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Abstract: Voluntary offsetting: credits and allowances

To date, the supply of units for the voluntary carbon market has been almost exclusively in the form of credits generated by projects under baseline-and-credit programmes. This report analyses the merits and challenges of another possible source of supply: allowances from emissions trading systems (ETSs). If the ETS cap is stringent, cancelling an allowance leads to an additional scarcity – and therefore to an additional emission reduction – within the system. Yet some ETSs have market stability instruments (MSIs), such as the Market Stability Reserve (MSR) in the EU ETS, which may provide for the invalidation of allowances in response to market developments. An MSI can thus affect the additionality (and consequently the environmental outcome) of voluntary offsetting. To address this in the specific context of the EU ETS, we find that voluntary buyers aiming to purchase allowances could adopt a 'buy-and-hold' approach, e.g. where a service provider purchases an allowance and holds it until the MSR no longer effects invalidations.

Ultimately, the differing interests and priorities of actors in the voluntary carbon market provide space for both credits and allowances. On the one hand, offset purchasers with a strong focus on international cooperation, the generation of co-benefits in developing countries, communicability with a clearer narrative, and a preference for the promotion of certain technologies may find credits more attractive. Credits often have lower prices but may carry integrity risks due to uncertainty in the establishment of additionality and crediting baselines, which may in turn also create reputational risks. On the other hand, actors in the voluntary market who prefer a higher certainty of the direct emission impact may favour allowances. Allowances may also be preferred by buyers keen to promote innovation or drive emissions reductions 'at home', as most buyers stem from developed countries. The main challenges of using allowances for voluntary cancellation are that emission reductions hinge on the stringency of the aggregated ETS cap over time, and that MSIs need to be appropriately considered.

Kurzbeschreibung: Freiwillige Emissionsausgleiche: Emissionsminderungsgutschriften und -zertifikate

Bisher erfolgte die Bereitstellung von Zertifikaten innerhalb des freiwilligen Kohlenstoffmarktes fast ausschließlich in Form von Emissionsminderungsgutschriften (Credits), die durch Projekte im Rahmen von Baseline-and-Credit-Programmen generiert wurden. Dieser Bericht analysiert eine weitere mögliche Bezugsquelle: Zertifikate aus Emissionshandelssystemen (EHS). Wenn die EHS-Obergrenze stringent ist, führt die Löschung eines Emissionszertifikats zu einer zusätzlichen Verknappung - und damit zu einer zusätzlichen Emissionsreduktion innerhalb des Systems. Einige Emissionshandelssysteme verfügen jedoch über Marktstabilitätsmechanismen (MSM), wie die Marktstabilitätsreserve (MSR) im EU EHS, welche die Stilllegung von Zertifikaten vorsehen als Reaktion auf anhaltende Überschüsse an Zertifikaten im Umlauf. Ein MSM kann daher die Zusätzlichkeit (und damit den Umweltnutzen) von freiwilligen Emissionsausgleichen beeinflussen. Um dem entgegenzuwirken, könnten Akteure, die freiwillig Zertifikate kaufen, einen "Buy-and-Hold"-Ansatz verfolgen, bei dem ein Dienstleister z.B. ein Zertifikat kauft und es hält, bis der MSM keine Stilllegung des Zertifikats mehr bewirkt.

Letztlich bieten die unterschiedlichen Interessen und Prioritäten der im freiwilligen Kohlenstoffmarkt agierenden Akteure Raum sowohl für Emissionsminderungsgutschriften als auch für Zertifikate. Auf der einen Seite könnten Kaufende von Emissionsausgleichen mit einem starken Fokus auf internationale Zusammenarbeit, Generierung von Zusatznutzen in

Entwicklungsländern, Kommunizierbarkeit der Emissionsminderung und die Förderung bestimmter Technologien Emissionsminderungsgutschriften attraktiver finden. Diese Gutschriften sind oft mit geringeren Kosten verbunden, können aber auch mit höheren Reputationsrisiken sowie erheblichen Risiken bei der Bestimmung der Zusätzlichkeit der Emissionsreduktion und der Referenzemissionen (Crediting Baselines) verbunden sein. Andererseits könnten am freiwilligen Markt Teilnehmende, die eine höhere Sicherheit der direkten Emissionsminderung bevorzugen, den Erwerb von Zertifikaten vorziehen. Zertifikate können auch von Kaufenden bevorzugt werden, die Innovationen fördern oder Emissionsminderungen "im eigenen Land" vorantreiben wollen, da die meisten Kaufenden aus Industrieländern stammen. Die größte Herausforderung bei der Verwendung von Zertifikaten zur freiwilligen Löschung besteht darin, dass Emissionsminderungen von der Stringenz der kumulativen EHS-Obergrenze im Zeitverlauf abhängen und MSM angemessen berücksichtigt werden müssen.

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ARP	Auction reserve price
BECCS	Bioenergy carbon capture and storage
CA	Corresponding adjustment
CER	Certified emission reductions
CCR	Cost containment reserve
CCS	Carbon capture and storage
DACCS	Direct air capture and carbon storage
CDM	Clean Development Mechanism
CSR	Corporate social responsibility
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
COP	Conference of the Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
ECR	Emissions containment reserve
EIB	European Investment Bank
ER	Emission reduction
ETS	Emissions Trading Scheme
EU ETS	European Union ETS
GHG	Greenhouse gas
GS	Gold standard
ICAO	International Civil Aviation Organization
IET	International Emissions Trading
IMO	International Maritime Organization
IPCC	Intergovernmental panel on climate change
ITMO	Internationally transferred mitigation outcome
JI	Joint Implementation
KP	Kyoto Protocol

LULUCF	Land use, land use change and forestry
MSI	Market stability instrument (generic)
MSR	Market Stability Reserve (of the EU ETS)
NDC	Nationally Determined Contributions (in Paris Agreement)
PA	Paris Agreement
RD&D	Research, Development & Deployment
RGGI	Regional Greenhouse Gas Initiative
TNAC	Total number of allowances in circulation (in the EU ETS)
VCS	Voluntary carbon standard
VER	Verified emission reduction
UNFCCC	United Nations Framework Convention on Climate Change

Summary

The voluntary carbon market has been a small but important piece in global action to address climate change. Increases in public awareness on the threats of climate change, alongside a clear gap in state-level climate ambition, have motivated increasing numbers of businesses, institutions and citizens to offset their emissions over the years.

To date, the supply of units for the voluntary carbon market has been almost exclusively in the form of credits generated by projects under baseline-and-credit programmes such as the Gold Standard, the Verified Carbon Standard (VCS), and the Clean Development Mechanism (CDM), among others. Done well, such projects can generate additional and real emission reductions and co-benefits in their host countries; however, credits have also been the source of concerns and criticism. The new context of the Paris Agreement, under which all countries have pledged mitigation targets or actions, brings additional challenges: new approaches for assessing additionality and establishing baselines may need to be developed, and double counting of emission reductions between the host country and the user of the carbon credits is a risk that should be mitigated.

Against this backdrop, this report analyses the merits and challenges of another possible source of supply for the purposes of voluntary offsetting: allowances from emissions trading systems (ETSs).

Emissions trading systems establish a cap on permissible greenhouse gas (GHG) emissions. An emission allowance is issued for each tonne of CO_2 equivalent allowed under the system. Cancelling an ETS allowance, then, means that aggregate allowed emissions by covered entities are one tonne lower. Whether this cancellation leads to an emission reduction depends on various factors, in particular the stringency of the cap: if the cap lies below the emissions level that would have occurred in the absence of the ETS, then in principle the cancellation of an allowance leads to an additional scarcity and therefore to an additional emission reduction within the system. The main ETSs have established caps that are likely to be below the emissions level that would occur in the absence of the ETS and, hence, the cancellation of allowances could drive emission reductions over time.

Yet ETSs have design elements – most notably market stability instruments (MSIs) – that can affect the environmental outcome of voluntary offsetting through cancellations of allowances. MSIs are policy tools that aim to reduce excess price variability from unexpected events such as economic downturns and technological breakthroughs. Most existing ETSs have some form of MSI; the EU ETS, for example, has the Market Stability Reserve – the MSR – which alters auction volumes depending on the total number of allowances in circulation. Other MSIs focus on price levels: allowance auction price floors and emission containment reserves can help deal with low prices, whereas cost containment reserves and price ceilings can help manage high prices. Importantly, MSIs may include provisions that alter the cumulative cap, e.g. through the cancellation of allowances in response to persistent allowance surpluses. Such cancellation (or ‘invalidation’) means that allowances are permanently removed from circulation, thereby reducing the cumulative cap. For example, in the EU ETS, the MSR is expected to invalidate approximately 2.3 billion allowances in 2023. In such cases, voluntary offsetting by businesses, institutions or citizens is no longer guaranteed to trigger additional emission reductions, as

(part of) that volume could be cancelled by the MSI had the voluntary cancellation not taken place.

In the context of the EU ETS we find that the additionality of voluntary cancellation can be maintained through a ‘buy-and-hold’ approach. Under such an approach, the entity acquiring allowances for voluntary offsetting purposes - usually a service provider – would purchase an allowance today, but would hold the allowance until the MSR no longer effects invalidations. Only then – possibly several years in the future – would the allowance be cancelled. Legal and contractual measures could be required to ensure that allowances purchased for voluntary cancellation are not brought back to the market at a future date. Similar strategies can be developed to account for the specific design features of MSIs in other ETSs to address this issue.

In terms of accounting, we find that the environmental risks arising from double claiming at UNFCCC level apply to both credits and allowances – highlighting the importance of applying corresponding adjustments in the NDC-level accounting to reflect cancellations from voluntary buyers. Alternatively, participants in the voluntary carbon market could change the nature of their claim to a (financial) ‘contribution’ to the implementation of a country’s NDC, rather than ‘offsetting’ or ‘carbon neutrality’.

Ultimately, the differing interests and priorities of the various actors in the voluntary carbon market provide space and opportunities for both credits and allowances. On the one hand, offset purchasers with a strong focus on international cooperation, the generation of co-benefits in developing countries, communicability with a clearer narrative, and a preference for the promotion of certain technologies may find credits more attractive. Credits often have lower prices but may carry integrity risks due to uncertainty in the establishment of additionality and crediting baselines, which in turn may also create reputational risks. On the other hand, actors in the voluntary market who prefer a higher certainty of the direct emission impact may favour allowances. Allowances may also be preferred by buyers keen to promote innovation or drive emissions reductions ‘at home’, as most buyers stem from developed countries. The main challenges of using allowances for voluntary cancellation are that emission reductions hinge on the stringency of the aggregated ETS cap over time, and that MSIs need to be appropriately considered.

Given the growing interest from non-state actors in increasing their contribution to global decarbonisation, new and innovative offsetting approaches, such as portfolios of credits and allowances aiming to capitalise on the various (and often complementary) benefits and risks of these units, may become increasingly relevant. This could facilitate urgently needed climate action and engagement while ensuring environmental integrity in voluntary offsetting.

Zusammenfassung

Der freiwillige Kohlenstoffmarkt war über die Jahre ein kleiner, aber wichtiger Teil der globalen Aktivitäten zur Bekämpfung des Klimawandels. Das gestiegene öffentliche Bewusstsein für die Gefahren des Klimawandels sowie eine deutliche Lücke in den Klimazielen auf staatlicher Ebene haben im Laufe der Jahre immer mehr Unternehmen, Institutionen sowie Bürgerinnen und Bürger dazu motiviert, ihre Emissionen auszugleichen.

Bislang erfolgte die Bereitstellung von Emissionszertifikaten für den freiwilligen Kohlenstoffmarkt fast ausschließlich in Form von Emissionsminderungsgutschriften (Credits), die durch Projekte im Rahmen von Baseline-and-Credit-Programmen wie dem Gold Standard, dem Verified Carbon Standard (VCS) und dem Clean Development Mechanism (CDM) generiert wurden. Wenn sie gut implementiert sind, können solche Projekte zusätzliche und reale Emissionsminderungen sowie Zusatznutzen in Ländern erzeugen, in denen sie implementiert werden. Solche Credits waren aber auch Gegenstand von Bedenken und Kritik. Der neue Kontext des Übereinkommens von Paris, in dem sich alle Länder zu Minderungszielen oder Minderungsaktivitäten verpflichtet haben, bringt zusätzliche Herausforderungen mit sich: Neue Ansätze zur Bewertung der Zusätzlichkeit von Emissionsminderungen und zur Festlegung von Anrechnungsgrundlagen (Crediting Baselines) müssen entwickelt werden und das Risiko der Doppelzählung von Emissionsminderungen zwischen dem Land, in dem das Projekt implementiert wird und dem Land, in dem die die Emissionsminderungsgutschriften genutzt werden, sollte reduziert werden.

Vor diesem Hintergrund analysiert der vorliegende Bericht die Vorzüge und Herausforderungen einer weiteren möglichen Bezugsquelle für freiwilligen Emissionsausgleich: Zertifikate aus Emissionshandelssystemen (EHS).

Emissionshandelssysteme legen eine Obergrenze für zulässige Treibhausgasemissionen fest. Für jede emittierte Tonne CO_2-Äquivalent, die innerhalb der Obergrenze zulässig ist, wird ein Emissionszertifikat ausgestellt. Die Löschung eines EHS-Zertifikats bedeutet also, dass die zulässigen Gesamtemissionen der vom EHS erfassten Unternehmen um eine Tonne geringer sind. Ob diese Löschung zu einer Emissionsreduktion führt, hängt von verschiedenen Faktoren ab, insbesondere von der Stringenz der Obergrenze: Liegt die Obergrenze unter dem Emissionsniveau, das ohne das EHS erreicht worden wäre, dann führt die Löschung eines Zertifikats grundsätzlich zu einer zusätzlichen Knappheit und damit zu einer zusätzlichen Emissionsreduktion innerhalb des Systems. Die wichtigsten Emissionshandelssysteme haben Obergrenzen festgelegt, die unter dem Emissionsniveau liegen, das ohne das Emissionshandelssystem eingetreten wäre. Daher könnte die Löschung von Zertifikaten in diesen Fällen im Laufe der Zeit zu Emissionsminderungen führen.

Emissionshandelssysteme haben jedoch Designelemente - vor allem Marktstabilitätsmechanismen (MSM) - die die Umweltwirkung der freiwilligen Emissionsausgleiche durch die Löschung von Zertifikaten beeinflussen können. MSM sind politische Instrumente, die darauf abzielen, Preisvolatilität bei unerwarteten Ereignissen wie wirtschaftlichen Rezessionen und technologischen Durchbrüchen zu verringern. Die meisten bestehenden EHS haben irgendeine Form von MSM; das EU-Emissionshandelssystem beispielsweise verfügt über die Marktstabilitätsreserve (MSR), die die Versteigerungsmengen der Zertifikate in Abhängigkeit von der Anzahl der im Umlauf befindlichen Zertifikate verändert.

Andere MSM konzentrieren sich auf das Preisniveau der Zertifikate: Preisuntergrenzen für die Versteigerung von Zertifikaten und Emission Containment Reserven können bei niedrigen Preisen eingreifen, während Cost Containment Reserven und Preisobergrenzen bei hohen Preisen helfen können. Ein wichtiger Aspekt ist, dass MSM zur Änderung der kumulativen Emissionsobergrenze beitragen können, z.B. durch die Stilllegung von Zertifikaten als Reaktion auf anhaltende Überschüsse an Zertifikaten. Eine solche Stilllegung (oder "Entwertung") bedeutet, dass Zertifikate dauerhaft aus dem Verkehr gezogen werden, wodurch die kumulative Obergrenze verringert wird. Im EU EHS wird erwartet, dass durch die MSR im Jahr 2023 etwa 2,3 Milliarden Zertifikate stillgelegt werden. Wenn ein MSM Zertifikate stilllegt, ist nicht mehr gewährleistet, dass freiwillige Emissionsausgleiche durch ein Unternehmen, eine Institution oder Individuen zusätzliche Emissionsminderungen auslösen, da (ein Teil) dieser Menge von der MSM stillgelegt werden könnte, wenn die freiwillige Löschung nicht stattgefunden hätte.

Wir stellen fest, dass die Zusätzlichkeit freiwilliger Löschungen durch einen "Buy-and-Hold"-Ansatz aufrechterhalten werden kann. Bei einem solchen Ansatz kauft das Unternehmen, welches Zertifikate zum freiwilligen Emissionsausgleich erwirbt - in der Regel ein Dienstleister - ein Zertifikat und behält dieses Zertifikat bis durch die MSR keine Zertifikate mehr stillgelegt werden. Erst dann - möglicherweise mehrere Jahre später - würde das zurückgehaltene Zertifikat gelöscht werden. Rechtliche und vertragliche Maßnahmen könnten erforderlich sein, um sicherzustellen, dass die für die freiwillige Löschung gekauften Zertifikate nicht zu einem späteren Zeitpunkt wieder auf den Markt gebracht werden. Bei anderen EHS können ähnliche Strategien entwickelt werden, um dieses Problem in Abhängigkeit vom spezifischen MSM-Design zu adressieren.

Was die Bilanzierung betrifft, so stellen wir fest, dass die Umweltrisiken, die sich aus der Doppelzählung (Claiming) auf UNFCCC-Ebene ergeben, sowohl für Minderungsgutschriften als auch für Zertifikate gelten. Das unterstreicht die Bedeutung der Anwendung von Corresponding Adjustments bei der Bilanzierung auf NDC-Ebene, um freiwillige Löschungen von Zertifikaten und Minderungsgutschriften korrekt widerzuspiegeln. Alternativ dazu könnten die am freiwilligen Kohlenstoffmarkt Teilnehmenden die Art ihres Anspruchs (Claim) auf einen (finanziellen) "Beitrag" zur Umsetzung des NDC eines Landes ändern, anstatt einen "Emissionsausgleich" oder "Klimaneutralität" zu beanspruchen.

Letztlich bieten die unterschiedlichen Interessen und Prioritäten der im freiwilligen Kohlenstoffmarkt Agierenden Raum sowohl für Emissionsminderungsgutschriften als auch für Zertifikate. Auf der einen Seite könnten Emissionsausgleich Kaufende mit einem starken Fokus auf internationale Zusammenarbeit, auf Generierung von Zusatznutzen in Entwicklungsländern, auf die Kommunizierbarkeit der Emissionsminderung und auf eine Präferenz für die Förderung bestimmter Technologien Emissionsgutschriften attraktiver finden. Diese Gutschriften sind oft mit geringeren Kosten verbunden, können aber auch mit Integritätsrisiken, aufgrund erheblicher Risiken bei der Bestimmung der Zusätzlichkeit der Emissionsminderung und der Referenzemissionen (Crediting Baselines), verbunden sein, was wiederum zu Reputationsrisiken führen kann. Andererseits könnten am freiwilligen Markt Teilnehmende, die eine höhere Sicherheit der direkten Emissionsminderung bevorzugen, den Erwerb von Zertifikaten vorziehen. Zertifikate können auch von Kaufenden bevorzugt werden, die Innovationen fördern oder Emissionsminderungen "im eigenen Land" vorantreiben wollen, da die meisten Käuferinnen und Käufer aus Industrieländern stammen. Die größte Herausforderung bei der Verwendung von Zertifikaten zur freiwilligen Löschung besteht darin, dass Emissionsminderungen von der Stringenz der kumulativen EHS-Obergrenze im Zeitverlauf abhängen und MSM angemessen berücksichtigt werden müssen.

Angesichts des wachsenden Interesses nichtstaatlicher Akteurinnen und Akteure, die ihren Beitrag zur globalen Dekarbonisierung erhöhen wollen, könnten neue und innovative Ansätze zum Emissionsausgleich immer relevanter werden: z.B. Portfolios von Emissionsminderungsgutschriften und Zertifikaten, die darauf abzielen, aus verschiedenen (und oft komplementären) Vorteilen und Risiken dieser Emissionseinheiten Kapital zu schlagen. Dies könnte dringend erforderliche Klimaschutzmaßnahmen und Engagement erleichtern und gleichzeitig die Umweltintegrität bei freiwilligen Offsets gewährleisten.

1 Introduction

The consensus reached by 195 countries on the long-term goal to limit the increase in global average temperatures to 'well below 2°C' and pursue efforts to limit the increase to 1.5°C is one of the Paris Agreement's (PA) key achievements. However, it is well documented that the aggregate greenhouse gas (GHG) emission reductions pledged so far in the Nationally Determined Contributions (NDCs) are insufficient to deliver that goal (UNEP 2018). At the same time, the Intergovernmental Panel on Climate Change (IPCC) Special Report on the impacts of global warming of 1.5°C outlined the significant damages and risks implied by even this modest level of warming and highlighted how narrow and rapidly closing the window of opportunity is for limiting warming to 1.5°C (IPCC 2018).

In response, 2019 saw numerous public protests demanding greater action and a more effective response to climate change. Activists coalescing around the Extinction Rebellion group brought major cities, including London, Paris, Berlin, Amsterdam, New York, Los Angeles and Sydney, to a stand-still (Financial Times 2019). With the emergence of an environmental movement amongst the younger generation, the public increasingly expects more from governments in terms of policy interventions and from businesses with regards to their corporate social responsibility (CSR) (New York Times 2019). In addition, private citizens themselves appear eager to engage as individuals and directly contribute via their own consumer choices or by voluntarily offsetting their environmental impact. While it is preferable to avoid or reduce GHG emissions, or switch to GHG-free alternatives altogether, these pathways are often less affordable or not readily available. In these circumstances, the voluntary offsetting of GHG emissions is one way that concerned businesses, institutions, citizens and even local or national governments can contribute to the overall mitigation effort. So far, such voluntary offsetting has occurred almost exclusively through the purchase and subsequent cancellation of credits generated by emission reduction projects under baseline-and-credit programmes such as the Gold Standard, the Verified Carbon Standard (VCS), and the Clean Development Mechanism (CDM), among others. Done well, such projects and activities can help reduce GHG emissions and contribute to the sustainable development of their host countries, yet several concerns and criticisms have been raised over the years. The new context of the Paris Agreement brings additional challenges, as rules for accounting, additionality and baselines are more complex when all countries have mitigation targets. Against this backdrop, some stakeholders are starting to promote voluntary offsetting through the *purchase and cancellation of allowances from emissions trading systems (ETSs)* – such as the European Union Emissions Trading System (EU ETS), the Regional Greenhouse Gas Initiative (RGGI), and the Korean ETS, among others.

This report assesses the possible benefits and drawbacks of using ETS allowances for voluntary offsetting, in comparison to using credits from baseline-and-crediting programmes. A particular emphasis is placed on assessing the implications of market stability instruments (MSIs) that have been implemented under several ETSs. To this end, chapter 2 describes the two different approaches to voluntary offsetting, namely the classical approach of using credits and the alternative approach of using allowances. Chapter 3 develops a framework for comparing these two distinct approaches to voluntary offsetting. This comprises various aspects, including the source, timing, additionality, and transparency of the emission reductions implied by the two types of voluntary actions, as well as the likelihood of double counting and the positive or perverse incentives that may arise from the use of these units. For simplicity, chapters 2 and 3 assume that allowances are obtained from an ETS that does not have a market stability instrument (MSI).

Chapter 4 confronts the fact that many existing ETSs do in fact have an MSI. In order to analyse how an MSI may interact with voluntary cancellation of allowances, the report provides a detailed exposition of the MSI in the world's largest and longest-running ETS, namely the MSR of the EU ETS. Using illustrative scenarios, it then clarifies the conditions under which the additionality of voluntary cancellations in the EU ETS – the most relevant dimension of comparison for the purposes of this chapter – can be compromised. The chapter also provides an overview of MSIs in other existing ETSs around the world and discusses how they can interact with voluntary cancellations. Chapters 3 and 4 are intended to create a basis for deciding whether and under what conditions businesses, institutions and citizens may be better served using credits versus allowances to implement their voluntary actions. This is the subject of chapter 5, which concludes by providing a synthesis of the project's findings and offering practical recommendations for businesses, institutions and citizens for effecting their voluntary actions.

Preliminary findings from the research were presented and discussed at the workshop "Future Role of Carbon Markets in Facilitating Voluntary Climate Action", held on 21-22 November 2019 in Berlin, Germany, and organized by the German Environment Agency. The feedback received during the workshop was considered in the completion of this report.

This report makes use of specific terminology. 'Voluntary offsetting' is understood to mean the activity of various actors in compensating for unavoidable emissions through the cancellation of carbon units. These units can either be 'credits' from crediting programmes such as the CDM and VCS, or 'allowances' from ETSs. Both credits and allowances can be 'cancelled', which is understood to mean that they are removed from the market such that no other market actor can make use of the same unit.

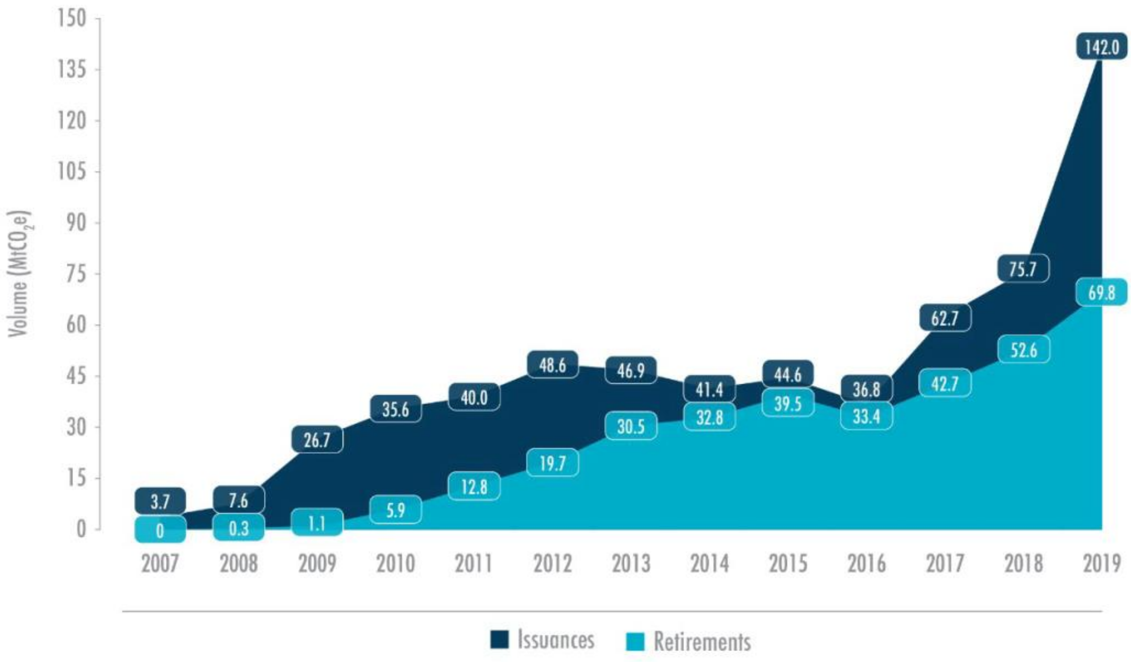
2 Two approaches to voluntary offsetting

The two approaches to raise climate ambition via voluntary offsetting (i.e. the purchase and cancellation of either credits or emission allowances) are briefly outlined in this chapter. Chapter 3 then compares them across several criteria.

2.1 The 'classical' approach: credits

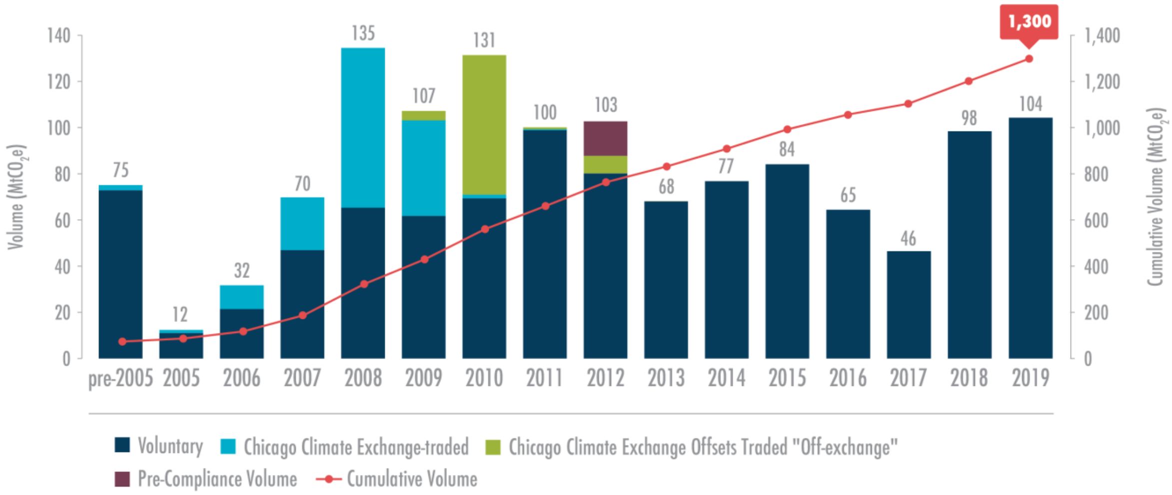
Most voluntary offsetting to date has concentrated on the purchase and cancellation of credits generated by baseline-and-crediting programmes such as the Clean Development Mechanism (CDM), the Gold Standard (GS) and the Verified Carbon Standard (VCS) managed by Verra. Ecosystem Marketplace (2020) estimates that around 612 million carbon credits were issued between 2007 and 2019 from baseline-and-crediting programmes that targeted mainly the voluntary market, including 142 million in 2019 alone. Of this total, 341 million credits were cancelled during the same period (see Figure 1). Figure 2 shows the various sources of demand and cumulative transaction volumes over the same period.

Figure 1: Annual Voluntary Carbon Offset Issuances and Retirements (or 'Cancellations')



Source: Ecosystem Marketplace (2020)

Figure 2 - Historical Transaction Volumes



Source: Ecosystem Marketplace (2020)

Figure 1 shows the increase in the volume of credits issued and cancelled in recent years, reflecting increased awareness of climate change as an issue that has led businesses, institutions and citizens to enhance their voluntary actions to reduce emissions. The voluntary market can also be used to help prepare businesses for new or expanding compliance markets that, once in operation, may lead to a downturn in the use of voluntary markets.[1] According to Ecosystem Marketplace (2020), the main buyers of credits on the voluntary market are made by multi-national, private, for-profit companies that in the past have often offset part of their emissions as part of a broader environmental sustainability strategy.

With increased awareness on the urgency of addressing climate change, demand for voluntary offsetting is likely to increase for both private enterprises and individuals purchasing offsets to lower their carbon footprint. An important source of (future) demand is also the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) adopted by the International Civil Aviation Organization (ICAO), which requires airline operators to offset emissions above 2020 levels. While CORSIA provisions foresee the possibility of using allowances for offsetting, for the initial years it is expected that only credits will be eligible.

2.2 Voluntary action by purchasing and cancelling allowances

To date, credits have been the primary focus for offsetting activities. Allowances from an ETS can also be used for offsetting, since offsetting of GHG emissions in essence means that these emissions are reduced elsewhere,[2] i.e. beyond the boundaries of the respective GHG reduction policy, activity, or installation. So far, however, allowances are hardly used as a vehicle for

[1] The methodology adopted for the 2019 edition of the State of the Voluntary Carbon Markets by Ecosystem Marketplace changed to instead focus on offsets transacted, as opposed to offsets issued or retired. According to this methodology (based on survey respondents only), tracked transactions of voluntary carbon offsets for 2018 accounted for emission reductions equivalent to 98.4 $MtCO_2e$.

[2] "A greenhouse gas (GHG) or "carbon" offset is a unit of carbon dioxide-equivalent (CO_2e) that is reduced, avoided, or sequestered to compensate for emissions occurring elsewhere." (Goodward und Kelly (2010))

voluntary climate action. For example, neither Ecosystem Marketplace (2020) nor World Bank (2019) mention allowances in the context of the voluntary carbon market.

TheCompensators* is one of the early organisations that explicitly focuses on allowance cancellation in the context of the EU ETS.[3] They are a spin-off of the Potsdam Institut für Klimafolgenforschung and were founded in 2006 (Neebe 2006). Another early example is Sandbag, "a non-profit climate change think tank based in Brussels and London", which operated a now-defunct "carbon destruction service".[4] More recently, there has a been an increasing interest in voluntary allowance cancellations with several organisations being formed in Europe, such as 50ZERO[5], Carbonkiller[6] and ForTomorrow[7].

In an ETS, the total emissions from covered sources cannot exceed the cap. In principle, the cancellation of allowances for voluntary purposes enhances the stringency of the cap and may thus induce further emission reductions in the ETS. In practice, a crucial condition for the cancellation of an allowance to trigger an emission reduction is "scarcity". This means that the number of available allowances (and other eligible compliance units) must be lower than emissions that the regulated entities would emit in the absence of the ETS, holding all else constant. Scarcity implies that the entities covered by the ETS are willing to pay a price to obtain allowances to comply with their obligations under the ETS.

Figure 33 illustrates the effects of the voluntary cancellation of allowances. The left panel shows a scenario without voluntary cancellation. The fixed supply of allowances is depicted with the vertical supply curve S_1 and the demand for allowances is given by the downward sloping demand curve D_1. The latter is downward sloping because more abatement options become economically viable with higher prices. In the figure, the resulting equilibrium price is P_1. The right panel illustrates the effect of cancelling one allowance for voluntary purposes. The cancellation increases the scarcity in the ETS by reducing the total number of available allowances for compliance to $Q_2 = Q_1 - 1$, as illustrated by a leftward shift of the vertical permit supply curve in Figure 3, and increases the price from P_1 to P_2. This may then lead to a decline in the emissions of the covered entities by 1 tCO2e. In other words, the voluntary action is additional because one less allowance is available for use for compliance purposes.

In practice, however, the scarcity in ETSs hinges on several conditions and assumptions:

1. **Stringency of the cap:** The stringency of the cap is determined by the regulator. If an ETS is over-supplied, i.e. if the cap is less stringent than the total emissions that the regulated entities would emit in the absence of the ETS, then the cancellation of an allowance may not trigger any emission reduction. As most ETSs allow for banking of allowances, scarcity does not only depend on the stringency of the current cap, but on the stringency of the cumulative cap over time. This issue is further discussed in section 3.1.4 below.
2. **Market stability instruments (MSI):** Many ETSs establish market stability instruments. These are policy instruments that aim to stabilise the allowance market and include the Market Stability Reserve (MSR) of the EU ETS and various price management mechanisms

[3] See https://thecompensators.org/en/ for details.

[4] See https://sandbag.be/index.php/carbon-destruction-service/for details.

[5] https://50zero.eu/

[6] https://carbonkiller.org/en

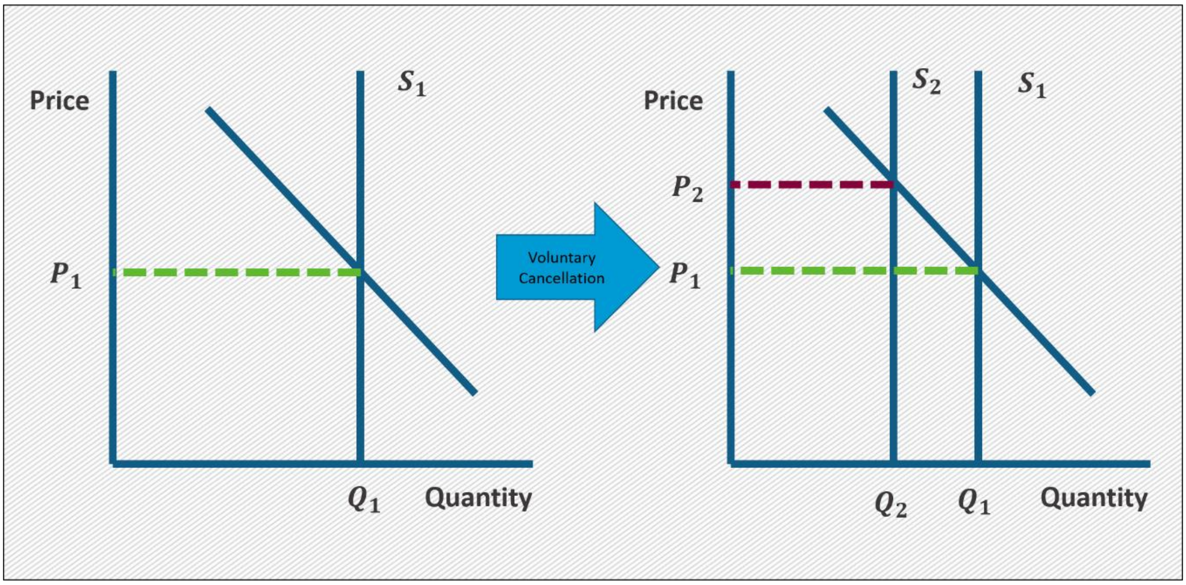
[7] https://www.fortomorrow.eu/en/home

adopted elsewhere (see Table 4 in Section 4.3). MSIs can, in effect, alter the number of allowances available. In the presence of MSIs, the cancellation of an allowance can change the number of allowances that are effectively available to the covered entities. Under these circumstances, the cancellation of one allowance may not necessarily induce further emission reductions. The significantly greater complexity implied by the presence of an MSI -- and of the EU ETS MSR in particular - is the focus of chapter 4 below.

3. **Linking ETSs:** Some ETSs establish linking agreements, where one system recognises allowances from the other scheme for compliance and vice versa, such as the linking agreement between Switzerland and the European Union (European Union 2017). In the case of linking, the stringency depends on the cumulative caps from *both* systems.
4. **Use of carbon credits:** Some ETSs allow regulated entities to use carbon credits to comply with their obligations. In this case, the voluntary cancellation of an allowance could imply that more carbon credits are used by the regulated entities, depending on the price of allowances and carbon credits and any limits established on the use of carbon credits. The effect of the voluntary cancellation would then depend on the "quality" (or direct emissions impact) of the carbon credits used.

In this study, we first compare in section 3 the use of credits and allowances for voluntary cancellation under the assumption of an ETS that provides for scarcity and that has no cap-altering provisions in place, such as MSIs, linking agreements or the use of carbon credits. Section 4 then explores the influence of market stability instruments on the environmental effects of allowance cancellations.

Figure 3: Supply and demand in an ETS



Source: Authors' elaboration, adelphi and Öko-Institut

3 Comparing credits and allowances

With the view to discussing the advantages and disadvantages of using allowances or credits to offset GHG emissions, we identify and discuss in section 3.1 a number of relevant criteria to understand the differences between and similarities of both approaches. These criteria are largely intertwined and can therefore not always be fully distinguished. In section 3.2 we provide an overview and discussion of the findings of this chapter.

3.1 Criteria and comparison

For this initial comparison we largely ignore the existence of MSIs, as they can add several layers of complexity. Before explaining these complexities in chapter 4, it is helpful to start the comparison with a 'simple' ETS such as the one described in section 2.2. For this simple case, we therefore assume, unless explicitly stated otherwise, that the ETS in question is not oversupplied, is appropriately monitored and managed, and provides at least some signal of scarcity, so that allowance prices are sufficiently high to induce emission reductions.

3.1.1 Identifying the mitigation measure

A project-based credit is directly linked to one specific GHG reduction project. Credits commonly have a serial number that identifies the project and the period in which the emission reductions occurred. Most programmes also include publicly accessible databases which allow identifying further relevant information, such as the relevant monitored period or the date that the credit was issued. It can thus clearly be identified from which exact project the credit used for offsetting a GHG emission stems. It also can be identified when the emission reduction was actually achieved, e.g. whether it was generated prior to 2021 or prior to 2013 (see also section 3.1.4).

In an ETS, the total emissions from all regulated entities are capped. In an ETS with scarcity and without cap-altering provisions (as described under section 2.2), the voluntary cancellation of an allowance leads to a tightening of the cap. The covered entities have fewer allowances available and therefore need to increase their mitigation. Pursuant to economic theory, the additional reduction is achieved where the mitigation cost is lowest. However, due to the complexity of the interaction it cannot be identified *where* the cancellation of an allowance actually triggers an additional reduction effort. In an ETS, the emission reduction is thus achieved at the system level and is not attributable to an individual installation. (The issue of the timing of emission reductions is further explored in section 3.1.4.)

A key difference between using allowances or credits for voluntary offsetting with regard to the mitigation measure is, thus, that those who intend to offset can in the case of credits select the types of mitigation actions they intend to support, whereas this is not possible for the cancellation of allowances.

3.1.2 Direct emissions impact

A key consideration for using credits or allowances for offsetting is whether the cancellation of a units leads to an emission reduction of at least 1 tCO_2e within the boundaries of the carbon crediting project or the ETS. This "direct" emissions impact is sometimes also referred to as "unit quality" (Schneider und La Hoz Theuer 2019) but does not consider indirect effects, such as whether the emission reductions was double-counted or how the cancellation may affect the ambition of countries' future mitigation targets. (These indirect effects are separately discussed in the sections below.)

The issues that matter for the direct emissions impact are partially the same for crediting programmes and ETSs and partially different.

Under crediting mechanisms, an emission reduction of at least 1 tCO_2e is, in principle, ensured if the mitigation action is additional – i.e., it would not occur in the absence of the incentives from the crediting mechanism – and if the emission reductions are not overestimated (Schneider and La Hoz Theuer 2019; Cames et al. 2016; Gillenwater 2011). Moreover, non-permanence risks – risks that the emission reductions or removals are only temporary and could be reversed in the future – must be appropriately addressed.

Assessing **additionality** is one of the main challenges for crediting mechanisms. The main challenge is that it requires assessing a counterfactual situation – what would have occurred in the absence of incentives from the crediting programme – which cannot be falsified. Moreover, there is often considerable uncertainty around parameters that influence investment decisions, such as future fuel prices, and information asymmetry between project developers and carbon crediting programmes can exacerbate the problem of assessing whether a project is truly additional. These challenges are recognised in a large body of literature which calls the additionality of many carbon crediting projects into question (for example: Bogner and Schneider 2011; Dechezleprêtre et al. 2014; Gillenwater 2011; Haya und Parekh 2011; He und Morse 2010; Kartha et al. 2005; Schneider 2009; Michaelowa 2009; Cames et al. 2016; Purdon und Lokina 2014 ; Kollmuss et al. 2015). One result of these analyses is that the likelihood of additionality varies considerably by project type (Cames et al. 2016). Some project types are very likely to be additional, but even some of these are at risk of discontinuing GHG abatement without carbon credit revenues (Warnecke et al. 2019a; Warnecke et al. 2019b; Schneider and La Hoz Theuer 2017; Schneider and Cames 2014); others are less likely to be additional.

These challenges are considered by carbon crediting programmes in different ways. First, some programmes have improved their approaches to assessing additionality over time, including the introduction of more standardised approaches to demonstrating additionality, such as eligibility criteria, market penetration rates or emissions benchmarks. Second, several crediting programmes have reassessed their project portfolios and excluded project types with a lower likelihood of being additional. In conclusion, the available research and experience suggest that the risk of non-additionality of project-based credits is indeed a problem. This may play an even greater role for voluntary offsetting than for in compliance markets since voluntary buyers may face a higher reputational risk if the units they purchase are accused of not being additional; this would undermine the initial intention of voluntary offsetting and even flip the original effort into a negative image.

In some instances, the direct emissions impact of credits does not only depend on additionality but also on **whether an already implemented project is at risk of discontinuing GHG abatement without revenues from carbon credits**, which has also been referred to as 'vulnerability' (Warnecke et al. 2019a; Warnecke et al. 2019b; Schneider and La Hoz Theuer 2017; Schneider and Cames 2014; Warnecke et al. 2017; Schneider et al. 2017). This holds for a market situation where the supply of credits considerably exceeds demand. If in such a market situation projects have already been implemented – and hence investment costs are sunk – a key consideration for the global GHG emissions impact is whether these projects would continue to reduce GHG emissions even without credit revenues, or whether they are at risk of discontinuing GHG abatement. In such markets, a direct emissions impact of at least 1 tCO_2e may only be ensured if credits from 'vulnerable' projects are used.

Under crediting mechanisms, ensuring that emission reductions are **not overestimated** involves several aspects, including that the emission reductions be real, measurable and attributable to the credited activity and that indirect emission effects be appropriately considered. As with assessing additionality, quantifying emission reductions is associated with uncertainty. This is often addressed by making conservative assumptions and choices in quantifying emission reductions.

Overall, the available research suggests that the risk of over-estimating emissions reductions is more easily addressed than the uncertainty around additionality (Cames et al. 2016). Nevertheless, serious problems with the quantification of emission reductions have been identified with some project types (Haya et al. 2019; Lo Re et al. 2019; Cames et al. 2016; Bailis et al. 2015; Kollmuss et al. 2015; Schneider et al. 2015; Schneider und Kollmuss 2015; Lee et al. 2013; Lazarus und Chandler 2011; Schneider et al. 2010; Schneider 2011; Sonter et al. 2015). For some project types, perverse incentives that led to over-estimation of emission reductions are a major concern (Schneider und Kollmuss 2015; Schneider 2011; Schneider et al. 2010). In some instances, the relevant methodologies were revised to address these concerns (Cames et al. 2016). It is also uncertain for how long projects will reduce emissions, as they might be implemented regardless at a later stage without incentives from a crediting mechanism – an issue that is usually not addressed under crediting mechanisms.

In quantifying emission reductions, emission increases outside the project boundary are a particular concern (leakage). Carbon crediting mechanisms generally aim to incorporate such effects in calculating emission reductions. In practice, some effects are not considered. This relates mainly to two areas: first, international leakage has been identified as a concern for types of activities, in particular for LULUCF activities such as avoiding deforestation (Pan et al. 2020; Schwarze et al. 2002) but for example also for N_2O abatement from adipic acid production (Schneider et al. 2010). Second, there are concerns that emission reductions may be over-estimated due to domestic rebound effects. Credit revenues are similar to subsidies, which often lower the cost of the product or service provided (e.g. electricity, cement, transportation), thereby inducing greater demand for the product or service (rebound effect). This may lead to an increase in emissions elsewhere, something that is usually not considered under crediting programmes. Calvin et al. (2015) show that ignoring such system-wide rebound effects due to the subsidies for crediting projects in the power sector can lead to significant over-crediting compared to the actual reductions at system level. This is mainly because credits subsidise the deployment of technologies with lower emissions instead of penalising the use of more emitting technologies and because methodologies draw the boundary around a project and do not consider the wider rebound effects (Doda and Fankhauser 2017).

Under ETSs, the direct emissions impact of cancelling allowances mainly depends on whether the ETS cap is set below the emissions level that would occur in the absence of the ETS, and whether the emissions from the regulated entities are monitored appropriately. Other design features, such as price collars, allowance reserves, the import of credits, and provisions for the banking of allowances, also affect the direct emissions impact of each unit, mainly by altering the cap (Schneider und La Hoz Theuer 2019).

Whereas for credits the direct emissions impact may vary considerably between different credits, for ETSs it does not matter which specific allowances from an ETS are used; rather, the direct emissions impact depends on the overall ETS design. The direct emissions impact therefore needs to be assessed at system level. This involves several challenges.

The most important component is the stringency of the cap over time. If the cap is below the emissions level that would occur without the ETS, i.e. if the ETS is not 'over-supplied', then the purchase and cancellation of an allowance lowers the level of emissions that the regulated entities may emit, thus implicitly enhancing the stringency of the cap, and thereby lowering emissions (not considering here the effect of MSIs). By contrast, purchasing and cancelling allowances from an ETS that is oversupplied, meaning that the cap is above the expected business-as-usual development of GHG emissions (hot air), would not contribute to reducing emissions.

The main question for comparing the direct emissions impact of cancelling credits and allowances is therefore the ability to assess and ensure the additionality of credits versus the stringency of the ETS cap, in particular whether one can be assessed more reliably than the other. As discussed above, the experience gained with crediting programmes indicates that the challenges of assessing additionality are considerable. So, can the stringency of the cap of an ETS be assessed and ensured more reliably?

The type of issues that matter for assessing the stringency of an ETS are rather different from the issues for assessing the additionality of credits:

- First, ETSs commonly allow the banking of allowances. This means that it is not only the cap for a current compliance that matters but the ambition of the cumulative cap from all compliance periods since the inception of the ETS. Several ETSs have accumulated allowance surpluses from previous periods which were 'over-supplied'. Nevertheless, the cumulative cap could still be below the emissions level that would occur without the ETS.
- Second, whether a cap is below the emissions level that would occur without the ETS may change over time for various reasons. For example, an economic recession could result in lower emissions from the regulated entities, bringing them below the emissions level that would occur without the ETS. Similarly, changes in fuel prices or other climate policies, such as renewable energy or energy efficiency policies, can affect the emissions level that would occur without the ETS. This means that there is some uncertainty about whether a cap that currently seems stringent will remain so in the future.
- Third, the cumulative cap depends not only on the stringency of past and current compliance periods but also on that of future compliance periods. In some instances, the caps for future compliance periods may not yet be decided, or after their adoption, the stringency of the cap might be changed by policy-makers in the future. An ETS could also be abandoned altogether. The direct emissions impact of allowance cancellations thus also depends on future decisions by policy-makers. Other external effects (such as technological developments) can also have important effects on ETS stringency. There is therefore some

regulatory uncertainty. A similar challenge also applies to crediting mechanisms, as observed with the CDM. The expected demand for credits can change over time, as happened to the CDM, for example due to changes in the number of offset credits that are eligible under ETSs. Once a carbon credit market is over-supplied to the extent that a significant number of offset credits can no longer be sold, then purchasing and cancelling credits from already existing projects that are not vulnerable to the risk of discontinuing GHG abatement would not trigger any further emission reductions, as compared to not purchasing and cancelling these credits.

A further important consideration is how the stringency of caps could be practically assessed. As with crediting mechanisms, the emissions level that would occur without the ETS is a counterfactual scenario that cannot be falsified, as it cannot be empirically observed. One approach could be using models to estimate the emissions level that would occur without the ETS. This could in principle be viable but also involves some uncertainty, in particular due to the model's assumptions and methodological approaches.

Another approach could be to use the allowance price as an indicator for the stringency or scarcity of allowances. The price of allowances depends on both the GHG abatement costs within the system and the stringency of the cap (see Figure 3 above). While GHG abatement costs may differ between ETSs, it is clear that the price would go towards zero if a system is oversupplied, i.e. if the cap is less stringent than the emissions that would occur in the absence of the ETS. The price reflects the expectations of all the market participants on both GHG abatement costs and the stringency of the system. For example, the price may increase if most market participants expect that a cap will be tightened by policy-makers, or it could decrease if they expect that economic growth will slow down. One could thus argue that a higher price reflects a higher confidence by the market participants that there will remain scarcity in the system. One could also argue that a higher price provides more certainty that there will still be scarcity in the case of unforeseen events, such as an economic recession. If the price is already low (say, 1 EUR) and an economic recession kicks in, it may slide close to zero. However, if the price is significantly higher, the likelihood that the system will still have scarcity in the case of an economic recession may also be much higher. In the course of the COVID-19 pandemic, for example, the allowance price in the EU ETS dropped from levels of about EUR 25 to about 15-20 EUR in March and April 2020, before recovering back to previous levels.

One advantage of using the allowance price as indicator for the stringency of the cumulative cap is that the price reflects the expectations of typically thousands of market participants, rather than relying on specific models (for ETSs) or on the assessment of information provided by a project participant (for crediting programmes). In this regard, the allowance price may also reflect to some extent the expectations of market participants about the stringency of future compliance periods. Moreover, for most ETSs the allowance price can be empirically observed and is publicly available information. It may thus be a more objective means of assessing whether the ETS has scarcity than using modelling.

An interesting question is what price level should be deemed high enough to have sufficient confidence that the system will continue to have scarcity. Ultimately, the 'minimum price' level that an ETS should have to use it for voluntary offsetting may depend on the level of confidence that the users may want to have.

Next to the stringency of the cap, it is also important to ensure that emissions are appropriately monitored. Even if an ETS has scarcity and therefore a high price, a systematic underestimation of the emissions from the regulated entities would still undermine the quality of the allowances. For example, if emissions were systematically under-estimated by 5%, the cancellation of one allowance may only lead to an emission reduction of 0.95 tCO_2e. In theory, a systematic underestimation of emissions could also lead to less scarcity in the ETS and lower allowance prices. In practice, however, it is unlikely that emissions are under-estimated to such an extent. For example, if the cap of an ETS were 20% below the emissions that would occur in the absence of the ETS and the emissions were systematically over-estimated by 5%, then there would still be scarcity, despite the price potentially being somewhat lower than it would be with accurate monitoring. Ensuring that emissions are appropriately monitored is thus likely to involve lower uncertainties than ensuring that the cap is sufficiently stringent. Quantifying emissions robustly mainly requires sound methodologies, as well as robust auditing, and enforcement systems.

International leakage, i.e. the shift of production outside the boundaries of the ETS, is also a key concern for such systems. This risk may be mitigated through the free allocation of allowances to industries that are exposed to this risk or through carbon border adjustments, as recently proposed by the European Commission for the EU ETS (EC 2019). Indirect emission increases can also occur if the use of biomass is permitted under an ETS but the possible consequential reduction in carbon stocks in the LULUCF sector is not accounted for.

In contrast to crediting approaches, indirect emission increases due to domestic rebound effects are not a concern for ETSs. Auctioning allowances under an ETS generally provides incentives to reduce the demand for products or services while simultaneously incentivising a shift in the technology mix used in producing these products and services towards less carbon-intensive technologies. Moreover, any increases in emissions due to rebound effects would fall under the ETS cap and thus not lead to an increase in emissions.

Lastly, both crediting programmes and ETSs need to address the risk of non-permanence, i.e. the reversal of emission reductions or removals in the future. This holds in particular for emissions and removals in the land-use sector but also applies to some other activities such as the geological storage of CO_2. Most ETSs – with the exception of the New Zealand ETS – do not cover the land-use sector, while most crediting programmes allow for such activities. The challenges are in principle the same for ETSs and crediting programmes, in particular ensuring that non-permanence is identified over a sufficiently long period and compensated or accounted for.

Overall, given the considerable uncertainties with assessing the additionality of credits, in our view an allowance price level that is sufficiently above zero[8] would provide a higher likelihood for achieving an emission reduction of at least 1 tCO2e than for most credits currently on the market, noting however that – in contrast to allowances – the quality of credits strongly differs depending on the project type and the specific project. Those project types that are deemed to have a high likelihood of additionality may provide a similar confidence, in particular if they determine the emission reductions in a rather conservative manner. This is because under ETSs

[8] According to economic theory, a price above 0 would already indicate that an ETS is not oversupplied, at least in the long-term. However, given that the conditions underlying current prices may change in the future, e.g. through a recession or policy decisions on the level of future caps and taking into account the precautionary principle as a fundamental requirement for all long-term environmental policy issues, it seem more appropriate to apply a minimum price level higher than 0, e.g. a level between 5 and 20 €/t. This level is to some extent arbitrary. However, it can hardly be determined scientifically and will remain a political decision. Providing justification for this level is not the focus of this paper.

emissions are typically determined accurately (i.e. the best estimate) whereas under crediting programmes emissions are typically intended to be estimated conservatively (i.e. with a bias towards under-estimating the emission reductions).

3.1.3 Avoiding double counting

An essential element of the Paris Agreement is that all countries must regularly communicate mitigation targets or actions in the form of NDCs. Article 6 of the Paris Agreement requires that countries must avoid double counting of emission when engaging in cooperative approaches to achieve their NDCs. Over the past years, stakeholders have controversially discussed whether it is also necessary to avoid the double counting of emission reductions in the case of voluntary offsetting and how the voluntary market could continue to operate after 2020 (Kreibich und Hermwille 2020; Fearnehough et al. 2020; Gold Standard Foundation 2020).

Double counting means that the same emission reduction is used more than once to achieve climate mitigation targets or goals (Schneider et al. 2019; Schneider et al. 2015). Double counting can occur in three different ways, through:

- Double issuance, i.e. issuing more than one unit for the same emission reductions;
- Double use, i.e. using the same unit more than once; and
- Double claiming, i.e. if the same emission reduction is claimed both by the user of the unit and by the jurisdiction where the emission reductions occur when it reports a lower level of emissions when demonstrating achievement of its mitigation target.

Double claiming

For voluntary offsetting, the main controversy regards the need for avoiding **double claiming**. Double claiming occurs if both the user of the offset and the country where the emission reductions occur claim the reductions associated with the cancellation of the credit or allowance. This can occur because the emission reductions from projects or ETSs are typically automatically reflected in the GHG inventories that countries use to track progress towards the implementation and achievement of their NDCs. Some stakeholders have argued that avoiding double claiming is only necessary between targets under UN agreements (NDCs, CORSIA, etc.), i.e. at the country level, arguing that "as private sector entities have no reporting requirements to the UN, their voluntary actions are not double counted in the UN's global inventory" (ICROA 2019). However, assuming countries aim to achieve their targets, such voluntary action may not contribute to *additional* GHG reduction but *rather alleviate countries' mitigation efforts* – so that these voluntary actions may not qualify as *offsetting*.

In the light of these concerns, different models for voluntary offsetting under the Paris Agreement are being discussed, including (see, for example, Gold Standard (2020)):

- Changing the nature of the claim made by the offset users to a (financial) 'contribution' rather than 'offsetting' or 'carbon neutrality';
- Using only offsets from sectors and GHGs that are not covered by NDCs; and
- Avoiding double claiming by ensuring that the relevant countries do not use the emission reductions to achieve their NDCs. This last option could be implemented if countries apply

so-called ‘corresponding adjustments’ for emission reductions that are used for voluntary offsetting, consistent with the accounting for the international transfer of emission reductions under Article 6 of the Paris Agreement.

It is important to note that the risk of double claiming applies to any offsetting measure – both from allowances and credits. In all cases it is conceivable that the voluntary cancellation could help the jurisdiction where the abatement occurs to achieve its targets, thereby alleviating the jurisdiction’s efforts – but without generating emission reductions that go beyond what the jurisdiction would have done anyway.

Double claiming can occur when:

- The voluntary buyer uses the credits, or allowances are used for offsetting or carbon neutrality claims;
- The underlying emission reductions lie within the scope of a mitigation target and are visible in the jurisdiction’s inventory; and/or
- No accounting is done at that target level.

Whether double claiming is an environmental integrity risk depends mainly on if mitigation actions and policies by the jurisdiction change according to what happens in the voluntary carbon market.

Let us imagine that a new forest is planted in Germany with the sole purpose of and incentive from generating offset credits. This forest captures 1 tCO2e that is issued as a credit and cancelled by a voluntary buyer. Moreover, let us imagine that an EU ETS allowance is cancelled for the purpose of voluntary offsetting, and that this cancellation leads to a reduction of the emissions within the scope of the ETS by 1 tCO2e (see section 2.2). In both cases, aggregate emissions in Europe decrease by one tonne and are visible in the relevant inventories. Absent further accounting measures, double claiming could occur in both scenarios with the various mitigation targets currently in place.

At UNFCCC level, the reduction of 1 tCO_2e (whether through the forest or in the ETS sectors) could enable Europe to overachieve its NDC target by 1 tCO_2e and lead to double claiming, unless the EU accounted for the voluntary cancellation by adjusting its NDC accounting by 1 tCO_2e. This double claiming would be an environmental integrity risk:

- if the EU were to reduce its mitigation efforts by 1 tCO_2e as a result of the cancellation (either by reducing its domestic efforts or purchasing fewer international credits to balance a difference); and/or
- if the overachievement were sold to other Parties (that then used it to compensate for their own lack of abatement), and/or
- if the overachievement of Europe’s NDC from the current period were banked into future periods and used to achieve a subsequent NDC.

The environmental risks arising from double claiming at UNFCCC level thus equally apply to both credits and allowances, unless cancellations from voluntary buyers are accounted for by applying corresponding adjustments in the NDC-level accounting. It is also worth noting that the need for corresponding adjustments in NDC accounting is relevant in the context of all countries, including for offsets generated in developed countries and 'traditional' offsets credits from developing countries.

Within jurisdictional (or supra-jurisdictional) targets that are accounted for separately from NDC targets (e.g. where mandated and enforced by local legislation), double claiming could occur and be an environmental integrity risk in the same way as in the case of NDCs.

In summary, double claiming can occur whenever the emissions reduced as a result of the voluntary cancellation (whether of allowances or credits) could be counted towards the achievement of jurisdictional targets – in current or future target cycles. Whether this poses a risk for environmental integrity depends on whether the jurisdiction reduces its mitigation actions in response to the reduced emissions from voluntary offsetting. The main difference between allowances and credits is that all current ETSs are covered by NDCs, whereas the picture is more diverse for credits: some emission reductions are covered by NDCs, others are not.

Most offset credit projects developed to date have been implemented in countries that have pledged economy-wide targets in their NDCs. However, there are exceptions, in particular non-CO_2 emission reductions in China and projects implemented in poorer countries, which often did not pledge economy-wide mitigation targets in their NDCs. Recently project development has focussed much more on these poorer countries. However, Article 4.4 of the Paris Agreement encourages countries to move towards economy-wide emissions targets, which may narrow the scope for implementing projects in countries or sectors that are not covered by NDCs in the future.

Double use and double issuance

Regarding the risk of **double use**, both crediting mechanisms and ETSs typically use registry systems, which avoids units being used more than once. For both allowances and credits, however, it is important that the purpose of offsetting is specified such that each cancelled unit cannot be claimed for more than one purpose. This could for example occur if the cancellation purposes are stated vaguely, without specifying the exact offsetting purpose, so that the cancellation could be claimed by two different users. In this context it is also important to distinguish mandatory from voluntary cancellations. For example, under the CDM cancellations are also required to compensate for excess issuances. Most crediting mechanisms registries allow but do not require users to specify cancellation purposes. In the case of ETS registries, however, this feature is commonly not foreseen. It is thus important that entities pursuing the cancellation of allowances transparently document the cancellation purposes.

Regarding the risk of **double issuance**, there are differences between allowances and credits. Under ETSs implemented by national or regional authorities, double issuance can be practically excluded. Under crediting mechanisms, avoiding double issuance can, in some instances, be rather challenging (Schneider et al. 2015). Most crediting programmes have procedures in place to avoid one project being registered twice under the same programme, but some – such as the CDM – do not pursue any checks on whether the same project has been registered under another crediting programme. Some projects have also transitioned from one crediting programme to another. Some programmes have dedicated procedures in place to manage such transitions, others have not. The largest risk may, however, arise from indirectly overlapping emission reduction claims. This can, for example, occur if one programme credits the production of biofuels (upstream) whereas another programme credits the use of biofuels (downstream). Indirect overlaps could occur in many ways, in particular where projects claim emission reductions upstream or downstream of the location where they are implemented.

As a result of these deliberations we conclude that the risk of double claiming may be relevant for credits and allowances alike. The risk of double use may be somewhat higher for allowances, as ETSs commonly do not provide for registry functionalities to document the purpose of cancellations, while this is common practice under crediting programme registries. The risk of double issuance is irrelevant for ETSs but can pose a significant risk for some types of credits (particularly in the case of downstream or upstream emission reductions).

3.1.4 Timing of emission reductions

One conceptual difference between credits and allowances is the point in time at which the emission reduction occurred or occurs, respectively. For credits, this point is known because credits are issued ex-post for emission reductions that were realized in the past.[9] By contrast, allowances are issued ex-ante for a certain trading period, usually between one and five years. However, as allowances can be banked, it is not known exactly *when* the emission reductions occur following the cancellation of an allowance.

The purchase and cancellation of allowances lead to further scarcity, which is then reflected in a marginally higher price. In principle, this marginal price effect is likely to take effect at the time of the purchase of the units, as an increase in demand for currently available permits induces an immediate price increase. It seems therefore reasonable to assume that the emission reductions mainly occur in a period that is close to the purchase of the allowances.

One could suspect that voluntary cancellations may increase the incentive for borrowing. However, that is unlikely to be the case for at least two reasons. First, allowance borrowing is not allowed or extremely limited in existing ETSs.[10] Second, the incentive for borrowing depends on the expectation of future carbon prices, which in turn depend on many factors, including current market prices. Empirical analysis of carbon market developments suggest that prices of futures tend to increase together with current scarcity (Chen et al. 2020). This way, cancellation of allowances would indirectly also reduce the incentive for borrowing and thus provide for timely emission reduction. The higher current allowance prices are, the stronger this incentive turns out.

In the case of credits, knowing when an emission reduction actually occurred may be relevant because the direct emissions impact may be affected by potential changes in the regulations of the crediting programme in the time since. The methodologies for determining the emission reductions from projects such as the rules for establishing the baseline may change over time. In other words, credits from the same project, but with different points in time when the emissions reduction occurred, may involve different mitigation efforts. An example is the CDM methodology for HFC-23 destruction, which has changed considerably over time (Cames et al. 2016). Taking into account that the rules for credits projects together with increasing

[9] It is worth noting, however, that some carbon credit retailers offer offsetting services and only purchase credits or develop projects afterwards. This means that not in all cases, emission reductions have occurred in the past when offsetting or carbon neutrality of a product are offered.

[10] The ETS Map of the ICAP Secretariat provides information on banking and borrowing provisions in the existing and upcoming ETSs around the world. For details, see https://icapcarbonaction.com/en/ets-map

knowledge on the efficacy of mitigation technologies usually become more environmentally stringent over time, older credits from the same project may involve less mitigation effort than units issued only recently. For voluntary offsetting, where the reputational risks are more relevant, it could thus be recommendable to purchase credits with younger rather than with older vintages.

In terms of the comparison between credits and allowances, both have certain ‘timing challenges’ which need to be taken into account. In the case of allowances, the emission reductions will occur in the future, following the cancellation. The exact point in time when the emission reductions will occur cannot be determined. However, price effects induced by the cancellation provide incentives for a prompt reduction in emissions. In the case of credits, the emission reductions occurred in the past and the period when they were reduced can be determined. The “vintage” of credits can play an important role in their emissions impact.

3.1.5 Transparency

Transparency is to a large extent dependent on complexity. An approach where the relationship between the emission and the unit used to compensate for it is simple and intuitive, is usually perceived to be more transparent than approaches where the interdependence is more indirect and complex. This is particularly relevant when considering technological and timing aspects. Take the example of a unit being used to offset a GHG emission stemming from the same technological area, such as when offsetting emissions from the production of leather products through a project that reduces methane emissions from a dairy farm. This may be perceived as more direct and thus transparent than offsetting these emissions through the purchase and cancelling of allowances from an ETS, where the emission reduction occurs at system level but where it is not possible to determine which installations actually have reduced their emissions due to the cancellation of an allowance (see section 3.1.1).

A large geographical distance between where the emission occurs and where a corresponding emission is reduced may also hamper transparency, e.g. offset purchasers may consider it more transparent to purchase offsets from a nearby forest than from a forest overseas. From a strict *mitigation* point of view, technological or geographical distances are inconsequential, as climate change is not an issue of hot spots but instead a global challenge. Nevertheless, these issues do increase *perceived* complexity and potentially hamper transparency (and in some cases also the communicability – see section 3.1.11), especially if the emission reduction occurs in different countries (see also section 3.1.3).

Lastly, if the point in time of an emission and the point in time of its reduction deviate considerably, transparency is usually diminished because the economic environments and the political context may have changed to the point that the mitigation efforts involved are not directly comparable anymore.

However, complexity could also arise from the regulation itself if, for example, the ambition of an ETS cannot be fully determined ex-ante but only after a certain time lag – in the future. Various market stability provisions introduce such layers of complexity, which may result in a situation where it is not irrelevant for the global atmosphere whether an allowance is cancelled today or only in several years in the future. Due to the complexity of these ETS provisions, we do not elaborate on further details in this section but devote a separate chapter, namely chapter 4, to explaining this complexity and potential strategies to ensure appropriate offsetting.

Although the crediting approach is certainly complex and for the lay person perhaps difficult to understand, it is usually perceived to be more transparent than allowances where the emissions reduction occurs only at system level.

3.1.6 Incentives for enhancing climate action

The voluntary cancellation of allowances or credits can generate incentives or disincentives for policymakers for enhancing climate action. In principle, the further emission reductions achieved through the voluntary cancellation of credits or allowances could support countries in setting more ambitious climate mitigation targets in the future. For credits, this holds in particular if the credited activity reduces emissions beyond the crediting period.

Crediting programmes, however, face an inherent dilemma with regard to the treatment of policies that require or promote low carbon technologies (Schneider und La Hoz Theuer 2019; Winkler 2004; Spalding-Fecher 2013):

- If crediting programmes require that such policies be considered in demonstrating additionality and calculating emission reductions, they might create perverse incentives for policy makers in host countries not to implement such policies – since this would reduce the potential for crediting.
- If crediting programmes allow to ignore such policies in demonstrating additionality and calculating emission reductions, they may credit activities that are not additional because they are implemented due to these policies, or the emission reductions of the activity could be overestimated.

For ETSs, such a dilemma does not exist because governments do not forego revenues from credits if they strengthen their ETS target. On the contrary, revenues may even increase if allowances are auctioned or sold, as the voluntary cancellation of allowances may lead to an increase in the allowance price.

If a large volume of allowances were used for voluntary action, jurisdictions may however fear that allowances prices may suffer undue (upwards) influence from external factors, generating a potential risk that future caps are set less ambitiously.

Another concern could be disincentives to broaden the scope of NDCs. If credits are issued for emission reductions that are not covered by NDCs and if no corresponding adjustments need to be applied by the host country for emission reductions outside the scope of NDCs, then crediting may generate perverse incentives for host countries not to broaden the scope of their NDCs, as they may fear foregoing revenues from carbon credits (Schneider et al. 2020; Spalding-Fecher 2017). Currently, this risk does not hold for ETSs, as all existing systems are covered by NDCs (Schneider et al. 2018).

3.1.7 Promotion of innovation

There is no generally accepted definition of innovation. However, in the context of climate policy it is usually understood as the ability of a policy to increase the market penetration of less carbon intensive technologies. That said, which of two given technologies is more innovative than the other is not always easy to determine.

For example, a super-critical and highly efficient coal power plant that replaces an old coal power plant with very low efficiency may reduce more emissions in the short-term than investing the same amount of money into wind turbines. However, the economic lifetime of the super-critical plant is about 40 years, so such an investment may result in carbon lock-in, which could delay full decarbonisation.

For crediting mechanisms, the innovation effects depend on the project technology. Current carbon crediting programmes include various project types, some of which deploy more innovative technologies that will be required in the long run, and others which use less innovative technologies or face serious risks of carbon lock-in. Some carbon crediting programmes do not exclude technologies that are less innovative or that pose risks for carbon lock-in.[11] If credits are used for offsetting, it may thus be important to focus on technologies that promote innovation and that are needed in the long run.

For ETSs, innovation effects depend, among other impact factors, on how allowances are allocated (auctioned or distributed free of charge). In the first two phases of the EU ETS, for example, allowances were distributed free of charge also to the electricity sector. Many power producers initially considered these grandfathered allowances as a subsidy for investments in new coal power plants (Neuhoff et al. 2006). Many electricity companies developed plans to invest in coal power. By 2016, over 25 new plants in Germany were in the pipeline (BUND 2016), whose plans all dated back to the first two allocation periods.

With this background it seems clear that neither ETSs nor credit programmes promote innovation *per se*, but rather that the promotion incentive depends on the specific design of the ETS and the project portfolio of the crediting programmes.

Since innovative technologies are more expensive than established technologies, the carbon price can be considered as a rough proxy for the innovation incentive: the higher the price, the higher the innovation incentive. An ETS with a higher carbon price will promote more innovative technologies than one with a lower price. Similarly, higher prices for credits may enable the implementation of more innovative technologies. However, very innovative technologies, such as synthetic fuels from renewables, bioenergy with carbon capture, and storage, are often so expensive that carbon prices would need to be very high to trigger investments in them. Lower prices would still incentivise emissions reductions, though rather those that can be achieved in the short term, such as shifting the dispatch of power plants to installations with lower carbon intensity. Therefore, to incentivise investments in innovative technologies, carbon pricing alone is usually insufficient; it needs to be complemented by other policies such as for Research, Development & Deployment (RD&D) or by subsidising such investments or the output of such technologies.Nevertheless, since a higher carbon price provides stronger innovation incentives than a lower carbon price,[12] price differences between

[11] The CDM provides a methodology for developing and registering super-critical coal power plants (ACM0013, https://cdm.unfccc.int/methodologies/DB/7E9VKG4RTU85IJ6HYJ3JTNLDHFDT2R). However, the methodology was last updated in 2012 and has not been used since for registering new CDM projects.

[12] There is comprehensive discussion on the innovation impacts of ETSs, which is ongoing. From a theoretical perspective, innovation incentives are often highlighted as an advantage of ETSs Endres (2013). However, several authors have questioned whether ETSs have actually provided such incentives, for example Matthes (2010) or SRU (2015). Empirical evidence was missing at the time of this criticism, also because climate innovation is determined by several factors beyond the carbon price. And since innovation is a long-term effect, it may have been too early to identify such effects. More recent studies suggest that ETSs may actually drive innovation towards climate friendly technologies Bayer und Aklin (2020); Calel (2020); Verbruggen et al. (2019); Calel und Dechezleprêtre (2016).

credits and allowances could be considered as indicators for the difference in innovation incentives. Since prices for credits tend to be lower than prices for allowances,[13] it could be argued that the innovation incentive provided by purchasing allowances – despite small – is likely to be higher than the one provided through purchasing credits.

3.1.8 Promotion of technologies

Buyers of voluntary offsets may want to promote a certain technology or a certain product. Butzengeiger-Geyer et al. (2012), for example, conclude that the "CDM can support technology providers that want to enter markets outside their home market". If, for example, a producer of wooden furniture may want to offset its GHG emissions, it may prefer to purchase credits from reforestation projects. Similarly, a producer of bicycles may prefer to use credits from a bus rapid transit project abroad. International cooperation through offset credit purchases can also foster the transfer of technologies (Spalding-Fecher et al. 2012).

These examples already indicate that similar connections can hardly be made through the purchase of allowances from an ETS. In an ETS, all covered sectors would be promoted equally. It would not be possible to link the emission reduction to a project type or technology that has some similarities to the original activity or business, even if it were covered under the ETS. In other words, through the selections of credits from certain projects or projects types, almost all types of technologies can be promoted, while this claim can hardly be substantiated if allowances are used to offset emissions.

3.1.9 Co-benefits

As with most policies, GHG mitigation policies are often accompanied with co-benefits in other areas. These co-benefits can be manifold and often contribute to several of the United Nations Sustainable Development Goals. The incentivisation of co-benefits is also often an explicit goal of crediting programmes, such as under the CDM and Article 6.4 of the Paris Agreement.

Examples abound. If a carbon price helps reduce the consumption of coal or lignite in favour of wind power, then in addition to the reduction in GHG emissions, other emissions such as sulphur dioxide, nitric oxide or mercury will also be reduced, thereby contributing to reduced air pollution and to improvements in public health. Projects that replace cooking on open fires by more efficient stoves reduce both GHG emissions and the risk of lung cancer. Credit projects and ETSs that promote the efficiency and electrification of road transport also reduce air pollution, with significant health benefits; modal shifts can also reduce traffic congestion costs and strengthen positive health impacts (Ministry of Environment of New Zealand 2018). Both can also contribute to technological spill-overs and innovation. Where a carbon price incentivises energy efficiency and renewable energy, co-benefits related to resource efficiency and energy security also come into play. In general terms, Deng et al. (2017) find that co-benefits from GHG mitigation include impacts on ecosystems, economic activity, health, air pollution, resource efficiency, conflict and disaster resilience, poverty alleviation, energy security, technological spill-overs and innovation, and food security.

[13] A systematic comparison of average prices for credits and allowances is not available. However, Ecosystem Marketplace (2018) as well as World Bank (2019) and ICAP (2019b) provide price overviews for credits and allowances, respectively. These overviews suggest that the prices for allowances currently tend to be one order of magnitude higher than those for credits.

Projects in developing countries may also contribute to economic development (Mori-Clement 2019), to capacity building, and improve the provision of services such as public transport. Another co-benefit is that purchasing credits from projects in developing countries may be perceived as an act of promoting international climate finance and international cooperation for GHG mitigation, thus helping address what is perceived by many as a gap in current climate policies.

Both ETSs and crediting programmes thus generate important co-benefits, although we note that the distribution and strength of the incentives towards those co-benefits may be different: while an ETS is unlikely to foster the use of efficient stoves within its coverage and may have few direct levers for biodiversity conservation, it will typically provide a broader and stronger mitigation incentive and is therefore more likely to both drive mitigation action and reap its resulting co-benefits.

On the other hand, allowances and credits may induce unintended consequences. Mitigation projects such as large dams, for example, have resulted in the resettlement or expulsion of indigenous people. ETSs have triggered criminal behaviour such as the VAT fraud through circular trading that resulted in several EU governments being cheated out of billions of euros (Berrittella and Cimino 2012).

Due to the size of the spectrum that spans potential co-benefits and potential harm, it is not possible to elaborate in detail on all potential and often idiosyncratic aspects. However, the considerations above already demonstrate that co-benefits occur in both credit programmes and ETSs and that they usually can be more precisely identified and 'attributed' in credit programmes than in ETSs. Since supporting the economic development of poorer countries is usually perceived as a positive co-benefit, purchasing credits from projects in least developed countries is often considered by many voluntary offset purchasers as a strong argument for using credits over allowances.

3.1.10 Supplementarity

The Kyoto Protocol already provided international flexibility in achieving mitigation targets through International Emissions Trading, Joint Implementation and through the CDM. However, the Kyoto Protocol also included a supplementarity clause (Articles 6.1 (d) and 17), which effectively required that at least half the reduction in emissions should be achieved domestically. The logic behind this clause is that although emissions reductions can, may the short term, be achieved more efficiently abroad than domestically, in the longer term all economies need to decarbonise and this transition should not be postponed for too long. Along these lines, entities in industrialised countries that aim to offset voluntarily may want to promote decarbonisation at home rather than abroad. They might therefore prefer domestic allowances to credits from projects in developing countries.[14]

3.1.11 Communicability

Voluntary offsetting usually aims at carbon neutrality of a product or service, which is seen as a unique selling proposition. Different to compliance buyers, voluntary buyers (particularly corporate ones) often wish to use carbon neutrality as part of their communication strategy.

[14] There are also several credit programmes implemented in developed countries. However, in the EU they have hardly been used for voluntary offsetting so far (see Nett und Wolters (2017)).

From a communications standpoint, explaining the generation of credits from individual projects could be easier than the system-level emission reductions achieved at a later point through an ETS.

While both offsetting projects and ETSs have been criticized for their past shortcomings, project-based credits from renewable power or forestry projects for example may be perceived as 'green' and more intuitive than allowances from an ETS. Corporate voluntary buyers who place strong emphasis on the public communication of their offsetting efforts may therefore favour credits over allowances. However, voluntary buyers such as individuals in industrialised countries, who want to offset their individual carbon footprint or do not aim to communicate their offset purchase, may put more emphasis on enhancing reduction incentives for installations in industrialised countries and therefore opt for allowances over credits.

3.2 Overview and analysis

Table 1 provides an overview of the criteria discussed in the previous sections and the conclusions we can draw from these considerations.

Table 1: Comparison of credits and allowances used for voluntary offsetting

Criterion	Credits	Allowances	Comment
Identifying the mitigation measure	Source of emission reduction can be clearly identified	Cancellation tightens the cap; reduction at system level	With credits, offset-ters can select their preferred projects or purchase portfolios
Direct emissions impact	Likelihood of additionality differs strongly among project types and its assessment is uncertain Credits from non-vulnerable projects would not reduce global GHG emissions Subsidising GHG emitting activities induces system-wide rebound effects Risk of non-permanence in the case of LULUCF projects	A (positive) price level in an ETS is a proxy for market stringency The stringency of an ETS may vary over time (uncertainties in economic development, regulatory uncertainty) Direct emissions impact can be influenced by MSIs (see chapter 4) Penalising the use of more GHG-emitting technologies avoids rebound effects	Direct emissions impact for projects depends strongly on the project type, whereas for ETS this depends mainly on the trust in continuous scarcity in the ETS Direct emissions impact of allowances can be determined with higher likelihood if allowances prices signal sufficient scarcity

Avoiding double counting	Higher risk of double issuance Credits from projects covered by NDC require corresponding adjustments Credits form projects beyond the NDCs do not require corresponding adjustments	Higher risk of double use since the purpose of voluntary cancellation cannot be specified in registries Allowances require corresponding adjustments to avoid double claiming	Double claiming relevant for both credits and allowances Rules for corresponding adjustments still have to be agreed under UNFCCC Number of projects beyond NDCs will decrease in future
Timing of emission reductions	Issuance of units for certified emission reduction in the past Point in time of the ERs can be identified (monitoring period) Vintage of the credit important for actual emission reduction	Emission reduction occurs only after the cancellation of an allowance and precise time cannot be known Market incentives provide for timely emission reduction	Both approaches have their timing challenges Credits from more recent vintages tend to provide higher environmental integrity Higher allowance prices generally provide stronger incentives for timely emission reduction
Transparency	Technological proximity between emissions and emission reductions is possible Often larger geographical distance	Emission reduction can be perceived as indirect and complex Market stability instruments increase complexity and hamper transparency (see chapter 4)	Crediting is largely perceived as more transparent by the general public
Incentives for enhanced mitigation action	Governments with emission reduction projects may tend to not include the respective sector in future NDCs	Possible perverse incentives in the case of high volumes of voluntary cancellation that could significantly impact the allowance price	Perverse incentives for credits could be addressed by requesting corresponding adjustments

Promotion of innovation	Innovation effects depend on the project technology Certain project types deemed innovative in the short term can induce carbon lock-in in the longer term Focus should be put on project types that employ innovative technologies that are needed in the long run	Allocation free of charge can induce carbon lock-in Carbon price signal can provide incentive for innovation	Incentives from carbon prices usually insufficient to fully address innovation externalities Crediting programmes could exclude technologies that are less innovative or that pose risks for carbon lock-in Incentives from allowances are likely to be higher due to higher average prices
Promotion of technologies	Offset buyers can select certain project types to promote technologies similar to their own activity International cooperation through offset credit purchases can foster the transfer of technologies	Economic theory suggests that the market forces decide which technologies are promoted	Promotion of certain technologies feasible with credits but not with allowances
Co-benefits	Reduction of other pollutants and wide-reaching co-benefits of GHG mitigation actions Promotion of economic or social development in developing countries without compliance markets Well-elaborated tools on additional assessment of co-benefits Spill-overs to other policies, e.g. promotion of renewables	Reduction of other pollutants and wide-reaching co-benefits of GHG mitigation actions Spill-overs to other policies, e.g. promotion of renewables	Present in both credits and allowances Can be more easily identified and allocated in baseline and credit projects ETSs provide a broader and stronger mitigation incentive and are more likely to drive (domestic) mitigation actions and reap resulting co-benefits Credits can generate co-benefits in developing countries

Supplementarity	Unless credits from domestic projects are purchased, no contribution to domestic transition	Contribution to the supplementarity criterion, provided that domestic allowances are purchased	Offset buyers from developed countries may want to provide incentives for domestic emission reductions
Communicability	Technology to achieve emission reduction can be identified and explained; timing is also straightforward. Together, they provide clear narrative Many project (types) are perceived as green or having environmental integrity, even if they are not	System-level impacts and uncertainty on timing of emission reduction are more difficult to explain ETS may have a negative image	Credits likely easier to communicate than allowances

Source: Own compilation, adelphi and Öko-Institut

The analysis above indicates that neither of the two approaches is clearly superior in all aspects. Rather, preferences and appropriateness change depending on both the origin of the specific units selected and on the purpose they are used for.

Key aspects favouring the use of credits include:

- Mitigation measure can be more precisely identified
- Possibility of choosing technologies and specific measures
- Emission reduction has already taken place when credits are cancelled
- Co-benefits generated by projects are often in developing countries; are easier to identify and attribute
- Easier to communicate to the public, e.g. clearer narrative in terms of carbon neutrality
- Promotes decarbonisation of developing countries
- Usually cheaper than allowances

On the other hand, the following are important advantages of using allowances:

- Direct emission impact can be determined more objectively through the allowance price; lower reputational risks
- Emission reduction occurs following the cancellation, but markets provide incentives for timely abatement
- Avoids perverse incentives for countries to delay expanding coverage of their NDCs, as well as challenges related to rebound effects from crediting measures
- Stronger incentives for (local) innovation and co-benefits due to broader and stronger price signal

- Promotes decarbonisation of developed countries or emerging economies (i.e., jurisdictions that have ETSs)

Offset purchasers with a strong focus on international cooperation, communicability with a clearer narrative, and a preference for the promotion of certain technologies may find credits more attractive. Credits also entail lower costs but may carry higher reputational risks.

On the other hand, actors in the voluntary market who prefer a higher certainty of the direct emission impact may favour allowances. Allowances may also be preferred by buyers keen to promote innovation or drive emissions reductions 'at home', as most buyers stem from developed countries.

The differing interests and priorities of the various actors in the voluntary carbon market create space and opportunities for both unit types. These considerations illustrate that neither credits nor allowances present a clearly superior option nor serve the interests of all buyer types who may be drawn to voluntary offsetting.

4 Impacts of market stability instruments

Table 1 offers a comparison between the use of credits versus allowances for voluntary cancellations. The characterisation is useful, but it entails one crucial simplification: it is useful because it creates a helpful contrast between two alternative ways that non-regulated entities can contribute to climate action. The simplification assumed there is that the allowances in question are obtained in an ETS that does not feature an MSI, as described in section 2.2. When a simple ETS is supplemented with an MSI, the one-to-one correspondence between a permit being cancelled and the decline in cumulative emissions can be broken. In other words, the additionality of the cancellation may be compromised. This section discusses the complex set of interactions that can give rise to the breakdown of this correspondence.

In order to ground the analysis in a real-world ETS with an elaborate MSI, the focus of this section is the EU ETS and its MSI, the Market Stability Reserve (MSR). It is important to note that there are different types of instruments that help stabilise markets in the face of unexpected developments. As described in further detail below, the MSR is triggered based on the *quantity* of allowances in circulation. Other jurisdictions have adopted instruments that are activated based on the observed *price* in the primary or secondary markets for allowances. These instruments may have different implications for the additionality of voluntary cancellations.

More specifically, section 4.1 starts by providing a historical overview of the MSR, which was announced in 2015, revised in 2018, and became fully operational in 2019. The evolution of its design is critical for the question at hand because the 2018 revisions determine whether and under what conditions the voluntary cancellation of an allowance corresponds to a unit of reduction in cumulative emissions as it does in the simpler case explored in section 2.2.

Next, given the current state of the MSR and the independent forecasts regarding the evolution of the key variables determining its impact over the 2020s, section 4.2 illustrates why the concerns that have been raised over the effectiveness of near-term voluntary cancellations may be valid. To this end, several possible cases are considered systematically. The findings provide further considerations to the analysis presented in Table 1.

In recognition of the diversity of the MSIs in existence, section 4.3 of the report reviews the approaches taken by other jurisdictions. These include cost containment reserves (e.g. in California); emissions containment reserves (e.g. in RGGI); auction reserve prices (e.g. in Quebec) and discretionary approaches (e.g. in Korea). A common element of these other approaches is that they are triggered by a price variable, as opposed to the quantity variable that determines whether and how many allowances are placed in the MSR of the EU ETS. The report highlights the similarities and differences of the implications of voluntary cancellations under these alternative MSIs relative to the MSR.

4.1 The EU ETS & MSR: context, mechanism and outlook

At the time of writing, the EU ETS is the world's largest carbon market, covering the GHG emissions of the 27 EU Member States as well as Iceland, Liechtenstein, Norway and the UK, which corresponds to about 40% of the region's aggregate emissions.[15] It is the longest running

[15] During the transition period following the UK's departure from the EU in 2020, the UK remains a part of EU ETS until 31 December 2020.

carbon market in the world, having continuously been in operation since 2005 – Phase I from 2005 to 2007 (ICAP 2019a). Currently in Phase III, which runs from 2013 to 2020, the system has weathered the impacts of the 2007-2008 Financial Crisis, the overlapping climate change and energy policies of governments in member countries and the inflow of cheaper offsets from the UN mechanisms under the Kyoto Protocol (Fuss et al. 2018; Hintermann et al. 2016; Kocha et al. 2014). These factors, among others, led to price volatility for allowances. Moreover, a large surplus of allowances emerged in Phase II (2008 - 2012).[16] Taken together, these developments undermined the smooth operation of the EU ETS and restricted its capacity to deliver emission reductions cost-effectively, both in the short- and the long-term.

The EU's response to the resulting imbalance between the supply and demand proceeded along two tracks. First, in 2014 the EU amended the EU ETS Directive to remove 900 million allowances from the scheduled auctions in 2014, 2015 and 2016 (European Union 2014). These 'backloaded allowances' were expected to be re-introduced in the auctions during 2019 and 2020.[17] Critically, the amendment did not alter the total number of allowances that would be issued over the lifespan of the EU ETS (i.e. the cumulative cap) but only the timing of their arrival in the market.

Second, in 2015 the EU created the MSR to accelerate the process of removing the surplus from the market and to improve the resilience of the EU ETS to unforeseen future developments.[18] It was also decided that the 900 million 'backloaded allowances', instead of being re-introduced in 2019-2020, would be placed in the MSR. Furthermore, the unallocated Phase III allowances will also be placed in the MSR in 2020, which are estimated to number 550-700 million.[19]

The MSR is a rule-based mechanism that adjusts the volume of auctions by Member States based on the total number of allowances in circulation, the so-called Total Number of Allowances in Circulation (TNAC). It is computed and announced by the European Commission once every year in mid-May. In technical terms, the TNAC in year *t* is defined as

$$\text{TNAC}_t = \text{Supply}_t - (\text{Demand}_t + \text{allowances in the MSR}_t)$$

where the major items included in the supply are allowances banked from Phase II and those auctioned and freely allocated from 2013 up until the end of year *t*; as well as the smaller volumes of allowances monetised by the European Investment Bank (EIB) and the international credit entitlements exercised by installations in respect of emissions up until the end of year *t*. Demand consists of the total verified emissions from stationary sources and the allowances cancelled from 2013 up until the end of year *t*.

More specifically, at the time of writing the most recent announcement on the TNAC was in May 2020 and covered the period up until the end of 2018. The cumulative supply of allowances was 14.9 billion and the cumulative demand was 12.2 billion, of which a tiny portion of 348,581

[16] Surplus is not a term that has a unique definition in this context. Here it is used to denote a persistent and substantial excess of allowance supply relative to allowance demand. Below a more precise definition is offered for the EU ETS, as the total number of allowances in circulation, or TNAC.

[17] https://ec.europa.eu/clima/policies/ets/reform_en

[18] http://data.consilium.europa.eu/doc/document/PE-32-2015-INIT/en/pdf

[19] https://ec.europa.eu/clima/policies/ets/reform_en#tab-0-0

allowances were cancelled. This resulted in a TNAC of almost 1.4 billion.[20] Using data from the European Commission,[21] Table 2 illustrates how the TNAC and its aggregate components have evolved since its inception.

Table 2: Evolution of the TNAC and its key components

	2016	2017	2018	2019
Supply	8,833,415,789	10,597,092,329	12,286,821,940	14,876,898,672
Demand	7,139,510,892	8,942,239,207	10,731,912,116	12,194277,784
(of which cancelled allowances)	(193,697)	(278,524)	(315,083)	(348,581)
Allowances in MSR (at year end)	0	0	0	1,297,124,722
TNAC	**1,693,904,897**	**1,654,574,598**	**1,654,909,824**	**1,385,496,166**

Source: European Commission

In a loose sense, the TNAC has been 'too high' since 2016. In each of the years depicted in Table 2, the size of the TNAC is only somewhat smaller than the total verified emissions from all stationary sources covered by the EU ETS.[22]

Put differently, based on empirical observations it is difficult to support the claim that there was significant short-run scarcity of permits; rather, the positive allowance price was supported by the expected scarcity in the long run. In fact, there is roughly an entire year's emissions worth of permits lying in the regulated entities' accounts. Against this backdrop, the MSR was designed primarily to reduce the TNAC as it was deemed 'too high'. However, it can also be increased in the future if circumstances lead to a scenario where the TNAC is deemed 'too low.'

There is another aspect of Table 2 that is relevant for the purposes of this paper's analysis, which is that cancellations were a tiny fraction of the overall demand for allowances. They are also small relative to the volume of voluntary offsets that were cancelled, as detailed in section 2.1 above. The low base in 2016 notwithstanding, cancellations reported in Table 2 rose by more than 40% between 2016 and 2017 but this strong growth subsequently slowed down to about 10% per year between 2017 and 2019.

Against this backdrop, we describe here the operation of the MSR in more detail. To implement 'too high' and 'too low' in practice, the EU introduced the threshold values of 833 and 400 million allowances, respectively. If, in a given year, the TNAC is greater than 833 million, then 24% of the allowances in the TNAC are removed from future auctions and added to the MSR. Conversely, if, in a given year, the TNAC is below 400 million, then 100 million allowances are taken from the MSR and added to future auctions. TNAC values in between these thresholds

[20] https://ec.europa.eu/clima/sites/clima/files/ets/reform/docs/c_2019_3288_en.pdf

[21] https://ec.europa.eu/clima/policies/ets/reform_en#tab-0-1

[22] Based on European Environment Agency data, total verified emissions from all sources declined from approximately 1.7 billion tons of CO_2-eq in to about 1.5 billion in 2019.

imply that the pre-announced auction volumes that are consistent with the agreed upon linear reduction factors remain unaltered.

For example, since the TNAC in 2017 was greater than the upper threshold, auction volumes were reduced between January and August 2019 by a total of 265 million allowances (i.e. equal to 1.655 x 0.24 x 0.67, where the 0.67 reflects the eight months of 2019). Similarly, the TNAC in 2018 was also greater than the upper threshold and so reduced auction volumes between August and December 2019 by a total of 132 million allowances (i.e. equal to 1.655 x 0.24 x 0.33, where the 0.33 reflects the final four months of 2019). Together with the 900 million backloaded allowances, this resulted in the MSR balance of 1.297 billion allowances at the end of 2019.

There are two additional points to highlight regarding the operation of the MSR. First, the original EU agreement in 2015 creating the MSR stipulated a 12% intake rate when TNAC was above the upper threshold. Further negotiations between the Member States temporarily doubled the intake rate to 24% until 2023. The injection rate, which is unlikely to be relevant in the foreseeable future,[23] was also doubled to 200 million permits. The agreement on the amendment was reached in 2018.[24]

Second, the same amendment in 2018 also introduced a limit on the number of allowances that can be held in the MSR after 2023. Specifically, the amendment states that "from 2023 allowances held in the reserve above the total number of allowances auctioned during the previous year shall no longer be valid."[25] In other words, the 2018 amendment to the EU ETS Directive for the first time raised the possibility that the cumulative emissions in the EU ETS may diverge from the pre-determined aggregate cap as allowances in the MSR become permanently invalidated.

Figure 4, taken from Perino (2018) synthesises this discussion and provides a succinct visual summary for the discussion in the following section. The volume depicted in the upper tank of the figure represents the balance of allowances in the MSR whereas that in the lower tank is the TNAC. Allowances can move from the MSR to auctions, or in the opposite direction from auctions to the MSR, depending on the level of the TNAC. Note in particular the second drain from the MSR tank in the middle and right panels, which represent the possibility that allowances may be permanently invalidated from 2023.

More specifically, panel (a) on the left is similar to the present situation where the TNAC is greater than 833 million and the auction volumes are being reduced by moving allowances to the MSR. Panel (b) in the middle may come to represent the situation in 2023 where the TNAC is within the upper and lower thresholds but the balance of the MSR is greater than the previous year's auction volumes so a share of allowances are invalidated (the light blue area), reducing the balance of allowances in the MSR. The situation depicted in panel (c) on the right is characterized by the TNAC being below 400 million so that the MSR augments the auction volumes by adding allowances from the reserve.

[23] There are differing modelling results on this. See Burtraw et al. (2018) for an overview of arguments concluding that lower threshold will not be activated for several years. Perino (2018) argues that it may.

[24] http://data.europa.eu/eli/dir/2018/410/oj

[25] ibid.

Figure 4: Illustration of the MSR of the EU ETS

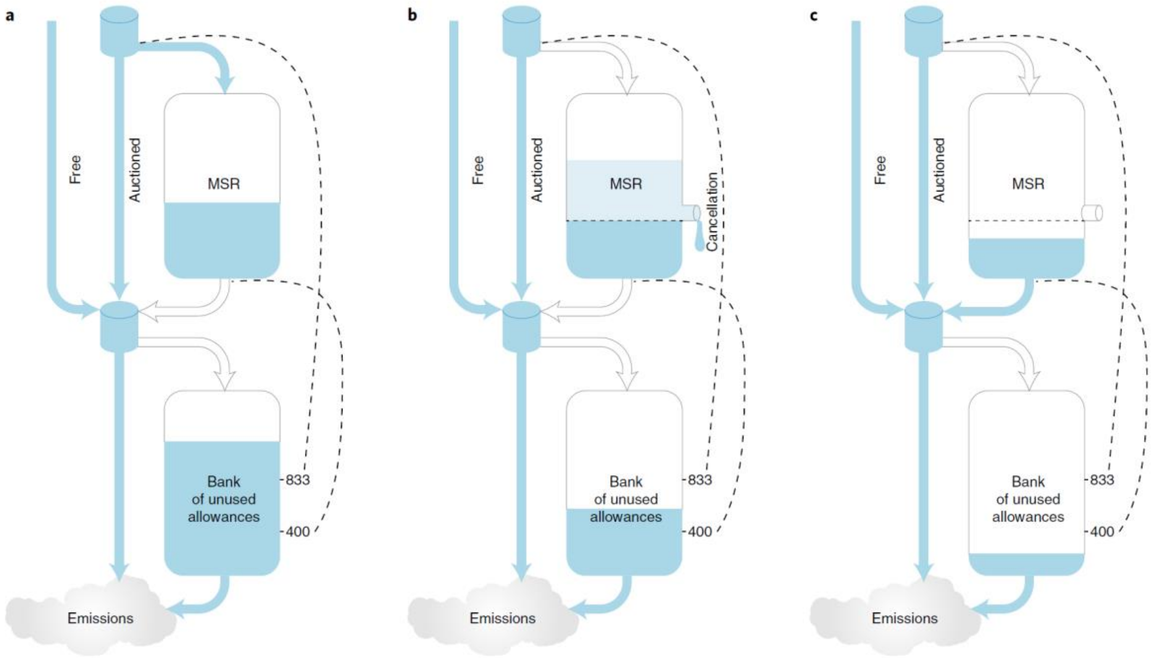


Fig. 1 | The MSR in three operational states. a, The bank contains more than the upper threshold (833 million). Allowances are withheld from auctions and placed in the MSR. This represents the year 2020, for example. Dashed lines starting at the two bank thresholds connect them to the switch they control. **b**, Allowances are not placed in the MSR nor does the MSR issue allowances, but some are cancelled (lightly shaded area above the dotted threshold represents total amount cancelled). This is expected to be the case in 2023, for example. **c**, The bank holds fewer allowances than the lower threshold of 400 million. Allowances move from the MSR back to the market. The cancellation threshold exists, but is non-binding. This represents a year towards the end of Phase 4.

Source: Perino (2018)

Each of these situations can be important for the analysis of the additionality of voluntary cancellations because the voluntary cancellation of an allowance directly reduces the TNAC. Moreover, whether the cancellation happens in a year when the MSR feed rate is 24% or 12% of the TNAC is also relevant. Crucially, if an allowance that is cancelled would have been invalidated anyway after 2023, then the effectiveness of voluntary cancellations to support climate action is undermined. The next section takes a detailed look at the interactions between the MSR and voluntary cancellations.

4.2 Voluntary cancellations and the MSR

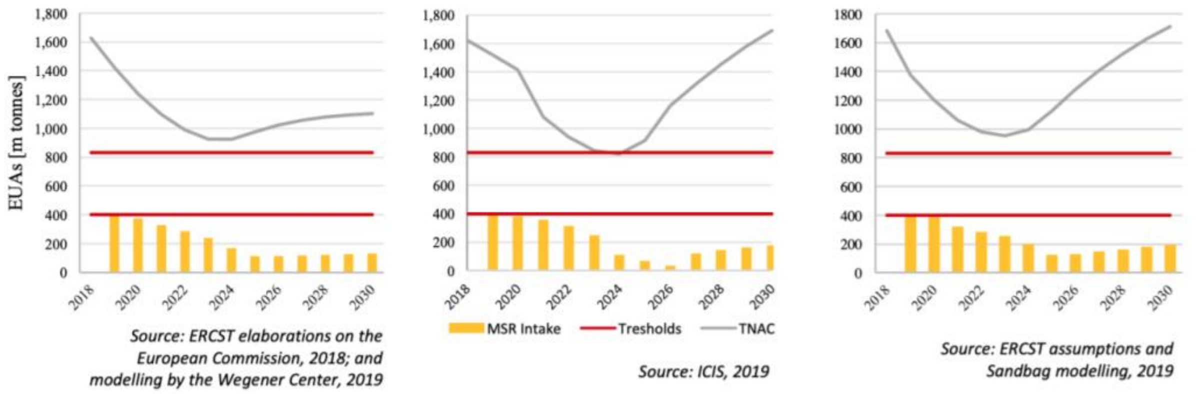
In section 3, this report states that the purchase and voluntary cancellation of allowances constitutes a viable and effective alternative to the cancellation of credits provided that the cancelled allowances are from an established and credible ETS with a pre-determined and sufficiently stringent cumulative cap. A key condition for this claim is that the system design contains no provision that can alter the cumulative cap based on explicit rules or discretionary interventions by the regulator. Many ETSs contain MSIs, which have the potential to alter the cumulative emissions permitted under the system. Some, like the MSR of the EU ETS, are explicitly designed to do so. In these cases, the effects of voluntary allowance cancellations, most importantly their additionality, require closer scrutiny.

To provide this scrutiny, this section constructs and discusses several illustrative scenarios to analyse the interaction between five crucial factors that determine the effects of cancellations in the EU ETS: (i) outlook for the $TNAC_t$; (ii) state of the MSR; (iii) timing of the cancellation; (iv) volume of the cancellation; and (v) identity of the actor cancelling. Throughout, all else is held constant in order to simplify the analysis but the report highlights where this standard assumption is especially restrictive. Moreover, we assume that the cancellation follows immediately after the purchase of an allowance.[26]

Outlook for the TNAC:

As illustrated in Table 2, the current level of the TNAC is about double the upper threshold of the MSR. Most but not all forecasts suggest it is likely to remain greater than 833 million for the next decade, if not longer under the assumption of no cap changes.[27] For example, Figure 5, taken from (ERCST, Wegner Center, Uni Graz, ICIS, Ecoact, I4CE 2019) illustrates the evolution of the TNAC (the grey line) using three recent forecasts of the variable.

Figure 5: Recent forecasts of TNAC and MSR intake



Source: Marcu et al. (2019) and references therein

That is, under the existing rules of the MSR, allowances will be transferred to the reserve at a rate of 24% of $TNAC_t$ until the end of 2023 and thereafter at a rate of 12% of $TNAC_t$. Note also that the backloaded and unallocated allowances from Phase III will also be placed in the MSR. A direct implication of the $TNAC_t$ being greater than the upper threshold of the MSR is that the total number of allowances in the reserve (plus the number of invalidated allowances) will be increasing. This is clearly observable by the positive MSR intake until 2030 in each of the three forecasts in Figure 5.

State of the MSR:

For the purposes of this report, the state of the MSR is then defined as the balance of the MSR in year *t* relative to the number of auctioned allowances in year *t*-1. The MSR is said to be *full* if former is larger than the latter and *not-full* otherwise.[28] If the MSR is *full* in any year after 2023,

[26] For brevity, in what follows, cancellation means 'the cancellation of an allowance that has just been purchased' unless specified otherwise.

[27] See Burtraw et al. (2018), Perspective (2017), Beck und Kruse-Andersen (2018), Quemin und Trotignon (2019) and Marcu et al. (2019). EEA (2019) forecasts a continuous decrease of the TNAC in the next decade, dropping below the upper threshold from 2023-2024. None of these studies take into account the upcoming strengthening of the EU emissions targets.

[28] Note that the state *not-full* encompasses the situation where there are no allowances left in the MSR, i.e. when it is empty.

allowances from the reserve are invalidated permanently so that the balance in the MSR is no larger than the volume of auctioned allowances in the previous year.

For example, in the hypothetical situation that there are 3 billion allowances in the MSR in year *t* and the volume of auctioned allowances in year *t*-1 were 1 billion, then 2 billion allowances will be permanently invalidated, reducing the balance of the MSR in year *t* to 1 billion and switching its state to *not-full*. It is important to note at this point that additional allowances may already be scheduled to be transferred to or from the MSR in year *t,* depending on the level of the relevant period's TNAC. This in turn may switch the state of the MSR to *full* again, unleashing a further round of permanent invalidations.[29]

Timing of the cancellation:

The timing of the voluntary cancellation is another crucial factor for determining its additionality. Compare for example the effect of the voluntary cancellation of a single allowance (which corresponds to an immediate unit decline in the TNAC) now versus in some future year when the TNAC is less than 833 million allowances and where simultaneously the MSR is *not-full.* In the former case, discussed in more detail below, the voluntary cancellation of an allowance will lead to less than one unit of reduction in cumulative emissions.[30] In the latter case, which may prevail from the mid-2020s by some forecasts, the voluntary cancellation is additional because it reduces cumulative emissions by one unit.

Volume of the cancellation:

Table 2 shows that to date the number of voluntarily cancelled EUAs is relatively small. Therefore, they are unlikely to tip the TNAC from being above the upper (lower) threshold to being below it. If that were the case, the MSR would be deactivated (activated) resulting in a discrete change in the TNAC relative to the situation without the voluntary cancellation. That said, the larger the volume of voluntary cancellations, the more likely it is that the TNAC moves over the threshold values of the MSR. Moreover, the state of the MSR may change under these circumstances making the volume of cancellations potentially relevant for assessing additionality.

Identity of the actor cancelling:

The identity of the actor implementing the voluntary cancellation can be an important factor determining additionality as it may have a large impact on a variable that has thus far been held constant, namely the expectations of market participants. For example, a Member State voluntarily cancelling a given volume of allowances, e.g. because other policies lead to a coal phase-out, can be seen as an important policy statement.[31] Regulated entities will likely revise their abatement/banking plans in light of this statement. This in turn may have an impact on the TNAC as firms scramble to bank more allowances for future use. The same volume of voluntary

[29] See, for example Table 3 in Burtraw et al. (2018).

[30] See, for example, Beck und Kruse-Andersen (2018).

[31] At the time of writing 12 Member States have announced plans for coal and lignite phase-out from their power generation mix. A recent ICIS report suggests 432-645 million allowances may need to be cancelled by the Member States to neutralise the negative effect of coal phase-out on the allowance price (ICIS (2019))

cancellation by concerned air travellers (say due to "Flygskam" being in the news) is unlikely to induce the same revision to plans.

Illustrative scenarios for voluntary cancellations in the EU ETS

To analyse the interaction between voluntary cancellations of allowances and the MSR, it is helpful to delineate between two periods:

- The near term covering the period up to the end of 2023
- The medium and long term covering the period after 2023

As mentioned above, the year 2023 is critical for two reasons. First, the rate of withdrawal will decline to 12% after 2023. Second, if the volume of allowances in the MSR at the end of 2023 is greater than the volume of allowances auctioned in 2022, the excess of the former over the latter will be permanently invalidated.

It is also helpful to start with the simpler case of a *small* volume of allowances being voluntarily cancelled in a given year. In this context *small* is taken to mean that the volume of allowances being cancelled by itself is not sufficient (i) to force the TNAC below the upper threshold of 833 million; or (ii) to force the TNAC below the lower threshold of 400 million, or (iii) to change the state of the MSR from *not-full* to *full*. In fact, there is no loss of generality from focusing on a single unit of allowance being voluntarily cancelled.[32] Throughout this analysis it is assumed that the rules of the MSR will remain as they are currently specified.[33]

There is little disagreement over how the TNAC and the state of the MSR will evolve in the near term and what will happen in the critical year 2023. Specifically, at 1.655 billion allowances in 2018, the TNAC is currently approximately twice the upper threshold of 833 million and virtually certain to remain above it until 2023. Therefore, the balance of allowances in the MSR will be augmented by additions in the years up to 2023. Recalling that the MSR balance already includes the 662 million allowances scheduled to be added to the reserve based on the TNAC in 2017 and 2018, as well as the backloaded and unallocated allowances from Phase III, it is virtually certain that a significant volume of allowances will be permanently invalidated in 2023 as the mechanism's rules pare back the balance of the reserve to the yet-to-be-determined total volume of auctions in 2022. According to the results reported in (ERCST, Wegner Center, Uni Graz, ICIS, Ecoact, I4CE 2019) the total volume of allowances to be invalidated in 2023 is expected to be in the range of 2.2-2.4 billion.

This invalidation induces a fundamental change in the EU ETS in the medium and long term because it alters arguably the most important parameter in any ETS, namely the cumulative cap. It therefore breaks the one-to-one correspondence between the voluntary cancellation of an allowance and the unit decline in cumulative emissions as discussed in section 2.2.

[32] The consequences of cancelling a larger volume of allowances are discussed below.

[33] The upcoming review of the MSR in 2021 may well alter the key parameters of the mechanism, invalidating this assumption.

Next, several scenarios are presented to provide the intuition behind how this happens. Two simplifying assumptions make the results as transparent as possible and help focus the analysis squarely in the near term.[34] Namely, it is assumed that:

i) the TNAC remains in between 400 million and 833 million after 2022; and
ii) the state of the MSR permanently switches to *not-full* after 2023 so there are no additional invalidations.

Baseline scenario: purchase and cancel in 2019

Consider the purchase and voluntary cancellation of an EUA in 2019. In the absence of the MSR, this would have led to a one-unit decline in the cumulative emissions permitted by the entities regulated under the EU ETS. With the MSR in place, the same transaction reduces the TNAC in 2019 by one unit and, since the TNAC is virtually certain to be greater than 833 million between now and 2023, reduces the flow of allowances into the MSR. Moreover, since the MSR is virtually certain to be *full* in 2023, a large share of the unit would have been cancelled in 2023 anyway.

Specifically, if the allowances were not cancelled in 2019, 24% of them would have been transferred to the MSR based on the TNAC in 2019. Analogously, 18% of the allowances (i.e. 24% of the portion of the original allowances still in circulation: 76%) would have been transferred to MSR based on the TNAC in 2020. Iterating on this process forward until the end of 2022, one can conclude that had they not been cancelled, 67% of the allowances would have ended up in the MSR and would therefore have been invalidated in 2023.

In the medium and long term, this means that a transaction involving the voluntary cancellation of one EUA in 2019 reduces the cumulative emissions of entities regulated under the EU ETS by 0.33 tCO_2e more relative to doing nothing. In contrast, the same transaction in a hypothetical world without the MSR would have led to a 1 tCO_2e reduction in cumulative emissions. Put differently, the voluntary cancellations are less effective when they interact with the MSR.

The set of assumptions and results in the example just discussed will be denoted as the **baseline scenario**, which is summarised in the first row of Table 3. Next, the complexity of the analysis is progressively increased by altering the aspects of the baseline scenario. It important to note that the table is constructed with the convention that only the cells, therefore the assumptions, that are different from the baseline scenario are filled. For example, the only difference between the baseline scenario and scenario I is the timing of the voluntary cancellation.

Table 3: Cancellation scenarios and implications for cumulative emissions

Scenario	TNAC	State of the MSR	Year of voluntary cancellation	Volume of voluntary cancellation	Decline in cumulative emissions
Baseline	>833m until 2022 <833m after 2022	Full in 2023 Not-full after 2023	2019	1 tonne	0.33 tonnes
I			2020		0.44 tonnes
II			After 2023		1.00 tonne

[34] The implications of relaxing these assumptions are discussed below.

III	>833m in some year after 2022				0.33 tonnes
IV		Full in some year after 2023			0.33 tonnes
V	>833m in some year after 2022	Full in some year after 2025			<0.33 tonnes
VI	<833m after 2019			1b tonnes	<1b tonnes
VII	<400m in a future year post 2023		Any year with TNAC<400m	1 tonne	1 tonne
VIII			Purchase in 2019 cancel after 2023	1 tonne	1 tonne

Source: Authors' calculations, adelphi and Öko-Institut

Scenario I (and II): purchase and cancel in 2020 (and after 2023)

Maintain the two assumptions above but in **Scenario I** consider what would happen if the allowance was cancelled in 2020 rather than in 2019. All else equal, a smaller share of the allowance, that is 56%, would have ended up in the MSR in 2023. As a consequence, delaying the cancellation by one year would be more effective because it would reduce the cumulative emissions by 0.44 tCO_2e rather than 0.33 tCO_2e as in the original example. In fact, postponing the cancellation until after the invalidation in 2023 would restore the one-to-one correspondence between the cancellations and cumulative emission reductions. In this case, the 2023 is crucial because under assumption (ii) there are no further invalidations from the MSR. This is summarised as in **Scenario II** in the table.

Scenario III: Baseline without assumption (i)

Next, consider the implications of relaxing assumption (i) while maintaining assumption (ii) as in **Scenario III**. Such a situation may arise in response to an economic recession similar to the one induced by the Financial Crisis or due to faster than expected coal phase-out in some Member States. It would push the TNAC higher than 833 million. In this case, the key result that the cancellation of a unit in 2019 ultimately induces 0.33 tCO_2e reduction in cumulative emissions relative to no action is unchanged.

To see this, observe that if in some future year after 2022 the TNAC is outside the range defined by the two thresholds, some portion of the remaining 33% of the original allowance would move to the MSR. However, since assumption (ii) continues to hold, the sum of the two and therefore the cumulative emissions permitted under the EU ETS are unaltered.[35] Over time the TNAC declines and the MSR may eventually be depleted as all allowances in it are auctioned and surrendered by the regulated entities for compliance. As auction volumes decline over time in line with the decrease in the cap, invalidations may also play an important role in depleting the MSR.

[35] It is straightforward to construct an example where the TNAC is pushed below 400 million in some future year, say due to a series of cold winters and or greater than expected coal fired generation. In this case, the mechanism just described would operate in reverse.

Scenario IV: Baseline without assumption (ii)

Conversely, consider the implications of relaxing assumption (ii) while maintaining assumption (i) as in **Scenario IV** so that some allowances from the MSR are invalidated in 2024, 2025 or some other year. Surprisingly, this is also irrelevant for the key result obtained in the original example even though cumulative emissions from the system would be lower. However, any future invalidation and therefore the change in cumulative emissions is not related to the voluntary cancellation in 2019 under assumption (i).

Scenario V: Baseline without assumptions (i) and (ii)

Both assumptions (i) and (ii) are relaxed in **Scenario V**. This can lead to complex interactions between the TNAC and the state of the MSR induced by the original transaction. Suppose the TNAC remains greater than 833 million after 2022 and the state of the MSR switches back to *full* in 2025 from being *not-full* in 2024. In addition, recall that had it not been cancelled, 33% of the allowance would have remained part of the TNAC in 2023. With the TNAC in 2023 greater than 833 million, 12% of the remainder is moved to the MSR in that year as well as 12% of the remainder based on the TNAC in 2024.

Ultimately, this results in a greater share of the original allowance being invalidated by the MSR, implying a smaller change in cumulative emissions due to the original transaction. In the case just considered, it is possible to provide precise numbers. The cumulative emissions are reduced by 26% more, relative to the case without any voluntary cancellation in 2019. Note that this is lower than the original 33% and the 100% without the MSR.

Scenario VI: Baseline with a large volume of cancellation

The scenarios considered so far focus on a *small* volume of cancellations, with *small* defined somewhat precisely above. **Scenario VI** considers the case where the volume of voluntary cancellation in 2019 is sufficiently large so that the TNAC drops below 833 million. For the sake of argument, let the volume of voluntary cancellation be 1 billion allowances which, given the value of the TNAC in 2018, is sufficient to deactivate the MSR in 2019.

In this case, it is difficult to assess the effectiveness of voluntary cancellations for at least two reasons. First, unlike in previous scenarios it will depend on the exact path of the TNAC between 2019 and 2022 which no longer satisfies assumption (i) due to the large volume of cancellations, all else held constant. Second, a large volume of cancellations, whether by governments, non-regulated entities or foreign actors, would likely lead to a revision of expectations of the market participants and to revisions in their plans regarding current versus future abatement. Put differently, it is no longer reasonable to hold all else constant when the volume of cancellations is large. Under those circumstances it is exceedingly difficult to arrive at a clear-cut conclusion other than the fact that the decline in cumulative emissions would most likely be less than 1 billion tons.

However, it is important to note that this is an extreme case. Given the volume of cumulative cancellations in the EU ETS – in the order of hundreds of thousands – it is extremely unlikely that voluntary cancellations on their own would be able to influence the dynamics of the TNAC sufficiently to deactivate the MSR or impact the expectations and therefore behaviour of the regulated entities.

Scenario VII: Scenario II with TNAC<400

With the current level of the TNAC significantly higher than the upper threshold of the MSR, much of the preceding discussion concentrated on the implications of voluntary cancellations when the MSR intake is positive. Several recent analyses, including those in Figure 5, indicate that this likely to be the case until the end of Phase IV (2021-2030) of the EU ETS. If and when in the future the MSR's lower threshold of 400 million is eventually breached, then the MSR will start injecting allowances into auctions. Under these circumstances, the implications of voluntary cancellations are specified in **Scenario VII**, which may be thought of as a special case of Scenario II.

The interaction in this case is straightforward because the one-to-one correspondence between cancellations and cumulative emissions reductions is broken only when some portion of a cancelled allowance would have been invalidated by the MSR anyway. Since additional invalidations are unlikely to be induced when the balance of the MSR is declining (i.e. when the TNAC is below the lower threshold), each unit of voluntary cancellation will trigger a unit reduction in cumulative emissions.

Scenario VIII: Buy-and-hold strategy

There remains a final option for an agent who can purchase an allowance in 2019, hold it until after 2023, and cancel it officially once invalidations from the MSR are no longer possible/likely. In the baseline scenario this happens after 2023 under assumption (ii) and restores the additionality of the voluntary cancellation. It does so by leveraging the ability of the agent to separate the two necessary parts of this transaction over time, namely the purchase of the allowance on the one hand and its formal cancellation in the registry on the other. Following this strategy implies that the allowance remains in the agent's, or its representative's, account and therefore part of the TNAC until 2023. The MSR invalidates 0.67 of the allowance in 2023 as in the baseline scenario. If the agent then cancels the allowance formally, cumulative emissions are reduced by a further unit as summarised in **Scenario VIII** in the final row of Table 3.

While this strategy appears particularly attractive from an additionality perspective and has received some attention in the academic literature (Gerlagh, & Heijmans 2019), it hinges heavily on the ability and willingness of the agent to wait several years before cancelling the allowance formally. This exposes the agent to changes in the market conditions as well as the rules of the EU ETS and the MSR. Moreover, the circumstances of the agent may change so that agent is tempted to sell the allowance instead of cancelling it if the prices are sufficiently high in the future.

In closing the analysis of the interaction between the MSR of the EU ETS and voluntary allowance cancellations, it is important to emphasise why the one-to-one correspondence between the cancellation of an allowance and the decline in cumulative emissions is broken. This happens because of the dependence of the TNAC on the volume of cancellations. It is, of course, the prerogative of the EU to exclude cancelled units from the calculation of the TNAC. Doing so would restore the additionality of the voluntary cancelation and obviate the need for the complex strategies described above. Such an option could be explored in the context of the upcoming MSR review.

4.3 Voluntary cancellations and other market stability instruments

The MSR of the EU ETS is a particular type of MSI in that it is triggered by a quantity variable, namely the TNAC. As the previous section has emphasised, the timing and magnitude of the voluntary cancellation of allowances will interact with the TNAC – and therefore with the balance of the reserve – to determine the ultimate impact on cumulative emissions permitted under the system's overall cap. Other ETSs have opted for MSIs where the trigger for the instrument is typically related to an observable price in the primary or secondary market. It is the aim of this section to briefly summarise these approaches and discuss their implications for voluntary cancellations.

Based on ICAP Status Reports, the ICAP ETS map and internal working documents, Table 4 collates information on the market stability provisions adopted in the ETSs of several jurisdictions. The table is not exhaustive but rather covers the broad spectrum of instruments that are in use, including auction reserve prices, price ceilings, cost containment reserves, emissions containment reserves and discretionary approaches.

This section assumes that any interested party can purchase, hold and/or voluntarily cancel an allowance in the jurisdictions covered in Table 4. This assumption may be inconsistent with the existing explicit or implicit restrictions on participation by non-compliance entities in the systems involved, rendering the whole question of voluntary allowance cancellations moot. However, even with such restrictions in place the analysis that follows can be valuable for assessing whether it is advisable to relax the restrictions on market participation.

A common element to all MSIs in Table 4 is that they are triggered by the price established in allowance auctions or in the secondary market. For example, the auction reserve prices (ARP) in California, Quebec, RGGI and Korea reduce the supply of allowances by not accepting bids below the ARP. The mechanism through which the ARP parameters are determined, and the treatment of unsold allowances, vary across systems. The price ceiling provisions (e.g. in California), cost containment reserves (e.g. in Nova Scotia), emissions containment reserves (e.g. in RGGI) or discretionary measures (e.g. in Korea) are typically activated based on prices in the secondary market.

Broadly analogously to the MSR's upper threshold for the TNAC activating the MSR and reducing the supply of allowances in the auctions, alternative MSIs such as ARPs and emissions containment reserves are activated when prices are too low. In principle, this could be due to too many allowances being in circulation already, relative to demand for them. Conversely, instruments such as cost containment reserves and price ceilings respond to contingencies where prices are too high, which, in the context of the EU ETS, could arise when too few allowances are in circulation relative to demand, impeding the cost-effective reallocation of abatement efforts among covered entities.

In both situations, the destination (source) and the fate of the allowances withdrawn (injected) are crucial for the implications of voluntary cancellations in systems with price-triggered MSIs. In particular, if the particular instrument has the potential to alter the cumulative emissions permissible under the ETS, then the one-to-one correspondence between voluntary cancellations and cumulative emissions reductions may be broken. A high-level description of the final destination or source of the allowances affected by an existing MSI is provided in the last column of Table 4.

In particular, the purchase and voluntary cancellation of allowances increase the scarcity in the secondary market, putting an upward pressure on the price there and increasing demand in the primary market. In the case of an auction reserve price this may mean that some allowances that would otherwise have been withdrawn now enter circulation. If these allowances were to be eventually re-introduced to the market in future auctions, then it does not matter, at least from the perspective of cumulative emissions, whether they are auctioned immediately following the voluntary cancellation or at a later point in time. Under these circumstances, there is a one-to-one correspondence between voluntary cancellations and cumulative emissions reductions. If, however, some or all these allowances would never have returned to the market, the effectiveness of the voluntary cancellation is diminished. Table 4 shows that the end fate of these allowances in California, Quebec or RGGI is not clear.

The case of an emissions containment reserve works in a similar way to an ARP with allowances never returning to the market. For example, voluntary cancellations can sustain allowance prices above the trigger level of the emissions containment reserve RGGI will adopt after 2021. If that were the case, voluntary cancellations would result in less than proportional reductions in cumulative emissions. Actors who want to restore the additionality of their voluntary allowance cancellations may consider waiting until allowance prices are well clear of the trigger points for the emissions containment reserve. In a way this is a variation on the buy-and-hold strategy discussed in the context of the MSR above and may more appropriately be termed a wait-buy-cancel strategy.

If allowance prices are high to start with, voluntary cancellations can push them higher still, potentially activating cost containment reserves (e.g. California pre-2021, Nova Scotia and RGGI), or breaching soft (e.g. California post-2021 and Quebec) or hard (e.g. California post-2021 and New Zealand) price ceilings and releasing new allowances into circulation. Under these circumstances, whether the newly released allowances were part of the original cap becomes important. For example, the provisions in Nova Scotia and in California pre-2021 do not have adverse implications for the additionality of voluntary cancellations. The cost containment reserve (CCR) provisions of RGGI on the other hand create new allowances and increase the cumulative emissions permitted under the cap. In other words, if they activate the CCR of RGGI, voluntary cancellations become less effective than they would have been had there been no CCR in place or if the allowances in the CCR had been sourced from within the cap.

An interesting intermediate case is the “price ceiling units” in California post-2021 and new units in New Zealand’s CCR once it becomes operational. The design of these MSIs is such that the revenues collected are to be spent on purchasing emissions reduction units elsewhere such that for every new allowance created, a unit of emission reduction credit must be obtained. As a consequence, a complex link is created between credit and allowance markets on the one hand, and voluntary cancellations of allowances on the other. Consider, for example, a hypothetical case when a non-regulated entity or a private citizen voluntarily cancels an allowance, rather than cancelling a credit. This can trigger the issuance of a new allowance through the market stability mechanism which in turn requires the regulator to obtain an emissions reduction unit, creating a new demand for a credit. In net, the cumulative emissions under the ETS are unchanged but additional demand for a credit is induced by the voluntary action. In a way, the private agent’s choice to cancel an allowance rather than a credit is undone by the MSM. To the extent that the choice of credit types and suppliers by private agents and regulators differs, the effects of voluntary cancellation are difficult to assess.

Another situation where additionality is difficult to assess is when discretion by the regulator has a large role to play in how the MSI operates (e.g. in Korea). In these cases, much depends on the priorities of the regulators at the time when they make decisions regarding whether to intervene or not, and if an intervention is deemed necessary, whether the cumulative cap is preserved or not.

The broad message of the section is that the additionality of voluntary cancellations depends heavily on the specifics of the MSI in place. Most crucial in this respect is whether the cumulative emissions allowed under the cap changes once the instrument is activated and if so by how much. This message is similar to that in section 4.2 for the MSR of the EU ETS, particularly in the long term once the TNAC declines below 833 million. Until then, however, there is an element of asymmetry because of the large volume of EU ETS allowances which will almost certainly be invalidated in 2023, representing a significant adjustment to the cumulative cap. Such large changes, even when normalised by market size, are unlikely to take place in the near to medium term for the jurisdictions in Table 4. As a consequence, the effectiveness of voluntary cancellations is likely to be diminished, albeit not to the same extent as under the MSR.

Table 4: Overview of market stability instruments in other ETSs around the world

System	Stability Mechanism	Operation	Destination/source of allowances withdrawn/injected
California Cap and Trade Programme	Auction Reserve Price (in joint Californian-Québec auctions)	Bids below the auction reserve price (ARP) are not accepted.	Unsold allowances are placed in the Auction Holding Account and reoffered at an auction following two consecutive auctions which result in settlement prices above the ARP. The maximum number of unsold allowances that can be returned is 25%t of the California allowances offered at that auction. If allowances remain unsold for more than 24 months, they are placed in the Allowance Price Containment Reserve (but some were retired in the past.).
	Allowance Price Containment Reserve (APCR)	A pre-defined number of allowances are offered for sale from a reserve quarterly. Since they are available at fixed tier prices, entities are expected to access the reserve when market prices reach tier levels.	The reserve is filled from within the allowance cap and is set at ~5% of the 2012-20 allowance budget. Through 2020, if all the allowances in the reserve are sold, allowances from future years are transferred to the reserve and made available for sale. This provision is removed starting in 2021.

System	Stability Mechanism	Operation	Destination/source of allowances withdrawn/injected
	Price Ceiling with "price points" (From 2021)	The CCR is replaced by two price tiers at which allowances are released for sale when market prices reach tier levels. Above these price points will sit a "hard price ceiling".	At the hard price ceiling, all APCR allowances remaining in the APCR at the end of 2020 and after reserve allowances are exhausted an unlimited number of price ceiling units will be made available to covered entities. Price ceiling units represent valid reductions and are not issued under the cap. Revenues from the sale of price ceiling units are to be invested in real and additional emission reductions on at least a metric tonne for metric tonne basis.
Québec Cap and Trade Programme	Auction Reserve Price (in joint Californian-Québec auctions)	Bids below the auction reserve price (ARP) are not accepted.	Unsold allowances are placed in the Auction Holding Account and reoffered at an auction following two consecutive auctions which result in settlement prices above the ARP. The maximum number of unsold allowances that can be returned is 25% of the California allowances offered at that auction. If allowances remain unsold for more than 24 months, they are either placed into the Allowance Price Containment Reserve or are retired.
	Allowance Price Containment Reserve	A pre-defined number of allowances are available in three categories of prices. To access these allowances, an entity must subscribe to a sale by mutual agreement.	Allowances come from within the cap.
RGGI	Auction Reserve Price	Bids below the ARP are not accepted.	Unsold allowances are transferred to an allowance reserve. To date, withheld allowances have not been reoffered.
	Emission Containment Reserve (from 2021)	Participating states will withhold up to 10% of their state allowance budgets when minimum price threshold is triggered.	Withheld allowances will not be available for future sale.

System	Stability Mechanism	Operation	Destination/source of allowances withdrawn/injected
	Cost Containment Reserve	A pre-defined number of allowances are released from a reserve when an upper price threshold is triggered.	Allowances are in addition to the allowance cap.
NZ ETS	Fixed Price Option (FPO)	A fixed fee is charged for emissions at the trigger price.	Allowances are created at the fixed price.
	Cost Containment Reserve	FPO will be replaced by a CCR from 2020, whereby a set volume of allowances will be auctioned onto the market when a predetermined trigger-price is reached.	Any units released from the CCR will be backed by an equivalent tonne of emission reductions.
KETS	Auction Reserve Price	The ARP that will be set by the following formula: "average price over the previous three months + average price of last month + average price over the previous three days/3."	Unsold allowances will be added to the next month's auction volume.
	Cost Containment Reserve	At the discretion of the Allocation Committee	About 5%of the total annual allowances are retained in the reserve
	Discretionary interventions by the Allocation Committee may also include Establishment of allowance retention limit Change in the borrowing limit Change in the offset limit Temporary price ceiling or floor	The committee can be called into action if market prices are deemed too high/too low; when the prices rise/fall too rapidly; or when there is a perceived imbalance of supply and demand making allowance trade difficult.	Unclear
Nova Scotia	Cost Containment Reserve	Allowances are made available at predetermined prices.	The reserve is filled with allowances set aside from the original cap.

Source: ICAP Status Reports, ICAP ETS map and internal working documents, adelphi and Öko-Institut

5 Conclusions

To date, the supply of units for the voluntary carbon market has been almost exclusively in the form of credits generated by projects under baseline-and-credit programmes. These projects have sparked a host of beneficial outcomes but have also been the target of concerns and criticism. The new context of the Paris Agreement brings additional challenges for crediting in a situation where all countries have mitigation targets. Against this backdrop, this report analyses the merits and challenges of using allowances from emissions trading systems for the purpose of voluntary offsetting. Our analysis shows that both credits and allowances can be used for voluntary offsetting, with different advantages and disadvantages.

Advantages and disadvantages of credits and allowances

Credits have the advantages that the source of emission reductions can be identified, and that credits are issued only after emission reductions take place; credit-generating projects often can provide sustainable development co-benefits and foster technology transfer in developing countries and are a tool for international cooperation. Moreover, credit purchasers can select particular project types and technologies that appeal to them. Put together, this also provides a simple and clear narrative that makes credits easy to communicate to the public. The environmental integrity of credits, however, is complex; additionality and crediting baselines rely crucially on complex counterfactual demonstrations, which are further complicated by the Paris Agreement context in which all countries have mitigation targets.

Allowances have the key advantage that their direct emissions impact – including additionality – can be determined at system level. While assessing cap stringency can require the establishment of counterfactual scenarios, observable indicators – such as allowance prices which are determined by the interactions between many market participants – are proxies that provide more robust assurance of additionality. Allowance cancellations from ETSs with stringent caps, moreover, could avoid some of the risks and disadvantages of credits from projects in developing countries: they do not provide incentives to delay expanding the coverage of NDCs and avoid overestimation of the emissions reductions, they may provide stronger incentives for innovation through higher prices and incentivise emission reduction at home rather than abroad. However, offsetting through allowances may be more difficult to communicate to the public, as emissions reductions are achieved at the system level and cannot be attributed to a specific source. Moreover, the cancellation of an allowance and the achievement of emission reductions are separated in time. Therefore, there is greater uncertainty with regards to regulatory and economic shocks, as core features of the ETS may be revised by the government and scarcity may depend on unforeseen economic events. In addition, prices of allowances tend to be higher than those of credits, which makes offsetting on the one hand more costly but can on the other hand underscore the sincerity of taking responsibility for emissions that can currently not be avoided or reduced.

In terms of accounting, we find that the environmental risks arising from double claiming at UNFCCC level apply to both credits and allowances, highlighting the importance of applying corresponding adjustments in the NDC-level accounting to reflect cancellations from voluntary buyers. Alternatively, participants in the voluntary carbon market could change the nature of their claim to a (financial) ‘contribution’ to the implementation of a country’s NDC, rather than ‘offsetting’ or ‘carbon neutrality’.

Dealing with the complexities of market stability instruments

Chapter 4 shows that MSIs can interact with voluntary cancellations of allowances in important ways. If the MSI includes provisions that can alter the cumulative cap in an ETS, then it can interfere with the environmental impact of voluntary offsetting through voluntary allowance cancellations – as (part of) the cancellation could have happened anyway. In other words, the MSI interferes with the additionality of the emission reduction sought through the allowance cancellation by the voluntary actor. Using the MSR of the EU ETS as a case study, the analysis suggests that the timing of cancellation is crucial: if the purchase and cancellation of allowances happen before the invalidation of allowances in the MSR, then the impact of the voluntary cancellation of one allowance is smaller than one tonne: for example, under the assumptions of the analysis in section 4.2, purchasing and cancelling one EU allowance in 2019 would reduce cumulative emissions by only 0.33 tonnes compared do doing nothing.

One possible approach to deal with this in the EU ETS context is to not purchase nor cancel any allowances at present – and instead, wait for the MSR to stop invalidating allowances and only then purchase and cancel allowances for voluntary offsetting. This would restore the one-to-one correspondence between the volume of voluntary cancellation and the reduction in cumulative emissions. However, this has a few important problems. According to recent forecasts it may mean waiting several years, if not more than a decade, for the necessary conditions to materialise. This makes the option less attractive to voluntary buyers who wish to demonstrate (and lock in) the climate action now. Moreover, it exposes them to the risk of significantly higher prices in the future.

Another alternative is to employ a buy-and-hold strategy, which is being employed by some of the new service providers offering EU ETS allowances for offsetting purposes. Under such a strategy, the actor can purchase the allowance today, but wait until after the last round of invalidations from the MSR before cancelling it. By not making the allowance available for compliance in the intervening period, the additionality of the emission reduction is restored. Moreover, by keeping the allowance as a part of the TNAC, the purchase does not interfere with the invalidations from the MSR. Loosely speaking, this strategy maintains the effect of the voluntary cancellation and eliminates the price risk for the actor compared to a situation where the actor would delay the purchasing of the allowance. In fact, to the extent that the actor who holds the allowance can commit to not selling the allowance to a compliance entity in the future, it is immaterial whether the allowance is cancelled or not. The commitment problem faced in the buy-and-hold strategy, however, is key. For the actor tasked with holding the allowance, the allowance could be regarded as an asset. Market conditions (such as strongly rising prices) or changing circumstances of the actor (such as financial woes) could incentivise the actor to sell the purchased allowance back to the market rather than holding it and – ultimately – cancelling it, thereby annulling any environmental benefit. Legally enforceable pre-commitment devices, such as locked accounts monitored by third parties subject to precise conditions for movement, could provide a workable solution to this problem, although mainly where allowances are bought through services providers that can then incorporate such safeguards into their operation. Similar strategies can be developed to account for the specific design features of MSIs in other ETSs to address this issue.

The analysis above focuses on a relatively *small* volume of voluntary purchases and cancellations – such that even though these actions would generate additional scarcity at the margin, they would not cause fundamental market shifts. Assessing the impact of very large volumes of voluntary cancellations, for example to account for the impact of large-scale coal phase-outs, is difficult as it would likely lead to a revision of the expectations of market participants and in turn of their plans regarding current versus future abatement. It could also directly affect the operation of the MSR. Under those circumstances it is not possible to arrive at a clear-cut conclusion other than the fact that the decline in cumulative emissions would most likely be less than one-for-one. However, it is important to note that this is an extreme case; given the volume of cumulative cancellations in the EU ETS – in the order of hundreds of thousands over several years – it is highly unlikely that voluntary cancellations on their own would be able to impact the expectations and therefore the behaviour of regulated entities or influence the dynamics of the TNAC sufficiently to deactivate the MSR.

Offsetting: credits and allowances

Overall, our analysis demonstrates that both credits and allowances can, in principle, be used for voluntary cancellations – with differing advantages and disadvantages. For the use of allowances, the interactions with market stability instruments can lead to problems in additionality that can, in the case of the EU ETS MSR, be resolved through a buy-and-hold strategy alongside pre-commitment devices that ensure purchased allowances for voluntary cancellation are not brought back to the market. The environmental integrity of credits remains challenging, with additionality and crediting baselines now further complicated by the Paris Agreement context where all countries have targets.

These considerations illustrate that neither credits nor allowances present a clearly superior option nor serve all purposes of voluntary offsetting. Ultimately, the differing interests and priorities of the various actors in the voluntary carbon market create space and opportunities for both unit types. Portfolios of credits and allowances could aim to capitalise on the various (and often complementary) benefits and risks of these units.

Given the growing interest from non-state actors in increasing their contribution to global decarbonisation, new and innovative offsetting approaches may become increasingly relevant but are beyond the scope of the current paper, notably by moving away from a 'carbon neutrality' model towards one where voluntary investors see themselves, rather, as facilitators of NDC implementation and increased ambition.[36]

[36] See e.g. Kreibich und Obergassel (2019)

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