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Under the European Union Emissions Trading System (EU ETS), operators must surrender allowances corresponding to the emissions of greenhouse gases (GHG) from their installations. The supply of allowances in the EU ETS decreases linearly and, all else equal, is expected to end around 2057. An earlier cut-off date is likely to follow from the European Council's recent decision that the EU should reach net-zero GHG emissions by 2050. Scenarios published by the European Commission even anticipate a net-negative cap in the EU ETS from 2045 onwards, generated through carbon dioxide (CO_2) removals. Upholding emissions trading, in the long run, therefore entails significant use of credits resulting from atmospheric CO_2 removal activities. However, in its current form, the ETS Directive does not contain any legal basis for generating CO_2 removal credits. Integrating CO_2 removal into the EU ETS would, thus, require fundamental amendments of the ETS Directive, waiving the currently mandatory association binding emitting activities to the adoption of emission abatement technologies. The next policy window for such amendments will open in 2021, following the decision on a more ambitious EU 2030 emission reduction target. This conceptual paper explores various design options for integrating negative emissions technologies (NETs) into the EU ETS. We discuss their potential implications for emissions trading at large and address the specificity of bioenergy with carbon capture and storage (BECCS): repealing the provision that installations exclusively using biomass are not covered by the ETS Directive, BE(CCS) installations could in principle fall within the scope of the ETS Directive. Theoretically, it would be possible to consider free allocation of biogenic credits to BE(CCS) installations. Bioenergy operators could avoid having to surrender these biogenic allowances through the use of CCS and instead sell them on the EU ETS market, having implicitly received credits for the removal of CO_2 from the atmosphere.

Keywords: European Emission Trading, Carbon Dioxide Removal, Negative Emission Technologies.

JEL classification: K33, Q54, Q58

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The Future of (Negative) Emissions Trading in the European Union

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Abstract
Under the European Union Emissions Trading System (EU ETS), operators must surrender allowances corresponding to the emissions of greenhouse gases (GHG) from their installations. The supply of allowances in the EU ETS decreases linearly and, all else equal, is expected to end around 2057. An earlier cut-off date is likely to follow from the European Council's recent decision that the EU should reach net-zero GHG emissions by 2050. Scenarios published by the European Commission even anticipate a net-negative cap in the EU ETS from 2045 onwards, generated through carbon dioxide (CO_2) removals. Upholding emissions trading, in the long run, therefore entails significant use of credits resulting from atmospheric CO_2 removal activities. However, in its current form, the ETS Directive does not contain any legal basis for generating CO_2 removal credits. Integrating CO_2 removal into the EU ETS would, thus, require fundamental amendments of the ETS Directive, waiving the currently mandatory association binding emitting activities to the adoption of emission abatement technologies. The next policy window for such amendments will open in 2021, following the decision on a more ambitious EU 2030 emission reduction target. This conceptual paper explores various design options for integrating negative emissions technologies (NETs) into the EU ETS. We discuss their potential implications for emissions trading at large and address the specificity of bioenergy with carbon capture and storage (BECCS); repealing the provision that installations exclusively using biomass are not covered by the ETS Directive, BE(CCS) installations could in principle fall within the scope of the ETS Directive. Theoretically, it would be possible to consider free allocation of biogenic credits to BE(CCS) installations. Bioenergy operators could avoid having to surrender these biogenic allowances through the use of CCS and instead sell them on the EU ETS market, having implicitly received credits for the removal of CO_2 from the atmosphere.

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1 Introduction

Currently, about 17 percent of global greenhouse gas (GHG) emissions are covered by emissions trading systems that have either already been implemented or are scheduled for implementation. The EU Emissions Trading System (EU ETS) is still the largest of its kind worldwide. It covers roughly 40 percent of the EU27's GHG emissions and is considered to be the EU's most important climate policy instrument. Due to an annual linear reduction factor (LRF), no further allowances will enter the market beyond a certain point in time. Calculations based on the current LRF of 2.2% p.a. indicate the year 2057, or shortly after, as the expected cut-off date. In the likely case of a more ambitious EU climate target for 2030, the LRF would increase accordingly, so that the trajectory of newly issued allowances would reach the zero line some years earlier (European Commission 2018a). Given the recently agreed EU target of reaching net zero GHG emissions by 2050, there are even expectations that the installations covered by the EU ETS will generate net negative carbon dioxide (CO_2) emissions from 2045 onwards (European Commission 2018b).

The EU not only needs to resolve the question of how to organize its ETS without issuing new allowances, it also needs to establish rules for integrating so-called "negative emissions," generated by removing CO_2 from the atmosphere and durably storing it in reservoirs, e.g. by bioenergy with carbon capture and storage (BECCS) or by direct air carbon capture and storage (DACCS) (for a recent review see for example Fuss et al. 2018). Because the EU ETS is still the largest and most important emissions trading system in the world, any regulatory adjustments and innovations regarding the integration of CO_2 removal credits is likely to be widely noted and will hence significantly influence global emissions trading in a net-zero or even net-negative GHG emissions future. Here we discuss various basic design options for integrating negative emissions technologies (NETs) into the EU ETS and their potential implications for emissions trading. We distinguish between unrestricted and restricted integration. Unrestricted integration implies that the substitution of emission abatement is endogenously determined by the resulting new equilibrium carbon price. Restricted integration implies separate targets (caps) for emissions abatement and NETs. Given current cost projections for NETs, separate targets are more likely to imply a support for NETs than the prioritization of emission abatement. However, restricted integration could be made conditional on traded allowance volumes or observed prices, for example enabling a mechanism similar to the current Market Stability Reserve (MSR) to support a carbon price collar.

There is increasing awareness that CO_2 removal is essential for reaching the long-term temperature goals set out in the Paris Agreement (IPCC 2018). But there is still little consensus on how and when measures for removing CO_2 should be implemented, incentivized and integrated into climate policy (Obersteiner et al. 2018, Rickels et al. 2018, 2019, Torvanger 2019). Provision of incentives might be of particular relevance for a bottom-up, small-scale development of NETs (Bellamy and Geden 2019). Cox and Edwards (2019) draw attention to obstacles for NETs deployment originating from interactions with other regulations. They also acknowledge that certain types of existing policies support NETS in that they provide co-benefits, such as in the case of enhanced weathering. Honegger and Reiner (2018) consider the market mechanism referred to in Article 6.4 of the Paris Agreement as a possible cornerstone for incentivizing the deployment of NETs globally. Conditions under which the market mechanism mentioned in Article 6.4 shall be implemented remain unclear to this day. The inclusion of emissions trading among nongovernmental actors also needs to be further elaborated. Haszeldine (2016) and Haszeldine et al. (2018) propose that i) new CO_2 storage credits need to be introduced, and ii) that firms be required to surrender an increasing share of these credits to provide incentives for commercial CCS (by creating a prescribed demand). However, appropriate market incentives for coupling the use of fossil fuels with CCS are already in place. Article 12(3a) of the current ETS Directive stipulates that there is no obligation to surrender allowances for emissions that are verified as having been captured and transferred to an authorized installation for permanent storage. However, these incentives are restricted to fossil CCS and do not provide incentives for removal CO_2. And CO_2 removal will become increasingly important if further sectors with diffuse emission sources are included in the ETS and/or if the design of future trading periods includes net-negative caps.

Scenarios considered under the European Commission's proposal for a new long-term EU climate strategy are enshrined in trajectories leaning toward net zero GHG emissions by 2050, reaching economy-wide net negative emissions in the second half of the century (1.5TECH and 1.5LIFE) (European Commission, 2018a, 2018b). In addition to making use of conventional CCS, these scenarios include measures to directly remove CO_2 from the atmosphere. These measures are designed not only i) to compensate for residual emissions that are hard or very costly to eliminate, such from agriculture, the steel and cement industry or aviation (Luderer et al. 2018), but also ii) to potentially reach net-negative emissions targets. The 1.5TECH scenario foresees the whole EU ETS transitioning to net negative emissions values (–50 $MtCO_2$ in 2050). However, there are currently no incentives provided for the generation of credits (which could be exchanged or treated equivalent with allowances) through the removal and storage of CO_2. Generating CO_2 removal credits would be contrary to the basic concept of the ETS Directive as set out in Art. 2(1), according to which the applicability of the EU ETS presupposes the existence of emissions at least in principle.

From a conceptual point of view, applying technologies to remove CO_2 from the atmosphere reverses the process taking place in a conventional cap-and-trade system. Each emitter of CO_2 must surrender emission allowances equal to the amount of their emissions. When CO_2 is removed from the atmosphere, emission allowances would re-enter the trading space. One can therefore imagine that for the CO_2 emissions that arise within the framework of an emissions trading system, a corresponding allowance counter-account exists (see Figure 1). This counter-account reflects the amount of "used" allowances associated with the stock of CO_2 in the atmosphere resulting from the corresponding emissions. When CO_2 is withdrawn from the atmosphere, the associated allowances are also "released" from the counter-account back to the free allowances (held either by companies or by the regulatory authority in the bank or the allowance pool, respectively). This conceptual explanation implicitly assumes that the amount of atmospheric CO_2 withdrawal is also determined by the total quantity of allowances in the emissions trading system.

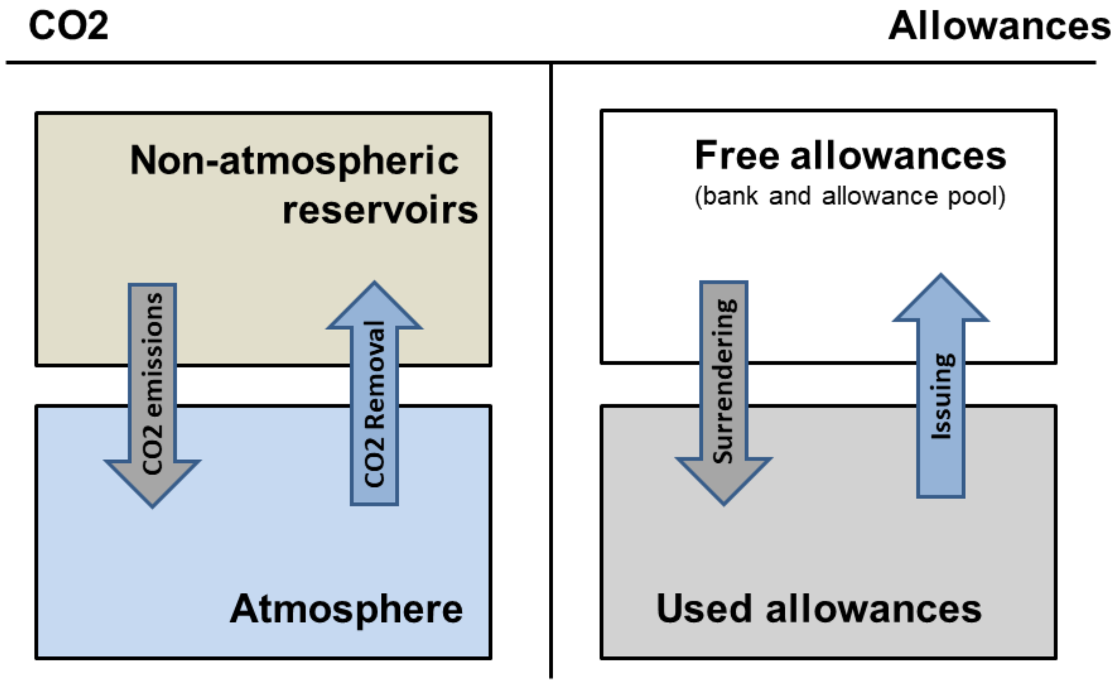

Figure 1. Diagram illustrating the integration of negative emissions in cap-and-trade systems. *The figure displays the physical flows of carbon dioxide (left) and the corresponding flows of emission allowances (right).*

2 Key Considerations for Integrating Negative Emissions in Cap and Trade Schemes

From an economic point of view, the (unrestricted) supply of credits obtained from CO_2 removal (i.e. NETs credits) would imply that the inelastic cap on emissions would become elastic at the allowance price from which upwards the provision of NETs credits becomes profitable.[1] Accordingly, we can distinguish between the overall cap defined by the regulatory authority and the effective cap resulting from the NETs allowance supply curve. The cap set by the regulator can be positive, zero, or even negative for the current situation with a positive amount of allowances, a net-zero target with zero allowances, or a net-negative target with annual allowance purchases by the regulatory authority. Figure 2 shows how the supply of NETs credits can be illustrated by introducing an effective cap in comparison to the overall cap for a stylized, static optimization problem with a quadratic aggregated abatement cost curve and a linear-quadratic aggregated NETs cost curve (both implying linear marginal cost curves, albeit with a positive intercept in the latter). The figure shows a positive and negative overall cap (in the case of a zero cap, the NETs marginal cost curve would have its initial intersection on the y-axis). In the former case, the introduction of NETs results in a lower equilibrium price (from p_A to p_N), while in the latter case a price based on abatement only is not feasible. It should be noted that depending on the elasticity of the NETs cost curve, the implication of technological innovations for emissions abatement become comparable to a setting under a carbon emission tax. In the case of a linear NETs cost curve (and constant marginal cost curve), an innovation in abatement technologies would result in

[1] Assuming that the NETs cost function, C(N), with N the amount of CO_2 removal, satisfies C'(0)>0.

a substitution of negative emissions without any price response (as long as the new equilibrium point still intersects with the horizontal part of the effective cap).[2]

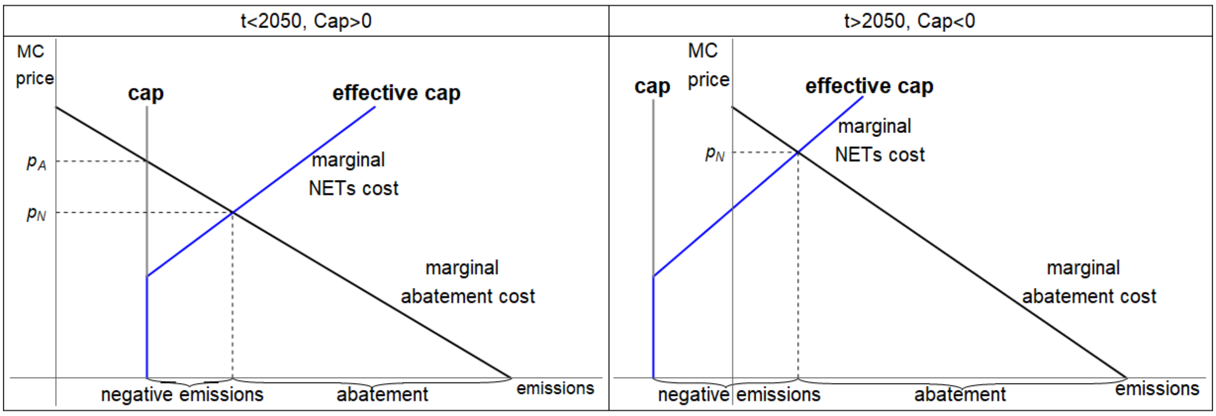

Figure 2. NETs credit supply under unrestricted integration. *The figure shows a positive and negative overall cap in the left and right panel, respectively (in the case of a zero cap, the NETs' marginal cost curve would have its initial intersection on the y-axes). In the former case, the introduction of NETs results in a lower equilibrium price (from p_A to p_N), while in the latter case a price based on abatement only is not feasible.*

From a political viewpoint, unrestricted integration of NETs credit supply does not appear to be a realistic scenario; proposals calling for stepwise integration with separate targets for emission reductions and CO_2 removal have entered the discussion on the EU's long-term climate policy strategy (McLaren et al. 2019, Geden and Schenuit 2020). In the context of carbon pricing via emissions trading, separate targets would only coincidentally equate marginal costs, implying efficiency losses compared to a situation with full integration. The introduction of separate targets is mainly motivated by the concern that full integration could lead to extensive substitution of conventional emissions abatement. Such a situation could arise under full integration of credits from, say, afforestation or land-/forest management, where Hepburn et al. (2019) estimate low or even negative break-even costs. Such a situation is displayed in Panel a) of Figure 3 (which again represents a stylized static optimization problem with the same assumptions regarding the functional forms of the cost functions as in Figure 2). However, the European Commission's current plan seems to be to restrict the integration of NETs into the EU ETS to options with relatively high standards for verification of permanence of CO_2 storage, such as BECCS and DACCS, where current estimated costs are still above both current and near-term projected allowance prices in the EU ETS. Accordingly, a situation as displayed in b) is (still) more likely to materialize in the near to medium term. Despite full integration, such a situation might mean that there would (still) be no use of NETs and thus no substitution for conventional emissions abatement. The panels c) and d) show the corresponding situation under separate targets. Here the overall cap is the sum of both individual caps, and the cap split indicates the division into negative emissions and emissions abatement according to the separate targets. While panel c) displays the hypothetical efficiency loss from limiting the integration of NETs allowance supply, panel d) shows the efficiency loss from forcing the integration of NETs, indicating that separate targets actually imply a promotion of NETs instead of a prioritization of emissions abatement.

[2] Compare with Requate and Unhold (2003) for the situation without NETs.

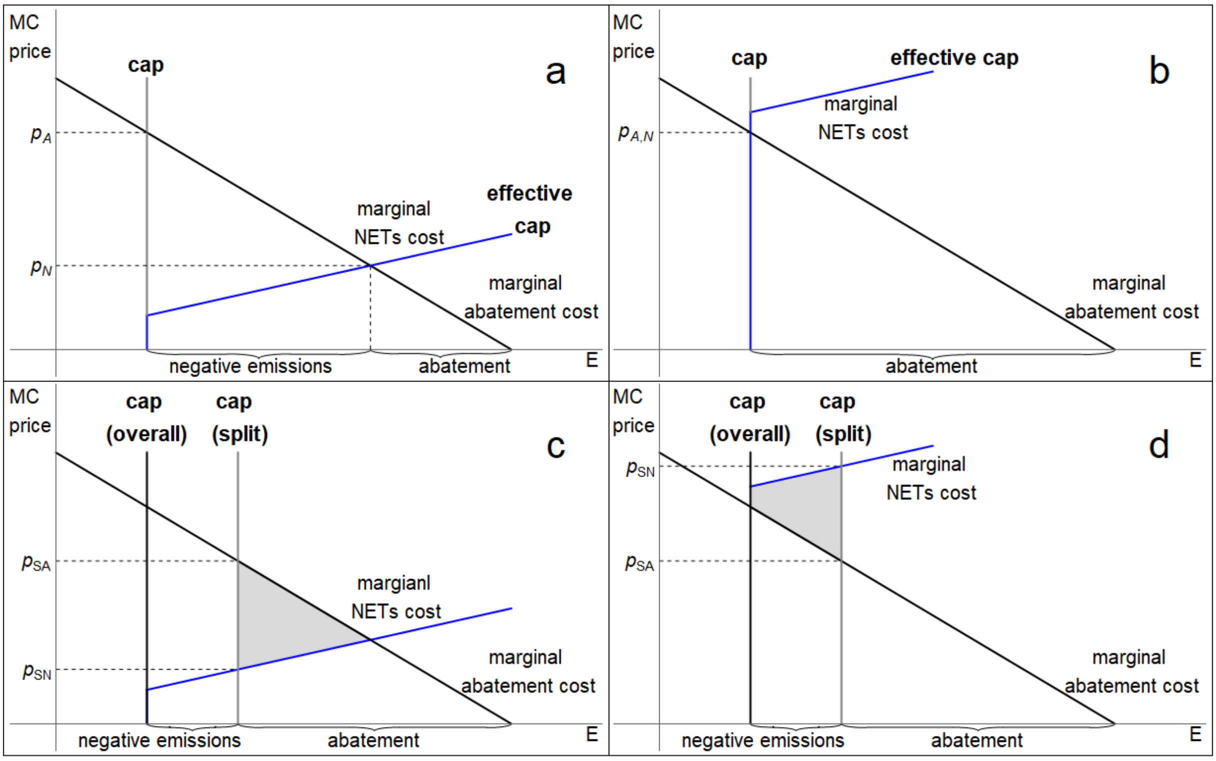

Figure 3. NETs credit supply under restricted and unrestricted integration with separate targets. *The figure shows restricted integration compared to unrestricted integration (lower and upper panel, respectively) for a low and high NETs cost scenario (left and right panel, respectively).*

So far, there is no policy debate on how best to organize a partial integration of NETs credit supply into the EU ETS. One possibility would be to integrate such credits in the same way as credits from the Kyoto Protocol's flexible mechanisms. Such an option is particularly interesting against the backdrop of an international market for CO_2 removals analogous to the market for Kyoto offsets that might develop in a world with an increasing number of national net-zero or even net-negative emission targets. Quantity limitations could be combined with a sectoral limitation on the use of such credits. One possibility would be to restrict the use or allocation of NETs credits to specific sectors. A similar, design with a one-way link of this kind already exists in the EU ETS for aviation. Flight operators can use both specific (European Union Aviation Allowances, EUAAs) and conventional allowances, while other sectors are not allowed to use EUAAs. A corresponding design could be applied to restrict use and trade of NETs certificates to sectors facing high levels of international competition, comparable to those on the "carbon leakage" list which currently still receive (increasingly limited amounts) of free allowances. Despite such distinct credits, a uniform market price would emerge (as long as conventional allowances exist parallel to NETs credits), but with corresponding distributional effects depending on how the allocation of these allowances is organized and how the market price reacts (Hinterman and Gronwald 2019).

However, in a situation like the one displayed in panel d) of Figure 3, where NETs are not yet competitive, a form of quota obligations comprising of minimum quantities for the use of such credits, as opposed to ceilings, could be an option to promote the integration of NETs. Another option could be to reward NETs with a higher than one to one relationship between emission removals and generated credits. The amount of rewarded surplus could be excluded from future allowance auctions and free allocations. However, both options imply efficiency losses compared to integrations without separate targets (as displayed in panel a) and b)). Accordingly, in a situation like in d) either market participants would bear the additional cost (i.e. in case of a quota obligation) or further instruments would be needed to cover the price difference between NETs credits and traditional allowances until the former become competitive (Bednar et al., 2019).

Potential positive R&D externalities may result from spillovers and higher capital cost or credit restrictions from capital market imperfections, notably in the case of NETs with different technological potentials (Jaffe et al. 2005, Stiglitz 1993, and Bramoulle and Olsen 2005, respectively). Here, having the regulator cover the price difference (i.e. subsidized integration) could be beneficial from a social point of view. Regarding the integration of NETs into the EU ETS, corresponding market-based price information already exists, so it is naturally a good idea to link additional remuneration to this price. For example, contracts for difference (CfD) would (initially) guarantee NETs operators a fixed amount per tCO_2 removed by covering the difference to the current allowance price in the EU ETS and the guaranteed price. This also implies that NETs operators would have to pay the difference if the allowance price exceeds the price specified in the contract. The (temporarily) guaranteed price could be set by the regulator or determined in tenders organized as reversed, second-price or other forms of auctions that also permits technology-specific quotas in order to ensure broad technology support. Such a consideration is particularly useful if there is a wide degree of variation in the maturity of the various technologies, which is the case among different NETs. Compared to the promotion of electricity feed-in from renewable energies, however, there is one crucial difference. The demand for electricity fluctuates in the course of a day, week or year. Accordingly, remuneration schemes for renewable power that do not take fluctuating demand into account will not necessarily result in an efficient composition of electricity generation capacity. Demand for CO_2 removal does not fluctuate over short time-scales, but rather depends on the cumulative amount of CO_2 sequestered and, possibly, overall GHG emissions (in cases when emission reductions and removal targets are not separated). Correspondingly, remuneration schemes providing marginal incentives for the removal of CO_2 result in fewer distorted incentives than in the case of electricity generation from renewable sources (Antonio and Strauz 2017)—given that deployment of BECCS does not receive a price premium for the generation of electricity. Similar observations may be pending BECCS for production of heat, paper and pulp, and biofuels. However, the implications of and the remuneration for combined CO_2 removal and electricity generation, or other goods, have not yet received much attention and are beyond the scope of this paper (For some initial analysis see Fajardy and Mac Dowell 2018 and Wohland et al. 2018).

The regulatory authority could also act as an intermediary by buying NETs credits (for example via a technology-specific tender system) and selling them on the allowance market in dependence of observed prices or traded volumes. Such an approach is appealing because i) various temperature targets favor an endogenous emission cap with the opportunity for aiming at the more ambitious target in the case of (abatement) cost being lower than expected, and ii) the supply of credits from NETs would result in a price-elastic effective cap (compare Figure 2). In turn, allowances from NETs could be used to feed an allowance reserve, similar to the current Market Stability Reserve (MSR), releasing additional allowances into the market in line with observed prices or volumes. Basically, such a setting would imply that allowance supply from NETs could be used to support a (soft) price collar.

Figure 4 shows a scenario of this kind, the assumption being that the NETs credit reserve is sufficient to support the maximum price. In contrast to a price collar without support by NETs credits, compliance with the overall cap is achieved, and the net emissions do not change. The downside is that the marginal cost of NETs and the marginal abatement cost would not be equivalent. However, Figures 2 and 3 are restricted to the case where the cap is positive. In a situation with a potentially negative cap, either the regulatory authority would be required to buy NETs credits from the market or require more than one NETs credit to offset an emission (which in turn makes it more likely for additional remuneration to be required to stipulate NETs supply).

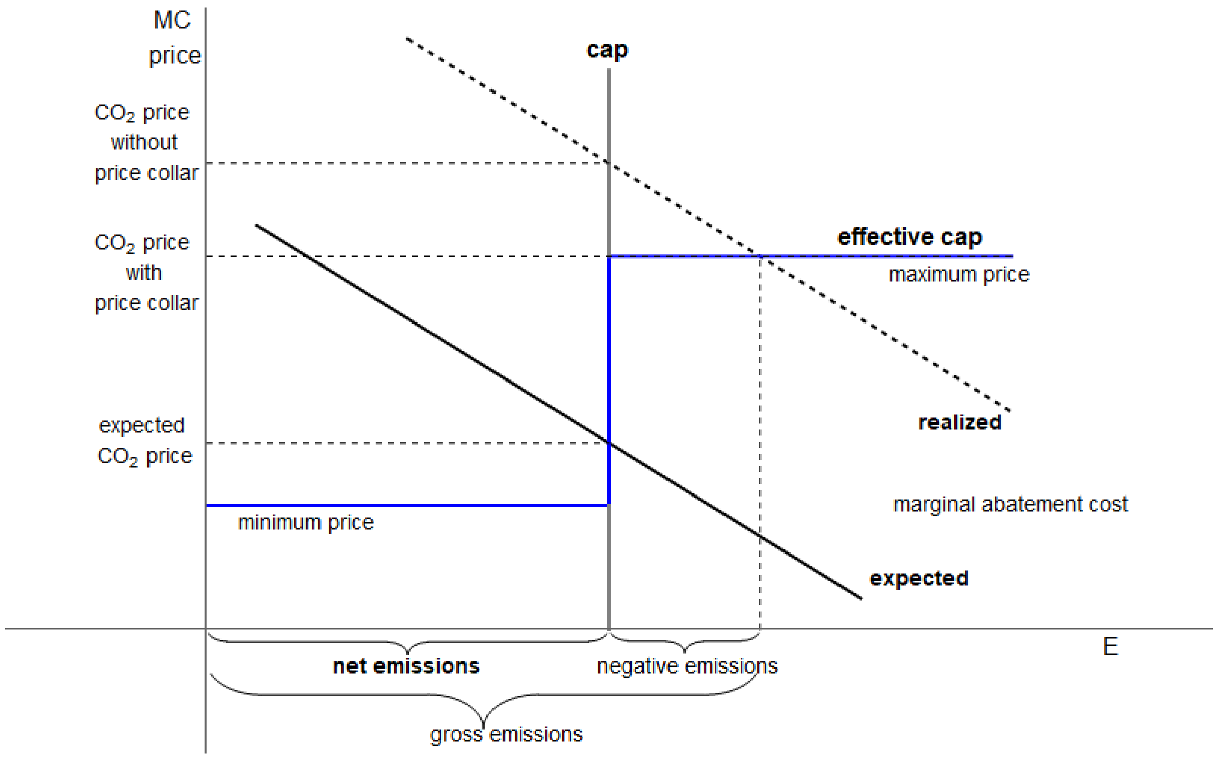

Figure 4. NETs credits to support a price collar. *In contrast to a price collar without support from NETs credits, compliance with the overall cap is achieved, and the net emissions do not change.*

Clearly, these conceptual considerations neglect various aspects, notably the dynamics of the constellation. For example, given the presence of the MSR in the EU ETS, the expectations of market participants regarding the future integration of NETs credits would already affect current allowance prices and banking decisions. However, as there are currently so many different ways of organizing the integration of allowances from NETs, we believe that our simple static illustration will serve to provide some guidance for future discussions.

3 Inclusion of NETs into the EU ETS

As far as EU legal requirements are concerned, a distinction must first be made between "technical" and "ecosystem-based" processes of GHG removal and storage. "Ecosystem-based" approaches are presently excluded from the EU ETS from the outset if they fall within the scope of the land use, land use change and forestry (LULUCF) Regulation. Based on the assumption that ecosystem-based removals are easily reversible and that LULUCF emissions and removals are subject to great fluctuations and reporting inaccuracies, LULUCF was designed by the EU as an independent climate policy pillar. That said, the sectors covered by the LULUCF Regulation are, yet only to a limited extent, included into the scope of another legislative act of the EU, namely the Effort Sharing Regulation (ESR). The ESR sets binding annual emission targets for EU Member States for 2021–2030. The ESR includes the so-called "non-trading sectors", i.e. the sectors that are not covered by the ETS Directive and excluding LULUCF. Under the conditions specified in its Article 7(1), the ESR allows Member States to consider net withdrawals from LULUCF when accounting for the achievement of their individual emission targets, but only to a maximum EU-wide total of 280 million tonnes of CO_2 equivalents (cf. Article 7 and Article 9(2) of the ESR). The total flexibility of 280 $MtCO_{2e}$ is allocated to individual Member States based on their relative share of agricultural emissions, noting that agriculture is one of the sectors in which it is very hard to achieve zero GHG emissions. Thus, a precedent exists in EU law for recognizing need to offset hard-to-abate emissions through ecosystem-based CO_2 removals.

The EU ETS, thus, do not include a scope for ecosystem-based removals. The EU ETS, however, does include installations that provide potential for CCS application. This inclusion only applies, however, with regard to the obligation to surrender emission allowances corresponding to fossil CO_2 emissions (and emissions of a few other GHGs from specific sub-sectors). In other words, there is no obligation to surrender allowances for emissions that have been captured and transferred to an authorised installation for permanent storage. This follows explicitly from Article 12(3a) of the ETS Directive. In contrast, the ETS Directive in its present form does not provide the generation of credits (additional allowances) through the removal and storage of atmospheric CO_2. This would be contrary to the basic concept of the ETS Directive expressed in its Article 2(1), according to which the applicability of the EU ETS requires the existence of emissions being accounted for. The current EU ETS thus only provides an incentive that CO_2 that does not enter the atmosphere does not have to be balanced by surrendering a corresponding amount of allowances. It is based on the coupling of emitting installations with mitigation strategies but does not permit for the additional or separate integration of installations that remove CO_2 from the atmosphere.

Against this background, the question arises whether the current regime of the ETS Directive contains clauses on the basis of which it could be decided to include NETs into the EU ETS in the near future. In this respect, while Article 24 of the ETS Directive entitles the Member States to unilaterally extend trading in emissions allowances to activities not listed in Annex I (note again, though, that CCS is already listed), this option does not allow for any deviation from the regime of the ETS Directive. Thus, no deviation from the linkage of emitting activities on the one hand and the use of emissions-reducing technologies on the other is allowed. Neither can Article 24a(1) of the ETS Directive serve as the legal basis for an autonomous integration of NETs into the EU ETS. This provision authorises the European Commission to "adopt measures for issuing allowances or credits in respect of projects administered by Member States that reduce greenhouse gas emissions not covered by the EU ETS." However, in light of the general approach on which the ETS Directive is based, this power only concerns projects aiming at a reduction of existing emissions. Furthermore, Article 24a of the ETS Directive only applies to activities carried out in another EU Member State, i.e., activities that lead to emissions reductions where their implementation is more favourable. This is demonstrated by the prohibition of double counting of emission reductions codified in Article 24a(2) as well as the reference in Article 24a(3) of the ETS Directive that "[s]uch projects will be executed on the basis of the agreement of the Member State in which the project takes place”. Thus, in its current form, the ETS Directive does not contain any opening clauses on the basis of which credits could be generated by removing CO_2 from the atmosphere. Any integration of NETs into the EU ETS would, therefore, require a fundamental amendment of the ETS Directive, including consequential amendments to MRV rules, which would waive the mandatory link between emitting activities on the one hand and the use of emissions-reducing technologies on the other. Even if the CO_2 removals would generally be included in the EU ETS (and, thus, the mandatory link between emissions and mitigation technology were repealed), several ecosystem-based NETs would fall outside the scope as they are accounted for under the LULUCF Regulation. Unilateral opt-in of several other NETs, such as various NETs in the agriculture sector, would probably not be approved by the European Commission, based on them threatening the environmental integrity of the EU ETS, a core evaluation criterion used by the Commission when assessing opt-in proposals submitted by Member States. The reason for such likely exclusion relates to the often uncertain or impermanent storage of CO_2 that would make it hard to equate one tonne of avoided fossil emissions with one tonne of removed (biogenic) emissions (Fridahl et al. 2020).

This leaves BECCS and DACCS as more realistic options for EU ETS integration, at least in the near term. With regard to the adjustment of the EU ETS, BECCS is associated with a distinctive set of requirements. Although the activities concerned are indeed characterized by the existence of a link between emissions and CCS, required by the ETS Directive, some of the European potential for BECCS cannot be taken into account in the context of the EU ETS due to the fact that, according to No. 1 of Annex I, installations using exclusively biomass are not covered by the ETS Directive. If that provision were to be repealed, the installations concerned would in principle fall within the scope of the ETS Directive, without the necessity to make use of the option provided for in Article 24. Several other large installations with big point-source emissions of both fossil and biogenic CO_2 are also already covered by the EU ETS. Even if these installations report biogenic CO_2 emissions for informational purposes, they are always accounted for as carbon neutral.

The provision is motivated by the fact that associated emissions are accounted for “upstream”, i.e. any emission or sink associated with LULUCF are accounted for under the LULUCF Regulation. Consequently, repealing No. 1 of Annex I of the ETS Directive would imply double accounting, inasmuch as emissions or sinks associated with biomass production would be accounted for under the LULUCF Regulation and again as an emission under the EU ETS. Technically, such double accounting could be circumvented by allocating to operators of biomass installations (extra) allowances for free, requiring though that these extra allowances are not accounted for under the corresponding emission of the EU ETS—similar to the current approach with European Aviation Allowances (EUAA) which are not considered, for example, in the calculation of the Total Number of Allowances in Circulation (TNAC). So far, the possibility of free allocation has been limited to industrial installations considered to be at significant risk of carbon leakage. If “biogenic” allowances were freely allocated to BE(CCS) installations (corresponding to the carbon content in the biomass purchased), operators would have an incentive to deploy CCS and could in turn sell these allowances once they have captured and stored biogenic CO_2. Such operators would thus implicitly receive credits for the removal of CO_2 from the atmosphere.

Furthermore, if these “biogenic” allowances would be deduced from the existing allowance pool (by for example reclassifying “conventional” allowances), the net emissions of the EU ETS would decrease more quickly than given by the current linear reduction factor while combined allowance supply would decrease less than proportional (depending from the degree biomass installations would make use of CCS). However, in order to estimate the associated effects quantitatively, feedback effects from the operation of the MSR should be considered too.

4 The Way Forward

Any immediate integration of NETs into the EU ETS should be designed such that appropriate incentives for emission reductions remain in place. Fully integrating NETs into the EU ETS at this stage would be an incentive to prioritise the use of low-cost NETs (e.g. afforestation and soil carbon enhancement). This would not only come at the expense of conventional emission reductions but also impede NETs with higher investment costs (and usually also greater long-term potential). These considerations are reflected in the scenarios presented by the EU, which (currently) limit the integration of NETs into the EU ETS to BECCS and DACCS.

The future integration of NETs into the EU ETS could theoretically take place in two different ways: On the one hand, through direct interaction between the companies involved in emissions trading and the providers of NETs and, on the other hand, through the intervention of a regulatory authority which coordinates the two markets. Both variants could be implemented through EU legislation. In the second case, the regulatory authority would purchase the NET credits and reintroduce them depending on observed prices or quantities into the EU ETS. Within the framework of emissions trading, the existing possibilities for quantity control could be maintained (i.e. similar to the MSR), or potential possibilities for price control could be newly introduced and combined with offering additional credits from removals of CO_2. In contrast to conditions under which market participants interact directly, the two markets (ETS and NETs) could be designed separately with the intervention of a regulatory authority in such a way that emission reductions (ETS market) on the one hand and technology development (NETs market) on the other hand can be targeted.

The European Commission, national emissions trading authorities, or a European agency that is yet to be established could assume the role of such a regulatory authority. The involvement of national emissions trading authorities is likely to be a preferable approach, if only for the sake of subsidiarity and consistency with the existing emissions trading system.

So far, there is no clear roadmap for any modification of the existing EU ETS with regard to the integration of NETs. The next policy window for amending the ETS Directive will open in 2021, after the European Council’s decision on a new EU 2030 emissions reduction target, which will then have to be translated into new EU climate policy legislation, e.g. the EU ETS Directive, the Effort Sharing Regulation (ESR) and the LULUCF Regulation. Given the necessity to start incentivizing CO_2 removals as soon as possible, the complexity of the issue, the need to avoid perverse incentives, and the large number of possible regulatory approaches available, the debate regarding policy design options should begin sooner rather than later. In its new Circular Economy Action Plan published in March 2020, the European Commission (2020) already announced its intention to examine the development of a legal framework for the certification of CO_2 removal options on the basis of robust and transparent carbon accounting.

Despite the European Commission's initiatives, the political debate on integrating intentional CO_2 removal into EU climate policy is still in an early phase. So far, it is difficult to assess which Member States, political party groups, industries, companies, and NGOs want to promote CO_2 removal, which coalitions are emerging and which methods are preferred (Geden and Schenuit, 2020). In addition, since it is hardly foreseeable how the individual CO_2 removal methods will develop in terms of technology and costs, it is currently impossible to predict how and at what speed the transition to a targeted CO_2 withdrawal policy will take place. However, there can be no doubt that in order to achieve the EU target of GHG neutrality by 2050, it will be essential to design efficient incentive structures for CO_2 removals and to open up the most important climate policy instrument—EU emissions trading—to NETs.

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