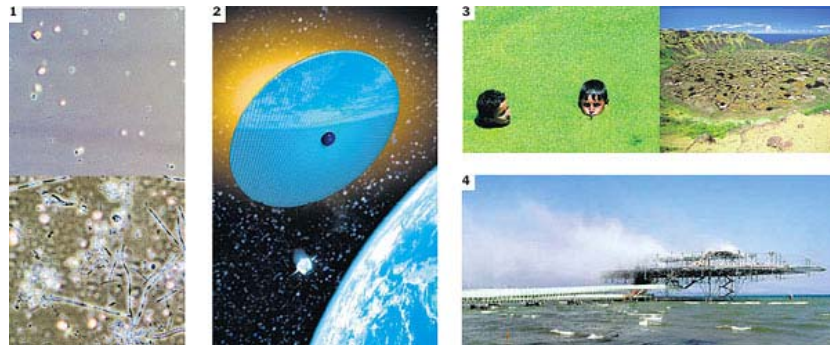




THE ENERGY CHALLENGE | EXOTIC VISIONS
How to Cool a Planet (Maybe)



Photos: 1. Dr. Kenneth Coale/Moss Landing Marine Laboratories; 2. Victor Habbick Visions/Photo Researchers; 3. Left, Rina Castelnuovo for The New York Times; right, David Nunuk/Photo Researchers; 4. Diller & Scofidio

PROBLEMS AND EXPERIMENTS 1 Before-and-after images of plankton in an experiment that increased iron in the Pacific. 2 A large mirror that would shield Earth from the Sun. 3 A reservoir in a Palestinian village that is now covered with algae, potentially capturing carbon dioxide from the atmosphere, and a crater lake caused by a volcanic eruption. 4 An example of cloud production, the Blur Building by the architects Elizabeth Diller and Ricardo Scofidio, at the Swiss Expo in 2002.

By WILLIAM J. BROAD
Published: June 27, 2006

In the past few decades, a handful of scientists have come up with big, futuristic ways to fight global warming: Build sunshades in orbit to cool the planet. Tinker with clouds to make them reflect more sunlight back into space. Trick oceans into soaking up more heat-trapping greenhouse gases.

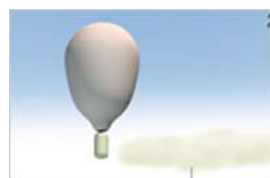
Their proposals were relegated to the fringes of climate science. Few journals would publish them. Few government agencies would pay for feasibility studies. Environmentalists and mainstream scientists said the focus should be on reducing greenhouse gases and preventing global warming in the first place.

But now, in a major reversal, some of the world's most prominent scientists say the proposals deserve a serious look because of growing concerns about global warming.

Worried about a potential planetary crisis, these leaders are calling on governments and scientific groups to study exotic ways to reduce global warming, seeing them as possible fallback positions if the planet eventually needs a dose of emergency cooling.

"We should treat these ideas like any other research and get into the mind-set of taking them seriously," said Ralph J. Cicerone, president of the National Academy of Sciences in Washington.

Multimedia



Graphic: Science Fiction? Maybe Not

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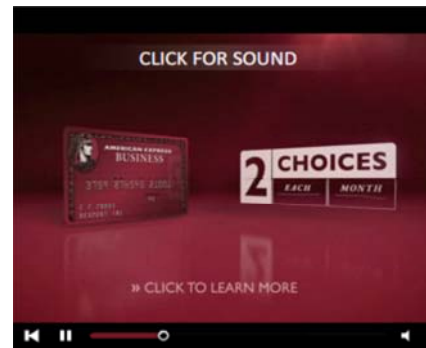
Articles in this series are examining the ways in which the world is, and is not, moving toward a more energy efficient, environmentally benign future.

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The plans and proposed studies are part of a controversial field known as geoengineering, which means rearranging the earth's environment on a large scale to suit human needs and promote habitability. Dr. Cicerone, an atmospheric chemist, will detail his arguments in favor of geoengineering studies in the August issue of the journal *Climatic Change*.

Practicing what he preaches, Dr. Cicerone is also encouraging leading scientists to join the geoengineering fray. In April, at his invitation, Roger P. Angel, a noted astronomer at the [University of Arizona](#), spoke at the academy's annual meeting. Dr. Angel outlined a plan to put into orbit small lenses that would bend sunlight away from earth — trillions of lenses, he now calculates, each about two feet wide, extraordinarily thin and weighing little more than a butterfly.

In addition, Dr. Cicerone recently joined a bitter dispute over whether a Nobel laureate's geoengineering ideas should be aired, and he helped get them accepted for publication. The laureate, Paul J. Crutzen of the Max Planck Institute for Chemistry in Germany, is a star of atmospheric science who won his Nobel in 1995 for showing how industrial gases damage the earth's ozone shield. His paper newly examines the risks and benefits of trying to cool the planet by injecting sulfur into the stratosphere.

The paper "should not be taken as a license to go out and pollute," Dr. Cicerone said in an interview, emphasizing that most scientists thought curbing greenhouse gases should be the top priority. But he added, "In my opinion, he's written a brilliant paper."

Geoengineering is no magic bullet, Dr. Cicerone said. But done correctly, he added, it will act like an insurance policy if the world one day faces a crisis of overheating, with repercussions like melting icecaps, droughts, famines, rising sea levels and coastal flooding.

"A lot of us have been saying we don't like the idea" of geoengineering, he said. But he added, "We need to think about it" and learn, among other things, how to distinguish sound proposals from ones that are ineffectual or dangerous.

Many scientists still deride geoengineering as an irresponsible dream with more risks and potential bad side effects than benefits; they call its extreme remedies a good reason to redouble efforts at reducing heat-trapping gases like carbon dioxide. And skeptics of human-induced global warming dismiss geoengineering as a costly effort to battle a mirage.

Even so, many analysts say the prominence of its new advocates is giving the field greater visibility and credibility and adding to the likelihood that global leaders may one day consider taking such emergency steps.

"People used to say, 'Shut up, the world isn't ready for this,' " said Wallace S. Broecker, a geoengineering pioneer at Columbia. "Maybe the world has changed."

Michael C. MacCracken, chief scientist of the Climate Institute, a private research group in Washington, said he was resigned to the need to take geoengineering seriously.

"It's really too bad," Dr. MacCracken said, "that the United States and the world cannot do much more so that it's not necessary to consider getting addicted to one of these approaches."

Martin A. Apple, president of the Council of Scientific Society Presidents, said of geoengineering at a recent meeting in Washington, "Let's talk about research funding with enough zeroes on it so we can make a dent."

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Andrew C. Revkin contributed reporting for this article.

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