Net Zero and Geoengineering

Geoengineering approaches—referring to large-scale technological schemes to intervene in the climate system—figure prominently in plans to implement 'net zero'. Governments and corporations, in particular, are betting on massive Carbon Dioxide Removal [CDR] to remove CO_2 from the atmosphere in the future. Many countries include support for building carbon capture and storage [CCS] infrastructure in recent spending plans, and include CDR technologies like Direct Air Capture [DAC] and Bioenergy with Carbon Capture and Storage [BECCS] in their nationally determined contributions [NDCs] on climate change action. Yet the feasibility of these technologies has not been demonstrated, they are prohibitively costly, and they come with serious risks and side-effects for humans and ecosystems.

Meanwhile, corporate 'net zero' commitments assume that either through subsidies or new carbon markets, they may obtain significant gains on investment in CDR technology development. This contributes to an environment where very necessary and urgent choices about deep decarbonization of industry, transport, and power production are postponed and wrong technologies are subsidized/supported. Furthermore, relying on speculative, high-risk technologies to remove CO_2 from the atmosphere and solve the problem in the future locks in another few decades of continued fossil fuel production. This is extremely problematic as we must get out of fossil fuels and stop polluting before we hit 1.5°C global warming and reach critical tipping points in the climate system.

Problems with geoengineering

All geoengineering technologies—in particular, those to remove CO_2 from the atmosphere, called Carbon Dioxide Removal technologies—require vast amounts of resources: energy, land, water, biomass, and minerals. To be relevant to 'net zero' and removals, the technologies must be deployed at very large scale. The development of CDR technologies therefore implies the establishment of new transnational extractive industries, creating new emissions along the entire industrial chain.

Also likely is that infrastructure associated with carbon removal will simply reproduce, or deepen, unjust patterns of extraction and exploitation of land and resources in the Global South. Large-scale CDR can have devastating impacts on local communities and natural ecosystems, such as land grabs, human rights violations, and sharp increases in food prices.

The prospect of a big expansion of BECCS—the geoengineering approach most favoured by climate models—would lead to large-scale destruction of biodiversity and natural ecosystems and their replacement with monoculture biomass as feedstock for energy production.

So, geoengineering really is a dead end: its large-scale rollout would come with devastating risks and unjustifiable ecological and societal impacts. Their ability to effectively remove large quantities of CO_2 from the atmosphere is also in doubt. Whether it works as planned, or fails to perform, relying on geoengineering is still likely to lock in several degrees of warming, with catastrophic impact.

The remainder of this brief looks more closely at some of the assertions made about geoengineering in the context of 'net zero' commitments.

Carbon Dioxide Removal (CDR) technologies

Some of the Carbon Dioxide Removal (CDR) geoengineering technologies that are most frequently discussed are Bioenergy with Carbon Capture & Storage (BECCS), Direct Air Capture (DAC) coupled with Carbon Capture and Storage (CCS) or Carbon Capture Use and Storage (CCUS) technologies, Enhanced Weathering (EW) and Ocean Fertilization (OF).

BECCS is based on cultivating biomass (fast-growing trees or energy crops), harvesting it and burning it for energy production, then capturing the CO_2 and storing it underground in suitable geological formations, such as saline aquifers or depleted oil wells (CCS).

Direct Air Capture (DAC) proposes to use chemical processes to scrub CO_2 from ambient air—a hugely energy- and cost-intensive process. Like BECCS, DAC requires another component that buries the captured CO_2—like CCS or CCUS, which essentially means turning the captured CO_2 into some sort of product. Lifetimes of such products vary significantly, and some of the more frequent destinies of such CO_2 are fuel or plastic, in which case the CO_2 is returned to the atmosphere after a very short period of time.

In marine geoengineering, Ocean Fertilization is one of the most frequently discussed technologies. It involves dumping large quantities of iron or other nutrients to enhance the growth of phytoplankton in marine areas with lower primary productivity. The additional plankton would sequester CO_2 from the atmosphere, eventually die and sink to the ocean floor, where, so the theory goes, the carbon would remain stored.

'Removals'. This is the awkward term used in the Paris Agreement to refer to the removal of carbon dioxide and other greenhouse gases from the atmosphere. While the Paris Agreement by no means legitimises the deployment of geoengineering technologies like BECCS and DAC, the term removals is easily exploited by geoengineering proponents to obscure the difference between unproven technological storage (geoengineering) and biological carbon storage in ecosystems.

It is deeply worrying, therefore, that the Task Force on Scaling Voluntary Carbon Markets has proposed a unified market for credits—no difference between carbon credits based on forest restoration, and carbon credits based on BECCS or DAC.

Massive CDR 'removals'?—a very uncertain future. Climate modelers got into the bad habit of just assuming the use of massive amounts of geoengineered CDR to limit warming. This is also a result of the models' devotion to endless economic growth across all world regions, as well as their focus on technological change rather than political and societal change. It is now generally acknowledged that the volumes of BECCS or DAC proposed in earlier IPCC models are unrealistic. Recent IPCC publications have caveated the use of BECCS and DAC, but mitigation pathways still rely on these CDR technologies to reach under 2°C scenarios.

Meanwhile governments and companies have tried to shift the conversation away from the need for immediate deep decarbonization of industry, transport, and power generation; it's much easier to talk about future CDR actions and project the image of taking 'serious' climate action. Long-term net zero goals indicating hypothetical CDR levels in 2050 are almost meaningless in current planning and investment contexts. 'Net zero' will remain a speculative moving target with ever-increasing amounts of CDR required to reach net-zero—at some point in the future—while maintaining an appearance of acting on the climate crisis.

Corporations bet on geoengineering to save their profits from dirty industries. Recent investment moves in geoengineering, by both Big Tech and by oil and gas companies, are accompanied by new rhetoric about how these corporations are in the best position to solve the 'mitigation ambition gap' through new technologies. Oil and gas firms are amongst the biggest proponents of geoengineering, and they are currently making investments in CO_2 pipelines for CCS, while at the same time renewing plans for further exploiting fossil fuels. But also many of the largest corporations in agriculture, retail, aviation, and finance have announced bold "net zero" plans that, in many cases, include technological CDR—but that also envision increasing current CO_2 emissions.

The climate system is not a machine that can be turned up or down. Many climate modeling pathways 'allow' for overshoot of the 1.5°C (or even 2°C) temperature limit goal, because CDR technologies are supposed to help bring down temperatures later in this century. Such temperature overshoot, however, can lead to irreversible societal damage and loss of ecosystems, and crucial tipping points in the climate system may be hit during this overshoot period that are impossible to reverse. Betting on a trajectory of temperature overshoot and recovery is extremely dangerous. Also, there is increased scientific evidence that the biophysical shifts caused by temperature rise occur much more abruptly—partly explaining the huge spike in extreme weather events around the globe in the last few years.

The CLARA network includes climate justice advocates, faith groups, conservation groups, land-rights campaigners, agroecologists, and representative of peoples movements around the globe. Our commitment to social justice brought us into the climate debate and informs our approaches to climate solutions. For more information about CLARA, visit **www.CLARA.earth**

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