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Markets negotiations under the Paris Agreement: a technical analysis of two unresolved issues

Luca Lo Re (IEA) and Manasvini Vaidyula (OECD)

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Luca Lo Re (IEA) and Manasvini Vaidyula (OECD)

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Foreword

This document was prepared by the OECD and IEA Secretariats in response to a request from the Climate Change Expert Group (CCXG) on the United Nations Framework Convention on Climate Change (UNFCCC). The Climate Change Expert Group oversees development of analytical papers for the purpose of providing useful and timely input to the climate change negotiations. These papers may also be useful to national policy-makers and other decision-makers. Authors work with the CCXG to develop these papers. However, the papers do not necessarily represent the views of the OECD or the IEA, nor are they intended to prejudge the views of countries participating in the CCXG. Rather, they are Secretariat information papers intended to inform Member countries, as well as the UNFCCC audience.

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Questions and comments should be sent to:
Luca Lo Re (IEA) and Manasvini Vaidyula (OECD)
OECD Environment Directorate
2, rue André-Pascal
75775 Paris Cedex 16
France
Email: manasvini.vaidyula@oecd.org Luca.LORE@iea.org

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Abstract

Markets negotiations under the Paris Agreement: a technical analysis of two unresolved issues

This paper provides a technical analysis of two specific unresolved issues in the negotiations of rules for Article 6 of the Paris Agreement: (i) accounting methods for single- and multi-year NDCs under Article 6.2 and (ii) the implications of a potential transition of activities and units from the Kyoto Protocol mechanisms to the Article 6.4 mechanism. The paper first describes the accounting methods under consideration in Article 6.2 discussions and highlights that different methods can have different implications for environmental integrity, particularly if used by Parties with single-year NDCs. The paper then presents different options of transition of activities and units from the Clean Development Mechanism to the Article 6.4 mechanism. The analysis highlights that a potential full transition of activities could inhibit or delay new investments in mitigation activities, and that the supply of units could be several times larger than demand in 2020, leading to a significant carry-over.

JEL Classification: F53, Q54, Q56, Q58

Keywords: UNFCCC, carbon markets, Paris Agreement, Article 6, Kyoto Protocol, CDM

Résumé

Négociations sur les marchés dans le cadre de l'Accord de Paris : analyse technique de deux questions en suspens

Le présent document contient une analyse technique de deux questions particulières non résolues dans le cadre des négociations sur les règles afférentes à l'article 6 de l'Accord de Paris : (i) les méthodes de comptabilisation applicables aux CDN avec un objectif à une année donnée ou bien réparti sur plusieurs années aux fins de l'article 6.2 et (ii) les implications d'un éventuel transfert des activités et unités découlant des mécanismes du Protocole de Kyoto au mécanisme prévu à l'article 6.4. Le document commence par décrire les méthodes de comptabilisation prises en considération dans les réflexions sur l'article 6.2 et souligne qu'elles n'ont pas toutes nécessairement les mêmes implications du point de vue de l'intégrité environnementale, en particulier si elles sont appliquées par les Parties à des CDN avec un objectif à une année donnée. Il présente ensuite différentes possibilités de transfert des activités et unités du Mécanisme pour un Développement Propre au mécanisme prévu à l'article 6.4. Il ressort de l'analyse qu'un éventuel transfert total des activités pourrait freiner ou retarder de nouveaux investissements dans les activités d'atténuation et que la quantité d'unités fournies pourrait être plusieurs fois supérieure à la demande en 2020, d'où un effet de report notable.

Classification JEL : F53, Q54, Q56, Q58

Mots-clés : CCNUCC, marchés du carbone, Accord de Paris, Article 6, Protocole de Kyoto, MDP

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List of acronyms

A6.4ER	Article 6, paragraph 4, emission reduction
AAUs	Assigned Amount Units
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
COP	Conference of the Parties to the UNFCCC
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CP1	First Commitment Period of the Kyoto Protocol
CP2	Second Commitment Period of the Kyoto Protocol
ERUs	Emission Reduction Units
ETS	Emissions Trading Scheme
EU	European Union
FVA	Framework for Various Approaches
GHG	Greenhouse gases
JI	Joint Implementation
JCM	Joint Crediting Mechanism
IET	International Emission Trading
ITMOs	Internationally transferred mitigation outcomes
KP	Kyoto Protocol
LDCs	Least Developed Countries
MPGs	Modalities, procedures and guidelines
NDCs	Nationally Determined Contributions
NMM	New Market-based Mechanism
OMGE	Overall Mitigation in Global Emissions
PoA	Programme of activities
SBSTA	Subsidiary Body for Scientific and Technological Advice
SEF	Standard Electronic Format
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

Article 6 of the Paris Agreement introduces market approaches as one way for Parties "to pursue voluntary cooperation in the implementation of their nationally determined contributions (NDCs) to allow for higher ambition in their mitigation and adaptation actions and to promote sustainable development and environmental integrity" (UNFCCC, 2015[1]). Under Article 6 there are two market-based components for voluntary international co-operation:

- Article 6.2: sets out the principles, including on accounting, for voluntary co-operative approaches involving the use of internationally transferred mitigation outcomes (ITMOs) towards NDCs; this co-operation among Parties could include various approaches and mechanisms.
- Article 6.4: establishes a mechanism to contribute to the mitigation of greenhouse gas (GHG) emissions and support sustainable development, under international oversight through the United Nations Framework Convention on Climate Change (UNFCCC).

At COP24, Parties made progress in negotiations on many aspects of the draft rules for Article 6, but did not ultimately reach an overall consensus. There are unresolved issues, of both a technical and political nature, in the negotiations relating to the implementation of Article 6.2 and 6.4. The "Katowice Climate Package", the main outcome of COP24, therefore requested the Subsidiary Body for Scientific and Technological Advice (SBSTA) to continue the work towards the elaboration of Article 6 rules and guidance. A draft decision is to be submitted for consideration and adoption at COP25 (UNFCCC, 2018[2]).

This paper provides a technical analysis of two specific unresolved issues under Article 6.2 and 6.4 negotiations. These are (i) accounting methods for single- and multi-year NDCs under Article 6.2 and (ii) the implications of a potential transition of activities and units from the Kyoto Protocol (KP) mechanisms to the Article 6.4 mechanism.

Article 6.2: accounting methods for single- and multi-year NDCs

The accounting methods currently under consideration in Article 6.2 discussions would determine how Parties adjust the emissions balance covered by their NDC to reflect transactions of ITMOs – called a "corresponding adjustment" – during the final accounting at the end of the NDC period. Five possible accounting methods are currently under discussion: the "target year only", "averaging", "cumulative", "multi-year trajectory" and "yearly" methods. The methods vary in the timing and calculation of corresponding adjustments. For example, the "averaging" method would allow transactions in all years of the NDC and would calculate a final corresponding adjustment for the target year emissions that is equal to the average of all ITMO transactions. The "target year only" method would limit ITMO transactions to those emission reductions (and/or removals) generated and used in the target year only.

In deciding which methods could be used to calculate and apply corresponding adjustments, it would be important for Parties to consider whether and how the method used ensures environmental integrity. Transfer (outgoing) and acquisition (incoming) of ITMOs by Parties with NDC targets that apply only in the final NDC year (single-year NDCs) in particular could potentially lead to an overall increase in emissions and raise

some environmental integrity risks. This could occur, for example, if Parties acquire ITMOs to offset emissions only in the target year, without reducing emissions – whether by domestic actions or ITMO acquisitions – in other years. A further source of risk for environmental integrity could be if ITMO transfers generated from emission reductions in non-target years are not accounted for against the target year emissions of the transferring Party. The "averaging" method could reduce this risk as the corresponding adjustment applied for the target year emissions takes into account ITMO activity throughout the NDC period. Alternatively, the "target year only" method also reduces this risk by limiting ITMO transfers to only those emission reductions generated within the target year.

If Parties engaging in Article 6.2 transactions could choose from a menu of different accounting methods, there might also be implications for environmental integrity. For example, it would be important for Parties using the "target year only" method to engage in ITMO transactions with others that use the same method to limit environmental integrity risks. Possible guidance under Article 6.2 could narrow the list of accounting methods that Parties with single- and multi-year NDCs could potentially choose from, and recommend which combination of methods trading partners could avoid, to ensure environmental integrity and avoidance of double counting. It could therefore be important for Parties to indicate any choice of accounting method at the start of the NDC period to identify who they could trade with while ensuring robust accounting principles.

Article 6.4: potential transition of Kyoto Protocol mechanisms

The potential transition of different elements of the KP mechanisms is part of the Article 6.4 discussions under SBSTA, even though the Paris Agreement does not explicitly call for such a transition. Discussions are on three main levels: transition of activities (e.g. projects), transition of units and transition of rules and methodologies. To inform the negotiations on this issue, this paper provides technical analyses of the implications of the potentially transitioning (i) activities and (ii) units from the Clean Development Mechanism (CDM) to the Article 6.4 mechanism. The CDM is chosen because it is the most heavily used among the three KP mechanisms. The transition of rules and methodologies is not analysed here but would benefit from further work.

There are risks and opportunities to allowing different levels of transition of activities and/or transition of units. A full transition of CDM activities would allow all existing registered CDM activities to potentially be re-registered under the new Article 6.4 mechanism. This could inhibit (or at least delay) the development of new, additional mitigation activities, because it would allow investments made before 2020 to generate credits in the Article 6.4 mechanism. This issuance of credits could then happen without requiring greater emission reductions beyond those that may have occurred in the absence of the Article 6.4 mechanism. However, a full transition of existing CDM projects and programmes of activities, if re-registered in the Article 6.4 mechanism, would rapidly constitute a pipeline of mitigation activities under the new mechanism. Parties could also decide on a limited transition. The limitation could focus on, for instance, only allowing the transition of specific types of mitigation actions or regions, considering that the geographical spread of CDM activities is uneven across countries. A limited transition could also be used to support CDM mitigation activities that are likely to cease to operate if the incentives from CDM are removed (so-called "vulnerable activities").

Regarding the transition of units, a full transition of potentially available Certified Emission Reductions (CERs), issued by CDM activities, carries a strong risk that the Article 6.4 mechanism might not generate emission reductions beyond those that may have occurred in the absence of the mechanism, potentially putting at risk environmental gains. A full

transition of units could also reduce the incentive to invest in new mitigation activities under the Article 6.4 mechanism as some Parties may decide to make use of pre-2020 CERs towards post-2020 mitigation targets, rather than supporting investment in new mitigation activities. However, a full transition of units could be seen as increasing the diversity of options for meeting mitigation targets[1] - albeit with potential implications for overall ambition - and could generate better liquidity in the Article 6.4 mechanism from the start.

In quantitative terms, the potential supply of CERs to 2020 could be very large relative to the estimated demand. A full transition of CERs would therefore be likely to heavily dilute the market of the Article 6.4 mechanism from the outset. The difference between the high levels of CER supply and low CER demand could lead to low credit prices, and less incentive for private sector investment in new Article 6.4 mechanism activities. Analysis for this paper estimates that around 0.8 billion already issued CERs are currently available (unused), equivalent to emissions reductions of 0.8 $GtCO_2e$, relative to estimated demand to 2020 of around 0.3 billion CERs. Moreover, when the potential supply of CERs up to 2020 from existing "dormant" activities[2] is included (by one estimate, 4.7 billion CERs), the volume of potentially available CERs in 2020 could be several times higher than the estimated demand.

Parties could also choose to limit the eligibility of CERs that can transition into the Article 6.4 mechanism, and this paper analyses three options for a limited transition: (i) a geographic restriction (limiting carry-over to projects in certain countries, such as from Least Developed Countries, LDCs); (ii) a "vulnerability" restriction (limiting carry-over to only CDM activities at risk of ceasing operations without the CDM incentive); and (iii) a time or vintage restriction (limiting carry-over by, for example, only allowing CERs from the second commitment period of the Kyoto Protocol). The results show that the choice of the design option can significantly change the volume of the CERs that could transition. For instance, the carry-over of all CERs from CDM activities in LDCs only could be limited (with a potential supply to 2020 of approx. 0.14 billion CERs), whereas the carry-over of all CERs from the 2nd commitment period of the KP could be significantly larger (with a potential supply to 2020 of approx. 2.35 billion CERs).

[1] Another means that pre-2020 (internationally transferred) CERs could in theory influence post-2020 NDC targets would be if Parties considered them as ITMOs to be used under Article 6.2 towards NDCs, provided this is in line with Article 6.2 guidance.

[2] An activity is considered dormant if the UNFCCC had no contact with it since 2013 or earlier. Some of these activities could potentially start re-issuing CERs before 2020, if for instance a signal is given that such units could be valid for the Article 6.4 mechanism.

1. Introduction

International carbon markets can help to achieve and enhance climate mitigation goals by providing access to enhanced cost-effective mitigation options compared to relying on domestic action only (Prag, Briner and Hood, 2012[3]; Michaelowa, 2017[4]). In 1997, the United Nations Framework Convention on Climate Change (UNFCCC) negotiations introduced market-based mechanisms as an important component of the Kyoto Protocol (KP). These have been widely used and some are still operating, with a potential to continue to generate emissions credits for several more years.

Through its Article 6, the 2015 Paris Agreement recognises that Parties may pursue voluntary co-operation "in the implementation of their nationally determined contributions (NDCs) to allow for higher ambition in their mitigation and adaptation actions and to promote sustainable development and environmental integrity" (Article 6.1). Article 6 describes two market-based components for international co-operation[3]:

- Article 6.2: sets out the principles, including on accounting, for voluntary co-operative approaches involving the use of internationally transferred mitigation outcomes (ITMOs) towards NDCs; this co-operation among Parties can happen using various approaches and mechanisms.
- Article 6.4: establishes a mechanism to contribute to the mitigation of greenhouse gas (GHG) emissions and support sustainable development, under international oversight through the UNFCCC.

The accompanying decision of the Paris Agreement (1/CP.21) called on the Subsidiary Body for Scientific and Technological Advice (SBSTA) to develop and recommend the guidance for Article 6.2 and rules, modalities and procedures for the Article 6.4 mechanism. These were set for "adoption by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA) at its first session", i.e. by the 24th Conference of the Parties to the UNFCCC (COP24). However, the "Katowice Climate Package", the main outcome of COP24, states that "Parties could not reach consensus" on the rules and guidance for Article 6 (Decision 8/CMA.1). This package also requests SBSTA to continue the technical work needed to advance discussions until the next CMA. A draft decision on this matter is to be submitted for consideration and adoption by the CMA at its second session (UNFCCC, 2018[2]).

Despite the lack of a formal outcome, Parties made substantial progress and had constructive discussions under the Article 6 negotiations at COP24. However, divergence remains on several issues. This paper first lists some of the unresolved issues under negotiations of Article 6.2 and provides a technical analysis of accounting methods for single- and multi-year Nationally Determined Contributions (NDCs) under Article 6.2 (section 2.1). It then provides an overview of unresolved issues under negotiations of Article 6.4 and examines the implications of a potential transition of Kyoto Protocol mechanisms to the Article 6.4 mechanism (section 3). Section 4 draws conclusions.

[3] The accompanying Articles 6.3 and 6.5-6.7 also establish key principles that govern Article 6.2 and 6.4 respectively. Additionally, Articles 6.8 and 6.9 introduce non-market approaches to sustainable development. While non-market approaches are an important component to co-operative approaches to mitigation, the paper does not address them due to space limitations.

2. Article 6.2: a technical analysis of accounting methods for single-year and multi-year NDCs

Article 6.2 of the Paris Agreement establishes the principles for Parties to engage on a voluntary basis in co-operative approaches towards achieving their NDCs by using internationally transferred mitigation outcomes (ITMOs). ITMOs could encompass different types of emission reductions and removals traded between Parties at a project, jurisdictional or national level, including via crediting mechanisms and emission trading schemes (ETS).[4] Article 6.2 states that Parties shall, when engaging in approaches involving ITMOs, "promote sustainable development and ensure environmental integrity and transparency […] and shall apply robust accounting to ensure, *inter alia*, the avoidance of double counting". Decision 1/CP.21, paragraph 36 requests SBSTA to develop and recommend guidance under Article 6.2 including "to ensure that double counting is avoided on the basis of a corresponding adjustment by Parties". Application of a corresponding adjustment involves Parties adjusting the emissions balance covered by their NDC to take into account ITMOs transferred (i.e. outgoing ITMOs) and acquired (i.e. incoming ITMOs).[5]

Negotiations on developing possible guidance under Article 6.2 are underway. This section first provides an overview of some of the issues that are still under discussion in Article 6.2 negotiations. Section 2.1 then examines different accounting methods under consideration in Article 6.2 negotiations that Parties with single-and multi-year NDCs could use to account for ITMO transactions.

A number of unresolved issues remain under negotiation under Article 6.2, often of both a technical and political nature. These include:

- **Features of ITMOs**: The Paris Agreement does not explicitly define ITMOs and Parties have different interpretations on the features of ITMOs (e.g. how to define if they are real, verified, etc.).
- **Accounting**: Application of robust accounting by Parties is required under the Paris Agreement, but there is yet no consensus on how to achieve it. Some outstanding issues include when and how Parties would apply a corresponding adjustment to avoid double counting, and which accounting methods could be used (e.g. for single- and multi-year NDCs) to account for ITMOs.
- **Generation, transfer, use and accounting of ITMOs outside the scope of NDCs:** In theory, Parties could transfer ITMOs that relate to emission reductions generated

[4] Whether ITMOs could include mitigation outcomes that are expressed in non-GHG terms (e.g. as Gigawatt hours of electricity transmitted between Parties) and how to account for these ITMOs is still under discussion.

[5] It is not yet agreed whether and how to apply corresponding adjustments including in metrics other than tonnes of CO_2 equivalent. As the paper analyses GHG-based adjustments, it focuses on corresponding adjustments that can be made against an emissions balance covered by the Party's NDC. There is also currently no agreement on whether Parties would apply a corresponding adjustment for ITMOs first transferred and used or transferred and acquired. This paper does not take a position on this issue and we use the terms "transfer" and "acquire" broadly to refer to outgoing and incoming ITMOs.

from a sector or from a GHG not covered by the scope of its NDC. Current areas of debate focus on whether and how to authorise such generation of ITMOs and their possible transfer, as well as on how to account for and use them.

- **Safeguards and limits**: The introduction of safeguards and limits could help, *inter alia*, to prevent potential environmental integrity risks. Examples of measures being discussed as safeguards and limits are: transfer limits on ITMOs; minimum holding requirements; use of ITMOs towards achievement of its NDC being supplemental to domestic action; maximum limits on the use of ITMOs towards an NDC; requirements relating to carry over of ITMOs from one NDC period to the next; limits relating to the use by a Party of ITMOs from emissions and removals not covered by the sectors and gases included in its NDC towards achievement of its own NDC; creation and first transfer of ITMOs in a manner that avoids significant fluctuations in the prices and quantities available in the international market for ITMOs; creation and first transfer of ITMOs from sectors that have a high degree of uncertainty; requirements relating to avoid unilateral measures and discriminatory practices in co-operative approaches.
- **Share of Proceeds**: The Paris Agreement explicitly mentions the concept of "Share of Proceeds"[6] for Article 6.4, but not for transfers under Article 6.2. Whether and how a share of proceeds could also be potentially applied to Article 6.2 transactions is under debate.

2.1. Technical analysis: Description and implications of accounting methods for single- and multi-year NDCs

Parties are required under Article 6.2 to apply "robust accounting" for ITMOs that they transfer (i.e. outgoing flows of ITMOs) and acquire (i.e. incoming flows of ITMOs) to ensure "*inter alia*, the avoidance of double counting". Article 6.2 also requires Parties to ensure environmental integrity, among other principles, when engaging in ITMO transactions. Accounting for ITMOs in line with these principles can also help build trust among Parties engaging in Article 6.2 co-operative approaches.

As well as upholding these principles, it would be key for any guidance developed under Article 6.2 to consider and to accommodate for the existing diversity of NDCs. Parties have put forward NDC targets that vary in *inter alia* scope, coverage and time frames, as well in whether they are based on GHG metrics or not. One particular aspect of variation is that NDCs are currently formulated as single-year or multi-year targets. A GHG-based single-year NDC is formulated as an emission reductions goal for a single year (also referred to

[6] The concept of Share of Proceeds was originally introduced in the Kyoto Protocol to "cover the administrative expenses and to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation" (Article 12, paragraph 8). It consisted of earmarking 2% of the Certified Emission Reductions (CERs) issued by Clean Development Mechanism (CDM) project activities to the Adaptation Fund. CDM activities in Least Developed Countries (LDCs) were exempted from the Share of Proceeds. The CDM introduced the Share of Proceeds as part of its purpose to assist non-Annex I Parties in achieving sustainable development. Share of Proceeds did not apply to the two other KP mechanisms (Joint Implementation and International Emissions Trading).

as the target year) in the NDC period. A GHG-based multi-year NDC is formulated as an emissions reduction goal that covers all years in the NDC period.[7]

The use of accounting methods that would determine the corresponding adjustments applied by Parties for their ITMO transactions to account for their NDC achievement is under consideration. The following section describes how each of the accounting methods under consideration could be applied for single- and multi-year NDCs and uses a worked example to demonstrate how the methods could affect final NDC accounting calculations. The section then explores some of the implications of using these methods including on environmental integrity. Finally, the section examines how Parties could engage in Article 6.2 transactions if they were able to choose from a menu of different accounting methods.

2.1.1. Description of accounting methods

Current discussions on Article 6.2 accounting are considering five possible options of accounting methods, some specifically for use towards single-year NDCs and the rest for use towards single- and multi-year NDCs. The paper uses shorthand to refer to the following five methods: "target year only"; "averaging"; "cumulative"; "multi-year trajectory"; and "yearly" methods:

- **"Target year only"**[8]: Parties with single-year NDCs would only transfer those ITMOs that relate to emission reductions generated in the NDC target year and acquire ITMOs to offset emissions only in the target year. The Party would calculate the total net ITMOs transactions in the target year and apply a corresponding adjustment for the target year emissions. Parties are currently discussing the possibility for this method to be used only by Parties with single-year NDCs.
- **"Averaging"**: A Party would apply a corresponding adjustment to the target year emissions that is equal to the annual average amount of ITMOs transferred and acquired over the NDC period. Calculating this average would involve dividing the total net ITMO transaction by the number of years in the NDC implementation period (e.g. 5 or 10). Parties are currently discussing the possibility for this method to be used only by Parties with single-year NDCs.
- **"Cumulative"**: For single-year NDCs, a Party would apply a corresponding adjustment for the target year emissions that is equal to the cumulative net amount of ITMOs transferred and acquired over the NDC implementation period. For multi-year NDCs, the same adjustment would be made for total emissions across all years in the target period.
- **"Multi-year trajectory"**: A Party would determine a multi-year trajectory for its NDC implementation period consistent with how it plans to implement its NDC. There are different ways that this method could be applied, in particular for single-year NDCs, which are currently under discussion. One approach would essentially involve determining a multi-year trajectory by creating a target emissions level for each year of the NDC period. If the Party's actual emissions exceed these annual

[7] Some Parties have communicated NDCs that contain targets not expressed in terms of GHG emission reductions. It is not yet agreed how to account for these targets. This paper focuses on GHG emissions-based accounting for single- and multi-year NDCs.

[8] Some Article 6 literature sometimes also refers to this method as the "vintage" method.

levels, it would acquire ITMOs and adjust the emissions balance covered by the NDC to stay below or at the emissions level. Parties could apply a corresponding adjustment every year in the NDC period against these target emission levels. Another possibility put forward by some Parties is for those with single-year NDCs to apply an adjustment for ITMOs acquired and transferred in the target year, while also being required to demonstrate that ITMOs were transferred or acquired in non-target years as necessary to maintain consistency with the trajectory throughout the NDC implementation period. Parties with multi-year NDCs could provide and translate the indicative multi-year trajectory into a multi-year emissions budget that would serve as the basis for accounting. In this case, the Party would assess its NDC achievement by comparing the ITMOs-adjusted emissions budget with the multi-year emissions budget limit. This budget-based approach would be similar to the one used by Annex I Parties to account for their mitigation targets under the Kyoto Protocol. Subsequent analysis of this method in the paper however considers a multi-year trajectory as the accounting basis.

- **"Yearly":** A Party with a multi-year NDC would apply the corresponding adjustments every year in the NDC period for the ITMOs transacted in that year. It is unclear how a Party with a single-year NDC would apply this method, for example, whether and how the Party would apply corresponding adjustments for emissions in non-target years. Further, it is unclear whether the Party's corresponding adjustment for its target year emissions would account for ITMOs transacted in all years of the NDC period (similar to the "cumulative" method) or only those in the target year.

Worked example: Final NDC accounting using different accounting methods for single-year NDCs

This worked example demonstrates how – for a given emissions trajectory – different accounting methods could lead to different corresponding adjustments being made during NDC accounting at the end of the period. The choice of accounting method can affect whether or not the Party could be assessed to have achieved its NDC target, due to differences in calculation and timing of the "corresponding adjustment" between the different accounting methods.

This example considers hypothetical transferring and acquiring Parties, both with single-year NDCs. Table 1 below indicates the transferring and acquiring Parties' actual emissions in Years 1 through 5, where Year 5 is the target year. The table also indicates the number of ITMOs the Parties transfer and acquire and the corresponding adjustments that would be applied based on the accounting method used. The worked example assumes that both Parties use the same accounting method. In the case of "multi-year trajectory" accounting method, the example considers that the Parties use a linear trajectory to the target[9].

[9] A linear trajectory to the target would be constructed by drawing a straight line to connect the starting level of emissions at the beginning of the NDC period and the target level of emissions at the end of the NDC period.

Table 1. Background information for worked example: actual emissions, ITMO transactions and corresponding adjustments of the transferring and acquiring Party

		Year 1	Year 2	Year 3	Year 4	Year 5 / Target year
Transferring Party						
(million tCO_2eq)	Actual emissions	100	102	104	107	108
	Target emissions					110
	ITMOs transferred	0	0.5	1	0.5	2
Corresponding adjustment calculated using method *(million tCO_2eq)*	"Target year only"	-	-	-	-	+2
	"Average"	-	-	-	-	+0.8
	"Cumulative"	-	-	-	-	+4
	"Multi-year trajectory"	0	+0.5	+1	+0.5	+2
	"Yearly"	0	+0.5(*)	+1(*)	+0.5(*)	+2 (if only target year accounted for) or +4 (if all ITMOs accounted for)
Acquiring Party						
(million tCO_2eq)	Actual emissions	100	98	96	94	92
	Target emissions					90
	ITMOs acquired	0	0.5	1	0.5	2
Corresponding adjustment calculated using method *(million tCO_2eq)*	"Target year only"	-	-	-	-	-2
	"Average"	-	-	-	-	-0.8
	"Cumulative"	-	-	-	-	-4
	"Multi-year trajectory"	0	-0.5	-1	-0.5	-2
	"Yearly"	0	-0.5(*)	-1(*)	-0.5(*)	-2 (if only target year accounted for) or -4 (if all ITMOs accounted for)

Note: (*) There is no agreement yet whether and how Parties would apply corresponding adjustments during the NDC implementation period. For example, it is unclear if and how a Party with a single-year NDC would apply corresponding adjustments for emissions in non-target years.
Source: Authors.

Table 2 describes the final NDC accounting calculations using different accounting methods. The table quantifies the adjusted target year emissions (and adjustments in other years, for the "multi-year trajectory" method) after a corresponding adjustment has been applied using the different methods.

Table 2. Results of worked example: final NDC accounting calculation using different accounting methods

	Transferring Party		Acquiring Party	
Accounting Method	**Target year emissions adjusted for ITMO transactions** *(million tCO_2eq)*	**Are adjusted emissions in line with the NDC target?**	**Target year emissions adjusted for ITMO transactions** *(million tCO_2eq)*	**Are adjusted emissions in line with the NDC target?**
"Target year only"	110	Yes	90	Yes
"Averaging"	108.8	Yes	91.2	No, and the acquiring Party a further reduction of 1.2Mt to achieve the NDC target.
"Cumulative"	112	No, and the Party would need a further reduction of 2Mt to achieve the NDC target.	88	Yes
"Multi-year trajectory" (assuming linear trajectory to target)	100, 102.5, 105, 107.5, 110 in Years 1 through 5	Yes	100, 97.5, 95, 93.5, 90 in Years 1 through 5	No, and the acquiring party would need a further reduction of emissions in Year 4 to achieve the NDC target.
"Yearly" (assuming only target year ITMOs accounted for)	110	Yes	90	Yes

Source: Authors, adapted from (Hood, 2018[5]).

2.1.2. Implications of using different accounting methods

This section first identifies how specific accounting methods could increase or decrease certain environmental integrity risks when used by Parties with single-year NDCs specifically. The section also explains how certain methods could facilitate further environmental gains and highlights other practical considerations for Parties' with single- and multi-year NDCs. Although it is important that Parties ensure the avoidance of double counting when engaging in Article 6.2 transactions, the paper does not draw out implications of different methods in ensuring this principle. Analysing possible implications of different methods on the avoidance of double counting can be challenging as ensuring this principle can depend on multiple factors (e.g. availability of tracking systems).

The design of the "target year only" and "averaging" methods could help reduce certain environmental integrity risks related to single-year NDCs

Assessing potential environmental integrity implications of accounting methods can be complex and depends on specific conditions related to the trading Parties' emissions trajectories and target year emissions. Schneider et al. (2017[6]) point out that there is a potential greater risk of higher aggregated cumulative emissions if *inter alia* Parties do not adjust their target year emissions for ITMOs generated in years not covered by its NDC target and if ITMOs acquired across multiple years are used in one target year to meet the NDC (Schneider et al., 2017[6]). Parties are therefore considering how the single-year accounting methods under discussion could ensure environmental integrity in a manner that is comparable to multi-year accounting. Indeed, some of the methods under discussion (e.g. "target year only" and "averaging" accounting methods) could address some concerns related to environmental integrity.

The "target year only" method essentially limits ITMO transfers to those emission reductions that are created in the target year and ITMOs acquisitions to those that would be used in the target year. Use of this method would therefore preclude Parties with single-year NDCs from transferring ITMOs in non-target years for which there are no emission reduction targets.

Any Party using the "averaging" or "cumulative" method could potentially transfer and acquire ITMOs for emissions reductions created in non-target years. However, these methods would apply an adjustment for the target year emissions that takes into account ITMO transactions in non-target years. Thus, these methods could limit the environmental risks related to ITMO transfers in non-target years.

On the other hand, applying a singular, potentially large cumulative adjustment to the target year emissions (for a single-year NDC) could present certain risks for environmental integrity when used by Parties to acquire ITMOs. For example, a Party with a single-year NDC using the "cumulative" method could achieve its NDC by acquiring enough ITMOs to reduce emissions in the target year only while emissions in non-target years could potentially increase. The "averaging" method could reduce this risk, as it would adjust the target year emissions by only the annual average of total ITMO transactions occurring throughout the NDC period.

Moreover, the "averaging" method could encourage further mitigation if used by an acquiring Party. An acquiring Party would need to buy 'x' (where 'x' is the number of years in the NDC period) times more ITMOs than would be needed to achieve the NDC target in the target year only. This potentially higher demand could in turn encourage transferring Parties to generate further emission reductions that they could transfer as ITMOs.

One option to reduce the risk of Parties only acquiring and using ITMOs to reduce emissions in the target year is under consideration.[10] This option would potentially ask Parties to demonstrate that there is some continuity in the emission reductions made (by implementing policies or offsetting using ITMOs) in non-target and target years. For example, if a Party is not able to implement policies to reduce emissions during the NDC period and is not on track to achieving the NDC, it could consider not only acquiring ITMOs to reduce the emissions in the target year, but non-target years as well. In this case, the Party would demonstrate there is some continuity in the emissions reductions pursued during the NDC implementation (in non-target years) and at NDC achievement (at target year).

There could be important implications for environmental integrity if Parties with single-year NDCs were to use the "yearly" method to account for their NDC achievement. Firstly, it is unclear if Parties' final NDC accounting would account for ITMO transactions for all years or only the target year in the NDC period. If the Party accounts for all ITMO transactions through a cumulative adjustment for the target emissions levels, then it would essentially be using a "cumulative" method. If the Party only accounts for those ITMOs transacted in the target year, there could be environmental integrity risks as any ITMOs transferred in non-target years would not be accounted for against the target year's emissions (Lazarus, Kollmuss and Schneider, 2014[7]). It is thus important to consider if

[10] This option in current discussions is also referred to as "demonstrating representativeness" i.e. that the corresponding adjustment(s) applied for ITMO transactions would be representative of how the Party has both implemented and achieved its NDC.

and how Parties with single-year NDCs could use this method while ensuring environmental integrity.

The accounting-related time frames implied by some methods may not fit some Parties needs

Parties may need to consider if the accounting methods and the implied accounting timeframes would be compatible with the mechanisms that Parties may use to drive their Article 6.2 transactions, such as ETS periods. The "target year only" method would potentially limit transfers and acquisitions of ITMOs to those generated from emission reductions made in the target year and used towards target year emissions. Parties that wish to use market mechanisms, such as ETS or crediting mechanisms, may need to conduct ITMO transactions throughout the NDC period as the mechanisms usually involve a continuous flow of units across several years. This could be a potentially important consideration for many Parties as the bulk of ITMO transactions could come from emission reductions traded via ETS and crediting mechanisms (Howard, 2018[8]).

Two accounting methods – the "multi-year trajectory" and "yearly" methods –under consideration for use by all Parties could imply the application of annual corresponding adjustments. For Parties with single-year NDCs, it is not clear whether and how they would make corresponding adjustments for emissions in non-target years. Further, some Parties – including those with multi-year NDCs – may prefer to signal which emission reduction transfers they would recognise as ITMOs only until their final NDC accounting. In this case, these Parties may prefer not to apply corresponding adjustments during the NDC period. Further technical examination and clarity on whether and how to enable annual corresponding adjustments may be useful to address these possible issues.

"Target year only" and "multi-year trajectory" methods: practical and political feasibility

A technical challenge associated with the "target year only" method is the need to generate emission reductions and transfer them as ITMOs within the same year. For example, there may be some delays between generating reductions and transferring them as ITMOs if many processes are involved, including recording the emission reductions in possible registries and other reporting and verification processes.

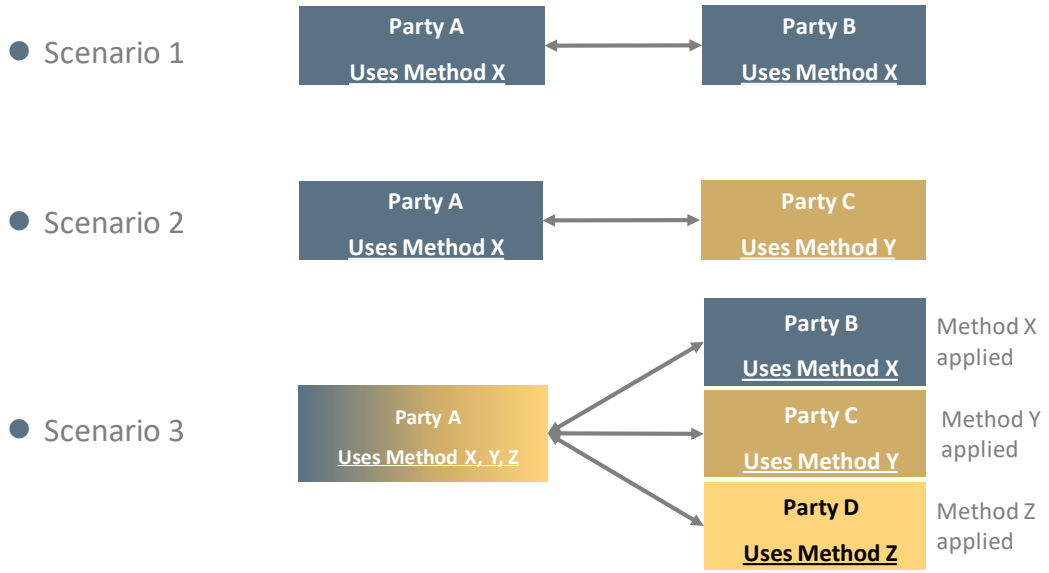
The use of the "multi-year trajectory" method would require Parties to provide multi-year trajectories and doing so may not be politically feasible for all Parties. Indeed, only one Party (South Africa) has thus far communicated a trajectory-based NDC target whereas the rest have single-year targets or multi-year budgets. Parties with multi-year budgets using this method could potentially consider providing an indicative trajectory while using a multi-year budget as the accounting basis.

A choice in accounting method can have implications on how Parties trade

A menu of different accounting methods that Parties with single- and multi-year NDCs could choose from to account for their ITMO transactions is currently under consideration. The accounting method used by Parties could influence their choice of trading partners, either because some combinations of methods may be incompatible or because of possible stipulations requiring trading partners to use the same method. Evidently, different factors could affect a Party's choice of a trading partner (e.g. ambition of the transferring Party's NDC or the ETS generating/using the ITMOs); the choice of accounting method could also

affect the decision. This section explores below different possible scenarios and the implications if Parties could choose from a menu of different accounting methods.

Figure 1. Three possible trading scenarios, if Parties can choose between different accounting methods



Source: Authors.

The first scenario is one where a Party would use only one method consistently over the NDC period and use the same method as their trading partner. One advantage of this scenario could be that the accounting calculations are straightforward as both Parties make the same corresponding adjustments. However, as Parties could only trade with others that use the same accounting method, the number of possible trading partners would be restricted. Moreover, a Party that has the potential to transfer or acquire a large amount of ITMOs may heavily influence the method other Parties would use.

In the second scenario, two trading partners can each use different accounting methods to engage in Article 6.2 transactions, but each Party would use only one method consistently throughout its NDC period. In this scenario, trading partners could potentially make different corresponding adjustments towards each of their NDCs depending on the different methods used. Application of different corresponding adjustments by each trading partner may not necessarily lead to environmental integrity or double counting risks if Parties each use methods that contain safeguards against these risks. For example, a Party with a multi-year NDC using a "cumulative" method acquiring ITMOs from a Party with a single-year NDC using the "averaging" method may not necessarily raise environmental integrity risks if both Parties ensure that the ITMOs transacted are accounted for and double counting has been avoided. For some methods however, e.g. the "target year only" method, it would be important to ensure both Parties use the same method and have the same target year to ensure environmental integrity (Schneider et al., 2017[9]).

A third scenario is that a Party would use the same accounting method as the trading partner for each transaction, but a different accounting method for every trading partner that uses a different method. This would mean that one Party could be using multiple accounting methods and applying different types of corresponding adjustments during its NDC period

to account for its NDC. The Party applying multiple accounting methods would need to keep track of which accounting method was used for which trading partners. Moreover, if there are many transactions with several Parties, it could significantly complicate the accounting exercise for the Party. Although it is technically possible to calculate a final corresponding adjustment after applying different accounting methods, such complicated accounting calculations could reduce the overall clarity and transparency on how Parties apply the corresponding adjustments. This lack of clarity and transparency could potentially increase double counting risks. It could also be important to consider – in developing possible Article 6.2 guidance – whether a detailed level of reporting and review of information on Parties' transactions and methods would then be needed to ensure the avoidance of double counting. Finally, in this scenario, trading partners would have to still mutually agree over a method that they both use consistently over their NDC implementation periods. A transferring or acquiring Party may wield greater power in such a negotiation depending on the prevailing market conditions, thereby potentially influencing another Party's choice of accounting method.

Any possible Article 6.2 guidance could narrow down the list of accounting methods available to Parties to those that would ensure environmental integrity. Possible guidance could also ask Parties to use only one method consistently throughout the NDC period to facilitate clarity and transparency of the accounting calculations. A narrow menu of options could also, all else being equal, increase the chances of finding trading partners that use the same method, regardless of the accounting method chosen. Overall, it could be important for trading partners to ensure that each other's methods and the combination of the methods ensure environmental integrity and avoidance of double counting.

2.1.3. Communicating a possible choice of accounting method

There is no agreement thus far regarding when Parties would indicate which accounting method they would use, if they were able to choose from different methods. Parties could communicate their preferred choice(s) of accounting method(s) for example, at the start of the NDC period (or at least before they engage in Article 6.2 transactions) or before they do their final NDC accounting. Both approaches could present important pros and cons that may need to be considered when developing any future Article 6.2 guidance. Indicating the choice(s) up-front could help Parties understand if and how they can engage in Article 6.2 transactions with their trading partners while applying robust accounting principles. On the other hand, Parties may wish to wait until the end of the NDC period to indicate their choice(s), if and when they could have a better understanding of their emissions performance. For example, if a Party with a single-year NDC has made domestic mitigation efforts throughout their NDC period and is on track to meeting its NDC but has experienced an unexpected one-off increase in emissions in the target year, it could prefer to use a "target year only" method and seek to acquire ITMOs from another Party that is using this method.

Some Parties are considering the possibility of using accounting methods also during the NDC implementation period (Mace, 2019[10]). If Parties are considering applying accounting methods during the NDC period, this could affect any decision on when Parties are to communicate their choice(s) of accounting methods. Parties could potentially apply the accounting methods when calculating and reporting the ITMOs-adjusted emissions balance required by paragraph 77(d) of Article 13 Modalities, Procedures and Guidelines

(MPGs) agreed at COP24 (UNFCCC, 2018[2]).[11,12] It is not yet agreed whether Parties could apply accounting methods when reporting this balance and further technical examination of this option could be useful.

[11] The procedural decision text under Article 6 of the Katowice Climate Package notes that information provided in a structured summary referred to in paragraph 77(d) is without prejudice to subsequent decisions under Article 6 (UNFCCC, 2018[2]).

[12] Paragraph 77(d) requires Parties that participate in co-operative approaches that involve *inter alia* the use of ITMOs towards an NDC under Article 4 to report an emissions balance that is adjusted to take into account ITMO flows (UNFCCC, 2018[2]).

3. Technical analysis of a possible transition of Kyoto Protocol activities and units to the Article 6.4 mechanism

Article 6.4 of the Paris Agreement introduces a mechanism "to contribute to the mitigation of greenhouse gas emissions and support sustainable development", by generating "real, measurable, and long-term benefits related to the mitigation of climate change" (Decision 1/CP.21, paragraph 37(b)). Hereinafter, this paper uses the shorthand "A6.4ERs" to refer to any emissions reductions resulting from the Article 6.4 mechanism.

This section begins with an overview of some of the unresolved issues in the negotiations under Article 6.4. It then provides some background about carbon markets in international negotiations (section 3.1). The section also analyses the implications of options for a potential transition of activities and a potential transition of units of the Kyoto Protocol (KP) mechanisms to the Article 6.4 mechanism. First, it describes the current areas of debate for the potential transition of activities (section 3.2) and then discusses issues related to and puts forward options for the potential transition of units (section 3.3). The implications of different options are assessed, supported by quantitative analysis.

The following is a non-exhaustive summary of issues still under discussion in Article 6.4 negotiations:

- **Accounting and avoidance of double counting**: According to Article 6.5 of the Agreement, A6.4ERs "shall not be used to demonstrate achievement of the host Party's NDC if used by another Party to demonstrate achievement of its NDC". There is however no consensus yet on the accounting methods to be used to achieve this aim.
- **Potential transition of Kyoto Protocol mechanisms to the Article 6.4 mechanism**: Whether and how elements of KP mechanisms could transition into the new Article 6.4 mechanism is under debate. Discussions around this issue are on three main levels: transition of activities (e.g. projects), transition of units and transition of rules and methodologies. The possibility of deferring discussions on these transitions to after agreement on the rules of the new mechanism is also under debate.
- **Eligibility of activities and units not covered by the scope of NDCs**: Article 6.4 does not explicitly mention whether the mitigation activities must fall within the scope of the NDC of the host Party. There is no consensus yet on issuing A6.4ERs from sectors outside the scope of a Party's NDC.
- **Share of Proceeds**: Article 6.6 indicates that a share of proceeds from activities under the Article 6.4 mechanism will be levied. The percentage to apply and the modalities of its application (e.g. if levied once, and if so when - at issuance or at the first transfer; or if levied at every subsequent transfer, and if so, if applied at a constant, progressive or decreasing rate) are under discussion.
- **Overall Mitigation in Global Emissions (OMGE):** Article 6.4(d), states that the Article 6.4 mechanism "shall aim to deliver an overall mitigation in global emissions". How OMGE will be delivered in practice is yet to be agreed. Examples of options under discussion include the delivery of OMGE by: leaving some A6.4ERs unused or uncredited at issuance/first transfer; a discount applied at either

acquisition or point of use towards NDCs; the application of conservative baselines or baselines that are below business-as-usual; the application of conservative default factors. It has also been suggested that the availability of the mechanism itself could be considered to deliver OMGE.

3.1. The Kyoto Protocol Flexibility Mechanisms and the Article 6.4 mechanism

In 1997, Articles 6, 12 and 17 of the KP introduced three "flexibility mechanisms": the Joint Implementation (JI), the Clean Development Mechanism (CDM) and International Emissions Trading (IET).[13] The mechanisms aimed to provide flexibility for Annex B Parties[14] to meet compliance targets cost-effectively. Additionally, the CDM has the further purpose to assist Non-Annex I Parties[15] in achieving sustainable development (UNFCCC, 1998[11]).

Domestic and bilateral market-based mechanisms have since developed alongside and with varying degrees of integration with the KP mechanisms, for example the European Union Emissions Trading Scheme (EU ETS), the linked California and Québec Cap-and-Trade Programmes, the New Zealand ETS, the Swiss ETS, the Korea ETS and the Joint Crediting Mechanism (JCM) of Japan, among others. These have continued to develop independently of a centralised international framework, creating a complex mosaic of evolving carbon markets.

Some of the KP mechanisms are still in use, generating emission reduction credits and, in some cases, could potentially continue to do so for several years, for example due to renewable crediting periods in CDM.[16] That said, the second commitment period of the KP

[13] The CDM allowed Annex B Parties to offset their emissions by purchasing Certified Emission Reductions (CERs) issued by projects based in Non-Annex I Parties (Parties without a commitment under the KP). One CER equals one metric tonne of CO_2 equivalent. Annex B Parties can use CERs for compliance in addition to Assigned Amount Units (AAUs) and Emission Reduction Units (ERUs).

JI allowed Parties included in the Annex B of the Kyoto Protocol to offset their emissions by purchasing ERUs generated by mitigation projects in other Annex B countries. "Annex B" consists of Parties of the Annex I of the UNFCCC and economies in transition. Annex B countries have binding emission reduction targets under the KP, expressed in AAUs. The host Party can convert the ERUs in AAUs.

The IET allowed trading of AAUs from national emissions budgets between Annex B Parties.

[14] Annex B Parties of the KP have committed to an emission reduction or a limitation commitment as a percentage of that Party's emissions in its base year or period (UNFCCC, 2019[31]). The Annex B of the KP includes developed countries (Annex I Parties to the UNFCCC) and economies in transition.

[15] Non-Annex I Parties are those Parties that have ratified the UNFCCC but are not included in Annex I of the Convention.

[16] For instance, the modalities and procedures of the CDM (Article 12, paragraph 12 of the Kyoto Protocol) define the maximum crediting period for CDM project activities to be 21 years (a 7-year period renewable at most twice). The crediting period could be even longer for programmes of activities (PoAs – 28 years) and for Afforestation and Reforestation (fixed 30-year period for projects and up to 60 years for PoAs). Therefore, a recently registered CDM project could potentially be able to generate CERs for many years post-2020.

will run until 31 December 2020 and the end of the true-up period[17] is expected by mid-2023. Therefore, the future of the KP mechanisms in the post-2020 era - including CDM – is currently uncertain (Chagas, Greiner and Hunzai, 2017[12]; Schneider and La Hoz Theuer, 2017[13]; Michaelowa et al., 2015[14]).

The international discussions on post-2020 long-term co-operative mitigation action have included a market component from the outset[18], culminating in Article 6 of the Paris Agreement. Article 6.4, in particular, establishes a mechanism to contribute to the mitigation of GHG emissions and support sustainable development, under international oversight through UNFCCC.

The Paris Agreement does not explicitly call for a transition of the KP mechanisms into Article 6. However, Parties included this issue as one of the discussion topics of the "Rules, modalities and procedures for the mechanism established by Article 6, paragraph 4, of the Paris Agreement" at the 49th session of SBSTA. Other Parties have suggested deferring discussions on the transition. Some Parties have also suggested other means by which KP mechanisms could be used as part of the Paris Agreement, such as through Article 6.2, provided this is in line with Article 6.2 guidance.

The discussions on the potential transition of Kyoto Protocol mechanisms[19] into the Article 6.4 mechanism are on three main levels:

- **Transition of activities**: the possibility of migrating the current CDM and JI projects and programmes of activities (PoAs) to the Article 6.4 mechanism;
- **Transition of units**: the possibility of allowing CDM units (Certified Emission Reductions - CERs) and JI units (Emission Reduction Units - ERUs) issued pre-2020 to be used post-2020 under the Article 6.4 mechanism;
- **Transition of baseline and monitoring methodologies and other rules**: the possibility of the Article 6.4 mechanism using the baseline and monitoring methodologies, modalities and procedures, accreditation standards, etc. developed under the KP mechanisms.

Among the three KP mechanisms, the CDM is the most heavily used in terms of volume of units issued, mitigation activities registered and number of participating Parties (Michaelowa, 2017[4]; Morel and Shishlov, 2014[15]; UNEP DTU, 2019[16]). Therefore, the focus of this paper is on the potential transition of activities and units from CDM to the Article 6.4 mechanism.[20] A technical examination of these issues, including a quantitative

[17] Annex I Parties that have not fulfilled their KP commitments by the date of the completion of the expert review process may use an additional period of 100 days for fulfilling their commitments. During this period, referred to as "true-up period", a Party may continue to acquire, and other Parties may transfer to such Party, ERUs, CERs, AAUs and removal units under Articles 6, 12 and 17 of the Protocol, from the preceding commitment period (UNFCCC, 2019[32]).

[18] The UNFCCC negotiations have explored various market-based concepts; such as the New Market-based Mechanism (NMM - Decision 2/CP.17; paragraph 83) and the Framework for Various Approaches (FVA - Decision 2/CP.17; paragraphs 79 and 80) (UNFCCC, 2012[28]).

[19] IET was established to allow the trading of AAUs allocated to Annex B Parties under the KP. Its functions will therefore not be relevant under the NDC approach of the Paris Agreement.

[20] This paper does not examine the transition of JI (activities, units, methodologies and rules) nor of the CDM methodologies and rules into the Article 6.4 mechanism. The latter has benefited from

analysis of a potential transition of units, is provided as context to inform the ongoing negotiations on this topic.

3.2. Potential transition of CDM activities

One question under debate regarding the potential transition of activities into the Article 6.4 mechanism is around which CDM activities could be eligible to migrate. The main options currently under discussion are the transition of all existing activities, the transition of a limited number of activities and no transition of activities. Each of these options assumes that even CDM activities complying with the rules of the Article 6.4 mechanism would need to re-register under the Article 6.4 mechanism governance process, as well as to (re-)obtain authorisation from the relevant Parties to participate in the new mechanism. A decision on the potential transition of CDM activities could be taken independently of any potential decision on the transition of units to the Article 6.4 mechanism. Therefore, the discussions around these two potential transitions are kept separate in the analysis.

3.2.1. Potential full transition of CDM activities

With a full transition, Parties may decide to re-register existing registered CDM activities under the new mechanism. This could inhibit or at least delay the development of new, additional mitigation activities under the Article 6.4 mechanism. In fact, a full transition could allow credits to be generated in the Article 6.4 mechanism without requiring greater emission reductions beyond those that may have occurred in the absence of the mechanism.

Notwithstanding these risks, a potential full transition of existing CDM activities could have positive implications for the creation of an Article 6.4 market. It could help to rapidly establish a pipeline of mitigation activities for the market under the Article 6.4 mechanism, because it would build on the existing CDM activities pipeline. A potential full transition of existing CDM activities would also allow on-going projects and PoAs at risk of ceasing operations if the CDM incentive is removed (so-called "vulnerable activities"[21] in the literature) to keep mitigating GHG emissions and issuing credits under the Paris Agreement. However, as shown by Warnecke et al. (2017[17]), the risk that ongoing mitigation activities will be discontinued without further support by CDM only applies to a small fraction of activities. Furthermore, a full transition of activities could boost private sector confidence in the mechanism, if it is interpreted as a recognition of past investments and as an incentive to continue engaging with UNFCCC market mechanisms.

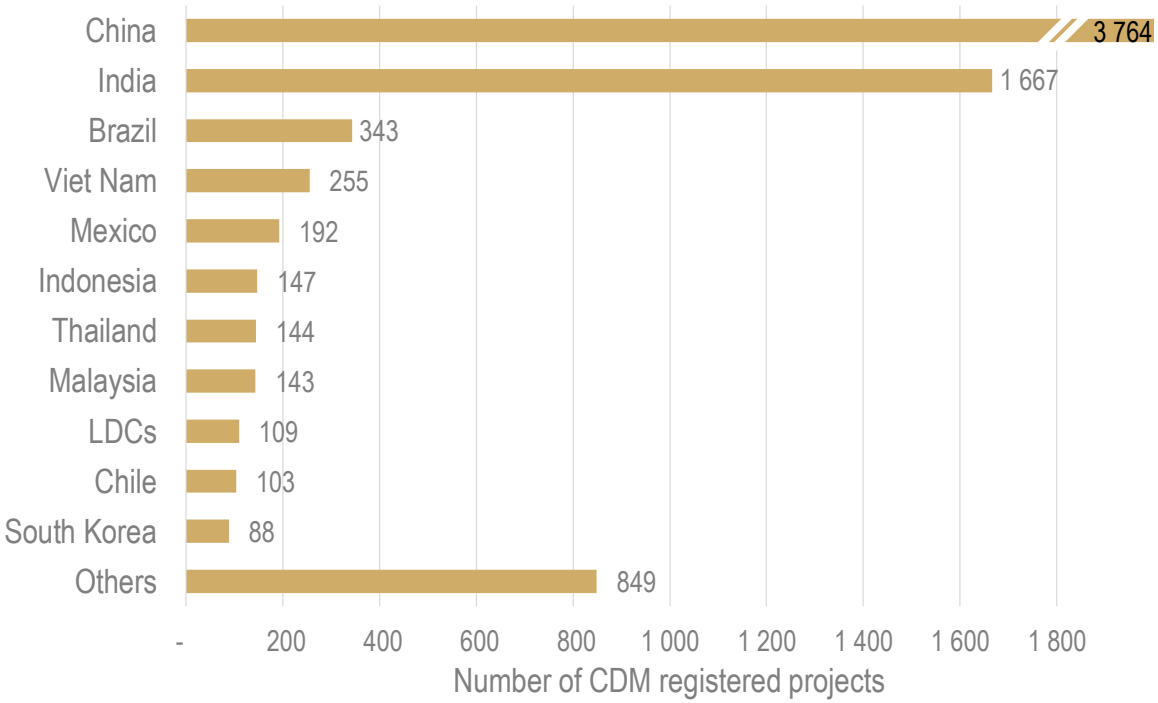
3.2.2. Potential transition of a limited number of CDM activities

Parties could also choose to limit the transition of activities, for instance, to reduce the potential negative impacts of a full transition, or to promote specific types of activities or the development of mitigation actions in specific regions (Greiner et al., 2017[17]). The current geographical spread of CDM projects is, in fact, uneven across countries (see Figure 2).

other studies (see for instance, (Fearnehough et al., 2018[24]), (Greiner et al., 2017[17]), (Michaelowa and Hoch, 2016[37]), (Schneider and La Hoz Theuer, 2017[13])and (Warnecke et al., 2019[26])). However, both topics could benefit from further work.

[21] According to (Warnecke et al., 2019[26]), projects are considered "vulnerable" if they have ongoing operational costs but insufficient financial benefits beyond CER revenues to maintain the GHG abatement or if they face important non-financial barriers.

Figure 2: Number of registered CDM projects on 31 December 2018 by selected host countries



Note: The chart considers CDM projects only (not PoAs). The total number of CDM registered projects on 31 December 2018 is 7 804. "LDCs" are Least Developed Countries. The category "Others" excludes LDCs and contains only non-LDC Parties with less than 80 registered projects.
Source: Authors.

Some examples of non-mutually exclusive options to limit the transition of activities include allowing the transition of: PoAs only; activities registered in the KP second commitment period only; CDM activities from certain sectors or technology types only; the transition of only those activities that are likely to cease functioning if the CDM incentive is removed. These options could help ensure the continuity of the mitigation component of some CDM activities that are vulnerable to discontinuing.

3.2.3. Potential no transition of activities

Finally, Parties could choose that no transition of CDM activities to the Article 6.4 mechanism is allowed.[22] Downsides to this option could include slower establishment of the Article 6.4 mechanism activities pipeline, which may have to be built from scratch and may not be able to leverage on the existing CDM activities pipeline. This option could also imply the termination of support to the small fraction of CDM mitigation activities that would not be able to continue without the incentives from CDM (Warnecke et al., 2017[18]).

[22] However, theoretically if Parties decided to allow the continuation of the CDM post-2020, but not to allow its transition into Article 6.4, some Parties could potentially decide to use post-2020 CDM activities to generate post-2020 CERs that could potentially function as ITMOs to be used under Article 6.2 towards NDCs and be accounted for following the possible Article 6.2 guidance. This option is not analysed in this paper.

3.3. Potential transition of CDM units (CERs)

In this analysis, the potential transition of units refers to the possibility of carrying-over, into the Article 6.4 mechanism, pre-2020 CERs issued but not yet used.[23] The two options analysed in this paper are the transition of all available CERs and the transition of a limited number of available CERs (the logical third option of no transition is not covered explicitly because its implications are the exact opposite of transitioning all available CERs).

3.3.1. Potential full transition of available CERs

A full transition of available CERs carries a strong risk that the Article 6.4 mechanism might not generate emission reductions beyond those that may have occurred in the absence of the mechanism, potentially putting at risk environmental gains. The potential transition could reduce the incentive to invest in new mitigation activities under the Article 6.4 mechanism, because some Parties (and potentially private sector actors, via voluntary schemes or ETS) may decide to make use of pre-2020 CERs, issued from already implemented CDM activities, towards post-2020 mitigation targets, rather than investing in new mitigation activities issuing A6.4ERs. As well as representing reductions realised before the NDC period, pre-2020 CERs were issued in the absence of any corresponding adjustment for host Parties, adding a further question mark on whether and how these credits could be used towards post-2020 mitigation targets. However, if there were an accounting provision for the Article 6.4 mechanism that required Parties to carry out a corresponding adjustment on pre-2020 CERs, there would be less risk to undermine the environmental gains that could potentially be achieved via the mechanism (Schneider and La Hoz Theuer, 2017[13]). Despite these risks, a full transition of units could be seen as increasing the diversity of options for meeting NDC targets[24] and could generate liquidity in the Article 6.4 mechanism from the start. Private sector confidence in UNFCCC mechanisms may also be boosted, for example because project developers could continue to sell the CERs, in the post-2020 period.

The potential environmental risks of a full transition of CERs are borne out by a quantitative estimation of the supply and demand balance for CERs up to and after 2020. The analysis, carried out for this paper, suggests that the potential supply of CERs is several times greater than the likely demand to 2020. The next paragraphs briefly explain the steps of the analysis.

Supply: volume of available CERs

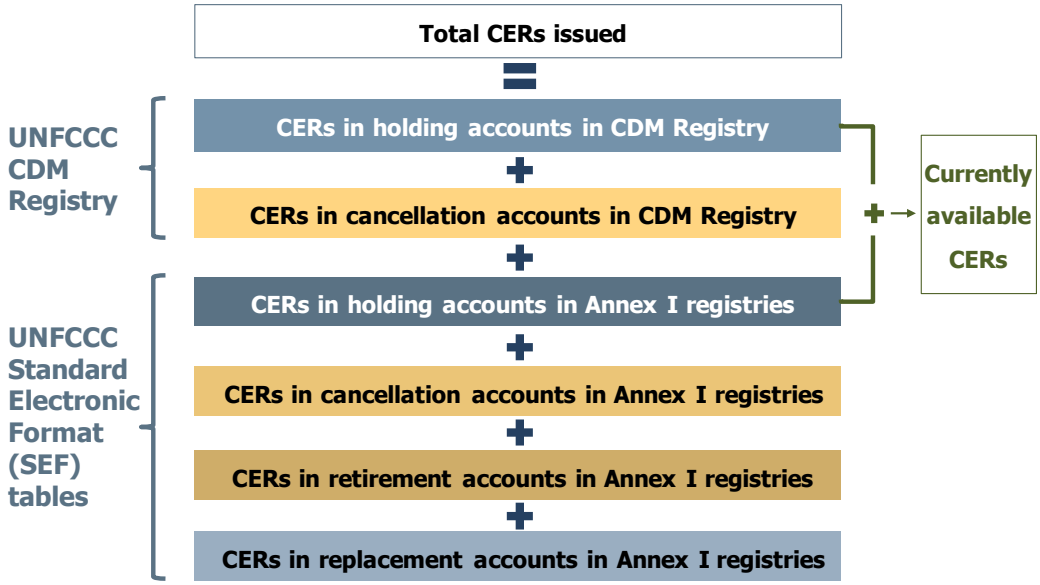
To understand the magnitude of the potential volume of CERs that could potentially transition in the Article 6.4 mechanism, the paper estimates first the current volume of available CERs and then makes considerations on the potential future supply and demand of CERs to 2020. A summary of the methodology used is presented in Figure 3 and more details are reported in Annex A. First, the approximate current total volume of the available CERs is estimated. This is calculated as the difference between the total CERs issued in the first and second Kyoto commitment periods (CP1 and CP2, respectively) and the total

[23] By "used CERs" in this context, it is meant those CERs that have been cancelled or retired. The pre-2020 CERs issued but not yet used are hereafter referred to as "available CERs".

[24] Another means that pre-2020 (internationally transferred) CERs could in theory influence post-2020 NDC targets would be if Parties considered them as ITMOs to be used under Article 6.2 towards NDCs, provided this is in line with Article 6.2 guidance.

CERs already used. Using publicly available data from the UNFCCC CDM registry (UNFCCC Secretariat, 2019[19]) and Standard Electronic Format (SEF) tables of Annex I Parties (UNFCCC, 2019[20]), the analysis estimates the amount of CERs available globally. The amount of available CERs issued from projects in the top five CERs issuer countries was also calculated. These are China, India, Republic of Korea, Brazil and Mexico, which collectively represent over 85% of the total CERs issued to date. The amount of available CERs from the group of Least Developed Countries (LDCs)[25] and the African Group of countries (not including LDCs) was also estimated.

Figure 3: Summary of the methodology used to calculate the amount of currently available CERs



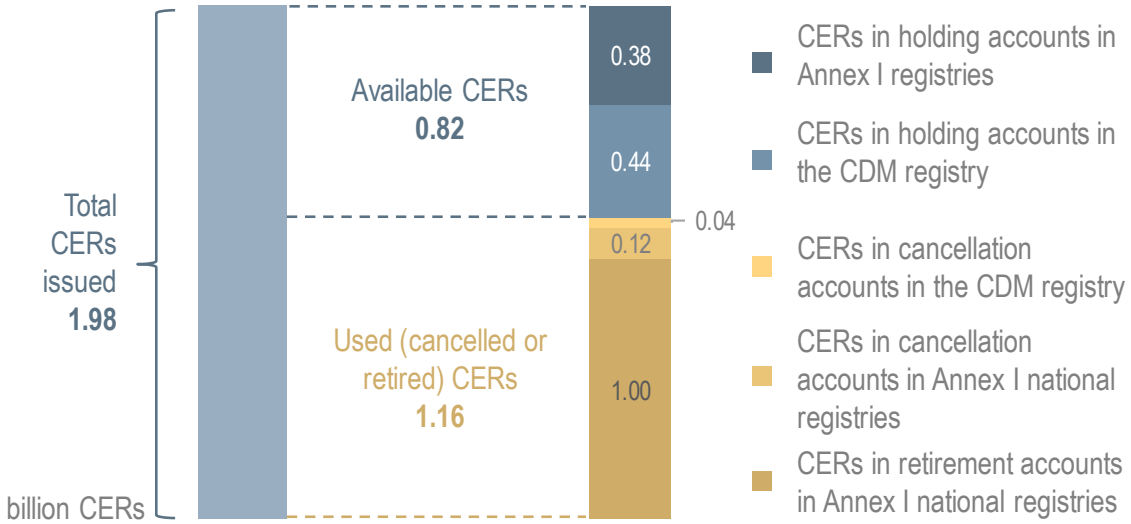
Source: Authors.

The global amount of available CERs is calculated to be around 819 million CERs.[26] This corresponds to around 41% of the total CERs issued by 31 December 2018, estimated to be about 1 980 million CERs (UNFCCC Secretariat, 2019[19]). Figure 4 summarises these findings.

[25] As of December 2018, 47 countries are classified as LDCs by the UN (UN CDP, 2019[27]).

[26] The volume of used CERs is calculated by summing the CERs in the cancellation accounts in the CDM registry (39 M CERs) and the CERs in the retirement (1 003 M CERs), cancellation (119 M CERs) and replacement accounts (no CERs) of Annex I National Registries. The available CERs volume is then estimated as the sum of the CERs in the holding accounts in the CDM Registry and those in the holding accounts in Annex I National Registries. The CDM Registry data also includes the CERs in the "pending accounts", for which the CERs issuance fee has not been paid yet. Therefore, the CERs in the pending accounts are only factually available after the CER issuance fee has been paid.

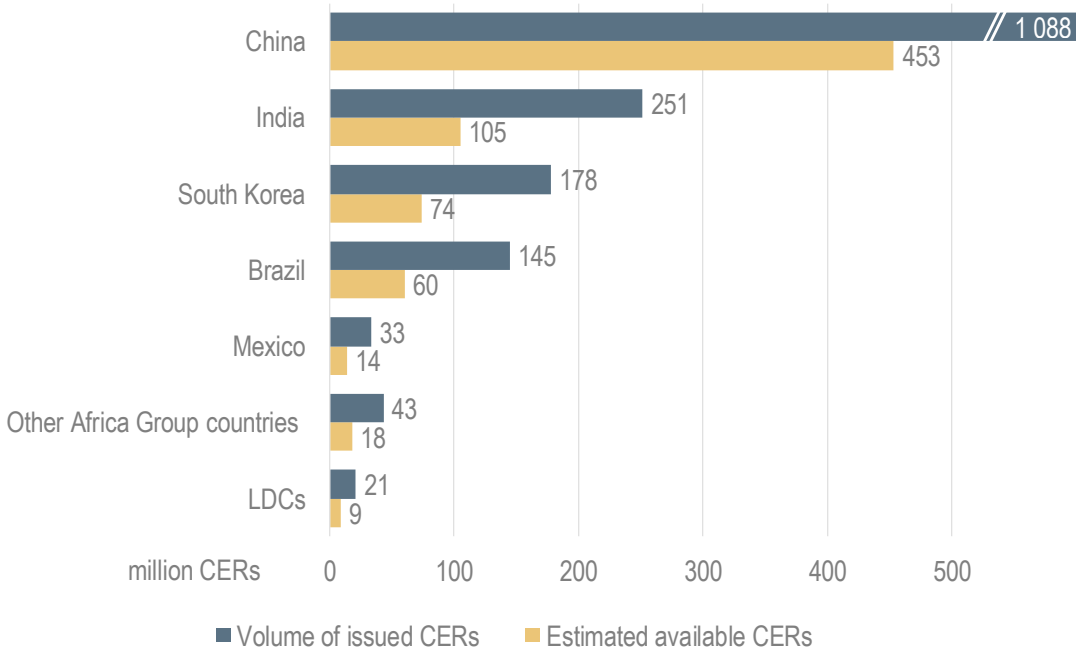
Figure 4: Breakdown of CER uses as at 31 Dec 2018



Source: Authors. Data sources: UNFCCC Secretariat, Standard Electronic Format (SEF) tables.

The analysis also estimates the amount of available CERs per country as at 31 December 2018, following a pro-rata approach (see Annex A). The results show that the issuance of CERs is spread very unevenly across countries. China alone represents 55% of the total CERs issued, followed by India at 13%, South Korea at 9% and Brazil at 7%. LDCs countries collectively represent 1% of the total CERs issued, while other Africa Group countries around 2%. Figure 5 illustrates these results.

Figure 5: Volume of issued CERs and estimated volume of available CERs for the countries analysed as at 31 December 2018



Source: Authors. Data sources: Volume of issued CERs: UNFCCC Secretariat; Estimated available CERs: own calculation through a pro-rata approach (see Annex A).

Supply: potential supply of CERs up to 2020

The potential supply of CERs up to 2020 also needs to be taken into account to provide a full picture of the potential transition of CERs into the Article 6.4 mechanism. The current CDM rules allow registered projects that are not currently issuing CERs but where activities have continued, to retroactively issue CERs at any time within their crediting period, provided that they have a monitoring system in place (Greiner et al., 2017[17]; Schneider et al., 2017[21]). There are many such "dormant"[27] projects that could quickly restart CERs issuance if market conditions change. A market signal (e.g. transition to the Article 6.4 mechanism, a spike in demand or a CERs price recovery) could lead "dormant" projects developers to request CERs issuance for those emission reductions that have been monitored continuously in the past.[28] To understand the magnitude of this potential it is interesting to note that, for the top five issuers only, there are currently around 3 500 "dormant" registered projects in the CDM pipeline.[29] Moreover, of the total of 7 804 CDM projects registered and at validation stage, only 3 165 have issued CERs (UNEP DTU, 2019[16]). A study conducted by Warnecke et al. (2019[26]) reported that 90% of CDM

[27] As per the definition of UNEP-DTU, a project is considered dormant if the UNFCCC had no contact with it since 2013 or earlier.

[28] The actual CERs issuance depends on the demand and the credit prices (Schneider et al., 2017[21]).

[29] Own calculation, based on (UNEP DTU, 2019[16]); Data as at January 2019).

projects still operate the GHG mitigation activity component, and 89% still have a CDM monitoring system in place. It is therefore possible that an agreement on transitioning CERs might trigger the "dormant" projects to issue a high volume of CERs in the pre-2020 period.

Given these uncertainties, several estimations of potential CERs supply up to 2020 exist.[30] These vary from 4.65 billion CERs over the period 2013-2020 (Schneider et al., 2017[21]), to 2.3 billion CERs over the period 2016-2020 (Greiner et al., 2017[17])[31] and to 2.3-5.4 billion CERs up to 2020 (UNFCCC, 2019[22]).[32] These estimates are difficult to compare as they are calculated using different assumptions and with different scopes. For the purpose of this paper, the estimates of Schneider et al. (2017[21]) have been used.

Potential demand for CERs

The outlook for demand for CERs remains unclear, with estimates that vary significantly depending on the assumptions taken (World Bank, Ecofys and Vivid Economics, 2018[23]). One estimate of the potential demand for CERs is approx. 0.32 billion CERs up to 2020 (Fearnehough et al., 2018[24]). The estimation of this demand includes the potential demands from compliance under CP2 of KP, from results-based financing mechanisms (e.g. from development banks and other agencies) and from the voluntary market.

Another possible potential source of demand for CERs after 2020 could be the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). This is a global market-based mechanism developed outside the UNFCCC by the International Civil Aviation Organization (ICAO) "to address any annual increase in total CO_2 emissions from international civil aviation above the 2020 levels" (ICAO, 2019[25]). From 2020, CORSIA will offset any GHG emissions that exceed the average baseline emissions of 2019 and 2020. Negotiations on the design of CORSIA are currently undergoing. Depending on how these will develop, there could be important implications for the market of the Article 6.4 mechanism. CORSIA could become a significant source of demand for CERs after 2020. Fearnehough et al. (2018[24]) estimate the potential demand from CORSIA to be around 0.12 billion emission reduction units until 2023 (CORSIA pilot phase), rising to 0.27 billion emission reduction units from 2024 to 2026 (CORSIA phase 1), and then an additional 2.32 billion from 2027 to 2035 (CORSIA phase 2). However, it is not predictable at the moment the exact proportion of this demand that could be met with CERs or with other type of emission reduction units (including potentially A6.4ERs).

Considerations for the Article 6.4 mechanism of the potential supply and demand of CERs under a full transition

Figure 6 summarises the estimated potential supply and demand of CERs. The volume of currently available CERs (0.8 billion CERs) is much lower than the potential supply up to 2020 (4.7 billion CERs). Therefore, the volume of potentially available CERs in 2020 could

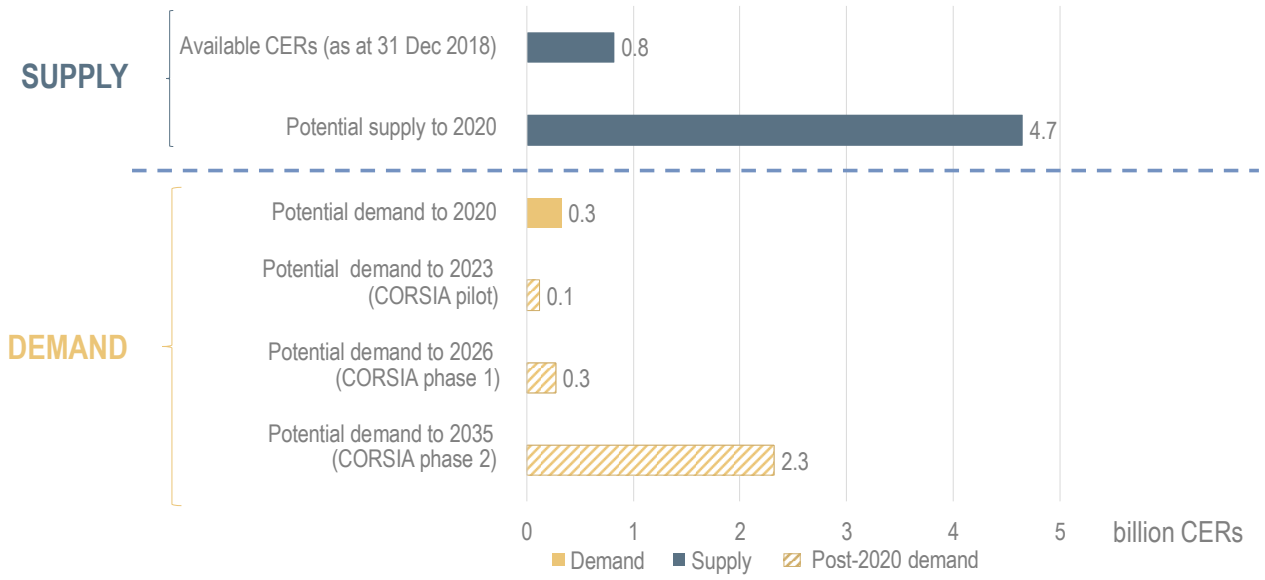
[30] This paper does not estimate the potential supply of CERs itself. As indicated by Schneider et al. (2017[21]), other previous estimates were also conducted by (Bailis, Broekhoff and Lee, 2016[29]), (Cames, 2015[30]), (Kuriyama, 2017[33]), (Warnecke, Day and Klein, 2015[34]), (Warnecke, Day and Tewari, 2015[35]), (World Bank, Ecofys and Vivid Economics, 2016[36]).

[31] Maximum issuance potential for CP2 registered projects.

[32] The UNFCCC Secretariat estimates that the potential incremental CERs supply up to 2020 is between 2.3 billion CERs (only from projects that have previously issued CERs) and 5.4 billion CERs (including all registered projects).

be several times higher than the likely demand to 2020 (0.3 billion CERs). A full transition of available CERs would then be likely to heavily dilute the market of the Article 6.4 mechanism from the outset. This could lead to low credit prices, and less incentive for private sector investment in new Article 6.4 mechanism activities. A full transition of CERs could then potentially undermine the development of new mitigation actions under the new mechanism, putting at risk the environmental gains of the mechanism.

Figure 6: Estimated supply and potential demand of CERs (including CORSIA)



Note: The potential demand of CORSIA is expressed in emission reduction units, because it is not predictable at this stage what proportion of this demand will be met with CERs or with other type of emission reduction units.
Source: Authors. Data sources: Available CERs: own calculation; Estimated potential CERs supply 2020: (Schneider et al., 2017[21]); Demand: (Fearnehough et al., 2018[24]).

3.3.2. Potential transition of a limited number of available CERs

Parties could also choose to limit the eligibility of which CERs can transition into the Article 6.4 mechanism. As for the options for limiting transition of activities (section 3.2.2), many possible design options could be considered to limit the volume of transitioning. These include national or international restrictions on CERs from certain geographies, or from certain project types, for example depending on how likely they are to cease their mitigation activities in the absence of a market for CERs.

This paper has analysed three main options for limiting the carry-over of CERs to estimate, where possible, the volume of currently available CERs and the potential supply of CERs to 2020 from these options, drawing on the available literature.[33] The results are summarised in Table 3. Further work, including assessing possible combinations of these and other options for limiting the transition of units, would be beneficial to further inform discussions around these topics. The options analysed in this paper are:

[33] Refer, for instance, to: (Greiner et al., 2017[17]), (Schneider and La Hoz Theuer, 2017[13])and (Warnecke et al., 2019[26]).

- **Option 1: Geographic restriction:** This option consists of limiting the carry-over of CERs by applying a geographic restriction, of which two variants are considered:
  - Variant 1: The first variant limits the carry-over to only those CERs issued by project activities and PoAs based in least-developed countries (LDCs). The estimated volume of currently available CERs that could potentially transition under this option is estimated at around 6 million CERs, while the potential supply to 2020 is estimated at about 140 million CERs, lower than the currently estimated potential demand by 2020 (320 million CERs – see previous section). This variant would have a relatively limited effect on the dilution of the Article 6.4 mechanism.
  - Variant 2: The second variant broadens the scope of available CERs to cover other Africa Group countries in addition to LDCs. The estimated volume of currently available CERs that could potentially transition under this option is estimated at around 21 million CERs, while the potential supply to 2020 is estimated at approx. 380 million CERs.
- **Option 2: "Vulnerability" restriction:** This option consists of limiting the carry-over of CERs to only CDM activities at risk of ceasing operations if the CDM incentive is removed. These "vulnerable" activities "have ongoing operational costs but insufficient financial benefits beyond CER revenues to maintain the GHG abatement or if they face important non-financial barriers" (Warnecke et al., 2019[26]). This option analyses two variants:
  - Variant 1: The first variant limits the carry-over to only those CERs issued by project activities and PoAs that are considered highly vulnerable.[34] It was not possible to estimate with the data available the volume of currently available CERs that could potentially transition under this variant. The potential supply to 2020 is estimated at approx. 170 million CERs. This variant would have a relatively limited effect on the dilution of the Article 6.4 mechanism.
  - Variant 2: The second variant broadens the scope of available CERs to cover those CERs issued by project activities and PoAs that are considered vulnerable, in addition to those highly vulnerable. It was not possible to estimate with the data available the volume of currently available CERs that could potentially transition under this variant. The potential supply to 2020 is estimated at approx. 600 million CERs, higher than the currently estimated potential demand by 2020 (320 million CERs – see previous section).
- **Option 3: Time/vintage restriction:** This option would limit the carry-over of CERs to only those issued by project activities and PoAs in the second commitment period of the Kyoto Protocol (CP2 - from 1 January 2013). The estimated supply to 2020 would be around 2 350 million CERs, significantly higher than the estimated demand by 2020 (320 million CERs).

[34] Highly vulnerable activities are those at risk of ceasing operations if the CDM incentive is removed and "have high vulnerability to (or high risk of) discontinuing GHG abatement" (Schneider and La Hoz Theuer, 2017[13]).

Table 3: Estimated volume of currently available CERs and total potential CERs supply up to 2020 for the options analysed limiting the transition of CERs into the Article 6.4 mechanism

Options		**Estimated volume of currently available CERs** *(million CERs)*	**Estimated volume of potential CERs supply to 2020** *(million CERs)*
Option 1: Geographic restriction	Variant 1: Limiting the carry-over of CERs to only those from LDCs countries	6	140
	Variant 2: Limiting the carry-over of CERs to only those from LDCs and other Africa Group countries	21	380
Option 2: "Vulnerability" restriction	Variant 1: Limiting the carry-over of CERs to only those issued by highly vulnerable activities	*N/E*	170
	Variant 2: Limiting the carry-over of CERs to only those issued by vulnerable activities	*N/E*	600
Option 3: Time/vintage restriction	Limiting the carry-over of CERs to only those issued from 1 January 2013 (CP2)	448	2 350

Source: Authors. Estimated volume of currently available CERs: own estimation. Estimated volume of potential supply up to 2020: data from (Schneider et al., 2017[21]). "N/E": not estimated.

A possible combination of these and other restrictions are also possible. Schneider and La Hoz Theuer (2017[13]) have analysed a few of these possible combinations, but further analysis would be beneficial.

4. Conclusions

At COP24, Parties could not reach consensus on the draft rules for Article 6 of the Paris Agreement. Consequently, several technical (as well as political) issues remain unresolved under international negotiations on how to implement Article 6. This paper explores two specific issues in depth: accounting methods for single- and multi-year NDCs under Article 6.2 and the implications of a potential transition of CDM activities and units to the Article 6.4 mechanism.

Article 6.2: Technical analysis on accounting methods for single- and multi-year NDCs

One issue under consideration is how Parties would account for internationally transferred mitigation outcomes (ITMOs) transacted under Article 6.2. Parties that engage in Article 6.2 co-operative approaches "shall" apply robust accounting for the ITMOs, while ensuring environmental integrity and the avoidance of double counting (Article 6.2 of the Paris Agreement). SBSTA is requested to develop and recommend guidance including to ensure Parties avoid double counting on the basis of "corresponding adjustments" for the emissions and removals that are covered by their NDC scope (paragraph 36, Decision 1/CP.21). A corresponding adjustment involves adding acquired (incoming) ITMOs to, and subtracting transferred (outgoing) ITMOs from the emissions balance covered by the Party's NDC.[35]

Five possible accounting methods are under discussion that would determine how Parties apply corresponding adjustments for ITMOs during their final NDC accounting: the "target year only", "averaging", "cumulative", "multi-year trajectory" and "yearly" methods. The "target year only" method would involve ITMO transactions only for the final target year of the NDC, while the others would facilitate ITMO transactions throughout the NDC period. The methods also differ in the calculation method and timing of corresponding adjustments applied by Parties. For example, the "averaging" method would apply a corresponding adjustment at the end of the NDC period that is equal to the average of all ITMO transactions over that period whereas the "cumulative" method would apply an adjustment equal to the cumulative sum. There are also methods that would apply yearly corresponding adjustments ("yearly" method) or adjustments against a multi-year trajectory ("multi-year trajectory" method).

The different methods under consideration have different levels of environmental integrity, particularly if used by Parties with single-year NDCs. For example, the "cumulative" method could present risks to environmental integrity as it would allow for the cumulative sum of ITMO transactions over the whole NDC period to be used towards adjusting emissions in a single target year. The "averaging" method could reduce this risk as it would adjust the target year emissions by the annual average of total ITMO transactions occurring throughout the NDC period. The "target year only" method could also limit this environmental integrity risk as it would limit ITMO transactions to only those emission reductions that are both created and used in the target year.

[35] It is not yet agreed whether Parties would apply a corresponding adjustment for ITMOs first transferred and used or transferred and acquired. The paper does not take a position on this issue and uses the terms "transfer" and "acquire" broadly to refer to outgoing and incoming ITMOs.

It is not yet agreed whether an acquiring Party and a transferring Party need to use the same accounting method when accounting for individual ITMO transactions. If Parties agree on a menu of possible methods, and if trading partners choose different methods, it would be important for them to ensure that methods used are compatible for ensuring environmental integrity and the avoidance of double counting. If trading partners were required to use the same method, a Party could either (i) use only one method consistently throughout its NDC period with every trading partner or (ii) use different methods in its NDC period, for every trading partner that uses a different method. The latter option could potentially lead to a very complex accounting exercise for the Party if there are many transactions throughout the NDC period with several trading partners. If a complex accounting exercise leads to a lack of clarity and transparency in understanding how Parties made the corresponding adjustments, this could raise double counting risks and undermine trust in Article 6.2 transactions.

Any possible guidance under Article 6.2 could consider recommending a single accounting method or a narrow menu of possible accounting methods that ensure environmental integrity. A single method could make implications of ITMO transactions easier to understand, but it could be difficult to find one method that meets all Parties' needs. A narrow menu of possible accounting methods could increase the likelihood of Parties finding trading partners that use the same method, as well as making it easier to understand implications for environmental integrity.

Possible Article 6.2 guidance may also need to consider the timing of when Parties indicate their choice of accounting method, if they are able to choose from several options. Doing so at the start of the NDC implementation period could help Parties identify potential trading partners and could influence Parties' reporting under Article 13. For example, Parties could potentially apply the chosen accounting method to report an ITMOs-adjusted emission balance in the "structured summaries" of their Biennial Transparency Reports, as required by paragraph 77(d) of the Modalities, Procedures and Guidelines (MPGs) under Article 13 agreed at COP24.[36, 37]

Article 6.4: Technical analysis on the implications of a potential transition of Kyoto Protocol mechanisms to the Article 6.4 mechanism

One of the unresolved issues for Article 6.4 is whether and how elements of the Kyoto Protocol market-based mechanisms could transition to the Article 6.4 mechanism. Although not explicitly mentioned by the Paris Agreement, the discussions on this topic under SBSTA are on three main levels: transition of activities (e.g. projects), transition of units and transition of rules and methodologies.

[36] Per paragraph 77(d) of the Article 13 MPGs in the Katowice Climate Package, Parties that participate in co-operative approaches involving ITMO transactions are required to report an emissions balance covered by the NDC that is adjusted for the ITMO flows.

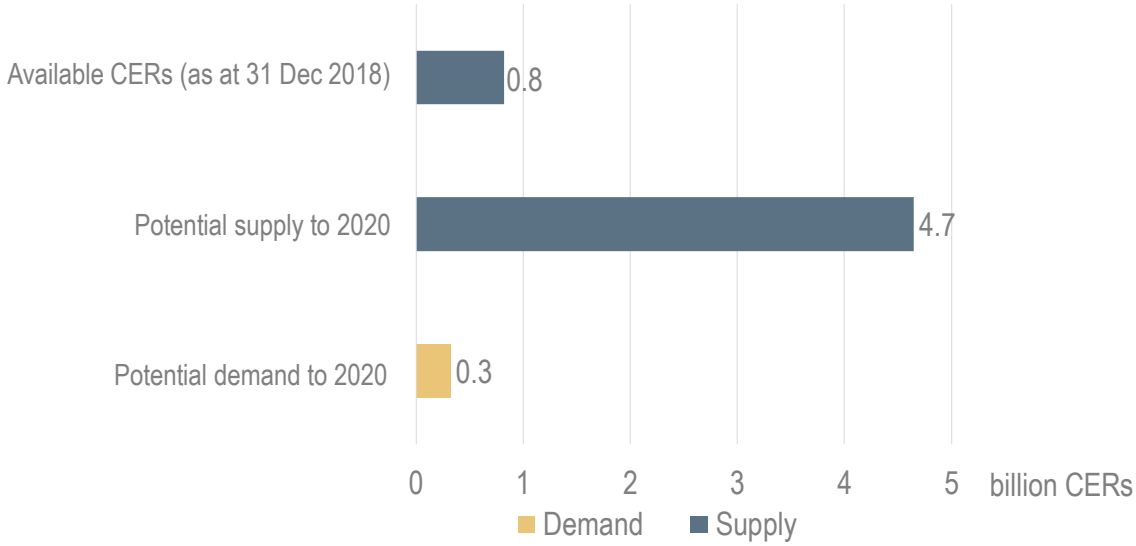
[37] The procedural decision text under Article 6 of the Katowice Climate Package notes that information provided in a structured summary referred to in paragraph 77(d) is without prejudice to subsequent decisions under Article 6.

The first issue analysed is whether existing Clean Development Mechanism (CDM)[38] activities could become eligible to issue units under the Article 6.4 mechanism after 2020, and if so what would be the associated environmental and economic implications. Parties could decide on a full transition of activities, a limited transition, or no transition at all. A full transition would allow all existing registered CDM activities to potentially be re-registered under the new mechanism. This could inhibit, or at least delay, the development of new, additional mitigation activities, because credits could be generated in the Article 6.4 mechanism without requiring greater emission reductions beyond those that may have occurred in the absence of the mechanism. However, a full transition of activities could allow existing CDM projects and programmes of activities, if re-registered in the Article 6.4 mechanism, to constitute a pipeline of mitigation activities under the new mechanism. If Parties decide on a limited transition, i.e. limiting the number of existing CDM activities transitioning, this could reduce the potential negative impacts of a full transition while still potentially providing a boost to the creation of a pipeline of Article 6.4 mechanism activities. The limitation could be used to promote specific types of activities in specific regions, and/or could support the small fraction of CDM mitigation activities that would not be able to continue without the incentives from CDM (so-called "vulnerable activities").

The second issue analysed is the transition of already-issued units into the Article 6.4 mechanism, focusing on the potential carry-over of pre-2020 Certified Emission Reductions (CERs) issued but not yet used (referred to as "available" CERs). This paper estimates the amount of currently available CERs at 0.8 billion CERs as at 31 December 2018, which corresponds to 41% of the total CERs issued cumulatively since the start of the CDM. The potential estimated demand of CERs up to 2020 is 2.5 times lower than this, at 0.32 billion CERs. Moreover, there are many "dormant" projects in the CDM pipeline that could potentially start re-issuing CERs before 2020, if for example a signal is given that such units could be valid for the Article 6.4 mechanism. One estimate of the total potential CERs supply up to 2020 is at around 4.7 billion CERs, which would be roughly fifteen times higher than the estimated demand up to 2020 (Figure 7).

[38] The CDM was chosen as focus of this paper because it is the most used mechanism of the Kyoto Protocol in terms of volume of units issued, mitigation activities registered and number of participating Parties.

Figure 7: Estimated supply and potential demand of CERs



Source: Authors. Data sources: Available CERs: own calculation; Estimated potential CERs supply 2020: (Schneider et al., 2017[21]); Demand: (Fearnehough et al., 2018[24]).

A full transition of CERs could therefore lead to low credit prices, and less incentive for private sector investment in new Article 6.4 mechanism activities, given this significant difference between the high levels of CER supply and low CER demand. A full transition of CERs could then potentially undermine the development of new mitigation actions under the new mechanism, putting at risk the environmental gains of the Article 6.4 mechanism. However, a full transition of units could also increase the diversity of options for meeting mitigation targets and could generate better liquidity in the Article 6.4 mechanism from the start.

Parties could also choose to limit the eligibility of which CERs can transition into the Article 6.4 mechanism. Several design options exist to limit the volume of the potentially transitioning CERs. These include national or international restrictions on CERs from certain geographies, or from certain project types depending on how vulnerable they are to cease their mitigation activities in the absence of a market for CERs.

This paper presents three options for limiting the carry-over of CERs. A geographic restriction would limit the potential carry-over of CERs to activities in certain countries, such as from LDCs (with a potential CERs supply to 2020 of approx. 0.14 billion CERs) or LDCs and other African countries (with a potential supply to 2020 of approx. 0.38 billion CERs). A "vulnerability" restriction would limit the carry-over of CERs to only CDM activities at risk of ceasing operations if the CDM incentive is removed. The potential CERs supply to 2020 for vulnerable activities is estimated at approx. 0.6 billion CERs, while the supply for highly vulnerable activities could be up to 0.17 billion CERs to 2020. A time or vintage restriction would limit the carry-over by applying a vintage restriction on the CERs, for example only allowing CERs from the second commitment period of the Kyoto Protocol to transition. This last restriction would nonetheless lead to potential supply several times greater than the estimated demand to 2020, potentially causing a large carry-over. These results show that the choice of the design option can significantly change the volume of the CERs that could transition. Further work, including assessing possible

combinations of these and other options for limiting the transition of units, would be beneficial to further inform discussions around these topics.

Annex A. Methodology of the estimation of the current volume of available CERs

The current total volume of available CERs is estimated through the following balance equation:

$$Total\ CERs\ issued = V_{holding,CDM} + V_{cancellation,CDM} + V_{retirement,Annex\ I} + V_{cancellation,Annex\ I} + V_{holding,Annex\ I} + V_{replacement,Annex\ I}$$

where:

- *Total CERs issued*: total number of CERs issued in CP1 and CP2; this data is sourced from the UNFCCC CDM Registry.
- $V_{holding,CDM}$: Volume of CERs in holding accounts in the CDM Registry; this data is sourced from the UNFCCC CDM Registry.
- $V_{cancellation,CDM}$: Volume of CERs in cancellation accounts in the CDM Registry; this data is sourced from the UNFCCC CDM Registry.
- $V_{retirement,Annex\ I}$: Volume of CERs retired in Annex I National Registries; this data is sourced from the Standard Electronic Format (SEF) tables on Kyoto Protocol units reported by Annex I Parties (UNFCCC, 2019[20]).
- $V_{cancellation,Annex\ I}$: Volume of CERs cancelled in Annex I registries. This includes all cancellation accounts: "Article 3.3/3.4 net source cancellation accounts", "Other cancellation accounts" (for CP1) and "Voluntary cancellation accounts" (for CP2); this data is sourced from the Standard Electronic Format (SEF) tables on Kyoto Protocol units reported by Annex I Parties (UNFCCC, 2019[20]).
- $V_{holding,Annex\ I}$: Volume of CERs in holding accounts in Annex I registries. This includes all holding accounts: "Party holding accounts" and "Entity holding accounts"; this data is sourced from the Standard Electronic Format (SEF) tables on Kyoto Protocol units reported by Annex I Parties (UNFCCC, 2019[20]).
- $V_{replacement,Annex\ I}$: Volume of CERs used in replacement accounts in Annex I registries; this data is sourced from the Standard Electronic Format (SEF) tables on Kyoto Protocol units reported by Annex I Parties (UNFCCC, 2019[20]).

The volume of available (unused) CERs is estimated as the sum of the CERs in the holding accounts in the CDM Registry and those in the holding accounts in Annex I National Registries:

$$Volume\ of\ available\ CERs = V_{holding,CDM} + V_{holding,Annex\ I}$$

There are a few limitations related to the methodology used. First, the publicly accessible data used for the calculations does not allow to establish a correlation between the amount of CERs cancelled and the country where the CERs were issued. Therefore, to calculate the available CERs for the Parties mentioned above, a pro-rata approach has been followed, assuming that the percentage of CERs issued by the Party over the global total CERs issued corresponds to the percentage of the CERs cancelled. This may differ from the actual cancelled CERs per Party, and therefore may provide distorted results for the amount of available CERs. However, this approach is considered sufficient for the purpose of this

exercise because the objective of these examples is to provide a first order of magnitude to stimulate discussions, rather than provide exact estimates.

The analysis shows that global cumulated issued CERs as at 31 December 2018 were around 1 980 million CERs (UNFCCC Secretariat, 2019[19]). China accounts for 55% of the total volume issued. The volume of used CERs is calculated by summing the CERs in the cancellation accounts in the CDM registry (39 million CERs) and the CERs in the retirement (1 003 million CERs), cancellation (119 million CERs) and replacement accounts (no CERs) of Annex I National Registries. The available CERs volume is then estimated as the sum of the CERs in the holding accounts in the CDM Registry[39] and those in the holding accounts in Annex I National Registries. The global amount of available CERs is therefore calculated at around 819 million CERs. This corresponds to around 41% of the total CERs issued.

Our analysis also looks at: the top five CERs issuers, namely China, India, Republic of Korea, Brazil and Mexico, which collectively represent over 85% of the total CERs issued to date (as at 31 December 2018); the group of Least Developed Countries (LDCs)[40]; and the African Group of countries (not including LDCs). The volume of estimated available CERs per country, using the pro-rata methodology described above, and the future supply as estimated by Schneider et al. (2017[21]) is reported in Table 4.

Table 4: Amount of CERs issued as at December 2018, available CERs, and volume of potential CERs supply to 2020 of selected host Parties

Party	Volume of issued CERs *(million CERs)*	Percentage out of the total volume issued *(%)*	Available CERs(*) *(million CERs)*	Volume of potential CERs supply to 2020 (**) *(million CERs)*
China	1 086	55.0%	453	2 770
India	247	12.7%	104	480
Republic of Korea	178	9.0%	74	130
Brazil	143	7.3%	60	230
Mexico	33	1.7%	14	70
African Group of countries (not including LDCs)	43	2.2%	158	240
LDCs	21	1.1%	9	140
All Parties	**1 980**	**100%**	**819**	**4 650**

Notes: (*) Calculated through a pro-rata approach; (**) Data source: (Schneider et al., 2017[21])
Source: Authors, based on (UNFCCC Secretariat, 2019[19])

Besides the central role of China, that has the potential to issue an additional 2.8 billion CERs up to 2020, there is a potential steep increase in CERs issued of India, Brazil, LDCs and the African Group of countries (not including LDCs) compared to the volumes issued to date. This could suggest that the future regional distribution of CERs issued may vary from the historical one.

[39] The CDM Registry data also includes the CERs in the "pending accounts", for which the CER issuance fee has not been paid yet. Therefore, the CERs in the pending accounts are only factually available after the CER issuance fee has been paid.

[40] As of December 2018, 47 countries are classified as LDCs by the UN (UN CDP, 2019[27]).

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