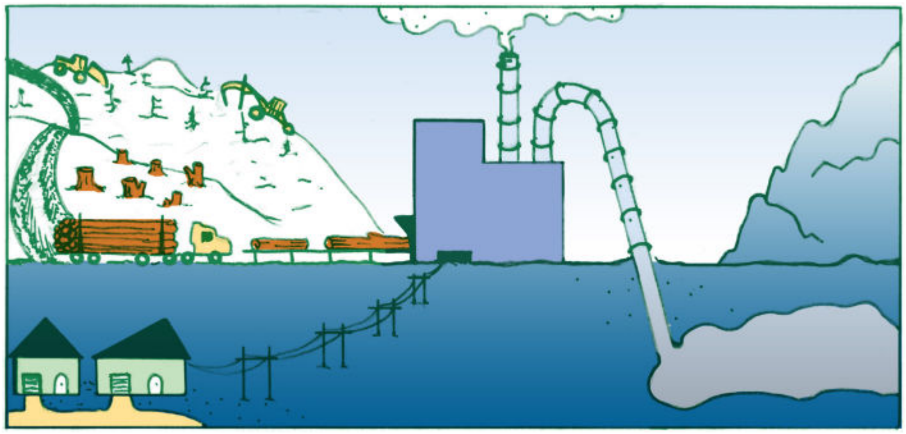
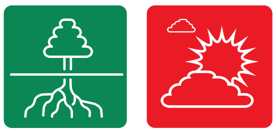
Bioenergy with Carbon Capture and Storage



The BECCS theory: capture carbon with trees; burn trees for energy; capture carbon at the smokestack; bury carbon underground.

POINT OF INTERVENTION

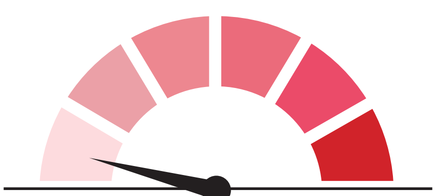


OVERVIEW

BECCS describes capturing CO2 from bioenergy applications and sequestering it through either Carbon Capture and Storage or Carbon Capture, Use and Storage. BECCS is considered "carbon negative" because bioenergy is wrongly considered "carbon neutral" based on the idea that plants will regrow to fix the carbon that has been emitted.

BECCS has taken centre stage as a climate "mitigation" technique and as a "negative emissions" technology.[1] Virtually all of the likely 2°C scenarios considered by the IPCC in their most recent assessment report assume that BECCS will be technically and economically viable and successfully scaled up, which has not been proven.[2] Across the scenarios considered by the IPCC, an average of 12 gigatons of removal annually through BECCS after 2050 is required, equivalent to a quarter of current global emissions.[3] However, it seems highly likely that BECCS may never be technically and economically viable.[4]

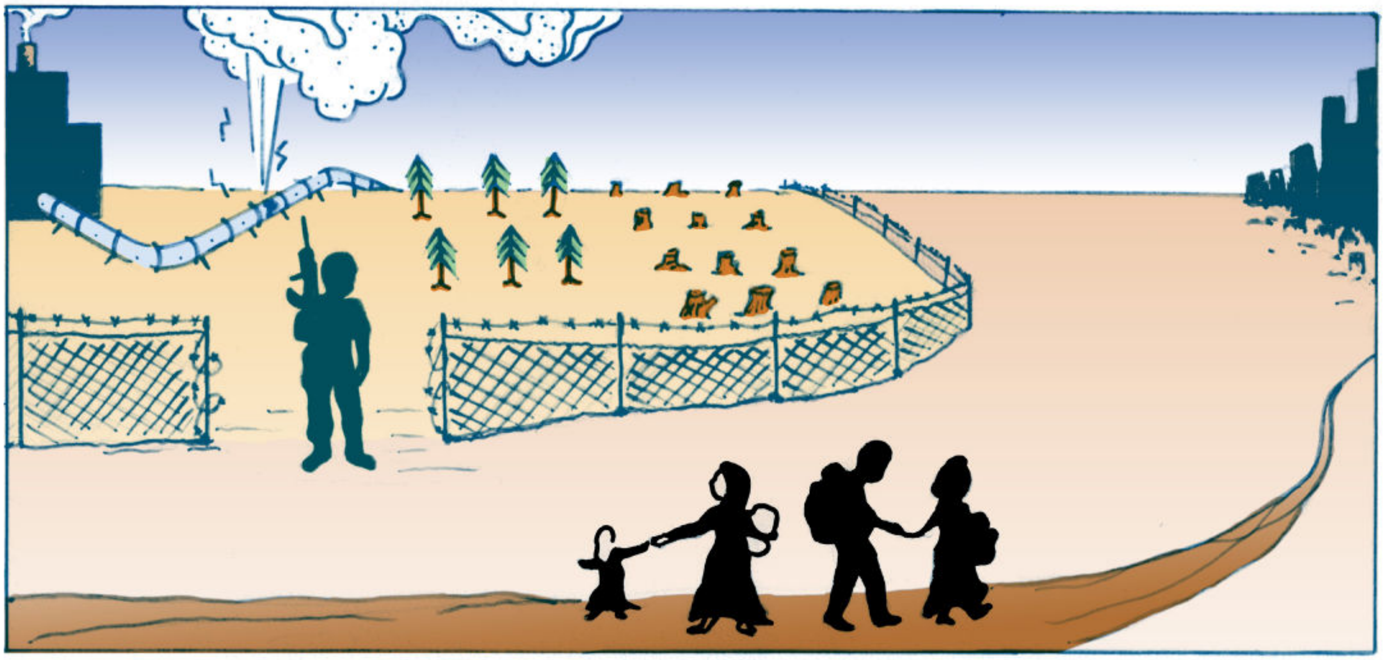
REALITY CHECK



ACTORS INVOLVED

As of 2018, there is only one BECCS project in the world: ADM's Decatur corn ethanol refinery in the USA.[5] CO2 is captured from the fermentation process and injected underground. This has been essentially a "proof of concept" project, funded by the Department of Energy (US$ 141 million[6]), which claims that it provides a "carbon negative footprint." In reality, the refinery is powered by fossil fuels and corn is an energy-intensive crop, giving it a net carbon positive footprint.[7]

There are at least four more ethanol plants in North America where captured CO2 is used for Enhanced Oil Recovery (see CCS fact sheet[8]). There are also plans for very small facilities in Brazil, Saudi Arabia, the Netherlands and Norway.[9] For all the emphasis on BECCS from industry and policy-makers, it is clear that the technology is not keeping up with expectations.



The biomass required for a scaled-up BECCS would take up between 25 and 80% of current global cropland. Mass displacement of peasants and farmers would be inevitable in such a scenario.

IMPACTS

A large body of peer-reviewed literature indicates that many bioenergy processes result in even more CO2 emissions than burning the fossil fuels they are meant to replace – it is certainly not carbon neutral.[10] This is due to emissions from (but not limited to): converting land into energy crop production which sometimes results in the displacement of food production, biodiverse ecosystems such as forests, or other land uses (indirect land use change); the degradation and overharvesting of forests; and emissions from soil disturbance, harvesting and transport.

Because BECCS needs fast-growing energy crops, its deployment could also require more than doubling fertilizer inputs, requiring as much as 75% of global annual nitrogen production. This would seriously exacerbate environmental degradation and emissions associated with fertilizers and agrochemicals, which currently cause large-scale anoxia in oceans and eutrophication of streams and rivers, for example.[11]

Capturing CO2 from bioenergy processes would be even more technically challenging and energy intensive than capturing CO2 from coal plants, which has been attempted at great cost and with little success. A unit of electricity generated in a dedicated biomass power plant results in up to 50% more CO2 emitted than if generated from coal,[12] meaning that yet more energy must be dedicated to the carbon capture process itself. Further still, there serious doubts that geological storage of CO2, in old oil and gas reservoirs, or deep saline aquifers, will be effective and reliable (see CCS fact sheet[13]).

A study looking at what would be required to sequester 1 gigaton of carbon annually using BECCS, equivalent to around a fiftieth of global annual emissions, concluded that between 218 and 990 million hectares of land would be needed to grow the biomass (this is 14-65 times as much land as the US uses to grow corn for ethanol).[14] More recent studies calculate that the biomass required for BECCS would take up between 25 and 80% of current global cropland.[15]

ADM's BECCS ethanol refinery, USA, is hardly 'carbon negative.' (Jonesy)

Land conversion on such a scale would result in severe competition with food production, depletion of freshwater resources, vastly increased demand for fertilizer and agrochemicals, and loss of biodiversity, among other problems.[16] Indeed, one study concluded that large-scale deployment of BECCS could result in a greater loss of terrestrial species than temperature increases of 2.8°C.[17]

Scaling up bioenergy to the extent envisaged would have devastating impacts on livelihoods and compete directly with food production. Severe human rights abuses and land-rights conflicts are already being caused by bioenergy globally, for example for biofuel production and tree plantations for wood pellet production. Indeed, industrial monoculture tree plantations would likely provide much of the raw material for BECCS.[18] At such a scale, current harm to communities and impacts from land-grabbing would be dwarfed by BECCS.

One recent assessment projected that large-scale BECCS deployment could result in sweeping food price rises across Africa, Latin America, and Asia, threatening food security for many of the world's most vulnerable. Another recent study indicated that even modest increases in bioenergy development could increase the number of malnourished children in sub-Saharan Africa by 3 million.[19]

REALITY CHECK

BECCS is currently purely aspirational and, given the technical challenges, it is unlikely to ever be scaled up significantly. However, fantasy technologies like BECCS allow polluters to keep using fossil fuels through the false hope that "negative emissions" can remove carbon from the atmosphere in the future, delaying urgent action on climate change further. This is likely to be the most dangerous impact of BECCS.

FURTHER READING

Biofuelwatch and Heinrich Böll Foundation, "Summary BECCS report: Last ditch climate option or wishful thinking?" http://www.biofuelwatch.org.uk/2016/beccs-report-hbf/

Global Forest Coalition, "The risks of large-scale biosequestration in the context of Carbon Dioxide Removal," http://globalforestcoalition.org/risks-of-large-scale-biosequestration/

ETC Group and Heinrich Böll Foundation, "Geoengineering Map." map.geoengineeringmonitor.org

The Big Bad Fix: The Case Against Climate Geoengineering, http://etcgroup.org/content/big-bad-fix

Biodiversity-destroying eucalyptus plantations would provide much of the raw material for BECCS. (Allysse Riordan/Flickr)

SOURCES

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7. Chris Mooney, "The quest to capture and store carbon – and slow climate change — just reached a new milestone," *Washington Post*, 2017, https://www.washingtonpost.com/news/energy-environment/wp/2017/04/10/the-quest-to-capture-and-store-carbon-and-slow-climate-change-just-reached-a-new-milestone/

8. See Geoengineering Monitor, "Carbon Capture and Storage," Technology Fact Sheet, April 2018.

9. ETC Group and Heinrich Böll Foundation, "Carbon Dioxide Removal," Geoengineering Map, 2017,https://map.geoengineeringmonitor.org/Carbon-Cioxide-Removal/

10. A compilation of peer-reviewed literature is available here: http://www.biofuelwatch.org.uk/biomass-resources/resources-on-biomass/

11. Wil Burns and Simon Nicholson, "Bioenergy and carbon capture and storage (BECCS): the prospects and challenges of an emerging climate policy response," *Journal of Environmental Studies*, 2017

12. Partnership for Policy Integrity, "Carbon emissions from burning biomass for energy," 2015, http://www.pfpi.net/carbon-emissions

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18. Global Forest Coalition, "The impacts of large-scale biosequestration in the context of Carbon Dioxide Removal," 2017, http://globalforestcoalition.org/risks-of-large-scale-biosequestration/

19. Wil Burns and Simon Nicholson, 2017