods, and also enriches soil.

**DRAWBACK:** The scientific jury is still out on how quickly this method could be scaled up, and on the stability of biochar used as a fertiliser.

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