ECONOMIC ANALYSIS OF CARBON DIOXIDE REMOVAL (CDR) TECHNOLOGIES

Kirill Borschevski, Technische Universität Berlin, kb@wip.tu-berlin.de
Christian Hauenstein, Workgroup for Infrastructure Policy (WIP), TU Berlin, ch@wip.tu-berlin.de
Christian von Hirschhausen, Workgroup for Infrastructure Policy (WIP), TU Berlin, cvh@wip.tu-berlin.de
Pao-Yu Oei, Workgroup for Infrastructure Policy (WIP), TU Berlin, pyo@wip.tu-berlin.de

Overview

Carbon dioxide removal (CDR) plays an essential part in discussed pathways limiting global warming to 1.5°-2°C (IPCC 2018). Minx et al. (2018), and Smith, et al. (2016) among others, have conducted meta-analyses and literature research on CDR. However, they do not critically discuss their findings in relation to the current state of technology and do not provide or refer to a detailed technical-economic analysis of CDR. In general, there is a lack of detailed technical-economic analysis of carbon dioxide removal.

The aim of this paper is to provide an in-depth technical-economic analysis of carbon dioxide removal technologies, in order to fill the gap in the literature, and to provide solid ground for the climate policy debate. At present, the available CDR technologies are expensive and not competitive compared to other carbon dioxide mitigation options. However, technological and economic assessments may change over time, both in absolute and in relative terms. Therefore, the different technologies have to be analyzed carefully with regard to their contribution to emission mitigation as well as their mitigation costs.

Methods

The paper is based on an extensive survey of the literature, a meta-analysis of the available technologies, and our own assessment of the perspectives of the individual technologies. The paper will cover the following carbon dioxide removal technologies:

~ Bioenergy with carbon capture, transport, and storage (BE-CCTS)
~ Afforestation and reforestation
~ Biochar production
~ Direct Air Capture (DAC) and process emissions capturing
~ Silicate weathering
~ Ocean fertilization

Preliminary Results

We are currently in the middle of the research, and it is too early to draw conclusions. However, it seems that among the technologies currently used in global climate models, no large-scale projects are yet in operation. Some studies on negative emission technologies (especially BE-CCTS) seem to rely on optimistic estimations, which we are currently updating to obtain a range of potential costs. There is a particularly controversial assessment of direct air capturing, which some scientists see at the verge of becoming economical. This, however, may be contradicted by the economic analysis of BE-CCTS, which faces much lower separation costs.

Conclusions

Carbon dioxide removal technologies have become increasingly important in climate policy models. There are different technologies available in different scale and costs. Whereas the authors of studies on carbon dioxide removal technologies state their assumptions, they do not refer to updated estimates of the technical-economical potential and barriers of these technologies. Therefore, a forward-looking assessment of the technical and economic potetnial of se emission technologies is an important element that we want to provide to the climate policy discussion.

References

IPCC. 2018. “Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty.” In Press.

Minx, Jan C, William F Lamb, Max W Callaghan, Sabine Fuss, Jérôme Hilaire, Felix Creutzig, Thorben Amann, et al. 2018. “Negative emissions—Part 1: Research Landscape and Synthesis.” *Environmental Research Letters* 13 (6): 063001. https://doi.org/10.1088/1748-9326/aabf9b.

Smith, Pete, Steven J. Davis, Felix Creutzig, Sabine Fuss, Jan Minx, Benoit Gabrielle, Etsushi Kato, et al. 2016. “Biophysical and Economic Limits to Negative CO2 Emissions.” *Nature Climate Change* 6 (1): 42–50. https://doi.org/10.1038/nclimate2870.