Environmental policy through climate engineering?

Gawel, Erik

UFZ Discussion Papers

Department of Economics

16/2014

Environmental Policy Through Climate Engineering?

Erik Gawel

July 2014

Publisher:
Helmholtz Centre for Environmental Research - UFZ
Permoserstr. 15
04318 Leipzig

ISSN 1436-140X

Revised version of the contribution to the e-book reader

Mohr, R. / Utikal, H. (eds.): Future Chemistry: Glimpses into the World of Tomorrow, FAZ Institute 2013, pp. 66-71.

Environmental policy through climate engineering?

Erik Gawel

For years, humans have been trying to stabilize the world's environment by lowering the amount of greenhouse gases that their societies pump into the air. In 1992, this approach was even incorporated into the UN Framework Convention on Climate Change. But because this strategy failed to produce the desired results so far, technology-based processes designed to save the environment have emerged as a popular new weapon in the climate-protection arsenal. The question is: Are such climate-engineering efforts a viable environmental policy option? And can they serve, at the very least, as the ultima ratio if all other efforts to stave off climate change fail?

From the dawn of the human race, people have believed that the environment must be adapted to meet human needs and that they must take command over the forces of nature to achieve this end. As humans honed their technological skills, geo-engineering efforts began to take shape. Unfortunately, earlier geo-engineering attempts produced environmental and economic disasters. Today, the Aral Sea stands out as both a forewarning and a symbol of the human hubris that characterizes efforts to tame the forces of nature. Once the world's fourth-largest lake, the Aral Sea is now a desert wasteland created by the massive diversion of the waterways that once fed it. Against this backdrop, climate engineering was an environmental black sheep for years. In recent years, though, the debate about it has significantly intensified, even becoming a topic addressed in German research policies.

Climate engineering is usually defined as the systematic large-scale and technology-supported effort to manage the world's environment for the purpose of affecting climate patterns. Typically, this work involves technical efforts to offset the effects of greenhouse gas emissions caused by humans. The economic processes that entail the emissions remain unchanged and society avoids paying high mitigation or adjustment costs. Climate engineering can be broken down into two elementary approaches:

1. **Solar radiation management**: The techniques employed by solar radiation management are designed to reduce the amount of sunlight hitting the Earth and to increase the deflection of solar rays as a way of retarding the rise in global temperatures. In one potential approach, mirrors placed outside the Earth's atmosphere would be used to dim the intensity of sunlight. In a contrasting solution, the Earth's ability to reflect sunlight, a phenomenon known as planetary albedo, would be expanded as a way of cutting the amount of heat that the Earth absorbs and of reversing the heating process. This could be achieved in part by using white rooftops on such places as factories, halls, barns and houses. These light-colored surfaces would reflect more sunlight than traditional dark rooftops do. But these approaches have one common weakness: They cannot do anything about the concentration of greenhouse gases in the atmosphere and these gases' impacts, including the acidification of seas. Admittedly, solar radiation management could have a relatively fast cooling effect on the Earth if an environmental disaster were about to strike. But such a solution comes with its own set of serious risks, including damage to the ozone layer and a threat to the well-being of humans, flora and fauna.

2. **Carbon dioxide removal**: In this process, greenhouse gases already released into the atmosphere would be removed by using technical or stimulated natural processes. These processes could include air filtering, ocean fertilization or even forest-protection steps. Because these methods are applied directly to the presumed causes of climate change, the uncertainties and side effects associated with them are considered to be rather manageable. In contrast to solar radiation management, efforts to remove carbon dioxide will take many years to have the desired effect.

Climate engineering as an option in environmental policies

The fundamental problem of (global) efforts to protect the environment by reducing greenhouse gas emissions is that a large number of nations around the world must join forces. By contrast, climate engineering conducted as part of solar radiation management can be carried out by high-technology countries working unilaterally, something that can appear to be a frightening political prospect for the rest of the world (Table 1). Climate engineering conducted with the help of solar radiation management also poses high, potentially irreversible and long-range risks.

The relationship between the climate policy approaches of mitigation and adaptation is frequently described as "complementary," while climate engineering is portrayed as taking on a "supportive" role. As a result, steps taken as part of solar radiation management could indeed help get through the critical phase of stabilizing the amount of carbon in the atmosphere until they would no longer be necessary. But the political repercussions of such steps are usually ignored in this process. The reason is easy to see: The mere existence of such climate management options could be viewed as an insurance policy against environmental damage, counteracting all efforts to encourage people to avoid doing the very things that stoke the heating process in the first place. Thanks to this new carefree attitude, climate engineering could even become the driving force behind new increases in emissions.

Technical climate management could result in a scenario that can only be described as a "balance of terror." Here, humans would place all of their environmental policy chips on solar radiation management, which would have to thwart the potentially disastrous effects caused by the steady rise in the concentration of greenhouse gases by carrying out continuous, systematic activities. But, given the unilateral aspect of this approach, who should assume both the political mandate and the responsibility? This is the core political and legal problem of climate engineering. For this reason, technological climate management can only be seen as an ultima ratio. But this option should not weaken efforts to lower emissions. The big question is the extent to which the mere awareness about the options of climate engineering will make their application more probable, if not imperative.

Table 1: Climate policy strategy triad with action characteristic

		Mitigation	Adaption	Climate Engineering as Solar Radiation Management
Actors (responsible party)		Originator	Aggrieved party	Undefined
Need for cooperation (number of stakeholders required)		Multilateral	Unilateral	
Specific Effectiveness (impact of „small" measures)		Low	High	
Relative costs		High		Low
Spatial incidence of benefits		Global (public good)	Regional	Global (public good)
Spatial incidence of costs		Regional		
Risks		Low	Low	High (public good or public bad?)
Conflict potential	National	High	Low	Low
	International	Low	Low	High
Temporal incidence of costs and benefits		High initial costs, late benefits	Simultaneity of costs and benefits	Continuous, increasing costs with simultaneous benefits
Maturity level (availability)		High		Low
Global Governance Key Issue		Establish incentives for voluntary cooperation by „many"	--	Regulate authority to decide over targets and measures

On the other hand, climate engineering is much more than an easy-to-apply alternative to prevention and adjustment: If global warming has already exceeded threshold levels or has set off self-reinforcement effects in the climate system whose ultimate impact will be seen sometime later, disastrous environmental impacts could occur in the future, and these impacts could no longer be reversed by reducing emissions or even by adjusting to climate change. In this case, it would be time to pull the emergency brake known as climate manipulation.

The risks

Naturally, the potential risks have been intensely discussed. Points being addressed in these debates include the unexplained effectiveness of individual steps (will they achieve the intended result?) as well as the many (possibly unknown) environmental and geophysical side effects to the Earth. Because the environment recognizes no borders and climate engineering could have different effects in various regions of the world, far-reaching international tension could occur.

Furthermore, consideration must be given to the question of whether efforts like solar radiation management can indeed be performed safely. After all, the margin of error is extremely small. A failure in solar radiation management – including technical malfunctions, a lack of financing or human error – could have a catastrophic impact. Sharp temperature spikes that could produce disastrous results could occur within a short period of time. Such a failure-prone, but relatively low-cost approach to climate engineering could also be misused. Consider for a moment that individual countries, or even wealthy individuals for that matter, were able to use technology to manipulate the environment. This would create new security risks that would have to be addressed.

Ensuring justice

A globally unauthorized and unilateral application of climate engineering, a process that could help the (industrial) practitioner avoid complying with costly emission-cutting regulations while having a powerful negative impact on other regions of the world would give rise to a completely new set of questions regarding climate justice.

The application of climate engineering as a form of solar radiation management will produce regional winners and losers – through regionally different climate impacts as well as through possible side effects. In addition, there will naturally be many different views regarding just what the "right" global climate actually is. For this reason, the real key question involving climate engineering lies in solving the global governance problem: Who should be authorized under which conditions to set climate engineering goals, select the appropriate instruments and then put them to use? The creation of a functioning international climate engineering regime will pose a huge challenge for the world community. Countries must agree on the climate they want as well as spread out the costs of technical implementation and the presumed or proven burden created by environmental impacts. They would have to ensure that attacks on the system could be countered and resolve liability issues. In addition, the system would have to smoothly function for many centuries to come – even as risks rose.

Conclusions

Even though it is frequently said that the climate engineering strategy has yet to reach technical and institutional maturity and that it poses both many and extensive risks, and even though environmental policies remain committed to emission-cutting efforts, an astonishing international preliminary action on the issue has already been amassed.

This brings to mind a play titled "The Visit" by the Swiss writer *Friedrich Dürrenmatt*: In this story, an matronly woman returns to the small town where she grew up and makes the community an indecent proposal: She will give the town a huge sum of money in return for the killing of her former unfaithful lover. Outraged, the town rejects the offer. But it rather obviously goes about the job of preparing for this very eventuality and does things that make it even more likely. The end to the story is well known. Given the potential impact of climate engineering, it is not surprising that the preliminary question of whether this environmental option should actually be researched at all as a way of improving the public's awareness of this strategy is highly controversial.

In this new age of Anthropocene, in which the human race has had an impact on nearly every geo-economic process, the vision of a man-made climate appears to represent a temporary climax of humans' presumed domination of nature. In light of the international inability to systematically cut emissions, environmental policies are painting themselves into a crowded corner. To the right, there is the Scylla of potentially irreversible latent effects of global warming. To the left, there is the Charybdis of potentially uncontrollable and highly combustible emergency steps to halt encroachment into the Earth system. In this unpleasant situation, the pressure regarding fall-back technologies in emergency situations may become so intense that consideration of them will appear to be unavoidable. The seal on the Pandora's box of environmental policy may have already been broken. In mythology, the complete opening of this box did bring trouble. But after all, it also offered hope.