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The Political Dilemma of Climate Engineering

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White clouds, mirrors in space, artificially created forests, factories extracting CO_2 from the sky: techniques to manipulate the climate and limit climate damage are gaining popularity, but they raise many political questions. Who determines whether, how, and where people are allowed to meddle with the climate, and who is responsible for the consequences? Utrecht University researcher Jeroen Oomen argues that it is time for a democratic debate to scrutinise this process.

In autumn 2019, more than seven million people worldwide demonstrated with the same message: the political elite has failed to halt climate change, worsening the prospects of the next generation.

According to the demonstrators, politicians have neglected their primary task. There is still no significant climate policy, or at least no significant reduction in global greenhouse gas emissions. To climate scientists, this is also one of the greatest ever political failures, one which could result in hundreds of millions of deaths or even the collapse of human civilisation. Panic over the state of the environment amongst climate scientists has led many to increasingly speculate about ways to tackle the problem other than politics. A growing group is looking for solutions in the form of geoengineering or climate-engineering: high-tech interventions to counteract climate change. Climate change, they argue, may result in so much damage in the 21st century that only risky technological interventions – despite their unexpected and undesirable side-effects – can mitigate the harm.

Climate manipulation

While the focus on climate engineering is steadily growing, most people have never heard of it. Politicians and even scientists often have no idea about the proposals circulating. It is significant that no Dutch word has been found so far to describe these technologies. A commonly used translation is “climate manipulation”. Although the negative connotations to the word “manipulation” make it too strong a term, this is effectively what it amounts to: actively manipulating the environment to combat the worst outcomes of climate change.

Many different technologies are being studied, from mirrors in space, a stratospheric veil of sulphur or chalk particles, to the whitening of clouds, plants, and infrastructure.

This manipulation comes in two forms. At their extremes, one form attempts to counteract the causes of climate change while the other seeks to counteract its symptoms. The former is called “carbon dioxide reduction”. It is founded on a simple observation: if humankind can raise the average temperature by adding greenhouse gases to the atmosphere, so can they lower it by removing greenhouse gases. Examples include building machines and factories to extract CO_2 from the air, the (re)forestation of huge areas of land, and fertilising the ocean to increase

the amount of CO_2-capturing algae.

The second form of manipulation, symptom-fighting climate engineering like solar radiation management techniques, tries to manipulate the climate system to limit the effects of high greenhouse gas concentrations and keep these to a minimum. This is no more than a simple physics calculation. Due to the increase in CO_2 in the atmosphere, more energy remains in the climate system, causing the temperature to rise. If the supply of this solar energy can be slowed down or if the output of this energy can be stimulated, then average temperatures can be kept artificially low despite increasing amounts of CO_2. Solar radiation management techniques increase the reflectivity of the earth so that less solar energy remains in the climate system. Many different technologies are being studied, from mirrors in space, a stratospheric veil of sulphur or chalk particles, to the whitening of clouds, plants, and infrastructure.

Weighing our options

Are these interventions desirable? Are they in any way a feasible solution to the climate problem? Can they even be carried out?

The simplest answer is no. Several studies have shown that the capture and storage of CO_2 cannot realistically make up for unrestrained global emissions. The proposed methods of CO_2 capture and storage have their own, considerable disadvantages. For example, direct air capture is expensive and extraordinarily energy-intensive – not an option if these machines do not run on sustainable energy and not economically viable with current CO_2 prices. Bio-energy carbon capture and storage(the cultivation of biomass as fuel and the immediate capture of its emissions) remains controversial due to uncertainty over how many climate benefits this method actually yields and at what expense. Additionally, questions about bio-energy carbon capture and storage persist: might the cultivation of biomass for capture and storage, for example, take the place of crop cultivation? Wouldn't this mean the climate policy of rich countries being implemented at the expense of poor communities in the Global South? It is also worth keeping in mind that storing CO_2 is not easy.

Other CO_2 reduction techniques such as ocean iron fertilisation are risky because they can disrupt entire ecosystems. The same can be said about large-scale reforestation (planting trees in an area where they were felled). Reforestation can be disruptive considering that new ecosystems emerge in long periods succeeding deforestation. Both reforestation and afforestation (planting trees in an area which previously had none) can affect nutrient and water cycles.

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Furthermore, limiting the influx of solar energy into the climate is not a solution. Solar radiation management (the artificial cooling of the earth) is surrounded by controversy and uncertainty. Intervening in the climate system can have major consequences that cannot be accurately predicted. Precipitation patterns – and especially monsoon rains – can get disrupted, resulting in massive flooding and drought locally. While some parts of the earth may cool down, others might not. These uncertain and unequal effects, especially in combination with the question of who controls the development and implementation of such a technology, could lead to great political tensions. It was for

good reason that Edward Teller, the intellectual father of the hydrogen bomb, once argued that conflict about the manipulation of the weather would probably cause the last war on Earth.

Yet we must ask ourselves seriously whether these major disadvantages outweigh the expected harm from climate change. Or, as the many advocates of research into climate engineering argue, we will have to weigh up a world with extensive climate change against a world with less climate change but with the disadvantages of climate engineering. What is worse, and who decides this?

From science to policy

There is no doubt that climate engineering is problematic, but in theory – and this is still an open question – some of these technologies, or a combination of them, may limit climate harm. In global politics, climate engineering is already beginning to play a major, if almost unnoticed, role. Speculative assumptions about significant CO_2 capture are part of almost all major climate projections by the UN's Intergovernmental Panel on Climate Change (IPCC). The politically dominant goals of 1.5 and 2 degrees Celsius of warming are realistically only feasible with considerable CO_2 capture and storage. In the recent IPCC report about the 1.5 degrees target, for example, four possible scenarios to keep warming below 1.5 degrees were developed – all of which are to a greater or lesser extent reliant on CO_2 capture and storage. Solar radiation management is even explicitly mentioned, with the proviso that there are still significant political and moral questions to be answered. The International Organisation for Standardisation, an influential consultancy for large companies, now presents solar radiation management as a potential cornerstone in its climate policies. The increase in political appeal raises the question of how we – as politicians, scientists, policymakers, or citizens – take a stand against these risky technologies.

While technological and scientific uncertainties constitute serious limitations to the potential of climate engineering, embedding the new technologies in the real world is the most fundamental question.

First, there must be a serious debate that includes all stakeholders. The most important questions about carbon dioxide reduction and solar radiation management are political and moral in nature. While technological and scientific uncertainties constitute serious limitations to the potential of climate engineering, embedding the new technologies in the real world is the most fundamental question. Who determines how the technology is implemented? How is this control regulated? And how are CO_2 capture or solar radiation management related commercially and politically? Questions about intergenerational ethics, such as whether it is acceptable to burden future generations with climate obligations arising from current policy decisions and the risk that climate manipulation reduces the willingness to implement rigorous climate policy, also play a major role. A mere technological fix cannot save the climate; a fundamental reduction in CO_2 emissions, for example, remains necessary to achieve the Paris Agreement climate goals.

There is no clear answer to these questions. They are therefore profoundly political: what kinds of climate policy are acceptable, and under what conditions? We can, however, base our debates around a number of principles. The Oxford Geoengineering Programme, set up at Oxford University to engage with society about geoengineering, has developed a five-part rule of thumb – better known as the Oxford Principles– for climate modification:

1. Climate modification must be regulated as a public good, which means that commercial interests must never come first;

2. The public must be involved in decision-making on these technologies;
3. Research into these technologies must be made known to a wide audience, and so must the results;
4. There must be independent assessments about the impact of the technologies;
5. Policies must be made for the implementation of the technologies.

These five principles should serve as the foundation for any debate about climate manipulation. They all stem from the same central conviction: climate manipulation must be at the service of as many people as possible and must be organised as such.

Democratising geoengineering

So long as there is no significant climate policy, the appeal of climate engineering will continue to grow. But that will make it no less controversial. On the contrary, these risky interventions in the climate will remain highly problematic to many people and not in line with the role they see reserved for humans on Earth. Political considerations about land use and power, for example, are inherent to the climate debate and do not suddenly disappear due to technological interventions. As a society, we often tend to relegate technological developments to the realm of science or entrepreneurs. But if we believe that climate manipulation should serve all people in a democratic fashion it is immediately clear that climate engineering is primarily a political question. This brings a number of further requirements to light.

As technologies differ among themselves, it is impossible for climate engineering to develop a one-size-fits-all policy. Solar radiation management measures such as the stratospheric chalk veil immediately raise questions about democracy: can a technology that can only, realistically, be controlled in a technocratic manner be democratic? Can we imagine that international decision-making on this issue will reflect the wishes and beliefs of a wide range of nations and communities? This requires a profound political and social debate as to which authority has the legitimacy to judge in this case. On the other hand, CO_2 reduction measures require openness about their effects on global power relations. Interventions such as (re)afforestation and bio-energy carbon capture and storage occasion a reflection on access to land as well as relationships between local communities and international politics, considering how the land needed for these interventions is already being used. The tacit assumption that negative emissions are part of climate policy also needs to be discussed more openly, as these assumptions can delay the necessary changes to the energy system.

A first goal must be the dissemination of knowledge – and the political implications associated with it – to politicians and citizens, rather than limiting it to scientists and top diplomats.

In short, political considerations should guide the development of these technologies. A first goal must be the dissemination of knowledge – and the political implications associated with it – to politicians and citizens, rather than limiting it to scientists and top diplomats. Secondly, while these technologies may not lead to laxer climate policies, it must be made clear how they are already affecting climate policy. Thirdly, there must be a consistent search for opportunities to stimulate public debate on this, centring political and moral questions rather than the scientific facts. This starts with politicians taking a stand, scientists providing their complete insights, environmental organisations campaigning, and political parties stimulating the debate. In some countries, politicians have already taken a stand. Both the UK government and parliament, for example, have rallied around the Oxford Principles. In the Netherlands, Green parties like GroenLinks should follow this example.

Above all, the most important thing is our mindset with regards to climate manipulation. It is a fact that climate manipulation brings both opportunities and risks, but what is not a given is the role it will play in global – as well as national – climate policy. It is time for this role to be determined by a political and moral debate.

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