# Negative CO2 emissions cannot replace rapid reductions

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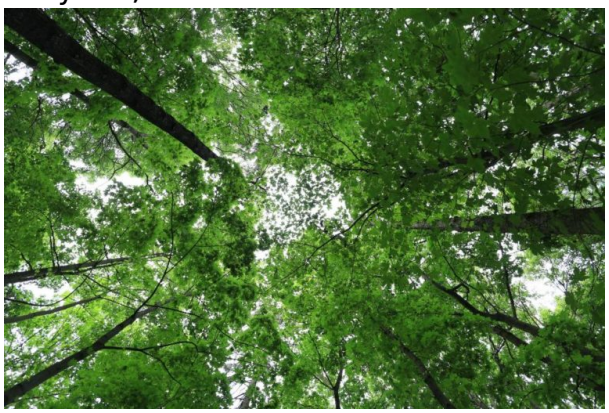

## Conference report: An international conference on negative emissions highlights extent of trade-offs and reinforces urgency of near-term emission reductions.

**by Kate Dooley** (*this article was originally posted by HBF*)

From May 22nd to 24th, over 200 academics, policy-makers, activists, and private sector actors gathered in Gothenberg, Sweden for a major conference on "Negative $CO_2$ Emissions", with discussions focused on the need to remove carbon dioxide from the atmosphere if we are to meet the temperature targets of the Paris climate agreement.

The conference opened with an announcement from Eva Seling, Swedish Secretary for State and Development, launching an official enquiry into the potential for forests, soil, and bioenergy to provide carbon removal in Sweden, followed by a keynote presentation from renowned climate scientist James Hansen.

Hansen expressed skepticism that we can remove emissions from the atmosphere cost-effectively at scale, and warned of the moral hazard that promising this technology in the future will delay action now. Hansen used his keynote to communicate the urgency of the climate crisis – outlining two imminent threats facing humanity: the inertia in oceans and ice-sheets, meaning we are close to the point of handing young people a situation where sea-level rise is out of their control; and mass species exterminationsdue to poleward movement of climatic zones at a rate beyond which species can adapt to.

Anders Lyngfelt of Chalmers University of Technology, hosting the conference, finished up the opening keynotes by describing negative emissions as a question of balance – arguing it is irresponsible to base climate policy on future negative emissions, but we are now in a situation where it is irresponsible not to remove $CO_2$ from the atmosphere. Lyngfelt suggested that trying to do this will make apparent the real costs of releasing $CO_2$ into the atmosphere for free.

## Negative emissions cannot replace rapid reductions

Perhaps put on notice by these stark warnings from Hansen, a persistent theme throughout the three-day conference was the reminder that negative emissions do not replace the need for urgent and rapid reductions in $CO_2$ emissions, but are needed in addition, to achieve a net reduction of $CO_2$ in the atmosphere.

Claire Gough of the Tyndall Center for Climate Change Research made the distinction between negative emissions (leading to net-zero atmospheric emissions), and net-negative emissions (meaning atmospheric concentrations of

$CO_2$ are actually reduced). A distinction that was made in several presentations, and underlines the climate value of carbon dioxide removal.

The majority of presentations ended with the reminder that there is no way around deep emissions reductions, indicating perhaps a consensus in the governance of negative emissions – that they are only part of a climate mitigation strategy when used in addition to, and not instead of, deep emission reductions. The message that removing $CO_2$ from the atmosphere does not compensate for ongoing emissions was a key takeaway from the conference.

# (Not) geoengineering?

Several presentations argued that carbon dioxide removal should not be considered as geoengineering**.** Jan Minx of the Mercator Research Institute on Global Commons and Climate Change in Berlin, presented a recently published synthesis of literature on negative emissions, which argues that negative emission technologies are "conceptually" similar to traditional mitigation measures, in that they prevent the accumulation of $CO_2$ in the atmosphere. As such they should be considered distinct from solar radiation management, which modifies and enhances the reflectivity of the Earth system, arguing that it is not useful to categorize these two very different clusters of response options under the same terminology of geoengineering.

Oliver Geden, from the German Institute for International and Security Affairs in Berlin, talked of the political motivations to separating carbon dioxide removal (CDR) and solar radiation management (SRM). Geden suggested that the European Union could remove the label of geoengineering from CDR to make deployment of CDR technologies more feasible, given concerns around public acceptability.

Others argue that more attention must be paid to the environmental impacts of large-scale $CO_2$ removal, and that the CBD considers most, if not all, techniques for $CO_2$removal to be climate geoengineering.

# (Natural) climate solutions

In terms of things definitely not geoengineering, there was a small but rich thread of presentations devoted to biospheric carbon removal – using forests, soils and landscapes to remove and store carbon. Public acceptability again was a key theme here, with evidence that people will accept (and prefer) natural climate solutions over interventions such as BECCS.

Pete Smith from the University of Aberdeen presented a new paper showing the impacts on biodiversity when moving from a 2°C world to a 1.5°C world, including impacts from mitigation measures. Smith also highlighted how a recent paper on natural climate solutions has caught the attention of policy makers because it offers more simple, natural solutions than the negative emissions technologies – but Smith questioned whether natural solutions gets us to where we need to be to hit the 2°C or 1.5°C target, suggesting 'nastier' forms of CDR would also be needed.

Oliver Geden made the point that 'natural climate solutions' sells politically – they are good things to do anyway – and Green parties, environmental movements and the public can get behind net-negative emissions if it is based on natural solutions. However, the distinction between natural and 'unnatural' climate solutions was often blurred, or missed entirely, with afforestation / reforestation (A/R) and ecosystem restoration being used interchangeably in many presentations, not to mention in integrated assessment models. The need to distinguish between BECCS and A/R, with negative environmental and social impacts, and ecosystem based solutions that bring real benefits for and biodiversity, has never been more important.

Anna Repo, of the Finnish Environment Institute, looked at the effects of large-scale forest harvest and residue extraction for bioenergy on forest carbon balance and deadwood in boreal forests, finding that residue harvesting reduces the forest carbon sink and reduces the net emissions savings from bioenergy by 18%. Depending on the scale, residue harvesting can turn the forest from a net sink into a net source, meaning bioenergy from forest residues may not be carbon neutral. Removal of deadwood also has detrimental effects on biodiversity and ecosystems as there is no replacement for deadwood in the landscape.

Stephanie Roe, of the University of Virginia looked at the contribution of the land-sector to meeting the 1.5°C goal,

finding that when bioenergy is held constant at baseline levels, then natural forests are maintained, suggesting there are alternative pathways that don't have the perverse outcomes on natural forests seen in BECCS-reliant pathways. However, this may drive more costly mitigation elsewhere and relies more heavily on demand side measures such as shifting to healthy diets. Roe concluded that integrated assessment models need to better integrate SDGs and prioritization with the land-use community to understand the trade-offs and challenges in land-sector mitigation.

Almut Arneth, from the Karlsruhe Institute of Technology, highlighted the scale of land-use change assumed by integrated assessment models, which suggest we could double the land sink by the end of the century, and double todays HANNP (human appropriation of net primary production) by 2050 to meet the projected scale of bioenergy demand. Yet achieving even a fraction of this scale of land conversion would have significant consequences on biodiversity and food production.

# (Unfounded) hope

Silke Beck of the Helmholtz Centre for Environmental Research spoke of how the IPCC serves as a site of de facto governance, and the risks of promoting unfounded hope in negative emissions. Beck outlined how integrated assessment models have legitimized the concept of negative emissions, thereby transforming models into tools for policy making – making what were sometimes previously unthinkable notions mainstream and acceptable. Beck argued that the presence of BECCS in models makes a BECCS colored future more likely, with a slippery slope between a 'possible' pathway and political reality where these essentially 'speculative' technologies are considered the only 'feasible' way to meet climate targets, while other options labeled 'not feasible' are off the table.

Duncan McLaren of Lancaster University warned against the evolving promises of NETs. McLaren described how new technologies evolve, from the peak of inflated expectations to the trough of disillusionment, and the eventual plateau of productivity. However, some technologies are never delivered, or are maintained as promises for long periods without ever materializing. CCS, for example, has functioned best as a promise that is not implemented, as large-scale implementation would imply excessive costs on the fossil fuel industry. There are risks that BECCS substitutes for fossil fuel mitigation in integrated assessment models, at a scale that cannot be delivered. BECCS has transitioned from a way of reducing costs to a physical necessity – and could become a sequence of promises that sustains the underlying regime.

In a panel discussing modelling, policy and incentives, Detlef van Vuuren from the Netherlands Environmental Assessment Agency said the amount of net-negative emissions are not a given – we can reduce reliance on carbon removals (and even eliminate it), but he argued that this doesn't make the transition any easier, as alternative mitigation pathways to BECCs are also challenging, requiring major behavioral changes in addition to zeroing out fossil fuel emissions. Van Vuuren concluded that an open discussion around negative emissions is urgently needed, as so far this has been too implicitly embedded in models.

Naomie Vaughan of the University of East Anglia and the Tyndall Centre for Climate Change Research suggested that it is not about the right amount of hope versus fear, it is about being honest – we are talking about trade-offs – stop flying or negative emissions? Reduce meat consumption or negative emissions? Vaughan suggested desirability rather than feasibility may be a framework to think about the future we want.

During the panel discussion Hansen pointed out that fossil fuels are currently subsidized – the costs are not paid to society. If the cost of getting carbon out of the atmosphere was attached to putting it there, we would understand that it makes more sense to reduce emissions, than to pay $400 – $500 billion per year to extract it. Hansen admitted that scientists have not done a good job so far of communicating the urgency of climate change, but felt that the 'solutions' coming out of integrated assessment models will not do anything to move us off the path we are on. Hansen suggested we are not going to reduce global emissions as long as fossil fuels are allowed to be cheap, and there has been a complete lack of leadership on this problem.

# Real world implications

There were many conference presentations on different technologies, with a controversial CCS plant presented as a success story, and cost analysis of various negative emissions technologies showing high costs and uncertainties. Most apparent in all of this was the mis-match between the scale of expected $CO_2$ removals (in models), and real-

world implementation.

Anders Lyngfelt explained that total $CO_2$ storage today is about 30 Mt/year (0.1% of global emissions). To capture even one years' worth of global emissions, would require a capture rate of 5 Gt $CO_2$ every year for seven years, but Lyngfelt emphasized that 5 Gt $CO_2$ is an enormous amount to capture. Glen Peters of CICERO in Oslo, speaking of tracking progress towards the Paris Agreement, noted that CCS deployment continues to lag behind expectations, with modelled scenarios requiring potentially 4000 facilities by 2030, compared to the tens currently proposed by 2020. Greg Nemet of the University of Wisconsin summed this up with a review that current research is not aligned with an imminent scale-up of negative emissions technologies.

The issue (and irony) of negative emissions scale-up being reliant of the fossil fuel industry was not lost. One speaker noted that if we shut down the fossil fuel industry, competence for storing emissions underground will be lost. Sally Benson of Stanford University, in a keynote on geological storage, made the point that to achieve a reduction in $CO_2$ emissions, long-term storage is key, concluding: "If we are interested in negative emissions, we probably shouldn't be looking at enhanced oil recovery".

The conference aimed to look at how negative emissions can become a reality at scale – but in reality, the scale question is fraught with challenges. The dialogue and debate that occurred was valuable in making clear the stark choices society faces: while the scale of a technology such as BECCS in modelled pathways may rightly be criticized as speculative, the reliance of a 1.5°C temperature limit on removing (some amount of) $CO_2$from the atmosphere is also a necessity. The conference highlighted the fact that there is no escape route from reducing emissions – the challenge before us is to limit reliance on carbon removals to levels that can be achieved through options that benefit, rather than undermine, people, biodiversity and food systems.