Geoengineering Explained: Pros and Cons of Geoengineering

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As the Earth faces increasing climate change, some policymakers, climate scientists, and members of the Intergovernmental Panel on Climate Change (IPCC) have suggested novel methods to reverse harmful trends. These climate intervention methods are known as geoengineering techniques.

What Is Geoengineering?

Geoengineering is a form of climate engineering or human climate intervention that seeks to alter long-term trends in Earth's climate. Many of today's geoengineering proposals focus on two key areas: reversing global warming and atmospheric carbon dioxide removal. Theoretically, however, large-scale geoengineering initiatives could seek to alter any aspect of Earth's ecosystems or climate system, potentially addressing the effects of global warming, ocean acidification, melting arctic ice, or volcanic eruptions that break through the Earth’s surface.

What Is the Purpose of Geoengineering?

Most geoengineering projects exist to reverse negative effects of industrial civilization on Earth's climate. For instance, Earth's atmosphere and stratosphere are taking on increased levels of greenhouse gas emissions such as carbon dioxide (CO_2) and methane (CH_4) due to deforestation and burning fossil fuels. To address atmospheric carbonization, humans can engage in resource conservation and carbon emissions reduction, yet geoengineering schemes go a step further by seeking to actively remove greenhouse gasses from the atmosphere and stratosphere.

2 Primary Types of Geoengineering

Current geoengineering technologies mostly focus on two categories: solar geoengineering and carbon capture.

1. 1. **Solar geoengineering**: Also known as albedo modification or solar radiation management (SRM), this form of geoengineering seeks to block incoming solar radiation and send it back out to space. Doing so will theoretically reduce global temperatures. Solar geoengineering research has focused on marine cloud brightening (where clouds are sprayed with seawater), stratospheric aerosol injections (where added sulfate molecules in the stratosphere would reflect incoming light), and launching giant mirrors into orbit to reflect sunlight. Simpler methods with greater feasibility include painting roofs and streets light colors so as to reflect sunlight rather than absorb it.
2. 2. **Carbon capture**: Carbon geoengineering seeks to remove carbon-based greenhouse gasses from the atmosphere and stratosphere. It goes beyond simple emissions reduction and enters the realm of negative emissions. Some carbon capture methods are relatively simple, such as reforestation, afforestation (introducing trees to a region where they did not previously grow), and forest restoration to capture carbon in the form of biomass. Other carbon geoengineering methods involve pulling carbon dioxide from ambient air and storing it in pressurized underground caverns. Still other carbon research programs have studied the prospect of iron fertilization, wherein iron is scattered across the ocean to stimulate the growth of carbon-absorbing phytoplankton.

3 Advantages of Geoengineering

Geoengineering, in the form of both carbon dioxide removal (CDR) and solar radiation management (SRM), stands to offer many climate impacts.

1. 1. **It aims to actively reverse climate damage**. When it comes to climate change, methods like emissions reduction and forest conservation serve as forms of mitigation, but they do not actively reverse damage done by human behavior. Proponents of geoengineering argue that the technology could offer a true reversal.
2. 2. **Its results could be rapid**. Certain geoengineering methods, such as seeding the ocean with iron particles or pumping aerosol injections into the atmosphere, could lower average temperatures on the planet faster than could be achieved by changing human behaviors.
3. 3. **It could create jobs**. Geoengineering research and geoengineering initiatives create jobs for scientists, engineers, and other workers.

3 Disadvantages of Geoengineering

Geoengineering is a new concept, and many of its initiatives only exist on theoretical or small-scale terms. This poses certain drawbacks.

1. 1. **It introduces unknown climate risks**. Geoengineering projects could alter Earth systems in unintended ways. Since the side effects of iron seeding or aerosol injections cannot be fully known unless put into practice, these initiatives present moral hazards to scientists.
2. 2. **It may be ineffective**. Geoengineering projects involve unproven technologies. Until these geoengineering technologies are thoroughly proven to work without deleterious side effects, they must be regarded with skepticism.
3. 3. **It may be financially unfeasible**. Some forms of geoengineering, such as reforestation, are comparatively affordable and easy to implement. Others require enormous government investment and public will.