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Towards net-zero emissions – how can carbon dioxide capture and storage contribute?

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Focus of the report

The SNS report “*Towards net-zero emissions – how can carbon dioxide capture contribute?*”[1] describes the role that carbon dioxide capture and storage (CCS) might play in achieving climate-change mitigation goals. The report also describes and discusses potential incentives and financing schemes for CCS, with the focus on Swedish conditions. Suggestions as to how incentives can be strengthened in Sweden are presented, as well as the challenges and obstacles for implementation and how these can be handled. The report also discusses the interactions between CCS applied to biogenic emission sources (BECCS) and alternative uses of biomass – a limited resource – and the conflicts that may arise along the way. Another area that is addressed is the way in which policies could be designed to increase incentives for CCS while minimizing dependence on fossil-based energy sources.

Method and organization

The report is based on a literature review and the experiences of the authors in relation to research studies and investigations of CCS and BECCS. The report provides a background that includes arguments as to why CCS and BECCS are needed, a brief orientation regarding the potentials for CCS and BECCS in Sweden, and a discussion concerning the policies for incentivizing CCS and BECCS, with focus on the latter. The focus on BECCS policies is motivated by the fact that Sweden has many large biogenic emission sources and the idea that negative emissions will be a key instrument for offsetting residual emissions from hard-to-abate sectors in Sweden and other parts of the world.

The report presents and discusses five models for generating funding and demand for BECCS: (1) governmental guarantees for purchasing BECCS outcomes; (2) the imposition on selected sectors of quota obligations to acquire BECCS outcomes; (3) allowing BECCS credits to be used to compensate for hard-to-abate emissions within the EU’s emissions trading system (EU ETS); (4) other states acting as buyers of BECCS outcomes to meet their mitigation targets under the Paris Agreement; and (5) private entities compensating on a voluntary basis for their greenhouse emissions.

1. ” SNS Analys 98. Mot nettonollutsläpp – hur kan koldioxidavskiljning bidra?”, November 2023.

Conclusions

Although CCS and BECCS are likely to play important roles in fulfilling the EU's and Sweden's climate goals, there remain several challenges to the realization of their full potentials. For example, there are no "turn-key" facilities that industries can procure if they want to invest in CCS or BECCS. This is likely to lead to high initial costs and tactical strategies in which actors wait for others to go first so that they can benefit from the lessons learned. Current storage capacity is also limited, and there is a risk of "Catch-22" situations in which investors in capture facilities are unsure of when and where storage will be available, while investors in storage facilities are unsure as to whether they can get customers for their storage facilities.

The authors argue that the credibility of CCS and BECCS hinges on a strong climate policy. The choice should be between leaving the fossil fuels unused or using fossil fuels together with CCS (albeit at a higher cost). Thus, there must be a sufficiently high cost for emitting carbon dioxide. Governments and businesses should only fund and deploy CCS and BECCS where few alternatives exist, to ensure that these technologies do not divert attention and resources from primary climate mitigation actions, i.e., those that reduce the use of fossil fuels.

Currently, the main instrument for creating incentives for CCS is the EU ETS. The challenges have been that the price of emissions allowances has been too low to justify CCS investments and that sectors for which CCS is an interesting alternative have received free allocations of emission allowances. However, in recent times, the price of emission allowances has approached the cost of CCS: in 2023, the price was around €100 per tonne of carbon dioxide. The price is estimated to increase to over €130 per tonne in 2030 and to increase further thereafter. The EU's *Fit for 55* climate package also means a significant tightening of the emissions trading system, involving fewer emissions allowances and phasing out of the free allocations. The EU ETS will, therefore, at least after Year 2030, likely create strong incentives for the introduction of CCS.

As far as BECCS is concerned, with few exceptions, there are currently no incentives for producing "negative emissions". This is despite the fact that most global mitigation scenarios that aim to achieve net-zero emissions by Year 2050 entail significant levels of negative carbon dioxide emissions, with BECCS together with afforestation and reforestation and direct removal of carbon dioxide from the atmosphere (DACCS) highlighted as the key options. In order for these technologies to be implemented, it is necessary to create incentives for negative emissions.

The overall conclusion is that a combination of the five (1–5) presented policy instruments is needed to maximize the potential for BECCS. The five models investigated differ in terms of the appropriate timing of their introduction and the specific actors that will be affected. While state support can be important during the initial stage, other forms and sources of financing need to emerge to reduce the costs for the state and increase the volumes of captured carbon dioxide.

The report also concludes that it is important that policy measures for CCS and BECCS are based on a holistic view of the carbon cycle, where circular material systems are rewarded, and there is a clear recognition that biomass

is a limited resource. Policy instruments that unilaterally focus on BECCS or CCS, without considering opportunities to reward systems that create circular carbon flows, should be avoided. For example, before capture is applied to municipal waste incinerators – an option that is currently being discussed in Sweden – it should first be investigated if there are ways to increase the recycling of the plastic (fossil) share, for instance through a system of chemical recycling, which could eventually contribute to a system in which plastic no longer needs to be produced from virgin fossil-based raw material.

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