Operationalising an ‘overall mitigation in global emissions’ under Article 6 of the Paris Agreement

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Executive Summary

Article 6 of the Paris Agreement establishes a framework for international cooperation that enables countries to engage in international carbon market mechanisms. Article 6.4 establishes a new crediting mechanism with international oversight. A key requirement of this new mechanism is that it shall aim to deliver an 'overall mitigation in global emissions', hereinafter referred to as 'overall mitigation'. In the ongoing negotiations on the international rules governing the Paris Agreement, countries have different views on what exactly this requirement means and how it should be operationalised and implemented. This report identifies and discusses key options for operationalising this concept.

The term 'overall mitigation in global emissions' was first introduced in the Paris Agreement. Similar concepts were previously discussed in the context of the review of the Clean Development Mechanism (CDM) and Joint Implementation (JI) under the Kyoto Protocol and as part of the conceptualisation of new market mechanisms under the Convention. In this context, a variety of options for operationalising these concepts were assessed in the literature. However, many of the options that might have led to a net decrease in global emissions in the context of the CDM, where host countries did not have targets under the Kyoto Protocol, no longer do so in the context of the Paris Agreement where all countries have to communicate 'nationally determined contributions' (NDCs). The findings from earlier research are therefore not automatically valid in this new context.

A key aspect for implementing and operationalising overall mitigation is a general common understanding of what delivers 'global' mitigation, as contrasted to the notion of 'own (mitigation) benefits'. In the context of the Paris Agreement, in which all Parties have NDCs, we recommend that overall mitigation in global emissions be understood to be delivered when a portion of the emission reductions resulting from an activity credited under the Article 6.4 mechanism is not used by any country to implement or achieve its NDC. Under this definition, if emission reductions that are achieved go unused by any Party toward its NDC, aggregated global emissions decrease as a result of engaging in the mechanism, rather than leading only to emission reductions that can be used by the host country to achieve its NDC – which is often referred to as a host country's 'own benefit'. In case overall mitigation should also be achieved if the mechanism is used for purposes other than achieving NDCs – such as for the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) established by the International Civil Aviation Organization (ICAO) – the definition could be extended by clarifying that the portion of emission reductions used for overall mitigation should also not be used for these other purposes.

Based on this definition – and assuming that environmental integrity and robust accounting are ensured and that emission reductions are covered by the scope of the NDC of the host country – we identify three criteria that need to be fulfilled to achieve overall mitigation. First, the portion of emission reductions used for overall mitigation must be quantified. Second, accounting provisions must ensure that this portion is not used by any country towards achieving their NDCs. This can be effectuated by requiring that the corresponding adjustment by the host Party equals the adjustment by the acquiring Party plus the volume of emission reduction used to achieve an overall mitigation in global emissions. And third, to ensure that overall mitigation is achieved, the approach for implementing overall mitigation must be mandatory and not an option for Parties.

Several of the options in the current negation text do not meet these criteria (see Table ES-1). The option that 'the mechanisms itself ensures overall mitigation' does not meet any of the three criteria. Ensuring environmental integrity, such as through 'additionality', does not lead to overall mitigation but is rather a prerequisite for actually achieving overall mitigation. 'Conservative baselines' and 'limiting the crediting period' do not ensure that the non-credited emission reductions cannot be used towards the achievement of a Party's NDC, since they remain with the host country Party. Both options also face other challenges: conservative baselines are often used to ensure environmental integrity, independent

of overall mitigation, and quantifying the implications of limited crediting periods would require monitoring and verifying emission reductions beyond the crediting periods for which very limited incentives exist. 'Voluntary approaches' do not ensure overall mitigation as they are voluntary actions and not a mandatory or automatic process.

Table ES-1: Summary of assessment of overall mitigation implementation options against criteria for ensuring overall mitigation

Option for implementing overall mitigation	Quantification	Accounting	Mandatory Application	Summary: ability of the option to ensure overall mitigation
Automatic cancellation (Option A)	✓	✓	✓	✓
Discounting (Option B and D(d))	✓	✓	✓	✓
Mechanism itself ensures overall mitigation (Option C)	×	×	×	×
Additionality (part of Option D (a))	×	×	✓	×
Conservative baselines (Option E)	×	×	✓	×
Limiting the crediting period (No longer in the most recent reflections note though possibly reflected in Option D(a))	(✓)	×	✓	×
Voluntary approaches (Option D(b), D(c) and Option F)	✓	(✓)	×	×

We find that only the options 'automatic cancellation' and 'discounting' fulfil all three criteria and thus ensure that overall mitigation is achieved. The differences between them mostly relate to when credits are cancelled and whether the host country or the acquiring country is responsible for cancelling them. The key functionality to transfer a defined number of units to a dedicated cancellation account, after the host country made a corresponding adjustment for the full amount of verified and certified emission reductions, ensures that an overall mitigation of global emissions is delivered. Through the issuance and subsequent cancellation of units the required quantification and a mandatory and automatic implementation can be achieved.

Among these two options ('automatic cancellation' and 'discounting'), we recommend policy-makers to pursue 'automatic cancellation'. For this option it is easier to ensure that the required cancellation actually occurs, as it can be conducted by the supervising body of the mechanism. The cancellation should be implemented at issuance but at least before units are transferred for the first time to an account under the control of Parties. In this way units meant to deliver an overall mitigation do not enter into circulation and corresponding adjustments by acquiring Parties are only made for the amount of

emission reductions that they use to achieve their NDCs, after subtraction of the contribution to overall mitigation.

Since a precedent for this implementation approach exists from the CDM, it would be comparatively easy and efficient to build on these experiences for delivering an overall mitigation contribution. A share of the CERs from CDM projects are already transferred to a special purpose account for the generation of funds for the Adaptation Fund. Such a special purpose account could also be established for units cancelled to achieve overall mitigation.

An important outstanding decision for policy-makers is the share of units that should be cancelled for the purpose of achieving overall mitigating. Some stakeholders fear that a higher share would lead to market distortions, fewer projects being implemented, and higher costs for buyers. Using a simplified model, we assess the market implications in 18 scenarios, using simple representations of hypothetical supply and demand curves and different rates for overall mitigation. Comparing a reference case, in which the principle of overall mitigation is not implemented, with the situation in which the principle of overall mitigation is implemented shows that the concept of overall mitigation has, for a broad range of possible circumstances, various benefits although the costs for supplying credits increase (see Table ES-2 below).

Table ES-2: Implications of overall mitigation relative to the reference case under different scenarios

SCENARIOS			RELATIVE CHANGE DUE TO OVERALL MITIGATION IN COMPARISON TO THE REFERENCE CASE					
Demand curve	Supply curve	Rate of overall mitigation	Credit price	Credits transacted	Abatement[1]	Market value	Supplier rents	Costs of buyers
Inelastic	Flat	10%	11%	0%	11%	11%	11%	11%
		30%	43%	0%	43%	43%	43%	43%
		50%	100%	0%	100%	100%	100%	100%
	Steep	10%	11%	0%	11%	11%	11%	11%
		30%	43%	0%	43%	43%	43%	43%
		50%	100%	0%	100%	100%	100%	100%
Elastic	Flat	10%	11%	-1%	11%	10%	9%	11%
		30%	41%	-3%	41%	36%	32%	40%
		50%	93%	-8%	92%	79%	65%	90%
	Steep	10%	7%	-3%	11%	4%	3%	7%
		30%	26%	-10%	39%	13%	9%	24%
		50%	53%	-21%	79%	21%	11%	47%
Very elastic	Flat	10%	10%	-2%	11%	8%	6%	10%
		30%	39%	-7%	40%	30%	21%	38%
		50%	88%	-15%	85%	60%	36%	81%
	Steep	10%	6%	-4%	11%	1%	-1%	6%
		30%	20%	-15%	36%	2%	-5%	18%
		50%	40%	-30%	70%	-3%	-17%	34%

Implementing overall mitigation increases the credit prices and, depending on the elasticity of demand, can reduce the number of credits transacted. Even though fewer credits are transacted, however, implementing overall mitigation leads to *more* overall abatement activity in transferring countries. Under a broad range of circumstances, the abatement in transferring countries is higher with larger rates of overall mitigation. Project owners also benefit because implementing overall mitigation leads to higher carbon market prices: while their costs of supplying offset credits increase, this is outweighed by higher revenue from higher offset credit prices. This increase in *net* revenues – referred to as 'supplier rents' in Table ES-2 – holds true under a broad range of circumstances.

The costs of achieving overall mitigation are borne by the buyers of the offset credits. Their costs of purchasing offset credits increase. With lower rates for overall mitigation, the costs increase relatively

proportionally, whereas they increase more strongly with high rates. If 10% of the offset credits are cancelled, for example, this leads to a maximum increase in costs of 11%, whereas cancelling 50% could, at the most, double the costs.

Although the shape of the supply curve and the demand curve is not currently known, based on current information some assumptions about likely scenarios can be made. For new mitigation activities, the shape of the supply curve is relatively uncertain: it will not only depend on the abatement potential and costs but also on the readiness of countries to sell offset credits and the international rules governing Article 6. If existing and already implemented projects would become eligible to supply credits after 2020, the supply curve is likely to be rather flat. Based on the currently known demand for credits after 2020, in particular from CORSIA, the demand is likely to be relatively inelastic. These considerations can inform the discussion on the rate of overall mitigation that should be applied.

Policy-makers could also implement overall mitigation for generating emission reductions under other mechanisms, in particular in the context of markets where several offsetting programmes compete, as for example in the case of CORSIA. Implementing overall mitigation only in the context of the Article 6.4 mechanism could otherwise lead to market distortions.

Overall, our analysis suggests that implementing overall mitigation can be straightforward – provided that the political will is given to implement this principle. Cancelling a portion of units after issuance and ensuring that overall mitigation is achieved through appropriate accounting provisions is relatively simple. At the same time, benefits for transferring countries, with only moderate increases in costs for buyers, can be achieved for a broad range of rates for overall mitigation.

Contents

List of Figures

List of Tables

1 Introduction

Article 6 of the Paris Agreement establishes a framework for international cooperation that enables countries to engage in international carbon market mechanisms. The cooperative approaches under Article 6.2 allow countries to use internationally transferred mitigation outcomes to achieve their nationally determined contributions (NDCs). Article 6.4 establishes a new crediting mechanism with international oversight:

> *"A mechanism to contribute to the mitigation of greenhouse gas emissions and support sustainable development is hereby established under the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to this Agreement for use by Parties on a voluntary basis. It shall be supervised by a body designated by the Conference of the Parties serving as the meeting of the Parties to this Agreement (…)."* (Article 6.4, Paris Agreement 2015)

Article 6.4(d) further specifies that the mechanism *"shall aim to (…) deliver an overall mitigation in global emissions"*. In the ongoing negotiations on the international rules governing the Paris Agreement, countries have different views on what exactly this requirement means and how it should be operationalised and implemented.

This report identifies and discusses key options for operationalising the concept under the framework of the Paris Agreement. The report aims to support countries in developing the 'rules, modalities and procedures' for the new mechanism established under Article 6.4, as well as related guidance on cooperative approaches under Article 6.2 of the Paris Agreement.

The term 'overall mitigation in global emissions' – for simplicity hereinafter referred to as 'overall mitigation' – was first introduced in the Paris Agreement. Similar concepts, however, have previously been put forward in the context of the review of the existing mechanisms established under the Kyoto Protocol, and as part of the conceptualisation of new market mechanisms in the period before the Paris Agreement was adopted. A variety of options for operationalising these concepts have been assessed in the literature, including recommendations for implementation as well as quantitative assessments of their implications. Although this literature serves as a useful point of departure, most previous work is not directly applicable to the new framework of the Paris Agreement – one in which all Parties have to communicate mitigation targets or actions through their NDCs. Implementation options that might have led to overall mitigation under the Kyoto Protocol may no longer do so under the Paris Agreement, meaning that the findings from research in the period before the Paris Agreement cannot automatically be transposed to the new regime.

To assess options for implementing overall mitigation and their implications, this report first explores possible definitions of this new concept, drawing on the discussions of similar concepts in the available literature, and highlights links to other elements of the Paris Agreement (section 2). Based on the current negotiation text, submissions by Parties, and the available literature, we then identify and discuss options for implementing overall mitigation (section 3) and explore practical approaches to operationalise two specific options (section 4). We then discuss the market implications of introducing overall mitigation, including how carbon market prices, the level of greenhouse gas (GHG) abatement, and benefits and costs change under different 'rates' for overall mitigation and different market circumstances (section 5). Lastly, we draw conclusions to inform the ongoing discussions on Article 6 (section 6).

2 Defining overall mitigation in global emissions

A key requirement of the new Article 6.4 mechanism is that it shall aim to deliver an 'overall mitigation in global emissions'. There are different views on what exactly this requirement means and how it should be operationalised and implemented. Moreover, some Parties propose that an overall mitigation in global emissions also be implemented in the context of the cooperative approaches under Article 6.2, while other Parties wish to limit the implementation of this principle to the Article 6.4 mechanism.

Literature published before the Paris Agreement was adopted describes concepts that are similar to the Paris Agreement's 'overall mitigation in global emissions'. However, it uses different terminology and definitions which are not automatically transferable to the Paris Agreement regime. We consider this previous work but present and discuss possible definitions that reflect the new context and provisions of the Paris Agreement. Previous literature referred to various terms including 'net climate benefit', 'net atmospheric benefit', 'net benefit' and 'net mitigation effect'. They do not always refer to the same definition and, depending on the circumstances in which these concepts are applied, they do not lead to the same effects.

Whenever we refer to previous concepts from literature or discuss specific implementation approaches for overall mitigation we therefore distinguish between concepts and approaches that lead to a ***'net decrease in global emissions'*** and/or a ***'benefit for the host country'***. With a 'net decrease in global emissions' we mean that aggregated global GHG emissions decrease compared to a situation where the participating countries or entities do not engage in the international carbon market mechanism. With a 'benefit for the host country' we refer to GHG emission reductions in the host country that occur as a result of the engagement in the international carbon market mechanism but that are not claimed by any other country or entity towards achieving climate change mitigation targets or goals. Depending on how they are designed, international carbon market mechanisms can either: lead to a net decrease in global emissions; to a benefit for the host country; or achieve both a net decrease in global emissions and a benefit for the host country. In this section, we provide an overview of the historical context of the concept to deliver an 'overall mitigation in global emissions', discuss a possible definition, highlight other factors that influence the aggregated emissions outcome, and point to links with other elements of the Paris Agreement. This section serves as a basis for an assessment of options for implementing overall mitigation in subsequent parts of this paper. Throughout the paper we use the term ***'overall mitigation'*** to refer to the provision of ***'overall mitigation in global emissions'*** under the Paris Agreement.

2.1 Historical context of the concept

Article 6 builds on a history of market mechanisms under the regime of the United Nations Framework Convention on Climate Change (UNFCCC). The flexible mechanisms established by the Kyoto Protocol, such as the Clean Development Mechanism (CDM) and Joint Implementation (JI), were designed to increase flexibility, but generally have a net neutral effect for the climate. Because measures to reduce GHG emissions have different costs in different countries and sectors, providing Parties which have emission reduction commitments with the flexibility *where* they reduce emissions would lower the cost to reach their mitigation or limitation targets. In theory, this could indirectly enable Parties to commit to more ambitious targets, with benefits for the global climate. In practice, it is unclear to what extent this flexibility has led to further ambition, and, over time, a growing number of Parties and stakeholders have started to critique the approach. On top of these discussions, further questions regarding the additionality of projects and low environmental integrity of some offset credits led to concerns that the mechanisms may only in the optimal case lead to net neutral effect. In other words, if some credits lack environmental integrity, their use would result in an overall *increase* of global emissions. Such concerns were an important aspect of the CDM and JI review processes.

Increasingly, several Parties and stakeholders called for these mechanisms to deliver a greater benefit for the climate by reforming the mechanisms so that they go beyond pure offsetting and directly deliver a net decrease in global emissions (see for example EIG, 2014, 2015). A variety of options were discussed in the CDM and JI review processes and in the literature to adapt these mechanisms so that they would lead to a net decrease in global emissions. Although Parties never reached agreement about how to implement the concept, the idea that mechanisms should directly deliver a net decrease in global emissions became subsequently part of the pre-Paris negotiations and were reflected in decisions adopted by the Conference of the Parties on a Framework for Various Approaches (FVA) and a New Market Mechanism (NMM). The decision in Durban (Paragraph 79 of decision 2/CP.17) *"emphasizes that various approaches (…) must meet standards that (…) achieve a net decrease and/ or avoidance of greenhouse gas emissions"* (UNFCCC, 2012) and the Cancun Agreements (Paragraph 80 (e) of decision 1/CP.16) requires *"ensuring a net decrease and/or avoidance of global greenhouse gas emissions"* for the New Market Mechanism (UNFCCC, 2011).

The majority of the literature published before the Paris Agreement was adopted discussed net mitigation options mostly related to the CDM (Schneider, 2009; Butzengeiger-Geyer *et al.*, 2010; Kollmuss, Lazarus and Smith, 2010; Chung, 2012; Vrolijk and Phillips, 2013; Erickson, Lazarus and Spalding-Fecher, 2014; Warnecke *et al.*, 2014). CDM based assessments therefore relate to a context in which the host country of the offsetting activity did not have a mitigation target under the Kyoto Protocol. If in this context, the mitigation activity reduces more emissions than are credited and used to fulfil Kyoto targets, the portion of the reduction that is not credited represents a net decrease in global emissions. The full amount of emission reductions would be recorded in the host Party's inventory[1] and since not the entire amount would be used to increase emissions elsewhere, this would lead to *both* a benefit for the host country and a net decrease in global emissions.

In the case of JI, where an emission reduction activity is carried out in a country with a Kyoto target and where any transferred credits were deducted from the host countries' emission budget, any non-credited reduction would be counted by the host country to achieve its target. In this case, because the reduction takes place in a context where emissions are covered by an emission reduction or limitation obligation, any non-credited reductions result in a benefit for the host country but does not result in a net decrease in global emissions. In some circumstances, however, crediting only a portion of the verified emission reductions can lead to a net decrease in global emissions. This is the case if the JI host country's mitigation target is set above business as usual, a situation that has also been referred to as 'hot air'. Such a case would mean that the Party's emission target is so unambitious that the global climate outcome is the same as for Parties without a target. This is undesirable and will not be further considered in this paper as a feasible option of achieving overall mitigation. In theory, a host country with an ambitious target could also intentionally waive its own benefit and reduce its emission budget by cancelling Assigned Amount Units (AAUs) for emissions mitigated but not transferred. In this case the host country takes an active decision to turn the 'benefit for the host country' into a 'net decrease in global emissions'. Applying AAU cancellations, however, requires the exact quantification of the amount in question which is not possible with all implementing options.

In literature, various implementation options were discussed in the Kyoto Protocol context to generate reductions that would not be credited. These options could either lead to a net decrease in global emissions; to a benefit for the host country; or achieve both a net decrease in global emissions and a benefit for the host country depending on the context (Vrolijk and Phillips, 2013; Warnecke *et al.*, 2014). The literature addressed various options, including, discounting the verified emission reductions or

[1] In practice, depending on the quality of GHG inventories, an emission reduction may in some instances not actually be "seen" in the GHG inventory. In principle, however, with robust GHG inventories most emission reductions would be automatically reflected.

cancellation of a portion of the issued offset credits; setting the baseline below actual BAU emission levels; limiting the crediting period; and using intentionally particularly conservative assumptions to calculate emission reductions. Further options are possible and were also discussed as variants thereof. The assessments showed that overlapping objectives of some options lead to uncertainty whether and to what extent the intended effect is achieved. Conservative approaches to determine emission reductions are, for example, also pursued to compensate for methodological and other uncertainties which remain unknown in their scale. If these uncertainties materialise in full, no decrease in emissions is achieved. Other options remain uncertain in their outcome since they cannot ensure the delivery or quantification of the actual impact due to a lack of control or sanctioning mechanisms for the governing body, e.g. in the case of shortened crediting periods, where the mitigation is generated when there is no longer an economic incentive to continue with monitoring, reporting and verification or the emission reducing activity itself. Governing bodies may not necessarily have the means to ensure overall mitigation is delivered after crediting periods end. Some of these findings remain relevant and have been considered for the assessment of options in this paper.

The Paris Agreement presents a context in which all Parties to the Agreement have to communicate and update NDCs. Many NDCs include quantitative mitigation targets, which resembles an extension of the JI context to these Parties. These targets, according to Article 4.3 of the Paris Agreement, should reflect the Party's highest possible ambition. This suggests that they should at least represent a lower emissions level than the countries' likely business as usual emissions. Accordingly, as most options for achieving a net decrease in global emissions in the context of the CDM would only have led to a benefit for the host country in the JI context, they also do not deliver a net decrease in global emissions in the new context of the Paris Agreement.

2.2 Possible definitions for overall mitigation

Conceptual options for achieving a net decrease in global emissions were discussed in negotiations on the review of the CDM and JI, as well as in negotiations on the NMM and FVA. They were, however, not further pursued as the CDM review process remains inconclusively open; the JI review process was closed with the understanding that there would be no third Kyoto Protocol commitment period; and the NMM and FVA discussions have been made redundant by the new context of the Paris Agreement and negotiations on Article 6.

In the negotiations, various definitions for an 'overall mitigation in global emissions' were proposed in submissions by Parties and observer organisations to the UNFCCC. Agreeing on a common definition for overall mitigation may be useful to make progress in the operationalisation of this concept.

The 8 May 2018 version of the revised informal note by the Co-Chairs of the negotiations (UNFCCC, 2018c) provides a potential definition of overall mitigation, stating that this takes place

> *"when the mitigation resulting from a cooperative approach is delivered at a level that goes beyond what would be achieved through the delivery of NDCs of participating Parties in aggregate".*

In later versions of the negotiation text, definitions are no longer included but will be reconsidered as part of a work programme in 2019.

Several considerations are important for defining overall mitigation:

- **Causality:** We assume here that overall mitigation should occur as result of the engagement in a relevant cooperative approach or a mechanism.
- **Net decrease in global emissions:** We understand here that overall mitigation should lead to a net decrease in global emissions and not only achieve a benefit for the host country.

- **Reference scenario for overall mitigation:** A key consideration is the emission level against which overall mitigation should be achieved. We assume here that aggregated global GHG emissions should decrease in relation to the emissions level that would occur under the same NDC targets without engaging in the cooperative approach or the mechanism. This reference scenario means that the engagement in the cooperative approach or the mechanism should itself ensure a net decrease in global emissions, irrespective of the ambition of NDC targets.
- **Applicability to mechanisms generating emission reductions:** The concept of overall mitigation could apply to the Article 6.4 mechanism exclusively, or also to other forms of generating emissions reductions, which may occur under the responsibility of Parties under Article 6.2. We focus our analysis on the Article 6.4 mechanisms but discuss possible implications if the principle is not applied to other forms of generating emission reductions in section 5.3 further below.
- **Applicability to different possible uses of emission reductions:** Emission reductions resulting from the Article 6.4 mechanism (or other mechanisms) could be used for different purposes: they could be internationally transferred and used to help achieve the NDC of another country; they could be used domestically by the host country, such as using domestic offset credits in domestic emission trading schemes (ETSs); they could be used under international agreements to reduce emissions from international bunker fuels, such as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) established by the International Civil Aviation Organization (ICAO); or they could be used in the voluntary market to offset emissions. Depending on how it is implemented, the principle of overall mitigation could only apply only to the first use, to some of these uses, or all of these uses. We assume here that the mechanism itself should result in overall mitigation, regardless of how the emission reductions are used.
- **Responsibility for ensuring overall mitigation:** Article 6.4(d) states that the mechanism shall aim to "ensure" overall mitigation. We assume here that achieving overall mitigation is not a voluntary option which Parties engaging in the mechanism may or may not implement but that the international rules governing the mechanism should ensure that it is achieved. We also assume that it should not only be achieved for some but for all activities implemented under Article 6.4.

Based on these considerations and assumptions, an alternative definition could be formulated as follows in the context of using the Article 6.4 mechanism towards NDCs:

> *"An overall mitigation in global emissions is understood to be delivered when a portion of the emission reductions resulting from an activity credited under the mechanism established under Article 6.4 is not used by any country to implement or achieve its nationally determined contribution."*

In this paper, we base our criteria and assessment of options for implementation on this definition. If the Article 6.4 mechanism is also used beyond NDCs, e.g. for compliance purposes of airlines covered under CORSIA, this definition needs to be extended to ensure overall mitigation is also ensured for other possible uses of the mechanism's emission reductions.

2.3 Conditions for achieving overall mitigation

Based on this definition for overall mitigation, in this section we explore the conditions that must be met for the mechanism to result in overall mitigation. Several factors affect the environmental outcome of engaging in carbon market mechanisms (Schneider and La Hoz Theuer, 2018). These factors can also impact whether overall mitigation is actually achieved. For example, if the emission reductions from a credited activity are grossly over-estimated, this could – under some circumstances – undermine the achievement of an overall mitigation.

In assessing and comparing different options for implementing overall mitigation, we make several assumptions on accounting and environmental integrity that influence whether or not overall mitigation is achieved:

- **Robust accounting:** We assume that the international transfer of emission reductions from the Article 6.4 mechanism are robustly accounted for, including that double counting is avoided. We assume that accounting for emission reductions from the Article 6.4 mechanism occurs through the accounting provisions of Article 6.2 and Article 4.13, including through the application of "corresponding adjustments".
- **Quality of the units**: We assume that the mechanism ensures that the credited activities are additional and that the emission reductions are not over-estimated. While crediting mechanisms face considerable challenges in ensuring unit quality, this assumption allows for the identification of provisions that are needed to achieve overall mitigation in a well-designed crediting mechanism.
- **Scope and ambition of NDC targets**: We focus our discussion on the situation that countries have communicated ambitious economy-wide GHG emission targets in their NDCs. While the scope and ambition of current NDCs varies between Parties, we focus on this situation because the Paris Agreement Art 4.3 calls for all Parties' NDCs to reflect that Party's "highest possible ambition", and Article 4.4 calls on Parties to "continue enhancing their mitigation efforts" and "to move over time towards economy-wide emission reduction or limitation targets". Several Parties and stakeholders have also pointed to possible environmental integrity risks and perverse incentives with regard to transferring emission reductions that are not yet covered by NDCs (CCAP, 2017; Spalding-Fecher, 2017; NewClimate Institute, 2018).
- **Quality of national GHG inventory reports**: We assume that the emission reductions from activities credited under the Article 6.4 mechanism are reflected in GHG inventories. While this is currently not always the case (Prag, Hood and Barata, 2013; Schneider, Füssler, *et al.*, 2017), countries are expected to improve their GHG inventories over time, including through re-calculations of previous years, which would allow them to claim emission reductions achieved through the Article 6.4 mechanisms, even if they were not yet reflected in previous GHG inventory reports.

Based on our definition for overall mitigation and these assumptions, we identify three key conditions that need to be fulfilled to achieve overall mitigation.

First, the mechanism only results in overall mitigation if a portion of the emission reductions is used exclusively for overall mitigation. This requires that this portion can be quantified. Without quantification it would not be clear whether an overall mitigation is actually achieved.

Second, it must be ensured that the portion of emission reductions that constitutes overall mitigation is not used by any country to achieve its NDC. To achieve this, the portion must count neither towards the host country NDC, nor towards the NDC of the country using the offset credits from the mechanism. This, in turn, requires that the involved Parties apply corresponding adjustments such that the adjustment of the country where the emission reductions originated is larger than the adjustment of the country using the emission reductions towards achieving its NDC:

Eq. 1 $$OMGE = CA_{PartyT} - CA_{PartyA}$$

Where $CA_{PartyT} > CA_{PartyA}$

The amount of 'overall mitigation in global emissions' (OMGE in equation 1) achieved thus corresponds to the difference between the 'corresponding adjustments' (CA in equation 1) of the Parties involved in Article 6.4 activities. Party T in equation 1 represents the host or transferring country and Party A corresponds to the acquiring country. The difference between the corresponding adjustments represents the amount of emission reductions which are not used towards the achievements of either

Party's NDC, and therefore lead to a level of mitigation that goes beyond what would be achieved by the countries without engaging in the mechanisms. Note that if the term OMGE is equal to zero, there is no overall mitigation, which is equivalent to pure offsetting (i.e. net neutral). If the term OMGE is negative, this would constitute an overall increase in global emissions and the transaction would not only not produce an overall mitigation, but also undermine the environmental integrity of the mechanism. The same considerations apply if overall mitigation should also be achieved for other uses of the emission reductions, such as aircraft operators under CORSIA. In this case, the number of emission reductions claimed by these entities would need to be smaller than the adjustment applied by the transferring country.

A third condition that is required to ensure overall mitigation is that the application of the approach for implementing overall mitigation is mandatory, or automatically triggered, rather than being a voluntary action, as voluntary action cannot be ensured.

To summarise this logic, three conditions are identified against which we assess whether potential implementation options will ensure overall mitigation:

1. **Quantification:** The portion of emission reductions used for overall mitigation is quantified.
2. **Accounting:** Accounting provisions ensure that the portion of emission reductions used for overall mitigation is not used by any country towards achieving their NDCs. This requires that the participating Parties apply corresponding adjustments such that the difference between the two adjustments equals to the volume of emission reductions that contribute to achieving overall mitigation.
3. **Mandatory application:** The application of the approach for implementing overall mitigation is mandatory and thereby ensured.

Section 3 of the paper assesses different options for the implementation of overall mitigation in line with this definition, and the above criteria.

2.4 Links to other Paris Agreement concepts

A clear definition of overall mitigation and the identification of the conditions under which it can be ensured also adds clarity on how overall mitigation relates to other concepts and principles discussed in the context of the Paris Agreement. These concepts include *higher ambition*, *own benefit*, and *environmental integrity.*

- **Overall mitigation is not directly related to *higher ambition of NDCs under* the Paris Agreement.** An important difference between the Paris Agreement and previous international climate change agreements is that all Parties must formulate a *nationally determined contribution* (NDC) and that Parties are required to update their contributions regularly in a way *that "reflects the Party's highest possible ambition"* and represents a "progression" from the previous NDC (Article 4.3). This implies that the concept of *ambition* in the Paris Agreement is related to the NDCs and the process for ratcheting the ambition of NDCs up over time. If the concept of overall mitigation is defined as in the previous subsection, it should result in mitigation that goes beyond the NDCs of the participating Parties. This means that overall mitigation is additional and separate to any domestic processes for achieving or ratcheting up the ambition level of NDCs. Emission reductions classified as overall mitigation can, therefore, be used neither by individual Parties towards the achievement of their NDCs, nor as a demonstration of domestic ambition raising.
- **A host country's *own benefit* does not constitute overall mitigation.** The revised informal note from 8 May 2018 offers the definition that an *own benefit* for a host country occurs "when the amount of A6.4ERs issued for a mitigation activity is lower than the verified emission reductions achieved by the mitigation activity" (UNFCCC, 2018c). Such a construct may lead to

an overall mitigation in global emissions in the context of countries that do not have a mitigation target. However, in the context of the Paris Agreement, where all Parties have NDCs, this will not necessarily lead to overall mitigation, since a host country's *own benefit* would count towards the achievement of its NDC. Ensuring that the emission reductions contributing to overall mitigation are not accounted for by any Party towards their NDC is identified as a key condition for ensuring overall mitigation.

- **Environmental integrity does not constitute overall mitigation**. Article 6.1 of the Paris Agreement calls for voluntary cooperation to promote environmental integrity, and Parties engaging in cooperative approaches under Article 6.2 shall "ensure environmental integrity". The Paris Agreement does not provide a definition of environmental integrity but it is often understood that environmental integrity is ensured if the engagement in international transfers leads to aggregated global GHG emissions that are no higher as compared to a situation where the transfers did not take place (Schneider and La Hoz Theuer, 2018). Environmental integrity thus means that *an increase* in global emissions is avoided, whereas overall mitigation means that the action results in *a decrease* in global emissions. If global emissions are unaffected by a transfer, environmental integrity is ensured, but the action does not result in overall mitigation. A lack of environmental integrity would, however, undermine achieving overall mitigation (e.g. if the increase in global emissions due to lack of environmental integrity exceeds the portion of emission reductions that are used to achieve overall mitigation). Ensuring environmental integrity is thus a prerequisite for achieving overall mitigation.

3 Options for implementing overall mitigation

3.1 Identification of options

To ensure that the mechanism results in overall mitigation, specific rules for the operationalisation of overall mitigation will be necessary under Article 6 of the Paris Agreement. Different options to implement overall mitigation and similar concepts are described in the literature, some of which date from before the adoption of the Paris Agreement and may not necessarily be fully aligned with the Paris Agreement context. Party and observer submissions have added to this discussion, and a catalogue of options has been agglomerated in several negotiation documents, including:

- the SBSTA 48 agenda item 12b revised informal notes (UNFCCC, 2018c);
- then revised in the "draft text on SBSTA 48-2 agenda item 12(b) Matters relating to Article 6 of the Paris Agreement: Rules, modalities and procedures for the mechanism established by Article 6, paragraph 4, of the Paris Agreement" (UNFCCC, 2018b) which came out of the Bangkok session; and
- most recently revised in the pre COP 24 "Joint reflections note by the presiding officers of the Ad-Hoc Working Group on the Paris Agreement, the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation Addendum 2 – Matters relating to Article 6 of the Paris Agreement and paragraphs 26-40 of the decision 1/CP.21"(UNFCCC, 2018a).

The following implementation options for overall mitigation are drawn from the submissions of Parties, and on the basis of the cumulation of roundtables and informal consultations under the SBSTA since COP 21. The lettering and order of these options has changed several times in the various iterations of informal notes and reflections notes. To facilitate a comparison of the options, we do not use the same but a similar structure as in the latest negotiation text and indicate the letter they correspond to in the most recent reflection note text. In some cases, we include options or further information that were included in previous iterations of the text.

- **Automatic cancellation** (Option A)
- **Discounting** (Option B and D(d))
- **Mechanism itself ensures overall mitigation** (Option C)
- **Additionality**[2] (part of Option D(a))
- **Conservative baselines** (Option E)
- **Limiting the crediting period** (No longer in the most recent reflections note though possibly reflected in Option D(a))
- **Voluntary approaches** (Option D(b), D(c) and Option F).

A full description of these options is given in the following, along with an assessment of their feasibility for ensuring overall mitigation.

[2] Additionality as its own option was included in the corrected version of the 9 Sept draft text (UNFCCC, 2018b), in the joint reflections note (UNFCCC, 2018a), it is included in Option D(a).

3.2 Assessment of the options to ensure overall mitigation

This section includes a description of the identified options and an assessment of their ability to ensure overall mitigation. The potential options are evaluated based on their ability to deliver on the conditions for ensuring overall mitigation, as outlined in section 2:

1. **Quantification:** The portion of emission reductions used for overall mitigation is quantified.
2. **Accounting:** Accounting provisions ensure that the portion of emission reductions used for overall mitigation is not used by any country towards achieving their NDCs. This requires that the participating Parties apply corresponding adjustments such that the difference between the two adjustments equals to the volume of emission reductions that contribute to achieving overall mitigation.
3. **Mandatory application:** The application of the approach for implementing overall mitigation is mandatory and thereby ensured.

For each option, we assess the negotiation text either in the most recent version or previous versions. An overview of assessment of all options is summarised in Table 1.

Automatic cancellation *(Option A)*

The joint reflections note (UNFCCC, 2018a) describes 'automatic cancellation' in Option A.

(a) After emission reductions are verified and certified, the host Party [shall][should] make a corresponding adjustment under the guidance for cooperative approaches referred to in Article 6, paragraph 2 for the full amount of issued A6.4ERs to be first transferred;

(b) At issuance/first transfer of A6.4ERs, the registry [shall][should] transfer X per cent of total amount of A6.4ERs to the cancellation account for overall mitigation in accordance with section XIII above;

(c) The cancelled A6.4ERs [shall][should] not be used for any transfer or purpose, including by any Party towards achievement of its NDC or for voluntary cancellation;

(d) The host Party [shall][should] use the remaining A6.4ERs in its account either towards its own NDC or transfer them to another Party's registry or to another Party's account in the mechanism registry.

In this option, all emission reductions achieved through the credited activity are issued as credits, but a pre-defined portion of the credits are cancelled, either directly after issuance or when the credits are first transferred. The cancellation occurs through the transfer of the credits to a cancellation account specifically established for implementing overall mitigation under Article 6. The cancelled credits cannot be transferred to other Parties and cannot be used towards the achievement of a mitigation target by the host Party or by any other Parties or entities, including voluntary cancellation. The host Party is required to make a corresponding adjustment "for the full amount of issued A6.4ERs to be first transferred". The country acquiring or using the credits only applies a corresponding adjustment for the amount of offset credits it acquires or uses towards achieving its NDC.

In this case, overall mitigation is ensured. Since the emission reductions issued as credits for achieving overall mitigation have been verified and issued as per normal procedures, they are quantified. The corresponding adjustments ensure that the emission reductions used to achieve overall mitigation are not used towards the achievement of any Party's NDC. The negotiation text describing the option does not explicitly state whether this would be an automatic or mandatory process, but it would be possible for the option to be constructed in this way.

Since Option A is able to fulfil all of the conditions for ensuring overall mitigation, it is considered a feasible option.

***Discounting** (Option B)*

The joint reflections note (UNFCCC, 2018a) describes 'discounting' in Option B.

> *(a) After emission reductions have been verified and certified, the host Party [shall][should] make a corresponding adjustment under the guidance for cooperative approaches referred to in Article 6, paragraph 2 for the full amount of issued A6.4ERs to be first transferred;*
>
> *(b) The acquiring/using Party [shall][should] discount by X per cent the acquired A6.4ERs at acquisition/use towards achievement of its NDC;*
>
> *(c) The discounted volume of A6.4ERs [shall][should] be transferred to the cancellation account for the overall mitigation of global emissions by the acquiring/using Party;*
>
> *(d) The volume of discounted A6.4ERs [shall][should] not be used by any Party towards achievement of its NDC or for voluntary cancellation;*
>
> *(e) The host Party [shall][should] use the remaining A6.4ERs in its account either towards its own NDC or transfer them to another Party's registry or another Party's account in the mechanism registry.*

In this option, the acquiring Party would discount a pre-defined portion of the credits, which would be transferred to a cancellation account and not used towards an NDC or other purposes. The host Party is required to make a corresponding adjustment for the full amount of verified emission reductions, including the portion of emission reductions that is not used towards a mitigation target.

This option is very similar to Option A, with the difference that the credits associated with overall mitigation emission reductions are cancelled at a different time.

For the same reasons that Option A is considered feasible, Option B is also considered a feasible option for ensuring overall mitigation.

***Mechanism itself ensures overall mitigation in global emissions** (Option C)*

The joint reflections note (UNFCCC, 2018a) does not provide details to describe this option beyond Option C saying:

> *Use of the mechanism itself ensures overall mitigation in global emissions.*

Because there are no further details to understand or assess this option, the concept of this option is understood to be that no additional rules or measures are required to implement overall mitigation, on the assumption that the use of Article 6 mechanisms will already result in an overall mitigation without these additional rules or measures. This might be based on the assumption that the possibility to engage in international carbon market mechanisms allows for accessing cheaper mitigation options, so that more can be done with the same available resources, and countries might over-achieve their NDCs.

Although it may be possible that the engagement in Article 6 enables Parties to mitigate more than they would have without Article 6, this cannot be *ensured*, for several reasons. First, although the over-achievement of NDCs of the participating countries could be *reported*, it may be difficult or impossible to clearly *attribute* the overachievement to the engagement in Article 6. This raises issues with regard to the *quantification* of overall mitigation. Second, this option does not ensure that NDCs are over-achieved. Countries could simply mitigate less in other sectors or could sell the over-achievement to other countries. It is thus not possible to ensure that some emission reductions are not counted towards the achievement of NDCs. And third, this option does not include any mandatory or compulsory elements that ensure that NDCs are over-achieved in aggregate.

Since this option does not fulfil any of the conditions for ensuring overall mitigation, Option C is not considered a feasible option for implementing overall mitigation.

Additionality *(Included in option D(a))*

Additionality is mentioned as an element in Option D(a):

> *Overall mitigation in global emissions [shall] [should] be implemented through (…)*
>
> *(a) Meeting the requirements for Article 6, paragraph 4 activities (…) including on baseline approaches, crediting period and* ***additionality;***

Further detail was provided in the earlier negotiation text out of Bangkok (UNFCCC, 2018b) where an additionality option was described as:

> *Determining that emission reductions achieved by Article 6, paragraph 4, activities are additional to any that would otherwise occur.*

This is not an option for operationalizing overall mitigation, but rather a repetition of paragraph 37 of decision 1/CP.21. As discussed in section 2.4 above, environmental integrity is not a measure for achieving overall mitigation in its own right, but is a key prerequisite under any option, in order to ensure overall mitigation.

Since environmental integrity must be ensured for *all* options in order to achieve overall mitigation, this option implies that no further actions are taking, as in Option C. Like for Option C, this option is therefore not considered a feasible option for ensuring overall mitigation.

Conservative baselines *(Option E)*

The most recent reflections note (UNFCCC, 2018a) provides two options for implementing overall mitigation through "conservative baselines":

> *(a) Applying conservative baselines/baselines that are below business-as-usual to the calculation of emission reductions for Article 6, paragraph 4 activities (Option E(a)); and*
>
> *(b) Applying conservative/higher default emission factors to the calculation of emission reductions achieved by project emissions from Article 6, paragraph 4 activities." (Option E(b))*

Conservative baselines and applying conservative or higher default emission factors to the calculation of emission reductions have the same effect in that they reduce the number of emission reductions that are credited.

These options cannot ensure that some emission reductions are not used towards the achievement of a Party's NDC, since the emission reductions which are not credited remain with the host country Party, which, in the context of the Paris Agreement, also has an NDC.

The use of conservative baselines alone also does not allow quantifying the emission reductions used to achieve overall mitigation: in baseline and monitoring methodologies, conservative approaches are usually pursued to address uncertainty in baselines and other parameters, in order to ensure environmental integrity, independent of overall mitigation.

For these reasons, these options could be used for generating a host country's own benefit, but they do not fulfil the criteria for ensuring overall mitigation and are therefore not considered suitable implementation options.

Limited crediting periods *(No longer explicitly in most recent reflection note though possibly reflected in Option D(a))*

"Crediting periods" is mentioned in the most recent reflections note (UNFCCC, 2018a) in Option D(a):

> *Overall mitigation in global emissions [shall] [should] be implemented through (…)*
>
> *(a) Meeting the requirements for Article 6, paragraph 4 activities (…) including on baseline approaches,* ***crediting period*** *and additionality;*

This seems to be a reduction from the further detail provided in the earlier negotiation text out of Bangkok (UNFCCC, 2018b) described an option of limiting crediting periods as:

> *Limiting the crediting period for an Article 6, paragraph 4 activity to a period shorter than the operational lifetime of the relevant technology or activity, in accordance with the relevant requirements developed by the Supervisory Body* (Option D(d))

Limited crediting periods have the same effect as conservative approaches in the previous option in that they reduce the number of emission reductions that are credited. A key difference is that, instead of reducing the issuance each year, the period for which emission reductions are credited is reduced, e.g. at the end of crediting periods. The option requires that mitigation activities are continued after the period for which credit sales ensure financial benefits from operating the activity.

Quantification of overall mitigation achieved through limiting the crediting period requires continued monitoring and verification processes after the end of the crediting period for which very limited incentives exist. This is therefore unlikely to happen in all cases and cannot be guaranteed.

This option cannot ensure that emission reductions for overall mitigation occur and are not used towards the achievement of a Party's NDC, since the emission reductions which are not credited remain with the host country Party, who, in the context of the Paris Agreement, also have an NDC.

For these reasons, this option could be used for generating a host country's own benefit, but it does not fulfil the criteria for ensuring overall mitigation and is therefore not considered a suitable implementation option.

***Voluntary approaches** (Options D(b), D(c), and Option F)*

"Voluntary approaches" is an element that is mentioned in multiple places in the most recent reflections note (UNFCCC, 2018a). These include:

> *Overall mitigation in global emissions [shall] [should] be implemented through (…)*
>
> *(b) Voluntary cancellation of A6.4ERs by Parties and stakeholders, including non-State actors (Option D(b));*
>
> *(c) Any other measures selected by participating Parties voluntarily (Option D(c)); and*
>
> *Any other measures selected by participating Parties voluntarily (Option F)*

It is not clear why the Options D(c) and Option F are listed as separate options other than that Option F is specifically listed as "voluntary approaches", while Option D includes a number of different options that are otherwise unrelated to each other.

These voluntary approaches lack further detail in the various negotiation texts but at least in principle voluntary cancellation could allow for quantifying overall mitigation emission reductions. Whether it is ensured that the emission reductions are not used towards a Party's NDC, depends on the rules governing the application of corresponding adjustments. If adjustments were applied with the issuance of credits, the subsequent cancellation of the credits could ensure that an overall mitigation is achieved. If corresponding adjustments are only applied when the credits are first transferred internationally, an overall mitigation would only be ensured if voluntary cancellation occurs *after* the international transfer, but not if it would occur *before*. However, since this option and any other voluntary measures are voluntary actions and not a mandatory or automatic process, it is not a feasible option for *ensuring* overall mitigation.

Table 1: Summary of assessment of overall mitigation implementation options against criteria for ensuring overall mitigation

Option for implementing overall mitigation	Quantification	Accounting	Mandatory Application	Summary: ability of the option to ensure overall mitigation
Automatic cancellation (Option A)	✓	✓	✓	✓
Discounting (Option B and D(d))	✓	✓	✓	✓
Mechanism itself ensures overall mitigation (Option C)	×	×	×	×
Additionality (part of Option D (a))	×	×	✓	×
Conservative baselines (Option E)	×	×	✓	×
Limiting the crediting period (No longer in the most recent reflections note though possibly reflected in Option D(a))	(✓)	×	✓	×
Voluntary approaches (Option D(b), D(c) and Option F)	✓	(✓)	×	×

3.3 Summary of feasible implementation options

The assessment of options, as summarised in Table 1, shows that two of the identified options may be feasible for ensuring overall mitigation:

- **Automatic cancellation** (Option A)
- **Discounting** (Option B)

These options both allow for the quantification of emission reductions that will contribute to overall mitigation. They both ensure that the emission reductions used for overall mitigation will not be used towards Parties' NDCs by ensuring their transfer to a cancellation account and ensuring that the corresponding adjustment from the host Party includes the full amount of the verified emission reductions including the emission reductions that are to be cancelled. Automatic or compulsory processes can ensure that these options are actually implemented and therefore lead to overall mitigation. The results are in line with the findings in pre-Paris literature related to options applied in Parties that have an emission reduction or limitation obligation as presented in section 2.

Implementation aspects of the remaining two options which have been found to be feasible in terms of ensuring overall mitigation are further discussed in section 4.

4 Practical approaches for implementing automatic cancellation and discounting

The assessment of options for implementing overall mitigation in previous sections identified **'automatic cancellation'** and **'discounting'** as capable of ensuring overall mitigation, with similar assessment results for both options. The way they are described in the most recent reflection note text (UNFCCC, 2018c) show that the differences between them mostly relate to when credits are cancelled and whether the host country or the acquiring/using country is responsible for cancelling them.

Table 2 compares the text for both options with regard to the different elements for implementing them. The table shows a variety of similarities. The most recent text requires for both options that the full amount of emission reductions is verified and certified. Both options require the host Party to make a corresponding adjustment for the full amount of issued emission reductions before the first transfer. Both options describe the final use of remaining emission reductions in a similar way and address the requirement that emission reductions related to overall mitigation should or shall not be counted towards any mitigation target. However, the exclusion of any other use in the text for 'automatic cancellation' is more comprehensive compared to the text for the option 'discounting' (cf. Table 2).

Textual differences mostly relate to the description of the discounting element. In the 'discounting' option, the acquiring or using Party is explicitly requested to discount X per cent of the acquired emission reductions at acquisition or at use and to transfer them to a cancellation account for overall mitigation. This is not explicitly requested in the 'automatic cancellation' option, although one could argue that the provision to transfer at issuance or first transfer X per cent of the total amount of the emission reductions to the cancellation account for overall mitigation, requires a deduction of a fraction of emission reduction similar to what is requested under the discounting option. Although at different points in the process, both options describe a split of the amount of emission reductions for the purpose of using a share of them and for cancelling a share for ensuring overall mitigation. Depending on the definition used for the term 'discounting', applying such a split could in both cases be called a discounting process.

In summary, both options require that a share of the credits is 'discounted' and 'cancelled' at some point. The differences in these options relate more to variations in how they are implemented, which we discuss in this section, rather than to the general approach. We therefore do not distinguish between these two options in this section but highlight differences where required.

How these options implement overall mitigation differs mostly with regard to timing, governance arrangements, and technical aspects for discounting and cancellation. Since implementing discounting and cancellation options requires that a Party or institution has control over mitigation outcomes and related units, and since control over or ownership of emission reductions and related units changes during the process, the different options for the timing and governance arrangements are related and therefore discussed together in the following.

Table 2: Overview of Automatic Cancellation and Discounting Options as described in the most recent reflection note text (15 Oct 2018)

Elements	Automatic Cancellation	Discounting
Verification, certification, corresponding adjustment	97(a) - After emission reductions are verified and certified, the ***host Party*** [shall][should] make a corresponding adjustment under the guidance for cooperative approaches referred to in Article 6, paragraph 2 for the full amount of issued A6.4ERs to be first transferred;	98(a) - After emission reductions have been verified and certified, the ***host Party*** [shall][should] make a corresponding adjustment under the guidance for cooperative approaches referred to in Article 6, paragraph 2 for the full amount of issued A6.4ERs to be first transferred;
Discounting	*(not explicitly mentioned in the text but implicitly required for transfers to a cancellation account (see next row))*	98(b) - The ***acquiring/using Party*** [shall][should] discount by X per cent the acquired A6.4ERs at acquisition/use towards achievement of its NDC;
Transfer to a cancellation account	97(b) - ***At issuance/first transfer*** of A6.4ERs, the registry [shall][should] transfer X per cent of total amount of A6.4ERs to the cancellation account for overall mitigation in accordance with section XIII above (Mitigation activity cycle);*	98(c) - The discounted volume of A6.4ERs [shall][should] be transferred to the cancellation account for the overall mitigation of global emissions by the ***acquiring/using Party***;
Emission reductions related to overall mitigation are not counted towards any mitigation target	97(c) - The ***cancelled*** A6.4ERs [shall][should] not be used for any transfer or purpose, including by any Party towards achievement of its NDC or for voluntary cancellation;	98 (d) - The volume of ***discounted*** A6.4ERs [shall][should] not be used by any Party towards achievement of its NDC or for voluntary cancellation;
Final use of remaining emission reductions	97(d) - The host Party [shall][should] use the remaining A6.4ERs in its account either towards achievement of its own NDC or transfer them to another Party's registry or to another Party's account in the mechanism registry.	98(e) - The host Party [shall][should] use the remaining A6.4ERs in its account either towards achievement of its own NDC or transfer them to another Party's registry or another Party's account in the mechanism registry.

** the most recent reflection note text outlines in section XIII potential elements of a mitigating activity cycle*

Timing of discounting and cancellation

Given the historical precedent and the elements of a mitigating activity cycle included in section XIII of the most recent reflection note text (UNFCCC, 2018a), we assume that the process to turn emission reductions into transferable units under the mechanism established by Article 6.4 of the Paris Agreement will broadly resemble the processes established under the CDM. Project proponents design a mitigation

activity, seek authorisation from the host Party, implement the activity, validate it, and, following a positive validation outcome, register the project. Project owners monitor, quantify and report reduced emissions resulting from a registered activity for a certain time period. The reported emission reductions are verified and certified by a designated body, which is likely to be an independent third party. The verified emission reduction reports are submitted to the institution responsible for oversight of the mechanism for issuance of corresponding emission reduction units. Units may first be issued to a registry account under the control of the institutions and may subsequently be transferred to accounts of Parties and, where applicable, private or public entities that were authorised by Parties. The transfer to accounts of Parties or public and private entities may be subject to conditions. This can include payment of related administrative fees, the (automatic) deduction of a fraction of the units for a share of proceeds, but could also be extended to the delivery of an overall mitigation and that the host Party makes a corresponding adjustment for the full amount of issued emission reduction units. Afterwards, units can be transferred between different registry accounts.

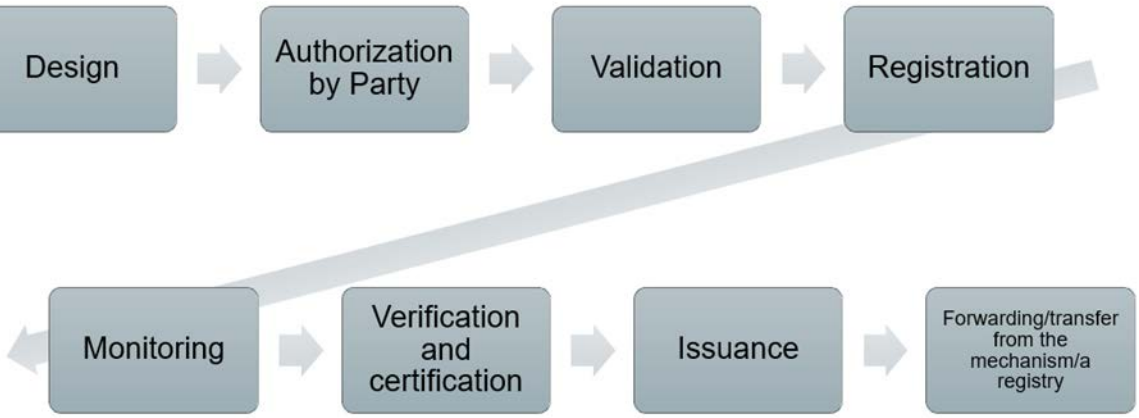

Figure 1: Mitigation Activity Cycle as described in Joint Reflections Note (cf. UNFCCC, 2018a)

Discounting and cancellation of emission reduction units for overall mitigation may take place:

(1) at initial issuance of emission reduction units;
(2) at the first transfer of emission reduction units to the registry account of the host Party or entities authorised by the host Party;
(3) as a condition for the first transfer to an acquiring Party or where applicable, to other entities; or
(4) as a condition for the final use of emission reduction units.

We assume that discounting and cancellation is applied only once, e.g. by applying it only to the first transfer but not also to subsequent transfers. Based on the most recent reflection note text, we furthermore assume that it is a precondition for the issuance or the first international transfer of emission reduction units that the host Party makes a corresponding adjustment for the full amount of issued emission reduction units. This is an interpretation of the current negotiation text. A possible alternative could be that at issuance corresponding adjustments would only have to be applied for those units that are transferred to the cancellation account established for the purpose of achieving overall mitigation. For the remainder of the units, an adjustment would only be applied if they are transferred for use by other countries or entities. This option might facilitate that the mechanism can be used domestically to

achieve emission reductions (e.g. by allowing domestic offset credits to be used in a domestic emissions trading system).

Although not described in the negotiating text, variations of a 'discounting approach' could implement the step of discounting earlier in the process, by issuing only a share of the emission reduction as credits either based on the reported emission reductions or based on the verified and certified emission reductions. These approaches do not include a cancellation element since cancellation initially requires emission reduction units to be 'created' in order to cancel them. If for the purpose of overall mitigation, a share of emission reduction is deducted from the reported emission reduction by the project owner, overall mitigation is applied to an unverified mitigation outcome with uncertainty whether the reported reductions actually occurred. Issuing transferable units only for a share of verified and certified mitigation outcomes would reduce these uncertainties but still requires a mechanism to ensure the host country makes a corresponding adjustment for the full amount of verified mitigation outcome. Implementing such an approach before credit issuance may also create technical difficulties to apply the rate of overall mitigation consistently, e.g. if the verification or further steps by the supervising body lead to a correction of the number of credits issued. In contrast, discounting and cancellation of emission reduction units after verification, certification, and initial issuance provides a mechanism with a high degree of transparency and certainty of the overall mitigation. Variations of a 'discounting approach' that apply prior to verification, certification, and issuance are therefore not further pursued in the following.

The **approaches (1) and (2)** do not significantly differ with regards to timing and governance. They apply discounting and cancellation for overall mitigation either at initial issuance or at the first transfer of emission reduction units to the host Party or authorised entities. Assuming that issuance processes are broadly similar to the CDM, the first transfer is made from an account under the control of the mechanism institutions (e.g. registry administration), to which the units are temporarily issued, to the account of the host Party or authorised entities. At this stage the first transfer is implemented by the mechanism institutions similar to the initial issuance of units. Implementation of both approaches can be automated and is under the exclusive control of the mechanism. Only subsequent transfers are initiated by the respective external unit holders.

Approach (3) requires discounting and cancellation to be applied as a condition for the first transfer to an acquiring Party. Since discounting and cancellation at the first transfer of emission reduction units to an acquiring Party is not exclusively initiated and implemented by the mechanism institutions, it requires a means for control and enforcement to ensure discounting and cancellation of emission reduction units actually takes place. An automatised registry and transaction infrastructure would be able to prevent transactions if certain conditions are not met, such as obligatory transactions to a cancellation account. Still, provisions and measures are required which are more complex and expensive compared to a situation where discounting and cancellation is directly implemented under the oversight of the supervisory body, for instance at issuance.

Approach (4) requires discounting and cancellation to be applied as a condition for the final use of emission reduction units. This can involve various different stakeholders. In addition to a bilateral approach where the host Party and only one acquiring Party is involved, units may be bought, sold and transferred multiple times between Parties and private or public entities before being used to demonstrate achievement of an NDC or other mitigation goals. This requires similar provisions and measures as for Approach (3). Tracing the whereabouts of initially issued units could be significantly more complex. Moreover, this approach leads to additional challenges which need to be addressed for implementation.

Whereas it can be assumed that in previous options mostly only small temporal differences exist between the corresponding adjustments by the host Party, the issuance and the first transfers of emission reduction units, significant delays may occur until emission reduction units are finally used. They might be held for long periods of time in Party accounts which have the intention to use them

towards their NDCs but do not do so until far in the future. Strategic considerations might lead to banking of units for subsequent NDC periods, if included as option in the Paris Agreement rulebook, reselling units to other Parties or even to non-Party stakeholders, such as sub-national governments, non-state actors including private initiatives or companies. Although the current negation text considers only Parties using emission reduction units towards achievement of their NDCs, it is possible that countries will also authorise the use of emission reduction units for other purposes, including by non-Party stakeholders. Non-Party stakeholders do not have NDCs and are therefore technically unable to make corresponding adjustments. They may also not be committed to deliver an overall mitigation, and the implementation of overall mitigation should therefore not depend on their cooperation. However, the provision for overall mitigation in the Paris Agreement Article 6.4(d) links to the mechanism established by Article 6.4 and it can thus be argued that it links to the mechanism generating the emission reduction units and not to its use towards NDCs specifically. It should therefore deliver an overall mitigation regardless of how the units are used.

With regard to the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) that has been established by the International Civil Aviation Organization (ICAO), the assembly resolution that establishes the scheme specifies that *"emissions units generated from mechanisms established under the UNFCCC and the Paris Agreement are eligible for use"* subject to certain ICAO criteria (ICAO, 2016). This suggests, that it is possible that the Article 6.4 mechanism will be used by airlines for their offsetting obligations. Parties might transfer units from their national account to the accounts of airline operators who use them to fulfil their obligations under CORSIA. In such a case, further provisions would be needed to ensure that overall mitigation is achieved. One option could be defining the 'final use' such that it refers to the moment when emission reduction units are transferred for the first time to non-Parties. In this case the 'last acquiring Party' or 'finally using Party' is by definition limited to Parties of the Paris Agreement and refers to the last Party holding emission reduction units on its account before they are for the first time transferred to a non-Party account. The 'last acquiring 'Party' or 'finally using Party' could then be required to discount and cancel emission reduction units in order to guarantee the delivery of an overall mitigation by the mechanisms regardless of who purchases units. Another option could be that the use of offset credits for the purpose of fulfilling CORSIA offsetting requirements is only possible in the registry of the Article 6.4 mechanism if prior to that a portion of the emission reduction units have been cancelled for the purpose of overall mitigation.

If the mandate to "*incentivize and facilitate participation (…) by public and private entities authorized by a Party*" as per Article 6.4(b) of the Paris Agreement is implemented similarly as was done in the case of the CDM, this could lead to issuances directly to accounts of non-Party stakeholders. In such a case, the above definition of "final use" lead in consequence to the application of discounting and cancellation at initial issuance in which case there is no longer a difference between this and the first option described above.

Transfers of emission reduction units generated by mitigation activities under the mechanism established by Article 6.4 might by be guided by provisions set for cooperative approaches under Article 6.2. The Paris Agreement does not include provisions for cooperative approaches under Article 6.2 to contribute to overall mitigation. It is therefore unclear if this requirement will be implemented for both Article 6 approaches or only for Article 6.4. The latter would create additional uncertainties for the implementation of approach (3) and (4), where discounting and cancellation is applied for the 'final use' of emission reduction units. Transfers between Parties resulting from mitigation activities initiated under Article 6.4 might be conducted under Article 6.2 and thus uncertainty about whether or not a contribution to overall mitigation is required will exist. Applying approaches (1) or (2) avoids this uncertainty since overall mitigation is ensured before transfers under Article 6.2 rules occurred.

Technical framework of discounting and cancellation

Given the increasing complexity of the above described implementation approaches, discounting and cancellation at initial issuance of emission reduction units or for the first transfer of emission reduction units to the host Party is the most effective approach to deliver a contribution to overall mitigation. For the technical framework to implement such an approach, a precedent from the CDM exists. The "share of proceeds" (SOP) for adaptation from CDM projects was collected in a similar way and provided the Adaptation Fund with a 2% share of all Certified Emission Reductions (CERs) issued in a simple and efficient way. Since Article 6.6 of the Paris Agreement calls for a similar contribution "*to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation*", a coordinated implementation of the SOP for adaptation and overall mitigation based on the experiences and tools from the CDM under the Kyoto Protocol seems the most simple and effective option.

The supervisory body could issue emission reduction units first to an account under its control. In parallel or afterwards, a share of units could be discounted and transferred to a dedicated cancellation account to deliver an overall mitigation. Both the initial account and the cancellation account would be under the control of the mechanism institutions, e.g. oversight institution designated by the CMA, and outside the control of the host or acquiring Party. Only the remaining units are issued to the host Party that will have already made a corresponding adjustment for the full number of emission reductions. In this way, the discounted and cancelled units are not even in circulation and additional provisions and measures are obsolete. This would deliver a transparent, timely, and efficient overall mitigation. In this case, there is no risk that emission reductions generated by a mechanism established under Article 6.4 and used for purposes other than NDCs do not deliver an overall mitigation. For consideration of units generated by other mechanisms we refer to section 5.3.

5 Market implications of overall mitigation

Implementing the principle of overall mitigation can affect the offset credit market in several ways. It may not only lead to a net decrease in global emissions but can also affect the number of offset credits transacted, the prices for offset credits, the value of the offset credit market, the revenues and costs of the project owners supplying the offset credits, the costs of the buyers of the offset credits, and the level of GHG abatement in transferring and acquiring countries. How these parameters are affected depends mainly on three factors:

1. The potential and costs of supplying offset credits;
2. The demand for offset credits;
3. The fraction of emission reductions or removals that should contribute to overall mitigation.

To assess the market implications of overall mitigation, we use a simple model that allows analysing the implications under different scenarios for these three key factors (section 5.1). We then discuss the findings, in particular with regard to the fraction of emission reductions or removals that should contribute to overall mitigation (section 5.2). Lastly, we qualitatively discuss potential implications if the principle of overall mitigation is not implemented in all circumstances (section 5.3).

5.1 Simplified model

5.1.1 Model description

Drawing upon earlier quantitative assessments (Schneider, 2009; Butzengeiger-Geyer *et al.*, 2010; Bakker *et al.*, 2011), we use a simplified model with a supply and demand curve to illustrate the market implications of overall mitigation. The model allows for a comparison of the market implications between the situation in which overall mitigation is implemented and a reference case in which the principle of overall mitigation is *not* implemented.

We assume that overall mitigation is implemented through 'automatic cancellation', i.e. in such a way that a portion of the verified emission reductions or removals are cancelled before they are transferred to a Party. We refer to the 'rate of overall mitigation' as the share of verified emission reductions or removals that are discounted and cancelled and that are neither used by the acquiring nor by the transferring country to achieve their NDCs.

As the supply and demand for offset credits after 2020 are uncertain and not known at this stage, we use a simple representation of a hypothetical supply curve and a hypothetical demand curve. While this does not allow to assess the implications in *absolute* terms (e.g. what absolute price level would result or how many credits would be transacted), it can help to understand the *relative* implications of introducing the concept of overall mitigation (e.g. how strongly the prices and the number of credits transacted would change as a result of introducing overall mitigation). The focus of the analysis therefore lies on comparing the results of the situation where overall mitigation is implemented with the reference case, without overall mitigation. The purpose of the simplified model is thus not modelling the market situation after 2020 but to help to understand the conceptual implications of overall mitigation.

The implications of overall mitigation depend strongly on the shape of the supply and demand curve. To cover a broad range of possible circumstances, we assess in total 18 scenarios with different supply and demand curves as well as different rates of overall mitigation. The equations and parametrisation of the model are provided in Annex I.

Lastly, it is important to note that the analysis relies on a number of assumptions. We assume here that the offset credits have 'quality', i.e. they result from activities that are additional and that the emission reductions or removals are accurately estimated, representing one tonne of CO_2 equivalent of emission

reductions or removals (see also section 2.3). We also assume that offset credits are primarily used to achieve climate mitigation targets or obligations (such as for NDCs, for ETSs or for CORSIA). However, we also discuss in a few instances the implications if offset credits are used for other purposes.

5.1.2 Reference case

Figure 2 illustrates the reference case, with no overall mitigation. The supply curve represents the marginal costs at which credits can be brought to the market, which depends on the GHG abatement potential and the GHG abatement and transaction costs. Transaction costs include, for example, costs for preparing relevant documentation, third party auditing, and any fees. The supply curve represents the costs of generating offset credits through a number of different abatement options with different abatement costs. Offset credit supply curves are often flatter at the beginning and become steeper with more expensive GHG abatement activities at the end. This is reflected in the shape of the curve in Figure 2. We assess the implications of a scenario where the supply curve is flatter further below.

The demand for offset credits is represented by the black curve in Figure 2. Here the demand is assumed to be 'elastic'; this means that the higher the price for offset credits is, the fewer credits will be purchased. We assess scenarios where the demand is inelastic or even more elastic further below. In the market equilibrium, the amount of offset credits transacted (x_E) and the offset price (p_E) is determined by the intersection of the supply and demand curves.

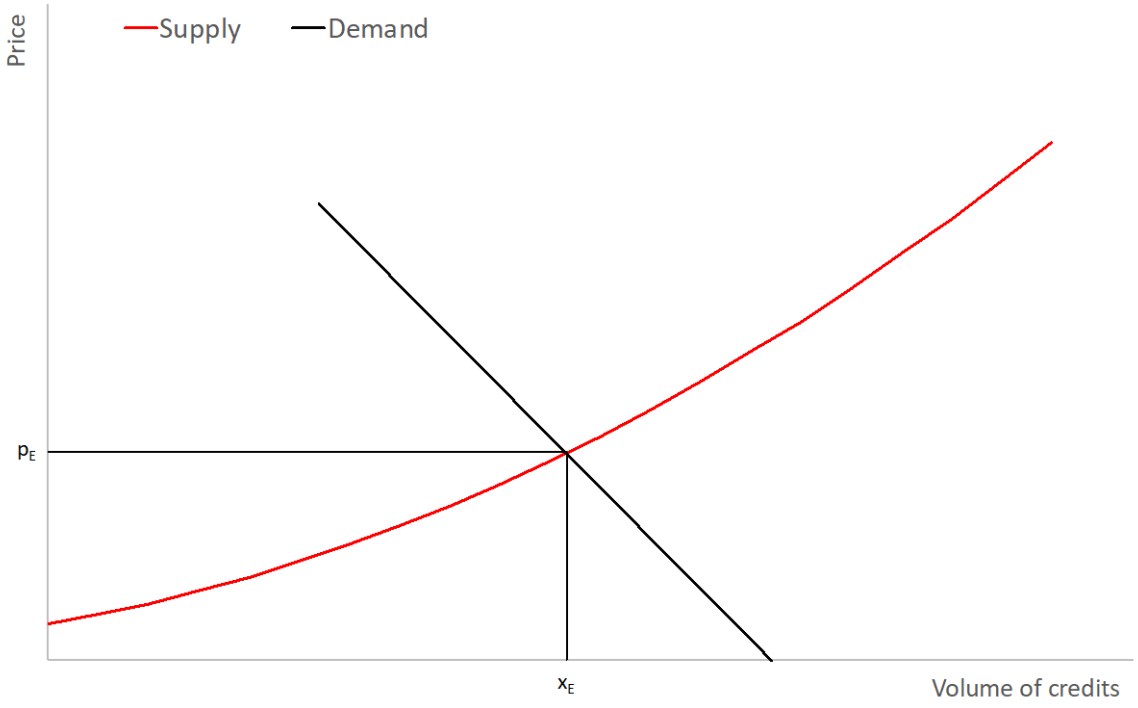

Figure 2: Supply and demand in the reference case

5.1.3 Implications of overall mitigation

Figure 3 illustrates the implications of introducing overall mitigation. Overall mitigation increases the cost of supplying offset credits, which is shown by the red dotted line. The project owners receive fewer offset credits for the same amount of mitigation. This implies that the cost of supplying offset credits increases, compared to the situation without overall mitigation. This shifts the offset credit supply curve upwards,

resulting in a new market equilibrium, determined by the intersection of the shifted supply curve (red dotted line) and the demand curve (black line).

This has several implications in comparison to the reference case:

1. **Credit price:** The upward shift of the credit supply curve increases the price for offset credits compared to the reference case (from p_E to p_{OMGE}).
2. **Credits transacted:** The total number of offset credits transacted between the transferring country and the acquiring country (or relevant entities) decreases compared to the reference case (from x_E to x_{OMGE}). This is due to the assumption of an *elastic* demand under which the acquiring country (or other entities) purchase less credits if their price increases.
3. **GHG abatement level:** While the number of credits transacted *decreases* due to the elastic demand, the total level of GHG abatement *increases* compared to the reference case. Interestingly, abatement may increase in both the transferring country and the acquiring country (or relevant sector):
    - In the **transferring country**, fewer offset credits are generated but – due to the implementation of overall mitigation – more than one tCO_2e of emissions is reduced per offset credit, resulting in a *net increase* in abatement under a broad range of assumptions. In Figure 3, for example, the implications are shown for a rate of overall mitigation of 50%. This rate would imply that for each offset credit, two tCO_2e of emissions must be reduced. The level of abatement in the transferring country would thus be twice as large as the number of credits transacted (i.e. two times x_{OMGE}), which is larger than the level of abatement in the reference case (x_E). The increase in abatement per offset credit thus over-compensates that fewer offset credits are transacted.
    - In the **acquiring country** (or relevant sector), fewer offset credits are purchased due to the higher price and the fact that demand is elastic in this scenario (only x_{OMGE} instead of x_E). As long as the offset credits are purchased to achieve a target, the country or entities buying the offset credits would have to compensate for the shortfall in their own emission reductions ($x_E - x_{OMGE}$). The country or entities would thus have to increase their own abatement respectively in order to still meet its/their target. This holds for most uses of offset credits, such as the use of offset credits in ETSs or for CORSIA, or government purchase programmes set up for achieving mitigation targets; if ETS installations or aeroplane operators use fewer offset credits they would have to further reduce emissions to comply with their obligations. Similarly, if a country has an ambitious target and intends to use offset credits to achieve it, it would have to do more domestically if it purchases fewer offset credits.

    For some other uses of offset credits, the level of abatement may neither increase in the transferring nor in the acquiring country. In some instances, for example, the purchase of offset credits is used as a vehicle to disburse climate finance. In this case, all purchased credits would be cancelled. The donors may only have a given amount of money available and may simply purchase half the offset credits if their price doubles. In this case, the same level of abatement would be achieved as without introducing overall mitigation.

Furthermore, the changes in the number of offset credits transacted and the offset credit price have several economic implications, including for the total value of the market, the rents of the offset suppliers, and the costs of the buyers of the offset credits (see also results in Table 3 further below and the calculation in Annex I):

1. **Market value:** The value of the market is here defined as the number of credits transacted multiplied with their price (i.e. $p_E \cdot x_E$ and $p_{OMGE} \cdot x_{OMGE}$). Introducing overall mitigation impacts the market value in two different ways: on the one hand, the market value decreases due to the lower number of offset transacted, on the other hand, it increases due to the higher price. In the

above example, the market value increases, because the price increases more than the volume of transacted credits decreases.

2. **Supplier rents:** The rents of the suppliers of the offset credits are defined as the difference between their carbon market revenues (which corresponds to the market value) and their GHG abatement costs (which corresponds to the area below the red supply curve up the point of market equilibrium). The supplier rents are also impacted in two ways if overall mitigation is introduced: on the one hand, the costs to supply offset credits increase, on the other hand, the revenues per offset credits also increase. In the above example, the revenues increase more strongly than the costs, leading to a net increase in supplier rents due to the implementation of overall mitigation.
3. **Costs of buyers:** The costs of the buyers include the costs of buying offset credits (which corresponds to the market value) and, in the case of use of offset credits to achieve to mitigation targets, the additional costs for increasing their own emission reductions to compensate for the lower purchase of offset credits. Introducing overall mitigation increases the costs of the buyers of the offset credits because they have to pay a higher price for each offset credit and they have to abate more themselves (x_E - x_{OMGE}).

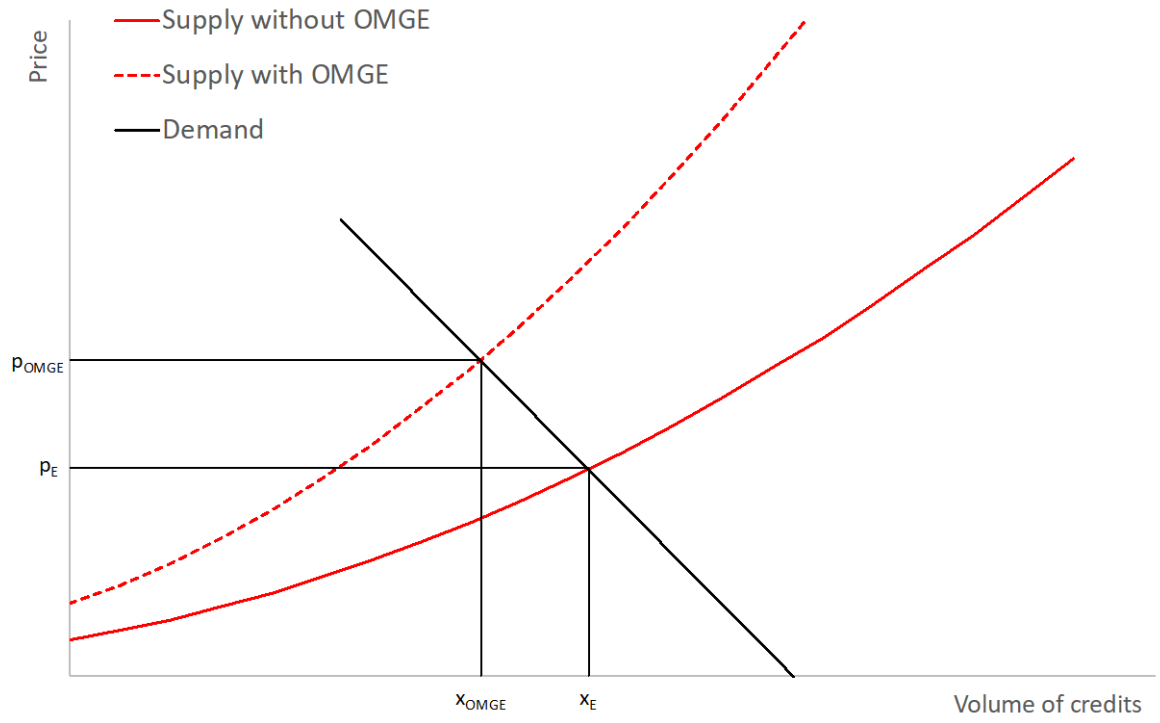

Figure 3: Market implications of overall mitigation

5.1.4 Implications under different scenarios

The magnitude, and in some instances the direction, of these effects depends on three factors: the shape of the offset credit supply curve, the shape of the demand curve, and the rate of overall mitigation. To assess the sensitivity of these factors, we therefore vary them through different scenarios:

- Three scenarios for the elasticity of demand: 'inelastic', 'elastic', and 'very elastic'
- Two scenarios for the shape of the credit supply curve: 'flat' and 'steep'
- Three scenarios for the rate of overall mitigation: 10%, 30%, and 50%

The combination of these scenarios leads to a total of 18 scenarios. Table 3 below summarises the results for all 18 scenarios. The table illustrates how implementing overall mitigation, in comparison to the reference case, changes the following six parameters which we introduced above:

- the offset credit price;
- the number of offset credits transacted;
- the total level of abatement;
- the value of the market;
- the rents for offset credit suppliers; and
- the costs of the buyers of the offset credits.

Note that the total level of abatement is here determined through a comparison with the verified emission reductions or removals from the credited activities in the transferring country without the implementation of overall mitigation. This is because without overall mitigation the use of offset credits is in principle a net neutral outcome – because emissions may increase in the acquiring country as much as they are reduced in the transferring country – but it is not possible to calculate a *relative* change in comparison to zero.

Table 3: Implications of overall mitigation relative to the reference case under different scenarios

SCENARIOS			RELATIVE CHANGE DUE TO OVERALL MITIGATION IN COMPARISON TO THE REFERENCE CASE					
Demand curve	Supply curve	Rate of overall mitigation	Credit price	Credits transacted	Abatement[1]	Market value	Supplier rents	Costs of buyers
Inelastic	Flat	10%	11%	0%	11%	11%	11%	11%
		30%	43%	0%	43%	43%	43%	43%
		50%	100%	0%	100%	100%	100%	100%
	Steep	10%	11%	0%	11%	11%	11%	11%
		30%	43%	0%	43%	43%	43%	43%
		50%	100%	0%	100%	100%	100%	100%
Elastic	Flat	10%	11%	-1%	11%	10%	9%	11%
		30%	41%	-3%	41%	36%	32%	40%
		50%	93%	-8%	92%	79%	65%	90%
	Steep	10%	7%	-3%	11%	4%	3%	7%
		30%	26%	-10%	39%	13%	9%	24%
		50%	53%	-21%	79%	21%	11%	47%
Very elastic	Flat	10%	10%	-2%	11%	8%	6%	10%
		30%	39%	-7%	40%	30%	21%	38%
		50%	88%	-15%	85%	60%	36%	81%
	Steep	10%	6%	-4%	11%	1%	-1%	6%
		30%	20%	-15%	36%	2%	-5%	18%
		50%	40%	-30%	70%	-3%	-17%	34%

Note: The simplified model and its parametrisation are described in Annex I. 1) The change in abatement is determined in comparison to the verified emission reductions or removals in the transferring country in the reference case.

5.2 Discussion of key findings

Several important aspects can be observed from the analysis.

5.2.1 Elasticity of demand

First, the elasticity of the demand for offset credits significantly affects the market implications of implementing overall mitigation. In Figure 2 and Figure 3 above, we assumed an *elastic* demand, i.e. that fewer offset credits are bought if their price increases. If the demand is completely *inelastic*, then the *same* amount of credits would be transacted as in the reference scenario, and credit prices, GHG abatement, the market value, supplier rents, and the cost of buyers all increase at the *same* rate (see Table 3). The degree of increase depends on the rate of overall mitigation. Cancelling 50% of the credits would imply that credit prices, supplier rents and GHG abatement are doubled. This outcome is illustrated in Figure 4 which shows the scenario of an inelastic demand, a steep supply curve, and a rate of overall mitigation of 50%.

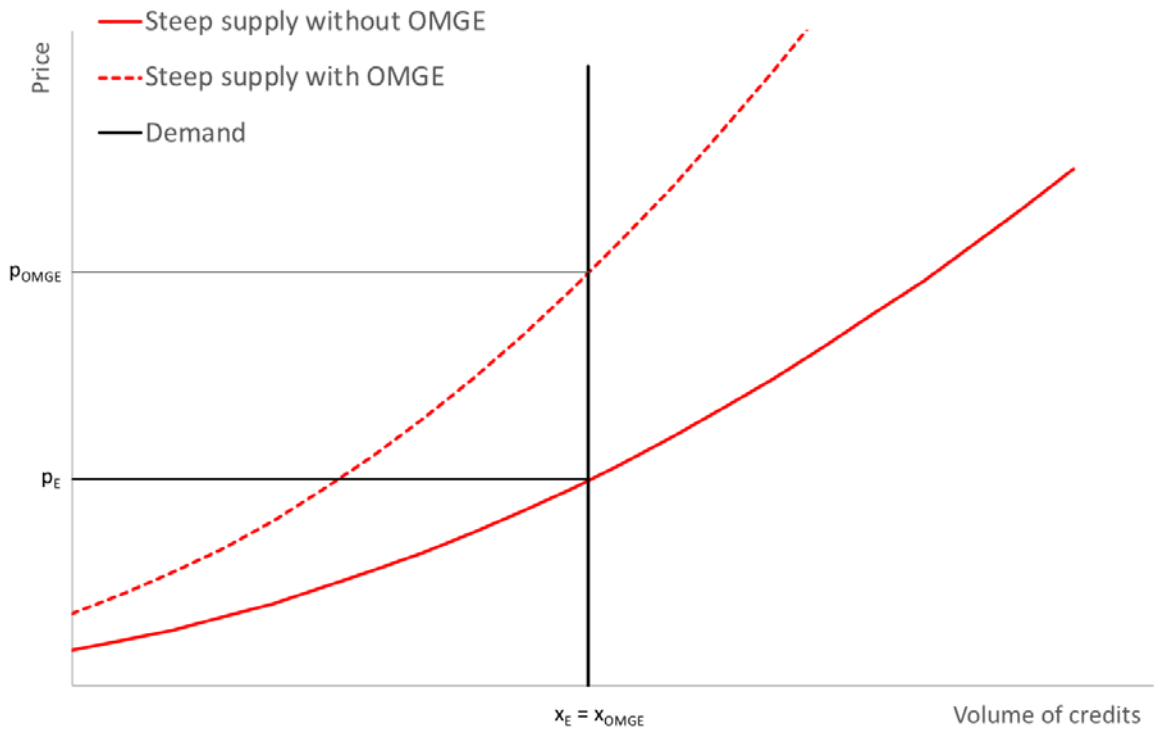

Figure 4: Market implications of overall mitigation under inelastic demand, a steep supply curve and a rate of overall mitigation of 50%

If the demand is elastic, fewer credits are transacted due to the implementation of overall mitigation. This means that credit prices and the level of abatement increase to a lesser extent than under inelastic demand. Table 3 shows, however, that the degree of change also depends significantly on the rate for overall mitigation, and to a lesser extent on the elasticity of the demand and the shape of the supply curve.

The results for the market value and the rents of the credit suppliers vary: both increase in most scenarios but decrease in the scenario of very elastic demand and a steep supply curve. In this case, the increase in offset credit prices does not compensate for the decrease in credits transacted and the increased costs of supply credits. Overall, the impact of the elasticity of demand is significant for these

two parameters. For example, for a steep supply curve and a rate of overall mitigation of 50%, the value of the market and the rents for offset suppliers could either double or slightly decrease – depending on the elasticity of demand.

An important consideration for the economic implications from overall mitigation is therefore how elastic the demand for offset credits is *in practice*, i.e. to what extent potential buyers of offset credits will react to changes in offset credit prices. This is likely to depend on the source of demand:

- **Emissions trading systems:** To date, the largest demand for offset credits has come from ETSs. Many ETSs allow regulated entities to meet part of their obligations through the purchase and retirement of offset credits. If regulated entities have access to this flexibility to an unlimited extent (making allowances and offset credits perfect substitutes), they will buy offset credits to the extent that allowances in the ETS are more expensive than offset credits. The elasticity of demand for offset credits will correspond to the elasticity of demand for allowances, which is dependent on the mitigation cost curve for abatement opportunities within the ETS. As offset prices start to exceed abatement costs for emissions within the ETS, then regulated entities would start to abate more and buy fewer offsets credits. In practice, ETSs usually limit the number of offset credits that regulated entities can use (reducing substitutability). As long as the price for offset credits remains below the price for allowances, the offset credit demand would then be inelastic; the limit would be fully used by regulated entities, irrespective of the price of offset credits. This applies, for example, to the EU ETS, where the prices for certified emission reductions (CERs) and emission reduction units (ERUs) were lower than for ETS allowances and the limit on the use of international offset credits for the period 2008 to 2020 has been used almost completely. If the allowances prices are lower or the same as offset credits prices, the demand is elastic.
- **CORSIA:** Another source of demand for offset credits could come from CORSIA. The opportunities for technical and operational improvements to reduce emissions from aviation are comparatively limited and, depending on sustainability criteria, the use of alternative fuels is likely to be more expensive than the purchase of offset credits. As long as offset credits are cheaper than using alternative fuels, the demand will thus be relatively inelastic to prices for offset credits. Only if prices for offset credits exceed the costs of using alternative fuels, the demand will become more elastic.
- **Government purchase programmes:** A further source of demand could be government purchase programmes. Here the elasticity of demand is less clear. Some governments may purchase fewer offset credits, if credit prices increase, while some demand may not strongly depend on credit prices but also on other factors, such as sustainable development co-benefits. For example, Switzerland plans to put forth the number of offset credits it will purchase over the period 2021 to 2030 in its national climate regulations. The amount is not foreseen to change with changing offset credit prices.

To conclude, it is likely that the demand for offset credits is relatively inelastic with currently observed prices for offset credits. With significantly higher prices, the demand could become more elastic. This would in particular hold if credit prices would reach price levels of ETS allowances or the GHG abatement costs of using alternative fuels under CORSIA.

5.2.2 Shape of the supply curve

In Figure 2 and Figure 3 above, we assumed a supply curve where price increase significantly as more offset credits are supplied. The shape of the offset credit supply curve depends on many aspects, including the international rules governing offset crediting mechanisms, the readiness of host countries to authorise activities and not to use the emission reductions towards their own NDCs, as well as the type of activities implemented.

Figure 5 illustrates the implications for a 'flatter' supply curve, assuming an 'elastic' demand and a rate for overall mitigation of 50%. The flatter supply curve implies that introducing overall mitigation affects the number of offset credits transacted less strongly. With our model parametrisation, the decrease in the number of offset credits is about a third of that with the steeper supply curve. The *relative* increase in offset prices due to the implementation of overall mitigation, however, is more pronounced with a flatter curve. This also leads to higher rents for offset suppliers and higher costs for the buyers of offset credits, compared to a steeper supply curve. A flatter supply curve is also much less sensitive to the elasticity of demand; in our example, in contrast to a steep supply curve, a flat curve leads in no cases to a decrease of the value of the market or the rents of the credit suppliers (see Table 3 further above).

The shape of the offset credit supply curve after 2020 is uncertain; however, it seems unlikely that abatement costs will significantly increase after 2020. If already implemented projects are authorised by the host countries to continue to generate offset credits after 2020 – or if their emission reductions from the period up to 2020 were eligible to use mitigation goals after 2020, as proposed by some Parties and considered under CORSIA – the supply curve could be rather flat and offset credit prices could continue to remain rather low. This is because there is a significant supply potential from existing projects. Many of these projects continue GHG abatement regardless of whether they can sell offset credits and could therefore supply offset credits at low costs. Fearnehough et al. (2018) estimate that about 3.5 billion CERs could be supplied at a cost of less than one Euro for the period 2013 to 2020.

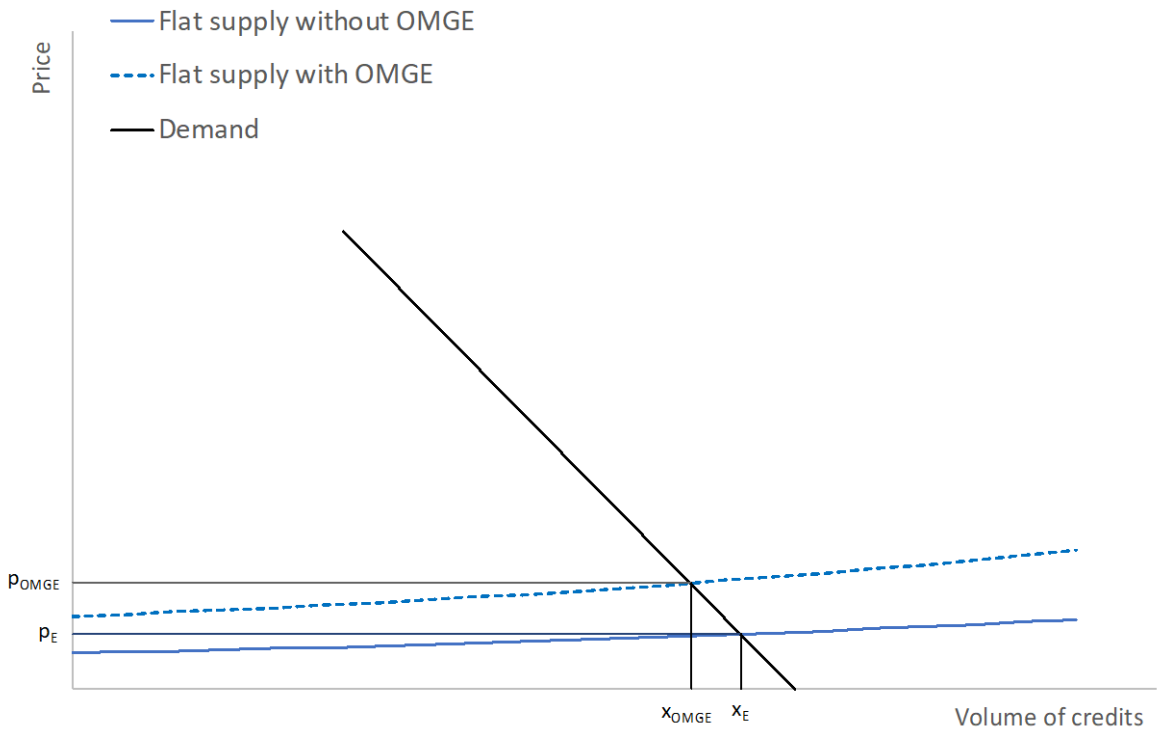

Figure 5: Market implications of overall mitigation under elastic demand, a flat supply curve and a rate of overall mitigation of 50%

5.2.3 Rate of overall mitigation

The rate of overall mitigation – i.e. the fraction of verified emission reductions or removals that are discounted and cancelled and that are neither used by the acquiring nor by the transferring country to achieve their NDCs – is a key policy choice. The market implications of different rates depend strongly on the elasticity of demand but also on the shape of the credit supply curve.

If the demand is completely inelastic, the number of offset credits transacted is not affected. A higher rate of overall mitigation results in higher credit prices, more GHG abatement, a higher market value, more rents for offset suppliers, and higher costs for the buyers of the offset credits.

A more elastic demand curve results in fewer credits being transacted and less pronounced effects on offset credit prices, the level of abatement achieved, the market value, rents for offset suppliers, and the cost of buyers. Under a steeper supply curve these effects are more pronounced than under a flatter supply curve (see Table 3 further above).

Figure 6 and Figure 7 illustrate the implications of different rates of overall mitigation, different elasticities of the demand, and different shapes of supply curves with regard to three parameters that may be particularly relevant for policy-makers when considering an appropriate rate of overall mitigation: the level of abatement achieved (green line), the costs of buyers (blue line), and the rents for offset suppliers (orange line). The figures show how these parameters change in response to different rates of overall mitigation, which are reflected in the x-axis. The black line illustrates the outcomes for all parameters if the demand is inelastic; the coloured continuous lines illustrate the outcome for the 'elastic' demand scenario; the coloured dotted lines illustrate the outcome for the 'very elastic' demand scenario. Figure 6 illustrates the implications for the steep supply curve, and Figure 7 for the flat supply curve.

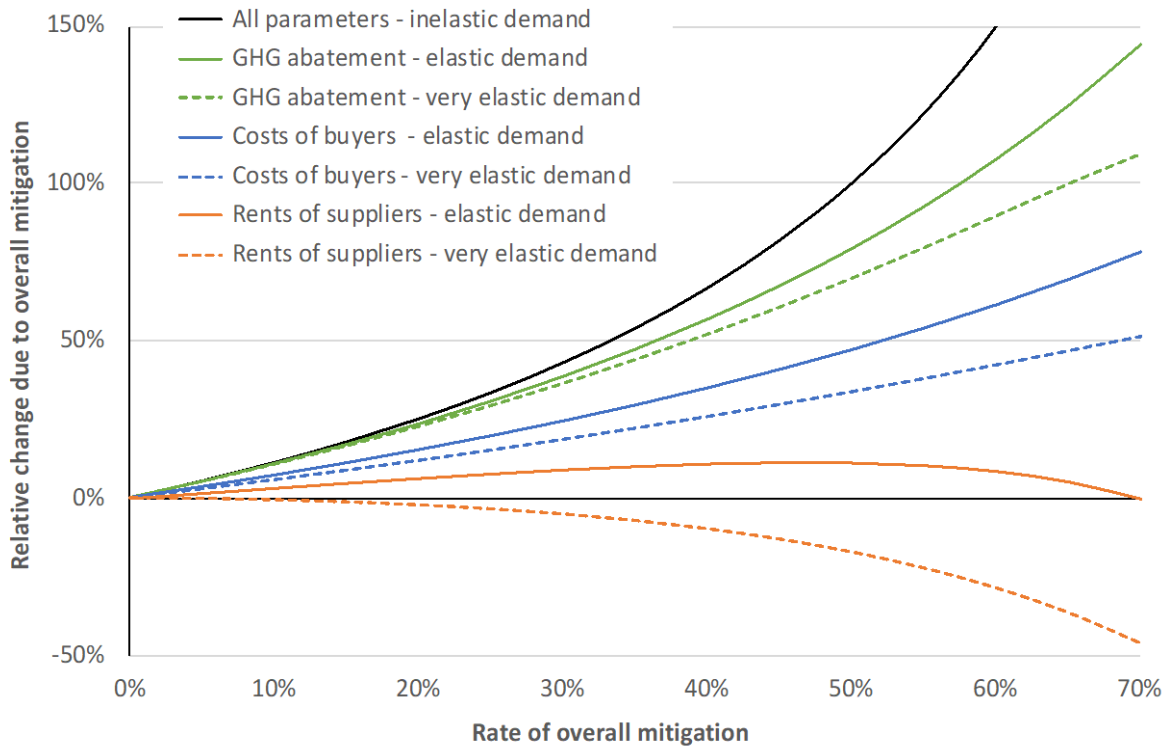

Figure 6: Market implications of different rates of overall mitigation under a steep offset credit supply curve

Figure 7: Market implications of different rates of overall mitigation under a flat offset credit supply curve

The three parameters change in different ways with increasing rates of overall mitigation:

- The **level of GHG abatement** increases with higher rates of overall mitigation. The increase softens with more elastic demand but remains significant under all scenarios. Under all scenarios, the level of abatement (relative to the verified emission reductions in the transferring country in the reference case) increases over-proportionally with higher rates of mitigation.
- The **costs of buyers** also increase more than proportionally with higher rates of overall mitigation. These costs respond strongly to changes in the elasticity of demand. The more elastic the demand is, the lower the increase in the costs of buyers. This holds in particular in the case of steep supply curves.
- The **rents of the suppliers** of the offset credits are highly influenced by changes in the elasticity of demand and the shape of the supply curves. In most scenarios, the rents increase, at least for low to moderate rates of overall mitigation. Only in the rather unlikely scenario of very elastic demand and a steep supply curve would rents decrease.

In selecting an appropriate rate of overall mitigation, policy-makers may thus mainly have to balance the benefits in terms of enhanced abatement with the increased costs of the buyers. A further consideration is that the overall cost-effectiveness of mitigating climate change may decrease with higher rates of overall mitigation. This is because the aggregated costs of achieving a given abatement level through carbon markets is lowest if each carbon market unit represents exactly one tCO_2e of emissions or emission reductions. Theoretically, the more the emissions or emission reductions associated with some carbon market units differ from one tCO_2e, the lower the overall cost-effectiveness.

On the other hand, one could argue implementing overall mitigation links the flexibility provided through the ability to access crediting mechanisms with the objective of enhancing climate action. It *directly* ensures that the cost savings due to the access to offset credits result in more global GHG abatement, as compared to the more uncertain possibility that countries increase the ambition of their mitigation

targets as a result of the possibility to access offset credits. Furthermore, the overall ambition of mitigation targets is not within the direct decision-making power of the negotiators designing the mechanism, while the rate of overall mitigation is. With overall mitigation, both transferring and acquiring countries still economically benefit through the cooperation, though acquiring countries face higher costs compared to the situation that they could access offsetting without implementing overall mitigation.

However, overall mitigation has different implications for the transferring countries and the acquiring countries or entities.

For **transferring countries**, introducing overall mitigation brings benefits. The main benefit is that – within the boundaries of plausible scenarios for the elasticity of demand and the shape of supply curves – the level of abatement in transferring countries increases. Under a broad range of plausible scenarios, a higher rate of overall mitigation leads to more emission reductions in transferring countries. Even though the increase in abatement cannot be used to achieve the transferring countries' NDCs (because an adjustment would need to be applied for the full amount of emission reductions achieved), enhancing abatement may accelerate the transformation of their economies towards a low GHG emissions pathway and can facilitate the adoption of more ambitious targets in the future, after the end of the crediting period of the credited activities. These benefits would only reverse with relatively high rates of overall mitigation or very elastic demand, which is unlikely to be the case. The level of abatement in transferring countries would decrease compared to the reference scenario if the rate of overall mitigation would be set so prohibitively high that only very few or no credits are transacted. In our example model, this would occur with rates between 86% (in the scenario of very elastic demand and a steep supply curve) and 95% (in the scenario with elastic demand and a flat supply curve). With fully inelastic demand, abatement cannot decrease in transferring countries due to the introduction of overall mitigation.

A possible second benefit could accrue from higher rents for the offset credit suppliers. To which extent these benefits accrue to entities located in the transferring countries depends on where the project developer is located and how the rents are shared between the different participants involved in a project. However, if rents increase, it is likely that at least some of these increased rents will remain with entities in the transferring countries. However, as discussed above, the rents of credit suppliers are more vulnerable to the elasticity of demand and the shape of supply curves. In the scenario of 'very elastic' demand and a 'steep' supply curve, they decrease even with low rates of overall mitigation (see orange dotted line in Figure 6). Under the 'elastic' demand scenario, the rents of credit suppliers would decrease – compared to the reference scenario without overall mitigation – if the rate of overall mitigation is set above 70% (in the scenario of a steep supply curve, see Figure 6) or above 92% (in the scenario of a flat supply curve).

For **acquiring countries**, introducing overall mitigation increases the costs of achieving mitigation targets through offset credits, as compared to the reference case, though the costs are still lower compared to a scenario where they have no access to international abatement opportunities. Lower rates of overall mitigation increase the costs more moderately than higher costs of overall mitigation. This is because under our assumptions for the supply and demand curves the price increases stronger than proportionally with higher rates of overall mitigation. The worst-case scenario in terms of increase of costs is a fully inelastic demand, in which case the costs increase by $1 / (1 + F_{OMGE})$, where F_{OMGE} is the rate of overall mitigation. This factor increases nearly linearly with low rates of overall mitigation but grows strongly with very high rates. A rate of overall mitigation of 10%, for example, would imply that the costs of the buyers can at maximum increase by 11%, whereas a rate of 75%, for example, would imply that the costs could increase by up to 300%. In choosing an appropriate rate of overall mitigation, policy-makers may thus consider that the costs increase disproportionally with higher rates of overall mitigation.

There is also a possibility that some potential buyers may refrain from buying offset credits under high rates of overall mitigation – not because the price would increase prohibitively high – but rather because

they reject the concept of overall mitigation for more principle reasons. For some buyers, for example, it may be difficult to justify that they spend more money for achieving further emission reductions which they cannot use. In this regard an important question is also how easy the concept can be communicated to the wider public. On the one hand, it could be complex to understand. On the other hand, it could address the criticism that offsetting has a net neutral outcome for the climate and might enhance the political acceptability of engaging in the use of offset credits.

Policy-makers could also review the rate of overall mitigation over time. Although there are no forecasts of future offset credit prices, given the limited demand and the significant abatement potential in some countries, it seems unlikely that offset credit prices will be significantly higher in the next decade than they were in the past 15 years. As long as prices do not significantly increase and prices for offset credits remain below prices for ETS allowances or the costs of alternative fuels under CORSIA, the demand is likely to be relatively inelastic (see section 5.2.1 above). Under these circumstances, higher rates of overall mitigation might be viewed as a reasonable balance between enhancing abatement and avoiding that costs increase to an extent that engaging international transfers becomes unattractive. The rate of overall mitigation could be reviewed and decreased in the future should the current market circumstances change significantly.

It is important to note that the present analysis has several limitations. Most importantly, our simplified model and its parametrisation is not based on *actual* supply and demand curves for the period after 2020 – which are not known at this stage. While different scenarios were established with the view to reflecting the range of possible outcomes, this does not mean that the assumptions reflect the actual possible outcome. It is in particular possible that the supply curves have a different shape than assumed here. It might also be possible – but less likely – that the demand is more elastic than assumed here. Despite these limitations, some conclusions – in particular the largest possible implications under fully inelastic demand – hold irrespective of the shape of cost and demand curves. Moreover, the different scenarios allow understanding how different parameters respond to changes in the shape of supply and demand curves.

5.3 Partial implementation of the principle of overall mitigation

In this section, we qualitatively discuss the implications if the principle of overall mitigation is only implemented under the Article 6.4 mechanism, and not in all relevant contexts. To understand the potential implications, it is helpful to map under which type of market mechanisms mitigation outcomes may be generated and for what purposes they could be used.

Mitigation outcomes could be generated in three distinct ways (Schneider and La Hoz Theuer, 2018), including through:

- **Crediting mechanisms**, including the Article 6.4 mechanism, (bilateral) governmental mechanisms such as the Japanese Crediting Mechanism, or non-governmental programmes, such as Verra's Verified Carbon Standard (VCS), the Gold Standard (GS), the Climate Action Reserve (CAR), the American Carbon Registry (ACR).
- **International linking of ETSs**, which can lead to shift in emissions and thus the international transfer of mitigation outcomes between countries.
- **Other forms of voluntary cooperation** where mitigation outcomes are generated without using crediting mechanisms or linking ETSs, such as the green investment schemes (GIS) pursued under the Kyoto Protocol.

These mitigation outcomes could then be used in multiple ways:

- **Internationally transferred and used towards achieving NDCs**, where the acquiring country would apply a "corresponding adjustments" when accounting for its NDC, e.g. by subtracting the acquired emission reductions from its emissions covered by its NDC.
- **Domestically as a mitigation tool**, e.g. where the host country of the emission reductions purchases domestic offset credits or allows private entities to fulfil requirements through domestic offset credits. Examples include the use of domestic offset credits in ETS, as for example implemented in South Korea and California, or to fulfil carbon tax obligations, as being implemented in South Africa and Colombia. In these instances, no international accounting is necessary, since the offset credits are solely used as a domestic climate mitigation policy, similar to other domestic climate mitigation policies.
- **International agreements complementing UNFCCC such as CORSIA**, where eligible emissions units can be used by aeroplane operators to fulfil their requirements and achieve ICAO's goal of carbon neutral growth.
- **Voluntary offsetting of emissions**, where governments, non-governmental organisations and individuals purchase emission units to offset their emissions.
- **Results-based climate finance**, where offset credits are used as vehicle to disburse climate finance in an effective manner. The rights to the emission reductions remain with the host country and the donor does not use the emission reductions to achieve its own mitigation targets.

In practice, some mechanisms could be used in multiple ways. So far, the CDM, for example, has been used for all purposes above except for CORSIA, and the Article 6.4 mechanism might be used towards any of the five purposes above. At the same time, the users of the mitigation outcomes may draw upon several mechanisms to achieve their goals, with emissions units from different mechanisms competing against each other. For example, different crediting mechanisms, as well as ETS allowances, have been used to achieve voluntary goals and might become eligible to supply emissions units under CORSIA. Depending on the extent that these are substitutes for each other, this difference between the Article 6.4 mechanism and other alternatives could lead to market distortions and undermine the effectiveness of implementing overall mitigation in different ways.

5.3.1 Competition with offset credits from other crediting mechanisms

First, the Article 6.4 mechanism could be competing with other crediting mechanisms. If the principle of overall mitigation were only implemented under the Article 6.4 mechanism but not under other crediting mechanisms competing for the same buyers, this could imply that project developers register their project under the competing mechanisms, rather than the Article 6.4 mechanism, because this gives them a larger number of credits. This may even hold for existing projects, as most crediting mechanisms allow projects to migrate from one crediting mechanism to another. The higher the rate of overall mitigation is, the larger would be the financial incentive to use mechanisms that do not implement overall mitigation. If many projects would disregard the Article 6.4 mechanism, this would undermine the goal of achieving an overall mitigation in global emissions.

This situation could apply to all possible uses of credits generated under the Article 6.4 mechanism. Under Article 6.2, countries could potentially use their own mechanisms, such as the JCM, or draw upon non-governmental mechanisms when engaging in cooperative approaches. Some domestic programmes for using offset credits, such as those in Colombia or South Africa, allow private entities to use different types of credits to fulfil their obligations. Under CORSIA, different crediting programmes, including non-governmental programmes, can apply to become eligible programmes and, once eligible, supply eligible emissions units to aeroplane operators. In the voluntary market, different types of offset credits are already being used, including from international market mechanisms, such as the CDM, as well as from non-governmental programmes. The same holds for some results-based climate finance

programmes, such as the Pilot Auctioning Facility (PAF) of the World Bank which recognised offset credits issued under the VCS or Gold Standard from the second auction round in May 2016.[3]

Market distortions due to competition with other mechanisms may constitute a stronger concern for compliance markets than for voluntary offsetting or delivering results-based climate finance, where prices differ and depend on the quality of the units offered. Voluntary buyers of offset credits or donors could be willing to pay more if the abatement achieved is greater. If offset credits are used for voluntary purposes (and the emission reductions are not used by the host country), their use would automatically enhance global mitigation action. The implementation of this principle may therefore seem more meaningful for compliance purposes.

In compliance markets, a level playing field with the same rate of overall mitigation applied among all crediting mechanisms may be more important but also politically more difficult to agree upon. With regard to using internationally transferred offset credits towards achieving NDCs, Article 6.2 could require, recommend, or invite Parties engaging in voluntary cooperation using crediting mechanisms other than the Article 6.4 mechanisms to implement overall mitigation using the same rate. Opponents of such an approach may argue that the principle of overall mitigation is only mentioned under Article 6.4 and that it would be the prerogative of the Parties involved in a cooperative approach under Article 6.2 whether or not to implement it.

Implementing overall mitigation in the context of CORSIA could also be politically difficult, as this principle is not included in the draft CORSIA Emissions Unit Eligibility Criteria, the Standard and Recommended Practice or the ICAO assembly resolution. If the CORSIA rules are not changed, programmes and emissions units may thus be eligible even if they do not implement overall mitigation. Introducing the principle could also be politically challenging because CORSIA specifically aims to achieve carbon neutral growth, whereas the implementation of overall mitigation could imply that aggregated GHG emissions are lowered further (although because participation is voluntary for the first two phases, carbon neutral growth will not be achieved).

There is also a possibility that other crediting mechanisms get under pressure to be at least as environmentally ambitious as the Article 6.4 mechanism and that they might also implement overall mitigation or offer a separate product that provides for overall mitigation.

5.3.2 Competition with ETS allowances

Second, credits from the Article 6.4 mechanism could, in some instances, compete with allowances from ETS. For example, ICAO is still deliberating the development of processes and criteria for enabling allowances from ETS to become eligible emissions units. In this case, the Article 6.4 mechanisms would compete against allowances from ETSs. Similarly, in the voluntary market, some buyers cancel ETS allowances instead of purchasing offset credits. If ICAO would agree, however, to implement the principle of overall mitigation, it could be implemented for ETS relatively easily at the demand side, by requiring that more than one ETS allowance be cancelled in order to offset one tonne of CO_2 emissions from aeroplane operators. In the context of Article 6.2, competition with ETS may be less of a concern, because the background and rationale for engaging in linking agreements is rather different than for purchasing credits.

Implementing the principle of overall mitigation for international transfers resulting from the linking of ETSs is not within the scope of this paper and would need further investigation. It involves a number of political and technical challenges. With fully linked ETSs, which implies mutual recognition of allowances for compliance, the aggregated emissions from the two ETS remain the same. The Parties would thus

[3] https://www.pilotauctionfacility.org/second-auction-criteria

not achieve overall mitigation through the linking of ETSs. To directly achieve overall mitigation through ETS linkages, the transfer or use of allowances would have to be restricted. Such restricted forms of linking could introduce discount rates that match the rate of overall mitigation, such that entities in one jurisdiction would have to surrender more than one allowance from the other jurisdiction to comply with their obligations (Burtraw *et al.*, 2013; Schneider, Lazarus, *et al.*, 2017).

To address these concerns, policy-makers could pursue the principle of overall mitigation only for crediting mechanisms but not for international linking of ETSs. This might also make the concept politically more acceptable outside the boundaries of the Article 6.4 mechanism. It may also be a valid approach as linking of ETSs does not practically compete with purchasing offset credits.

In conclusion, in the context of compliance markets that recognise different types of offset credits, creating a level playing field between crediting mechanisms is important in order to effectively implement the principle of overall mitigation. It is therefore recommended that policy-makers ensure that the principle is implemented consistently, either for all uses of offset credits, or at least coherently for specific compliance uses of offset credits, such as towards NDCs or towards CORSIA.

6 Conclusions

Delivering an 'overall mitigation in global emissions' is a key requirement of the new mechanism established by Article 6.4 of the Paris Agreement. The Parties to the Paris Agreement are currently deliberating on the rules for implementing this provision. Key aspects considered in the negotiations include how overall mitigation should be defined, which options should be pursued to implement it, how these options could be operationalised, and what share of the emission reductions should contribute to overall mitigation.

In the context of the new mechanism established under Article 6.4 we recommend that overall mitigation is defined to take place when a portion of the emission reductions resulting from an activity credited under the mechanism is not used by any country to implement or achieve its NDC and not used by any authorised public or private entity to achieve mitigation efforts that contribute to the goals of the Paris Agreement. This definition means that aggregated global GHG emissions should decrease as a result of engaging in the mechanism and not only lead to emission reductions that can be used by the host country to achieve its NDC – which is often referred to as a host country's 'own benefit'. It also assumes that overall mitigation should also be achieved if the emission reductions are used for purposes other than towards NDCs, such as for CORSIA.

The current negotiation text includes several options for implementing overall mitigation. Our evaluation of these options shows that most of them are not able to achieve overall mitigation, as defined above. Many of these options would lead to a net decrease in global emissions in the context of the CDM where host countries did not have targets under the Kyoto Protocol, but no longer do so in the context of the Paris Agreement where countries have NDCs. We find that only the options ‘automatic cancellation’ and ‘discounting’ ensure that overall mitigation is achieved. The differences between them mostly relate to when credits are cancelled and whether the host country or the acquiring country is responsible for cancelling them.

Among these two options, we recommend policy-makers to pursue 'automatic cancellation'. For this option it is easier to ensure that the required cancellation actually occurs, as it can be conducted by the supervising body of the mechanism. The cancellation should be implemented at issuance but at least before units are transferred for the first time to an account under the control of Parties. In this way units meant to deliver an overall mitigation do not enter into circulation and corresponding adjustments by acquiring Parties are only made for the amount of emission reductions that they use to achieve their NDCs, after subtraction of the contribution to overall mitigation. Since a precedent for this implementation approach exists from the CDM, it would be comparatively easy and efficient to build on these experiences for delivering an overall mitigation contribution.

An important outstanding decision for policy-makers is the share of units that should be cancelled for the purpose of achieving overall mitigating. Some stakeholders fear that a higher share would lead to market distortions, fewer projects being implemented, and higher costs for buyers. Using a simplified model to assess the market implications, we find that overall mitigation brings various benefits although the costs for supplying credits increase. Importantly, while fewer credits are transacted, the level of abatement in host countries increases under a broad range of circumstances. In all 18 scenarios considered, the level of abatement in host countries becomes larger with higher rates of overall mitigation. Project owners also benefit because implementing overall mitigation leads to higher carbon market prices: while their costs of supplying offset credits increase, this is outweighed by higher revenue from higher offset credit prices. This increase in *net* revenues holds true under a broad range of circumstances.

The costs of achieving overall mitigation are borne by the buyers of the offset credits. Their costs of purchasing offset credits increase. With lower rates for overall mitigation, the costs increase relatively proportionally, whereas they increase more strongly with high rates. If 10% of the offset credits are

cancelled, for example, this leads to a maximum increase in costs of 11%, whereas cancelling 50% could, at the most, double the costs.

The exact implications depend on the supply and demand curve, which are not currently known. For new mitigation activities, the shape of the supply curve is relatively uncertain: it will not only depend on the abatement potential and costs but also on the readiness of countries to sell offset credits and the international rules governing Article 6. If existing and already implemented projects would become eligible to supply credits after 2020, the supply curve is likely to be rather flat. Based on the currently known demand for credits after 2020, in particular from CORSIA, the demand is likely to be relatively inelastic. Under these circumstances, higher rates for overall mitigation are likely to lead to more benefits for host countries.

Policy-makers could also implement overall mitigation for generating emission reductions under other mechanisms, in particular in the context of markets where several offsetting programmes compete, as for example in the case of CORSIA. Implementing overall mitigation only in the context of the Article 6.4 mechanism could otherwise lead to market distortions.

Overall, our analysis suggests that implementing overall mitigation can be straightforward – provided that the political will is given to implement this principle. Cancelling a portion of units after issuance and ensuring that overall mitigation is achieved through appropriate accounting provisions is relatively simple. At the same time, benefits for transferring countries, with only moderate increases in costs for buyers, can be achieved for a broad range of rates for overall mitigation.

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Annex I: Model description to assess market implications

The elastic credit demand is characterised by a linear curve:

$Demand = A \cdot x + B$,

where x is the number of offset credits, and A and B are parametrised in the example as A = -0.3 and B = 20. For the sensitivity analysis of a twice as elastic demand, we use A = -0.15 and B = 10. The inelastic demand is set such that in the situation without overall mitigation the demand is identical to the scenario with elastic credit demand.

The credit supply curve is characterised as follows:

$Supply = C \cdot x^2 + D \cdot x + E$,

where x is the number of offset credits, and C, D and E are parametrised as C = -0.0005, D = 0.005 and E = 1 for the "flat" credit supply curve and as C = -0.001, D = 0.05 and E = 1 for the "steep" credit supply curve.

With implementing overall mitigation, the costs of supplying offset credits increase, as follows:

$Supply = \frac{1}{1-F_{OMGE}} \cdot [C \cdot x^2 + D \cdot x + E]$,

where F_{OMGE} is the rate of overall mitigation, i.e. the fraction of verified emission reductions that should contribute to overall mitigation.

The market equilibrium without and with implementing overall mitigation is calculated by setting supply equal to demand, and determining the number of offset credits x.

Without overall mitigation: $A \cdot x + B = C \cdot x^2 + D \cdot x + E$

With overall mitigation: $A \cdot x + B = \frac{1}{1-F_{OMGE}} \cdot [C \cdot x^2 + D \cdot x + E]$

The rents for the project developers correspond to the cumulative difference between the price for credits and the costs of supplying credits, as follows:

$$Rents = \int_0^{x_E} p - \frac{1}{1-F_{OMGE}} \cdot (C \cdot x^2 + D \cdot x + E)$$
$$= p \cdot x_E - \frac{1}{1-F_{OMGE}} \cdot \left(\frac{1}{3} \cdot C \cdot x_E^3 + \frac{1}{2} \cdot D \cdot x_E^2 + E \cdot x_E\right)$$

where x_E is the number of offset credits in market equilibrium.

The market value (or market turnover) corresponds to the number of credits transacted multiplied with the price.

In the reference case without overall mitigation, the costs of the buyers correspond to the market value. With implementation of overall mitigation, the costs of the buyers correspond also to the market value, plus, in the case of an elastic demand, the increased costs of abatement:

$$Costs\ of\ buyers = p_{OMGE} \cdot x_{OMGE} + \int_{x_{OMGE}}^{x_E} A \cdot x + B$$
$$= p_{OMGE} \cdot x_{OMGE} + \left[\frac{1}{2} \cdot A \cdot (x_E^2 - x_{OMGE}^2) + B \cdot (x_E - x_{OMGE})\right]$$

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